DESIGN STANDARDS

AND

CONSTRUCTION SPECIFICATIONS

FEBRUARY 2025

THIS PAGE IS INTENTIONALLY BLANK

TABLES AND FIGURES

APPENDIX A – CONSTRUCTION SPECIFICATIONS

APPENDIX B – STANDARD DETAILS

APPENDIX C – MAIN EXTENSION AGREEMENTS

APPENDIX D – DESIGN AND DEVELOPMENT REVIEW DOCUMENTS

APPENDIX E – FIELD INSPECTION CHECKLISTS (INTERNAL USE ONLY)

CHAPTER 100 INTRODUCTION AND GENERAL PROVISIONS

101 INTRODUCTION

101.1 General Provisions

A. This document shall be known as the Evergreen Metropolitan District (EMD) Design and Construction Standards for the Design and Construction of Public and Private Improvements, 2024 Edition, referred hereinafter as the Standards and Specifications. This document may be amended periodically by EMD, referred hereinafter as the District, and it shall be the responsibility of the Responsible Party to obtain and cite the most recent version and addendums to these Standards and Specifications.

101.2 Purpose

A. The purpose of these Standards and Specifications is to provide design and construction standards supplementary to the District Rules and Regulations, restated and adopted, referred hereinafter as the Rules and Regulations. The Standards and Specifications shall not be utilized independently of the Rules and Regulations. Any ambiguity, conflict, omission or question of interpretation of these Standards and Specifications shall be determined by the District in its sole discretion, and its determination shall be final and conclusive. The District's interpretation of the Standards and Specifications shall not be deemed to be a new enactment, amendment or change of any Standard or Specification for any purpose.

B. The Standards and Specifications outline minimum standards for safety, health, and general welfare of the District by regulating the design, construction, choice of materials, location, maintenance, and use of all Public and Private Improvements. These include, but are not limited to, sanitary sewer systems, water supply systems, private utility service lines for water and sewer, and appurtenances thereto. All equipment and material used in the construction of public and private improvements shall be new unless approved by the District.

C. These Standards and Specifications represent minimum requirements and design values. Additional requirements or higher design values, commensurate with conditions, may be required by the District Engineer when they are in the best interest of the District.

101.3 Scope

A. The provisions of these Standards and Specifications shall apply to the planning, design, construction, enlargement, alteration, moving, removal, conversion, demolition, repair, and excavation of any Public or Private Improvements specifically regulated herein. These Standards and Specifications present the minimum standards for construction of Public and Private Improvements completed by Responsible Parties. These Standards and Specifications shall relate to the District's capital improvement projects, unless specifically noted in the contract documents. With the exception of maintenance practices, the District shall follow these Standards and Specifications where practicable.

B. In the case of those improvements that are required by the District and are not specifically covered in these Standards and Specifications, the Responsible Party shall follow applicable local, state, and federal guidelines, or standards promulgated by professional organizations. The District Engineer shall be consulted for guidance on proper references.

102 GENERAL CONDITIONS

102.1 Authority by the District

A. Engineering Services:

The Responsible Party shall procure at its sole expense all engineering services necessary and appropriate in conjunction with the development of the property, which shall fully conform to the District's applicable ordinances, and these Standards and Specifications. Professional services shall be performed by engineers, surveyors, landscape architects, or other professionals duly licensed by the State of Colorado as is appropriate.

B. The Responsible Party shall pay all installation charges for water, sanitary, sewer, lighting, communication, electric, and/or gas services required by the appropriate service provider for the property/project.

C. Variances

A variance may be granted by The District Engineer in situations where it is not practical to carry out the provisions of these Standards and Specifications. The District Engineer shall first determine that conditions exist to make impracticable the procedures set forth herein. A variance may be granted provided that it is compliant with the intent and purpose of these Standards and Specifications. A variance shall not lessen any design requirements or degrees of integrity set forth in this document, and it shall result in a level of safety, service, and quality equal to or greater than the minimum requirements described herein. The Responsible Party shall provide a written request for variance. If approved by the District, a variance will be issued in writing by the District Engineer, stating what the variance is, and the reason for approval.

D. Alternate Materials and Methods of Construction

1. The provisions of these Standards and Specifications are not intended to prevent the use of any material or method of construction not specifically prescribed by these procedures, provided any alternate in the Standards and Specifications is approved in writing by the District Engineer, and thus authorized by the District.

2. The District Engineer shall require that sufficient evidence or proof be submitted to substantiate any request that may be made regarding the alternate method or material. The details of any action granting approval of an alternate shall be recorded and filed with the District.

E. Tests

1. The Responsible Party shall employ at its sole expense a professionally qualified, independent third-party testing company to perform all testing of materials or construction that may be required by the District to ensure compliance with these Standards and Specifications. The Responsible Party shall furnish to the District certified copies of test results and agrees to release and authorize full access of its designated representatives to all work-up materials, procedures, and documents used in preparing the test results.

2. Whenever there is insufficient evidence of compliance with any of the provisions of these Standards and Specifications or evidence that any material or construction does not conform to the requirements herein, The District Engineer may require that test results shall be provided to establish compliance, at the expense of the Responsible Party. Such tests shall be as specified by these Standards and Specifications or by other recognized test standards approved by the District Engineer. If there are no recognized and accepted test methods for the proposed alternate, the District Engineer shall determine test procedures. All tests shall be performed by an agency approved prior to testing by the District Engineer.

F. Organization and Enforcement

1. The District Engineer shall have the power to enforce all provisions of these Standards and Specifications. The District Engineer may appoint a project manager, construction

inspector, landscape architect, technical officer or inspector, or other employee to act as an authorized representative. Said authorized representative may be a District employee or approved consultant.

2. Whenever any work is being done contrary to the provisions of these Standards and Specifications or approved plans, the District Engineer may order the work stopped by a written notice which shall be served on any persons engaged in the doing or causing of such work to be done, and any such persons shall forthwith stop such work until authorized by the District Engineer to proceed.

G. No Waiver of Legal Rights

1. The District shall not be precluded or stopped by any measurement, estimate, or certificate made either before or after the completion and acceptance of the work from showing the true amount and character of the work performed and materials furnished by the Responsible Party, or from showing that any such measurement, estimate or certificate is untrue or incorrectly made, or that the work or materials do not conform in fact to these Standards and Specifications.

H. Control of Work

1. Authority of District Engineer

   The District Engineer shall have the authority to stop work whenever such stoppage is deemed reasonably necessary to protect public's health, safety and welfare. The District Engineer shall resolve all questions which arise as to the quality and acceptability of materials furnished, work performed, interpretation of the plans and specifications, and acceptable fulfillment of the requirements of these Standards and Specifications.

2. Authority and Duties of an Appointed Inspector

   a. An Inspector appointed by the District or District Engineer is authorized to inspect all work completed and all material furnished. Inspections may extend to all or any part of the work and to the preparation, fabrication, or manufacture of the materials to be used. The Inspector is not authorized to revoke, alter, or waive any requirements of these Standards and Specifications. The Inspector shall notify the Responsible Party of any failure of the work or materials nonconformity of these Standards and Specifications. The Inspector shall have the authority to reject materials until any questions at issue can be resolved by The District Engineer. The Responsible Party shall pay for all time and materials used for inspection and testing.

   b. The Inspector shall, in no case, act as foreman or perform other duties for the Responsible Party or interfere with the management of the work done by the Responsible Party. Any "advice" which the Inspector may give the Responsible Party shall not be construed as binding upon the District in any way or release the Responsible Party from fulfilling all of the terms of these Standards and Specifications.

   c. The presence or absence of the Inspector shall not relieve, in any degree, the responsibility or the obligation of the Responsible Party to follow these Standards and Specifications.

   d. The District Engineer, or an authorized designee, shall, at all times, be provided reasonable and safe access to inspect the work whenever it is in preparation or progress.

3. Responsible Party's Responsibility for Work:

   In case of suspension of work for any cause whatsoever, the Responsible Party, before leaving the job site, shall take such precautions as may be necessary to prevent damage

to the work, property, and persons, provide for proper drainage and erect any necessary barricades, signs, or other facilities, at the Responsible Party's expense, as required by applicable standards.

4. Removal of Unacceptable Work:

   Work which does not conform to the plans and these Standards and Specifications, and which results in an inferior or unsatisfactory product, shall be considered unacceptable work. Unacceptable work, whether the result of poor workmanship, poor design, use of defective materials, damage through carelessness, or any other cause found to exist prior to the final acceptance of the work, shall be immediately removed and replaced or corrected by, and at the expense of, the Responsible Party. This expense includes total and complete restoration of any disturbed surface to original or better than the original condition which existed before the repairs or replacement, regardless of improvements on lands where the repairs or replacement are required.

5. Requirements of Other Jurisdictions:

   Where proposed construction will affect other agencies or utility providers such as CDOT, adjacent cities and counties, railroads, ditch companies, Xcel, etc., said construction shall be subject to the review and approval of said agencies. Generally, where more than one requirement is imposed, the more restrictive requirement shall govern. Exceptions must be authorized by the District Engineer in writing.

102.2 Utility Location Requirements for Design

A. Per the provisions of the Colorado Revised Statutes Section 9-1.5-101 (also referred to as Colorado Senate Bill 18-167), projects that meet all of the following four (4) criteria are required to meet Quality Level B for design utility locations as identified in the subsurface utility engineering (SUE) standard ASCE 38.

   1. Project involves a construction Contract with a public entity.
   2. Project involves primarily horizontal construction and does not involve primarily the construction of buildings.
   3. Anticipated excavation footprint exceeds two (2) feet in depth and is a contiguous 1000 square feet (excluding fencing and signing projects) OR involves utility boring.
   4. Project requires the design services of a licensed PE.

B. For all projects that fall under SUE the following requirements must be initiated as part of the project design.

   1. A thorough subsurface utility engineering investigation that takes the results of any comprehensive geophysical services for known and unknown utilities and integrates the results of the geophysics with existing records and physical evidence in a risk based depiction
   2. Test holes where needed for utility locations
   3. Utility location data that is transmitted to the Design Engineer in order to make informed design decisions and the Quality Level of each utility is marked on the plan set.
   4. All of the utility investigation must take place under the direct responsible charge of a licensed Professional Engineer with training and a working knowledge of surface geophysics, engineering surveying, utility construction and design principles, utility conflict identification resolution, and utility risks as they pertain to the project.

C. The Standards and Specifications are not intended to alter the requirements of or to conflict with the Colorado Revised Statues Section 9-1.5-101.

THIS PAGE IS INTENTIONALLY BLANK

CHAPTER 200 DESIGN AND DEVELOPMENT REVIEW

201 INTRODUCTION

201.1 Purpose

The purpose of this section is to establish the extents of the on-call engineering review of submitted development projects within the District, from the preliminary review phase through final construction documents. This section provides a list of submittal requirements for the required Utility Report that shall be submitted to initiate the System Development Engineering Analysis (SDEA) by the District On Call Engineer. It is advised that any developer coordinate this SDEA with the District prior to submission of a site development plan or plat application submittal to Jefferson County Planning and Zoning to determine actual feasibility of the proposed project prior to a formal development application.

202 PRELIMINARY UTILITY PLAN REVIEW

A. The developer may have general high-level questions about a proposed development. The District's Water Resource Department Manager can assist with preliminary questions. If the development requires an SDEA, the developer will be required to prepare a comprehensive Utility Report to submit for review by the on-call engineer.

202.2 System Development Engineering Analysis - Submittal Requirements

A. In order to complete a review of the proposed development, the District requires the developer to submit the following items as part of a Utility Report.

1. Utility Report Submittal List:

    a. Description of the site including a vicinity map and site map with layout of proposed development and infrastructure

        a. Proposed alignments of distribution and collection systems

        b. Proposed connection location to existing distribution and collection systems

        c. Proposed number of taps for the development

    b. Calculations for the water demand using the information provided in Chapter 300, including but not limited to:

        a. Peak Hour Demand in gallons per minute (gpm)

        b. System pressure analysis displaying adequate pressure for the development

    c. Calculations for the sewer loading using the information provided in Chapter 400, including but not limited to:

        a. Peak Hour Flow in gallons per minute (gpm)

        b. System capacity analysis displaying adequate pipe capacity for the flows produced by the development

        c. If the development is not residential, calculations demonstrating the proposed organic strength of the wastewater ($cBOD_5$ loading)

    d. Letter from Evergreen Fire Protection District stating the fire flow requirements, specific to the proposed development

B. The District requires that the Developer model their utility system in order to assess impacts to the District water and sewer systems in the impacted area. If the Developer chooses not to model their system, they will be subject to the cost associated with the District performing that analysis.

C. The District will perform a cursory review of the submitted development and assumptions based on these Standards and Specifications, and District Rules and Regulations. The District will not commence their review until the submittal items outlined in this section have been satisfied.

202.3 Site Development Engineering Analysis (SDEA) – District Review

The developer will need to establish a professional services contract with District to cover the costs of SDEA. Once the SDEA professional services contract is in place, the District will authorize the on-call engineer to review the Utility Report.

The review of the Utility Report will be based on the compliance with District Standards and Specifications, and Rules and Regulation.

A. The water treatment facility (WTF) and wastewater treatment facility (WWTF) capacity analysis and impacts from the proposed development will be reviewed based on the provided information from the Developer in the Utility Report.

B. The complete District distribution and collection systems will be modeled by using the existing models maintained by the District as well as utilizing the new models for areas within the systems that have not been modeled or are proposed. A capacity analysis will be completed for both systems. There will also be a determination of the effects on the surrounding water system and pressures.

C. If the Capacity Analysis indicates that the existing infrastructure does not have the capacity for the proposed development, further discussion will be required before progressing.

D. Timeline

1. Allow for approximately one (1) month for review from the time of the submission of the Utility Report to the time of the comment letter from the District.
2. It is common for the District to have comments on the proposed development that will need to be answered by the Developer. Comments will be provided in writing and then the developer can submit additional information.
3. Ultimately, if the SDEA shows compliance with District Standards then the District will issue a final comment letter and a ‘Will Serve’ letter for the proposed development.
4. The developer can then proceed with developing construction documents for the proposed development. The construction documents are required to be reviewed and approved by EMD prior to commencing construction.

203 CONSTRUCTION DOCUMENT REVIEW

203.1 Construction Development Plan (CDP) Review

A. The submitted Construction Developments (design drawings and specifications) will be reviewed for compliance with the District Standards and Specifications herein.

1. Construction Documents will be reviewed to ensure compliance
    a. Alignments, utility separation, bury depth, slopes, easements, sizing, connection locations, and all other pertinent design requirements are met
    b. Details match District details per Appendix B of these Standards and Specifications
    c. Comply with specifications per Appendix A of these Standards and Specifications
    d. Design must align with approved Utility Report submitted as part of the SDEA.
2. Construction Drawing Requirements

a. General
    a. Plans shall be drawn to scale and shall have sufficient clarity to indicate the location, nature, and extent of the work proposed and show in detail that it shall conform to the provisions of these Standards and Specifications as well as all relevant laws, ordinances, rules and regulations.
b. The following items shall be shown on all plans:
    a. Cover Sheet, including Title Block (lower right-hand corner preferred)
    b. Scale (1"=50' horizontal and 1"=5' vertical for plans and profiles are a minimum)
    c. Legend including all line types and symbols
    d. Revision number and date
    e. Name of professional engineer or landscape architect and firm
    f. Professional engineer's (PE) number, signature, landscape architect as applicable, and stamp
    g. District General Notes
    h. Drawing number(s)
    i. Horizontal and vertical coordinate systems
        (a) Datum: NGVD88
        (b) Horizontal Coordinate System: NAD83 Colorado Central (CO83-CF)
c. Plan Details
    a. Key Map and Vicinity Map
    b. Legend of symbols
    c. North arrow, pointed to the top of the page, or to the right side of the page
    d. Property lines, including lot numbers as applicable
    e. Survey monuments
    f. Ownership or subdivision information
    g. Street names, ROW, and easements with width dimensions
    h. The location of existing utility lines - water, gas, telephone, storm drain, irrigation ditches, sanitary sewers, and other pertinent details, such as houses, curbs, water courses, cable television, etc.
    i. All benchmarks
    j. If irrigation ditches are involved, an approval block for the ditch company shall be provided.
d. Profile Details
    a. Vertical and horizontal grids with scales and stationing
    b. Ground surface existing (dashed) and proposed (solid)
        (a) Existing utility lines
        (b) Benchmarks and project benchmark noted
        (c) Existing manhole inverts and rim elevations
e. Overall Utility Plan (single-sheet)
f. Water Construction Plan

In addition to the above general plan and profile details, all water supply construction plans shall include the following items at a minimum:

a. Proposed water mains (Include Profile):
    (a) Size
    (b) Length
    (c) Materials, types of joints, and proposed depth
    (d) Location dimensions. Other information including elevation at/of top of valve nut, rim elevation of valve box, meter box, etc. may be required.
b. Fittings (size and type), for example:
    (a) Tees
    (b) Crosses
    (c) Reducers
    (d) Bends
    (e) Plugs
    (f) Blow-offs
    (g) Thrust Blocks
c. Valves (size and type)
d. Fire Hydrants
e. Irrigation tap locations and meter sizes with spot elevations
f. Plan, profile, and complete details for offsite transmission mains, pump stations, valves, vaults, tanks, service locations, etc.
g. Complete material list included in drawings
h. Crossings (clearance, show sleeving, if needed) Details
i. Detail Sheets including District Standard Details where applicable

g. Sanitary Sewer Construction Plan

In addition to the general plan and profile details, sanitary sewer construction plans shall include the following:

a. Proposed sanitary sewers (Profile Sheets):
    (a) Diameters
    (b) Materials and types of joints
    (c) Gradients
    (d) Length between manholes
b. Proposed manholes and cleanouts:
    (a) Stationing and other number designation
    (b) Elevation of inverts in and out of manhole
    (c) Elevation of manhole rim
c. Location control dimension
d. Manhole stub-outs
e. Proposed future extensions
f. Proposed wye and riser connection for services

g. Proposed service connections or stub-ins
h. Proposed underdrain
i. Proposed concrete encasement
j. Proposed cutoff walls

h. Other related construction documentation listed below may be provided but will not be required for this analysis:
a. Storm Drainage Construction Plan
b. Stormwater Management Plan (SWMP)
c. Erosion Control Plan(s)
d. Street Construction Plan

B. Timeline

1. Allow for approximately one (1) month for review from the time the Construction Documents are submitted to the first comment letter from the District.

C. Reporting

1. Ultimately, if the Construction Documents are approved the District will issue an approval letter to the developer.
2. After District approval, if any changes are mad ethe construction documents they shall be approved by the District prior to construction.

203.2 Construction Document Standard Notes

The following standard notes shall be included on all CDP sets as appropriate.

A. General Notes

1. ALL MATERIALS AND WORKMANSHIP SHALL CONFORM TO THE LATEST DISTRICT STANDARDS AND SPECIFICATIONS FOR THE DESIGN AND CONSTRUCTION OF PUBLIC AND PRIVATE IMPROVEMENTS, COLORADO DEPARTMENT OF TRANSPORTATION, JEFFERSON COUNTY, AND ALL APPLICABLE STATE AND LOCAL STANDARDS AND SPECIFICATIONS.
2. THE CONTRACTOR SHALL HAVE IN POSSESSION AT THE JOB SITE AT ALL TIMES ONE (1) SIGNED COPY OF APPROVED PLANS, STANDARDS AND SPECIFICATIONS, AND PERMITS. CONTRACTOR SHALL CONSTRUCT AND MAINTAIN EMERGENCY ACCESS ROUTES TO THE SITE AND STRUCTURE AT ALL TIMES PER THE APPLICABLE FIRE PROTECTION DISTRICT REQUIREMENTS. THE CONTRACTOR SHALL OBTAIN WRITTEN APPROVAL FOR ANY VARIANCE TO THE ABOVE DOCUMENTS. THE CONTRACTOR SHALL NOTIFY THE ENGINEER OF ANY CONFLICTING STANDARDS OR SPECIFICATIONS. IN THE EVENT OF ANY CONFLICTING STANDARD OR SPECIFICATION, THE MORE STRINGENT OR HIGHER QUALITY STANDARD, DETAIL OR SPECIFICATION SHALL APPLY.
3. THE CONTRACTOR SHALL OBTAIN, AT HIS OWN EXPENSE, ALL APPLICABLE CODES, LICENSES, STANDARD SPECIFICATIONS, PERMITS, BONDS, ETC., WHICH ARE NECESSARY TO PERFORM THE PROPOSED WORK, INCLUDING, BUT NOT LIMITED TO A LOCAL AND STATE GROUNDWATER DISCHARGE AND COLORADO DEPARTMENT OF HEALTH AND ENVIRONMENT (CDPHE) STORMWATER DISCHARGE PERMIT ASSOCIATED WITH CONSTRUCTION ACTIVITY.
4. ALL WORK SHALL BE SUBJECT TO INSPECTION AND APPROVAL BY AUTHORIZED DISTRICT PERSONNEL OR DISTRICT APPOINTED PERSONNEL.

5. THE CONTRACTOR SHALL BE RESPONSIBLE FOR NOTIFYING THE ENGINEER, GEOTECHNICAL ENGINEER, AND ALL UTILITY OWNERS, AT LEAST 48 HOURS PRIOR TO START OF ANY CONSTRUCTION, PRIOR TO BACKFILLING, AND AS REQUIRED BY JURISDICTIONAL AUTHORITY AND/OR PROJECT SPECIFICATIONS. THE CONTRACTOR SHALL CONTINUE WITH NOTIFICATIONS THROUGHOUT THE PROJECT AS REQUIRED BY THE STANDARDS AND SPECIFICATIONS.
6. THE CONTRACTOR SHALL BE SOLELY AND COMPLETELY RESPONSIBLE FOR CONDITIONS AT AND ADJACENT TO THE JOB SITE; INCLUDING, SAFETY OF PERSONS AND PROPERTY DURING THE PERFORMANCE OF WORK. THIS REQUIREMENT SHALL APPLY CONTINUOUSLY AND NOT BE LIMITED TO NORMAL WORKING HOURS. THE DISTRICT CONSTRUCTION REVIEW OF THE CONTRACTOR'S PERFORMANCE IS NOT INTENDED TO INCLUDE REVIEW OF THE ADEQUACY OF THE CONTRACTOR'S SAFETY MEASURES IN, ON, OR NEAR THE CONSTRUCTION SITE.
7. THE CONTRACTOR SHALL PREPARE A TRAFFIC CONTROL PLAN FOR COUNTY APPROVAL PRIOR TO CONSTRUCTION AND PROVIDE ALL LIGHTS, SIGNS, BARRICADES, FENCING, FLAGMEN OR OTHER DEVICES NECESSARY TO PROVIDE FOR PUBLIC SAFETY. THE CONTRACTOR AGREES TO COMPLY WITH THE PROVISIONS OF THE TRAFFIC CONTROL PLAN AND THE LATEST EDITION OF THE "MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES (MUTCD)," PART VI, FOR CONSTRUCTION SIGNAGE AND TRAFFIC CONTROL. ALL TEMPORARY TRAFFIC SIGNS SHALL COMPLY TO THE MUTCD WITH REGARD TO SIGN SHAPE, COLOR, SIZE, LETTERING, ETC. UNLESS OTHERWISE SPECIFIED. IF APPLICABLE, PART NUMBERS ON SIGNAGE DETAILS REFER TO MUTCD SIGN NUMBERS.
8. THE TYPE, SIZE, LOCATION, AND NUMBER OF ALL KNOWN UNDERGROUND UTILITIES ARE APPROXIMATE AS SHOWN ON THE DRAWINGS BASED ON INFORMATION BY OTHERS. NOT ALL UTILITIES ARE SHOWN. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO VERIFY THE EXISTENCE, SIZE, TYPE, AND LOCATION OF ALL UNDERGROUND UTILITIES WHETHER SHOWN OR NOT ALONG THE ROUTE OF THE WORK. LOCATION OF EXISTING UTILITIES SHALL BE VERIFIED BY CONTRACTOR PRIOR TO DATE OF CONSTRUCTION. IT IS THE CONTRACTOR’S RESPONSIBILITY TO FIELD VERIFY SIZE AND HORIZONTAL AND VERTICAL LOCATIONS OF EXISTING FACILITIES PRIOR TO CONSTRUCTION AND NOTIFY THE DISTRICT OF ANY DISCREPANCIES. THE ENGINEER AND/OR OWNER ASSUMES NO RESPONSIBILITY FOR THE ACCURACY OR COMPLETENESS SHOWN ON PLANS. THE CONTRACTOR SHALL BE FULLY AND SOLELY RESPONSIBLE FOR ANY AND ALL DAMAGES AND COSTS WHICH MIGHT OCCUR BY THE CONTRACTOR'S FAILURE TO EXACTLY LOCATE AND PRESERVE ANY AND ALL UTILITIES. THE CONTRACTOR SHALL NOTIFY ALL PUBLIC AND PRIVATE UTILITY COMPANIES AND DETERMINE THE LOCATION OF ALL EXISTING UTILITIES PRIOR TO PROCEEDING WITH GRADING AND CONSTRUCTION. ALL WORK PERFORMED IN THE AREA OF UTILITIES SHALL BE PERFORMED AND INSPECTED ACCORDING TO THE REQUIREMENTS OF THE UTILITY OWNER. LIKEWISE, THE CONTRACTOR SHALL BE RESPONSIBLE FOR LOCATING AND MAPPING ANY EXISTING UTILITY (INCLUDING DEPTH) WHICH MAY CONFLICT WITH THE PROPOSED CONSTRUCTION, AND FOR RELOCATING ENCOUNTERED UTILITIES AS DIRECTED BY THE ENGINEER. CONTRACTOR SHALL CONTACT AND RECEIVE APPROVAL FROM THE ENGINEER AND THE UTILITY OWNER BEFORE RELOCATING ANY ENCOUNTERED UTILITIES. THE CONTRACTOR IS RESPONSIBLE FOR SERVICE CONNECTIONS AND RELOCATING AND RECONNECTING AFFECTED UTILITIES AS

COORDINATED WITH UTILITY OWNER AND/OR ENGINEER, INCLUDING NON-MUNICIPAL UTILITIES (TELEPHONE, GAS, CABLE, ETC., WHICH SHALL BE COORDINATED WITH THE UTILITY OWNER). THE CONTRACTOR SHALL IMMEDIATELY CONTACT THE ENGINEER UPON DISCOVERY OF A UTILITY DISCREPANCY OR CONFLICT. AT LEAST 3 BUSINESS DAYS PRIOR TO CONSTRUCTION, THE CONTRACTOR SHALL NOTIFY THE UTILITY NOTIFICATION CENTER OF COLORADO (1-800-922-1987, WWW.UNCC.ORG).

9. ALL TRENCHES SHALL BE ADEQUATELY SUPPORTED AND THE SAFETY OF WORKERS PROVIDED FOR AS REQUIRED BY THE MOST RECENT OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA) "SAFETY AND HEALTH REGULATIONS FOR CONSTRUCTION." THESE REGULATIONS ARE DESCRIBED IN SUBPART P, PART 1926 OF THE CODE OF FEDERAL REGULATIONS. SHEETING AND SHORING SHALL BE UTILIZED WHERE NECESSARY TO PREVENT ANY EXCESSIVE WIDENING OR SLOUGHING OF THE TRENCH WHICH MAY BE DETRIMENTAL TO HUMAN SAFETY, TO THE PIPE BEING PLACED, TO TREES, OR TO ANY EXISTING STRUCTURE WHERE EXCAVATIONS ARE MADE UNDER SEVERE WATER CONDITIONS. THE CONTRACTOR MAY BE REQUIRED TO USE AN APPROVED PILING INSTEAD OF SHEETING AND SHORING.
10. THE CONTRACTOR SHALL BE RESPONSIBLE FOR REMOVING ANY GROUNDWATER ENCOUNTERED DURING THE CONSTRUCTION OF ANY PORTION OF THIS PROJECT. GROUNDWATER SHALL BE PUMPED, PIPED, REMOVED AND DISPOSED OF IN A MANNER WHICH DOES NOT CAUSE FLOODING OF EXISTING STREETS NOR EROSION ON ABUTTING PROPERTIES IN ORDER TO CONSTRUCT THE IMPROVEMENTS SHOWN ON THESE PLANS. GROUNDWATER TO BE PUMPED SHALL BE TESTED, PERMITTED, AND PUMPED PER THE STATE OF COLORADO AND LOCAL GROUNDWATER DISCHARGING PERMIT REQUIREMENTS.
11. THE CONTRACTOR SHALL BE RESPONSIBLE FOR CLEANING NEARBY PUBLIC STREETS OF MUD OR DEBRIS DUE TO CONSTRUCTION ACTIVITY INITIATED BY SAID CONTRACTOR ON A DAILY BASIS OR AS OTHERWISE DIRECTED BY LOCAL AUTHORITY.
12. ALL SURPLUS MATERIALS, TOOLS, AND TEMPORARY STRUCTURES, FURNISHED BY THE CONTRACTOR, SHALL BE REMOVED FROM THE PROJECT SITE BY THE CONTRACTOR. ALL DEBRIS AND RUBBISH CAUSED BY THE OPERATIONS OF THE CONTRACTOR SHALL BE REMOVED, AND THE AREA OCCUPIED DURING CONSTRUCTION ACTIVITIES SHALL BE RESTORED TO ITS ORIGINAL CONDITION OR BETTER, WITHIN 48 HOURS OF PROJECT COMPLETION.
13. PRIOR TO THE BEGINNING OF WORK, A PRECONSTRUCTION CONFERENCE SHALL BE HELD BETWEEN THE DISTRICT, THE RESPONSIBLE PARTY WHO IS SCHEDULED TO PERFORM THE WORK, THE DESIGNATED ON-SITE FIELD REPRESENTATIVE, THE CONSULTING ENGINEER OR LANDSCAPE PROFESSIONAL, AND ANY OTHER ENTITIES INVOLVED IN THE CONSTRUCTION.
14. THE CONTRACTOR IS REQUIRED TO PROVIDE AND MAINTAIN EROSION AND SEDIMENT CONTROL MEASURES IN ACCORDANCE WITH THE DISTRICT STANDARDS AND SPECIFICATIONS, THE STATE OF COLORADO, THE M-STANDARD PLANS OF THE COLORADO DEPARTMENT OF TRANSPORTATION, AND THE APPROVED EROSION CONTROL PLAN. THE DISTRICT MAY REQUIRE THE CONTRACTOR TO PROVIDE ADDITIONAL EROSION CONTROL MEASURES AT THE CONTRACTOR'S EXPENSE DUE TO UNFORESEEN EROSION PROBLEMS OR IF THE PLANS DO NOT FUNCTION AS INTENDED. THE CONTRACTOR IS RESPONSIBLE

FOR PROHIBITING SILT AND DEBRIS LADEN RUNOFF FROM LEAVING THE SITE, AND FOR KEEPING ALL PUBLIC AREAS FREE OF MUD AND DEBRIS. THE CONTRACTOR IS RESPONSIBLE FOR RE-ESTABLISHING FINAL GRADES AND FOR REMOVING ACCUMULATED SEDIMENTATION FROM ALL AREAS INCLUDING SWALES AND DETENTION/WATER QUALITY AREAS. THE CONTRACTOR SHALL REMOVE TEMPORARY EROSION CONTROL MEASURES AND REPAIR AREAS AS REQUIRED AFTER VEGETATION IS ESTABLISHED AND ACCEPTED BY THE LOCAL AUTHORITY.

15. DEVELOPMENT PHASING OF ANY PROJECT MUST BE SHOWN ON THE CONSTRUCTION PLANS, APPROVED BY THE ENGINEER AND MADE A PART OF THE APPLICATION PROCEDURE. NO PHASING SHALL BE PERMITTED UNLESS THIS REQUIREMENT HAS BEEN ADHERED TO.

16. NO WORK SHALL BEGIN UNTIL THE RESPONSIBLE PARTY IS IN POSSESSION OF AN APPROVED SET OF PLANS AND THE DISTRICT STANDARDS AND SPECIFICATIONS FOR THE DESIGN AND CONSTRUCTION OF PUBLIC AND PRIVATE IMPROVEMENTS, AND ALL NECESSARY PERMITS FOR THE IMPROVEMENTS HAS BEEN ISSUED BY THE DISTRICT. ENGINEER'S APPROVAL SHALL BE FOR GENERAL CONFORMITY TO THE UTILITY SPECIFICATIONS AND SHALL NOT CONSTITUTE BLANKET APPROVAL OF ALL DIMENSIONS, QUANTITIES AND DETAILS OF THE MATERIAL OR EQUIPMENT SHOWN. NOR SHALL SUCH APPROVAL RELIEVE THE RESPONSIBLE PARTY, CONSULTING ENGINEER, OR LANDSCAPE ARCHITECT OF THEIR RESPONSIBILITY FOR ERRORS CONTAINED IN THE DRAWINGS.

17. THE RESPONSIBLE PARTY SHALL FURNISH REASONABLE AID AND ASSISTANCE REQUIRED BY THE ENGINEER FOR THE PROPER EXAMINATION OF THE MATERIALS AND WORK. WORK SHALL BE PERFORMED IN ACCORDANCE WITH ACCEPTED WORKMANSHIP PRACTICES AND THE EMD STANDARDS AND SPECIFICATIONS FOR THE DESIGN AND CONSTRUCTION OF PUBLIC AND PRIVATE IMPROVEMENTS. ANY WORK NOT ACCEPTED BY THE ENGINEER SHALL BE REDONE UNTIL COMPLIANCE WITH THESE STANDARDS IS ACHIEVED. INSTRUCTIONS GIVEN BY THE ENGINEER RELATING TO QUALITY OF MATERIALS AND WORKMANSHIP MUST BE OBEYED AT ONCE BY THE RESPONSIBLE PARTY. THE DISTRICT SHALL NOT SUPERVISE SET OUT WORK, OR GIVE LINE AND GRADE STAKES.

18. THE MATERIALS USED IN PROJECTS SHALL BE NEW AND SUBJECT TO THE INSPECTION AND APPROVAL OF THE DISTRICT OR APPOINTED ENTITY AT ALL TIMES. THE DISTRICT HAS THE RIGHT TO PERFORM ANY TESTING DEEMED NECESSARY TO ENSURE COMPLIANCE OF THE MATERIAL WITH THESE STANDARDS. NO MATERIAL SHALL BE USED BEFORE BEING INSPECTED AND APPROVED BY THE DISTRICT. FAILURE OR NEGLECT ON THE PART OF THE DISTRICT TO CONDEMN OR REJECT INFERIOR MATERIALS OR WORK SHALL NOT BE CONSTRUED TO IMPLY THEIR ACCEPTANCE SHOULD THEIR INFERIORITY BECOME EVIDENT AT ANY TIME PRIOR TO FINAL ACCEPTANCE OF THE WORK. THE DISTRICT HAS THE AUTHORITY TO REJECT DEFECTIVE OR INFERIOR MATERIALS AND/OR DEFECTIVE WORKMANSHIP AND TO SUSPEND WORK UNTIL SUCH TIME AS THE RESPONSIBLE PARTY SHALL CORRECT THE DISCREPANCIES IN QUESTION.

19. WHENEVER DEFECTIVE MATERIALS AND WORK ARE REJECTED, THE RESPONSIBLE PARTY SHALL PROMPTLY REMOVE SUCH DEFECTIVE MATERIALS

AND CONSTRUCTION FROM THE JOB SITE AND REPLACE ALL DEFECTIVE PORTIONS TO THE SATISFACTION OF THE ENGINEER. IN THE EVENT THE RESPONSIBLE PARTY FAILS TO REMOVE REJECTED ITEMS FROM THE JOB SITE WITHIN A REASONABLE LENGTH OF TIME, THE ENGINEER MAY ARRANGE FOR SUCH REMOVAL AT THE EXPENSE OF THE RESPONSIBLE PARTY.

20. INSPECTION SHALL NOT RELIEVE THE RESPONSIBLE PARTY FROM ANY OBLIGATION TO PERFORM THE WORK STRICTLY IN ACCORDANCE WITH THE PLANS AND SPECIFICATIONS OR ANY MODIFICATIONS THEREOF. WORK NOT SO CONSTRUCTED SHALL BE REMOVED AND CORRECTED BY THE RESPONSIBLE PARTY AT HIS SOLE EXPENSE, WHENEVER SO ORDERED BY THE ENGINEER, WITHOUT REFERENCE TO ANY PREVIOUS ERROR OR OVERSIGHT IN INSPECTION.
21. EXCEPT IN CASES OF EMERGENCY, MAINTENANCE, OR PROTECTION OF WORK ALREADY COMPLETED, NO WORK SHALL BE ALLOWED BETWEEN THE HOURS OF 7 P.M. AND 7 A.M.; NOR ON SATURDAY, SUNDAY, OR LEGAL HOLIDAYS UNLESS APPROVED BY THE ENGINEER IN EACH CASE. WHEN ANY DISTRICT PERSONNEL IS REQUIRED TO WORK OUTSIDE THE HOURS OF 8 A.M. TO 4 P.M. ON REGULAR BUSINESS DAYS, OVERTIME SHALL BE CHARGED TO THE RESPONSIBLE PARTY. HOWEVER, SUCH PERSONNEL SHALL REMAIN EMPLOYEES OF THE DISTRICT FOR ALL PURPOSES. REQUESTS FOR OVERTIME SHALL BE MADE TO THE ENGINEER AT LEAST 48 HOURS IN ADVANCE. PAYMENT FOR SUCH OVERTIME WORK SHALL BE MADE TO THE DISTRICT PRIOR TO FINAL ACCEPTANCE.
22. PROTECT ALL TREES AND VEGETATION. PLACE CONSTRUCTION FENCING AT DRIP LINE OF TREES AND PLANTS NEAR THE WORK ZONE. DEEP WATER TREES WEEKLY. HAND EXCAVATION REQUIRED AT ROOT ZONES WHERE PROPOSED PAVING OR UTILITY WORK IS WITHIN DRIPLINE OF TREES. REPAIR OF ANY DAMAGE TO EXISTING IMPROVEMENTS OR LANDSCAPING IS THE RESPONSIBILITY OF THE CONTRACTOR.
23. THE WORK SHALL BE SURVEYED AND STAKED UNDER THE SUPERVISION OF A LICENSED LAND SURVEYOR IN ACCORDANCE WITH THE APPROVED PLANS.
24. RIM ELEVATIONS SHOWN ON PLANS ARE APPROXIMATE ONLY AND ARE NOT TO BE TAKEN AS FINAL ELEVATIONS. THE CONTRACTOR SHALL ADJUST RIMS AND OTHER IMPROVEMENTS TO MATCH FINAL PAVEMENT AND FINISHED GRADE ELEVATIONS.
25. THE CONTRACTOR SHALL FURNISH THE ENGINEER OF RECORD A COMPLETE SET OF CONSTRUCTION RECORD DRAWINGS ("AS-BUILTS"), FOR THE CONSTRUCTED IMPROVEMENTS. THE PLANS SHALL SHOW SUFFICIENT DIMENSION TIES TO PERMANENT SURFACE FEATURES FOR ALL BURIED FACILITIES TO ALLOW FOR FUTURE LOCATING. THE PLANS SHALL SHOW FINAL PAVEMENT, FLOW LINE ELEVATIONS, CONTOURS AT POND/DRAINAGE FEATURES (AS SURVEYED AND CERTIFIED BY A COLORADO P.L.S.), MANHOLE, PIPE, AND INLET LOCATIONS, INVERTS, GRATE ELEVATIONS, SIZES OF ALL UTILITIES, AND ANY VARIATIONS FROM THE APPROVED PLAN. FINAL AS-BUILT PLANS PREPARED BY THE ENGINEER OF RECORD SHALL BE PROVIDED TO THE DISTRICT.

204 PERMITTING

204.1 Permits Required

All Contractors, public utility agencies, and property owners installing public or private improvements, or storing materials or equipment, within any public right-of-way or easement must obtain the required permit prior to the commencement of the work.

A. State and Federal Permits

1. Land development activity and the construction of public infrastructure often requires additional permits from state and federal agencies. Examples include an Emission Permit for fugitive dust (issued by the Colorado Department of Public Health and Environment), a Discharge Permit for storm water associated with construction activity (issued by the Colorado Department of Health), and a Section 404 Permit for impacts to wetlands or waterways (issued by the US Army Corps of Engineers). It is the responsibility of the developer to obtain all applicable State and Federal Permits.

204.2 Construction Water

A. Water obtained from the District for construction purposes must be sourced through a District-approved meter at a District-approved hydrant. Contractors are obligated to compensate the District for all water used. Non-compliance with these regulations may result in fines and penalties. Unauthorized use of water, including obtaining it without an approved meter or from an unapproved hydrant, will be classified as water theft.

204.3 Stop Work Orders

A. Any person, corporation, quasi-governmental agency, special district, public utility, or private utility company that has performed work without first having obtained a permit or has performed work in the right-of-way that is considered a safety hazard or has non-conforming items that have not been addressed will be issued a notice to stop work. All specified work shall be discontinued until such time that the appropriate repair or permits are in place. The Engineer is authorized to issue Stop Work Orders. The stop work order shall contain a written statement of the violations that caused the issuance. Immediately upon receipt of a stop work order, the Applicant shall consult with the Engineer to resolve the violations.

THIS PAGE IS INTENTIONALLY BLANK

CHAPTER 300 WATER UTILITY

301 GENERAL PROVISIONS

301.1 General

A. These Standards and Specifications are promulgated by the District in accordance with the authority contained in the District Rules and Regulations.

301.2 Purpose

A. This section pertains to all components of the water distribution and transmission systems. Designs are intended to provide safe, reliable water supplies to customers and provide fire suppression flows where available.

B. All utilities must be clearly labeled on the plans and include the type, size, depth, etc.

301.3 General Specifications and District Jurisdictions

A. There is one Water Service Provider within the District:

1. Evergreen Metropolitan District

B. All developments within the District boundary must adhere to the District Standards and Specifications for water distribution and transmission systems.

C. The Evergreen Fire Protection District (EFPD) has authority over fire protection and emergency services within the District and the surrounding community. The Foothills Fire Protection District (FFPD) has authority over areas to the north and east of the EFPD boundary. The Responsible Party shall design and construct the water system to provide fire suppression flows as required by International Fire Code (IFC) and the appropriate fire protection district.

302 DESIGN CRITERIA

302.1 General

A. Water distribution design and construction shall adhere to the District's criteria and standards. Additional criteria may be required by the District for the overall hydraulics of the impacted water utility system.

B. Water mains and appurtenances shall be constructed in conformance with these Standards and Specifications and shall be designed by or under the direct supervision of a licensed P.E. licensed to practice in the State of Colorado.

C. Refer to Chapter 200 for construction drawing requirements related to water utilities.

D. Utility marker posts must be utilized for projects in locations including ditches, unpaved roads, and across open country.

302.2 Water Distribution System

A. General

1. Water is delivered to the individual customer in sufficient volumes without excessive head loss. The design and layout criterion presented herein applies solely to distribution systems.

2. The sizing and layout of a water system are elements of the total consideration of the design, operation, and maintenance of a water supply system that yields optimum quality service at the lowest total cost to the consumer.

B. Pipe Material

1. The following materials are required for new District water mains:
    a. Ductile Iron (DI)
    b. District approved other
2. The following materials are required for new service lines from the water main tap to the corporation stop:
    a. Type K Copper
3. For new service lines from the corporation stop to the water meter, recommended pipe material will be at the discretion of the Owner.
    a. All Polyethylene (PE) pipe shall be equipped with tracer wire
4. Refer to the sample Water Utilities specification in Appendix A for District approved pipe material requirements.

C. Layout and Alignment

1. Main layout shall be of such grade, alignment, curvature, and other characteristics as to permit installation and maintenance in accordance with these Standards and Specifications.
2. Mains shall be installed in dedicated public streets and ROW where possible.
3. When the District determines it is not feasible for an installation to be made in a dedicated street, the installation shall be made in a water easement or combined water and sewer easement.
4. Deflections greater than or equal to 11.25° in alignment shall be made with fittings. Any deflections less than 11.25° must meet the allowable bend radius of the selected material. Water and sewer lines shall be installed with a minimum ten-foot horizontal separation and an eighteen-inch minimum vertical separation at utility crossings, as measured from outside pipe diameter to outside pipe diameter.
5. No water mains shall be installed within fifteen (15) feet of any building, retaining wall or structure unless approved by the District. No building, retaining wall or structure shall be constructed within a minimum of fifteen (15) feet from any water main, unless approved by the District.
6. In no case will a dead-end main line be accepted without a blow-off or a hydrant for flushing the distal end. Looping is preferred.
7. Depth of Cover
    a. The minimum depth of cover for water main lines and water service lines shall be six (6.0) feet measured from the pipe to the surface or planned finished grade in all directions, whichever provides the greatest depth of final cover.
    b. When minimum depth of cover is deemed infeasible, the District may accept Blue Board pipe insulation as an alternative.
        a. Blue Board is defined as extruded polystyrene foam closed call insulation board, R-20, 30 psi or equal. Blue Board must be utilized at a minimum ratio of 2 inches of insulation per 1 foot of depth to surface required.
            (a) A maximum of 2 feet of cover may be made up with Blue Board
8. Whenever possible, water lines shall be located on the high side of any street, roadway, irrigation ditch or right of way.

9. Waterway, railroad, highway, fiber optic or any other type of crossing, which may require boring and casing must be reviewed with the District before final plans are prepared.
10. Easement Width Requirements
    a. Any new utility easements must be sufficiently defined and recorded
    b. An exclusive water easement shall have a minimum width of 20-feet. Pipes that have a bury depth of more than 6.0 feet may require an easement wider than 20-feet and will be at the discretion of the District.
    c. A combined water and sewer easement shall have a minimum width of 30-feet.
    d. Private Roadways
        a. The easement shall have a minimum width of 20-feet. The District shall have exclusive use of 20-feet thereof, except for right angle utility crossings.
    e. Undeveloped Areas:
        a. A water easement shall have a minimum width of 20-feet.

D. Sizing of Distribution Mains

1. All water main lines shall be sized from a hydraulic analysis based on present and anticipated future flow demands and pressure requirements.
2. New mains shall be a minimum of 6-inch and sized based on capacity analysis.
3. Final main line size determination and layout shall be at the discretion of the District and shall not be open to arbitration or negotiation.
4. Mains shall be sized to provide for domestic and fire protection flows to the area requesting service but not so large as to cause water quality issues.
5. The maximum acceptable head loss is 2-feet per 1,000-feet of main for the maximum hour flow using a C-value of 130. This does not apply under fire flow conditions.
6. Mains shall be sized for fire protection utilizing maximum day flows and needed fire flow resulting in a minimum residual pressure of no less than 20 psi in the distribution system.
    a. This shall be confirmed with the District.
7. Site fire flows for multi-family and mixed-use developments are evaluated with one side of the looped system out of service. This evaluation is used to simulate a distribution system outage that would result in a worst-case scenario for the development.
8. All fittings on the main shall be provided with a mechanical restraint.

E. Distribution Mains Greater Than 12 Inches

1. General
    a. Developers are unlikely to be designing mains 12-inch and larger.
    b. Standards that apply to distribution mains shall also apply to larger mains along with the following requirements or exceptions herein.
2. Design
    a. The maximum design head loss for mains less than 20-inch is 2-feet per 1,000-feet of main. The maximum design head loss for mains 20-inch and greater is 1 1/2-feet per 1,000-feet of main. Head loss is based on a Hazen-Williams C-value of 130 at the maximum hourly demand. Head loss criterion does not apply under fire flow conditions.
    b. Blow-off assemblies shall be installed at low points in mains.

a. Mains larger than 12 inches shall not be dead-ended and shall always be looped.

F. Pressure Regulating Valves (PRV)

1. The need for PRVs will be evaluated on a case-by-case basis by the District. If required, the District shall provide the design of the PRV(s). The District will be the ultimate authority on whether a PRV is necessary, and the Standards and Specifications provide general guidelines for such cases.

2. The Developer shall be solely responsible for all costs associated with the design and construction of the PRV(s).

   a. PRV installations are used to control pressures within distribution systems and should be considered in any location in which a 45 psi pressure differential is likely.

   b. When main extension plans are submitted for review, the need for a PRV installation will be determined based on existing pressure zones and the existing distribution system layout. PRV settings shall be included on plans with the elevation and the upstream and downstream hydraulic grade line and pressure.

   c. PRVs shall be sized so that the velocity through the valve at maximum demand does not exceed 25 fps or shall not exceed the manufacturer's recommended velocity, whichever is less. If a wide range of flow rates is anticipated, more than one valve may be required.

   d. PRV vaults shall be sized in order to accommodate the necessary equipment and depth and must be a minimum of 8-feet by 10-feet. Each vault must allow for accessibility and maintenance.

      a. Preferred PRV manufacturer is OCV or District-approved other.

         (a) If PRV is over 8" in size, design must be coordinated with the District.

      b. There will be no PRV manholes approved by the District.

   e. PRVs shall be properly supported and have adequate clearance above and below the valve to facilitate servicing. Telemetering of data may be required. Each PRV shall have a gate valve on both sides for isolation purposes and pressure gauges on both sides.

      a. A regulated bypass may be required by the District

      b. A flow meter may be required by the District

   f. All new PRVs shall be equipped with I-beams and chain hoists.

   g. The District may require the installation of SCADA equipment for PRV installations of the type specified by the District.

G. Valves

1. Isolation valves are required every 500-feet in the distribution system.

2. Where blocks exceed 500-feet in length, or if two or more hydrants are connected to the same main, additional isolation valves are required.

3. Valves are required at the following locations:

   a. Between fire hydrants

   b. Street intersections that carry heavy traffic or that contain major water distribution mains in both directions, as determined by the District, require four valves, one on each extended property line.

   c. Between a fire hydrant and main line

d. River and ditch crossings on each side

e. Between a blow-off and main line

f. Vaults –on the upstream and downstream side

g. All tees with a minimum of three (3) valves

h. All crosses with a minimum four (4) valves

4. Isolation valves shall be resilient seat gate valves. Valves shall be the same size as the main and shall open counterclockwise

H. Air, Blow-off and Vacuum Valves

1. The need for blow-off or drain valves at low points and combination air valves at high points in the distribution system will be at the discretion of the District.

2. Air release and vacuum valve assemblies shall be installed at high points in the main, where there is an abrupt change of slope, at isolation valves where the conduit slopes away from the valve, or as determined by the District.

3. All above grade blow-off valves shall have an appropriate drainage path to an appropriate drainage feature.

302.3 Water Storage

A. The need for water storage shall be evaluated on a case-by-case basis by the District. If required, the District shall provide the design of a water storage tank(s).

B. The Developer shall be solely responsible for all costs associated with the design and construction of the water storage tank(s). This includes the cost of design, any easements, land acquisition, documents associated with permitting approval through CDPHE, and any other costs associated with the project.

C. Where additional service area outside of the proposed development is anticipated, the District will require the water storage tank and associated improvements to provide additional capacity than what is necessary for the initial development. A reimbursement agreement may be appropriate in this condition.

D. If a water storage tank(s) is required for the proposed project, each tank shall be designed with respect to the following:

1. Type: Buried or approved other

2. Material: Concrete or approved other

3. Include (at a minimum): Water testing station vault with sample tap on main and internal telemetry, SCADA

302.4 Supervisory Control and Data Acquisition (SCADA)

A. General

1. The District maintains a SCADA system for remote monitoring of assets in the water distribution system. Pump Stations, Storage Tanks and PRVs will be required to be integrated into the Districts SCADA system for remote monitoring. The Developer shall coordinate with the District on SCADA requirements.

302.5 Water Main Pipe Selection, Fittings, and Protection

1. Pipe Selection: The selection of the type of pipe shall be left to the discretion of the engineer in charge of the design. See Section 302.2 for preferred pipe materials. However, the District reserves the right to deny the use of any material in any circumstance.

a. The installation of mains through hazardous areas, at depths greater than 10-feet, and in the roadways of state and federal highways may require the selection of pressure classes in excess of the minimums stated above.

b. All joints must be restrained.

c. All mechanical joint fittings including: hydrants, plugs, caps, tees, and bends shall be restrained with Mega lugs (or other approved mechanical joint restraint) and concrete thrust blocks supported by undisturbed ground. Thrust blocks should not be used on bends less than 45 degrees.

    a. Bends or other fittings requiring thrust blocks shall be protected from concrete.

B. Pipe Fittings

1. Joints and fittings shall be in accordance with applicable AWWA Standards and bear the pressure rating of the straight pipe involved at a minimum.

2. Acceptable types for straight lengths of pipe are push-on, mechanical joint, and bell spigot restraint systems. Mechanical joints for straight lengths of pipe are allowed in specific situations at the discretion of the District.

3. Fittings shall be furnished with mechanical joint ends. The use of wyes is prohibited.

4. Bolted sleeve-type couplings, in accordance with AWWA C219, shall be of a gasketed, sleeve-type with a diameter that properly fits the pipe. Table 300-1 contains the minimum center sleeve dimensions for bolted sleeve-type couplings:

Table 300-1: Minimum Center Sleeve Dimensions

Pipe Diameter (Inch)	Center Sleeve Thickness (Inch)	Center Sleeve Width (Inch)
6	0.250	5
8		
12		
16	0.375	7
20		

5. Ductile iron sleeves shall have mechanical joints of the proper size and tolerance to ensure a watertight fit.

6. Split sleeve couplings in accordance with AWWA C227 are acceptable.

7. Long bell closure pieces shall be equal in strength, at a minimum, to the straight pipe being joined and shall contain push-on joints of the proper tolerance to ensure watertight connections.

8. Where pipes of different types are connected or where pipe is connected to fittings or valves of different materials, care shall be taken to ensure the proper ring, insulating gasket, or adapter is selected.

9. Flanged adapters, plugs, end caps, bulkheads, cut-in sleeves, anchor couplings, repair fittings, and other appurtenances shall be used where appropriate throughout the system at the discretion of the District.

C. Mechanical Joint Restraint Devices

1. A mechanical joint restraint gland is the normal mechanical joint restraint system used in the District's water line installations and all joints shall have a mechanical joint restraint gland.
2. Mechanical joint restraint glands, other than Megalugs (Stargrip), may be approved by the District.
3. Proprietary joint restraint systems for pipe and fittings require the approval of the District prior to installation.
4. Harnessing of joints by harness rods must be approved by the District prior to installation.
5. The harnessing of joints may be accomplished using one of the mechanical joint restraint systems in accordance with District Standards.
6. Where joint restraint is required on PVC pipe, the designer may use a joint restraint system of the type approved by the District or switch to a metallic pipe. The use of rods and clamps on PVC pipe are not allowed.

D. Corrosion Protection Systems

1. DI pipes and fittings shall be protected against corrosion:
   a. Polyethylene wrap shall be used on buried metallic pipe fittings, rods, and appurtenances. Irregular shaped valves and fittings shall be covered with flat 48-inch wide polyethylene sheet material.
   b. With the installation of metallic pipe, a soil resistivity survey of the construction area may be required at the discretion of the District.

E. Thrust Blocks

1. Concrete thrust blocks shall be sized for working pressure plus water hammer surge pressures and soil bearing capacity. Thrust blocks shall be constructed of Class B concrete or of a premeasured, sacked industrial mix.

F. Concrete Encasement or Pads

1. Under unusual circumstances, it may be necessary to lay pipe at shallow depths. Concrete encasement or pads shall be used over the pipe to protect it from traffic loading when this occurs. The encasement or pads shall be designed to support loads from traffic without transmitting the load to the pipe. Approved insulation shall be required between the pipe and the concrete encasement or pad to protect the pipe from frost. Designs are subject to the District's approval.

G. Casing Pipe

1. Installation of mains through ROW or easements of others, (e.g., highways, waterways, and railroads) may require casing pipes to facilitate the installation of the main. The casing pipe may be required by the District. The type of casing material and its properties shall be specified by the agency granting permission to cross.

302.6 Pumping Facilities

A. Pumping facilities are allowed on mains or services supplying water from the District's system only where specifically authorized by the District. The District will prohibit the installation of pumping facilities where such installations would be injurious to the operation, or future operation, of the District's system. This requirement is not applicable to individual building fire sprinkler system pumps, domestic system boosters required in multi-story buildings, or irrigation system pressure boosting. Such applications require backflow prevention (BFP) to eliminate the possibility of pumping into the District's distribution system. Materials,

equipment, and construction shall be in accordance with applicable codes and standards and approved by the District.

B. Pumping facilities are not recommended by the District and must be designed as a regional pumping facility with the ability to accommodate future demands. The need for pumping facilities shall be evaluated on a case-by-case basis by the District.

C. The Developer shall be solely responsible for all costs associated with the design and construction of the pumping facility. This includes the cost of any easements, land acquisition, and any other cost associated with the project.

D. Where additional service area outside of the proposed development is anticipated, the District will require the pumping facility and associated improvements to provide additional capacity than what is necessary for the initial development.

E. Public pumping facilities are defined as any pumping facility serving more than one user and accepted by the public utility. Operations and maintenance activities shall be the responsibility of the District for all public pumping facilities only upon completion and acceptance of the proposed improvements. The Developer shall provide an operations and maintenance manuals and procedures for all equipment and processes associated with the pumping facility. The Developer shall coordinate with the District during the planning and design phases on equipment operations and maintenance requirements.

F. Private booster pumping facilities are defined as any pumping facility serving only one user. Operations and maintenance responsibilities for private pumping facilities are the sole responsibility of the owner or private entity.

1. Design shall follow plumbing code.

G. Pumping facilities shall be located and sized appropriately to serve the target area and must meet pressure requirements within the target area.

H. All new pumping facilities require SCADA monitoring.

I. General Design Criteria

1. Pump stations receiving water from the District shall:

a. Be secured against unauthorized entry.

b. Be located and kept in a manner that allows for easy and safe access for maintenance and inspection.

c. Provide mechanical forced ventilation in the pump station at a rate of no less than 6 air changes/hour. The intake and exhaust vents shall be designed to prevent the entry of small animals and insects. The intake vent ductwork shall include a filter rack. Vents shall have motorized dampers to prevent air infiltration into the vault when the ventilation system is not in operation. Fans, ductwork, and damper materials shall be constructed of aluminum and/or PVC. Vent stacks may be steel gooseneck type or aluminum tiered caps depending on architectural requirements.

d. Provide heating, cooling, and humidity controls to ensure the safe, dry, and efficient operation of piping, pumping equipment, instrumentation, and alarms.

e. Have pumping capacity sized to provide adequate flow coverage for minimum demands up to the maximum requirements as determined by fire demand, maximum day demand, maximum hour demand, or replenishment, whichever is greater.

f. Provide a means for measuring flow on pump discharge headers as well as sampling for water quality.

g. Butterfly valves shall be installed only for throttling on the discharge side of the pump station. If installed, there shall be vault to access the gear reduction on the valve.

h. Provide corrosion protection for underground steel and iron.

i. Provide code compliant plumbing systems that include floor drains, sump pump systems, and wash-down service water systems. Pump and valve packaging leakage shall be piped to the floor drain or sump pump system.

j. Provide local and remote electronic telemetry equipment of the type specified by the District for monitoring the discharge pressure and confirming the pump motor status.

k. Provide a frost proof gravity line or sump pump for pump station drainage to the local sanitary sewer. Provide a check valve, p-trap, and cleanout on the sump discharge line.

l. Provide a means to prevent water from backing up into the pump station from other sources (e.g., installing a check valve on the drain line).

m. Standardize equipment to permit interchangeability with other equipment.

n. Ensure special care is exercised in the selection of pumping units and associated components to prevent pressure surges. Ensure the suitability, flexibility, and adaptability of the units to the hydraulic conditions of the system from which water is taken and the system into which it is pumped.

o. Ensure the horsepower rating of each pump motor will continuously carry the maximum load that may possibly develop (non-overloading at any point on the pump curve) without exceeding the motor nameplate rating and without using the service factor.

p. Provide that pumps are located to receive positive suction head and meet the Manufacturer's required net positive suction head requirements.

q. Provide steel pump and motor bases that are level, coplanar, free from internal stress, and have internal voids filled with epoxy grout above a steel reinforced concrete base.

r. Provide DI or steel piping designed according to AWWA Standards with adequate couplings for equipment, stainless steel piping supports, and drains.

s. Ensure the mechanical design, equipment selection, and installation practices are approved by the District. Drawings and information shall be provided to describe the system curve and pump curve interactions, the pump operating conditions and associated efficiencies, the pumping equipment sizing and features, the valve/actuator sizing and operating requirements, and the HVAC design loads, ductwork sizing, and equipment selections. Provide the certified Manufacturer’s pump performance curves.

t. Ensure that electrical design, equipment selection, and installation practices are approved by the District. Drawings shall show the power system, switchgear, protective devices, feeder panels, and wiring and motor controllers along with sizing, fault current, and protective device coordination calculations. The latest edition of the NEC, OSHA's Design Safety Standards for Electrical Systems, and applicable ANSI/IEEE Standards shall set the minimum standards to which the design, equipment, and installation shall conform. The District set higher standards for safety or reliability purposes.

u. Provide slow-closing regulating and/or check valves on pumps to minimize water hammer.

v. Provide ample clearance between equipment for operation and maintenance.

w. Provide electrical outlets and lighting on walls in the pump room.

J. Conditional Design Criteria

1. Depending on the function and the location of the pump station, the following criteria may be required by the District:
    a. Exterior and interior lighting.
    b. Access and parking for vehicles on the pump station site.
    c. Fencing for securing the area around the pump station and transformers.
    d. Space for the future addition of pumps and piping.
    e. A means to lift heavy equipment (e.g., a bridge crane or access for a boom crane).
    f. Variable speed or throttling control with the appropriate discharge valves and controls.
    g. An emergency power supply for telemetry, lights, a drain sump pump, and other necessary items.
    h. Surge anticipation valves (required).
    i. The installation of isolation valves on each side of the pumping unit.
    j. Systems capable of supplying adequate fire protection during power outages.
    k. Resistance temperature detectors in stator windings of pump motors for remote alarming in the event of overheating.
    l. A spare pump for backup capability.
    m. Pump and motor bearing high-temperature sensors for remote alarming and lock out relays to shut down the pump and the motor in the event of bearing overheating.
    n. There shall be a temperature shutdown switch on the pump to protect the pump from overheating.
    o. Dual transformers cross-connected with a tie breaker and separately switched for isolation.
    p. Controls for pumps and filling valves (start – stop – position discharge valve).
    q. Local and remote instrumentation for monitoring:
        (a) Discharge valve positions, if applicable.
        (b) Discharge header pressure and flow.
        (c) The reservoir level, if applicable.
        (d) Upstream pressure, if applicable.
        (e) Suction header pressure, if applicable.
        (f) The pump status (on-off).
        (g) Gas engine standby generator status (on-off).
        (h) Total kilowatt demand, peak kilowatt demand, voltage, and amperage (station).
    r. Provide remote and local sensors and alarms to detect:
        (a) Water on the floor.
        (b) Bearing high-temperature for each pumping unit.
        (c) Motor windings high-temperature for each pumping unit.
        (d) Pump building door intrusion.
        (e) High and low room temperature.
        (f) Electrical ground fault.
        (g) Low accumulator pressure, if applicable.

(h) Power failure.

(i) High and low reservoir levels, if applicable.

(j) Fire and/or smoke.

302.7 Service Lines and Appurtenances

A. General

1. The following Standards are to be used in conjunction with the District Rules and Regulations for Water Service.
2. Water is conveyed from mains to consumers by service lines and their associated appurtenances. Except for fire service lines, water delivered to customers shall be metered.
3. Service lines shall include all pipe and fittings up to and including the connection point provided by the District.
4. The Customer shall own the entire water line from the connection point outside to the point-of-use.
    a. The District will install taps up to and including 2 inches. The Customer is responsible for the installation of any taps greater than 2 inches.
    b. The District shall be responsible for creating the connection point in the existing water main.
5. The District may supply the following for service lines 1-inch or smaller:
    a. Saddle
    b. Corporation Stop
    c. Water Meter
    d. Yoke

B. Layout of Water Service Lines

1. The service line shall be arranged to provide convenient access to the curb stop and the meter for meter reading, operation, and maintenance. Residential and commercial water meters shall be installed within the residence or business.
2. If the service line crosses property boundaries, a private easement shall be required.
3. The service line shall be installed in a continuous straight line when feasible, perpendicular to the property line or curb.
4. Service lines shall be installed with a minimum of 6-feet of ground cover in all directions.
5. Deviations to the service line standards contained in this Section will need to be approved through the District.
6. Backfill material around service lines, stop boxes, and meter settings shall be at 90% compaction with 95% compaction or more in paved areas.
7. Service lines may not share a trench containing conduits which carry any substance other than potable water if there is space for multiple trenches outside of the ROW. If the lot outside of the ROW is too narrow to provide separate trenching, a service line should be separated horizontally from foreign conduits by a minimum of 5 feet and shall follow plumbing code.
8. If same trench is required due to lot width, the water service pipe and building sewer shall not be horizontally separated by less than 5 feet.

C. Sizing of Service Lines

1. Taps and service lines shall be of a size that is adequate to supply the requirements of the property being served while not being so large as to cause inaccuracies in metering low flows. The minimum size allowable for a service line shall be 3/4-inch.
2. Taps and services shall be sized to produce a water velocity that is no greater than 10 fps at peak demand as estimated by an accredited Fixture Unit/Count methodology.
3. The total pressure drop in the service line from the main to the building shall not exceed 25 psi without BFP or 35 psi with BFP and a minimum residual pressure of 20 psi at the building beyond any BFP under peak domestic demand flow.
4. The manifold tap, manifold service line, manifold corporation stop, curb stop, and manifold trunk line shall be the same size.

D. Pipe Material and Joints

1. Pipe material is dependent on the size of the service line and shall extend from the tap to the first mechanical fitting inside the structure:
    a. Seamless copper tube, designated as “Type K” soft, is recommended for 3/4-inch through 2-inch service lines.
    b. Ductile iron pipe or PE pipe are recommended for 3-inch and larger service lines.
    c. Copper joints installed underground shall be flared or brazed. Flaring and brazing shall be performed in accordance with the best plumbing practices.

E. Connections for Service Lines

1. Taps for 2-inch and smaller (larger taps will be performed at the District’s discretion) domestic, irrigation, or fire service lines will be made by the District. The connection shall be made using a corporation stop of the same size as the service line through a bronze tapping saddle, both of which shall be supplied by the District and funded by the Customer. Taps shall be made only after satisfying the following conditions:
    a. The main has been released by the District following the completion of the conditions and tests.
    b. The license application has been completed, signed by an authorized individual, and submitted to the District.
    c. Appropriate fees and charges have been paid to the District.
    d. The street opening permit has been obtained from the authority having jurisdiction.
    e. Underground utilities near the tap are marked.
    f. Tapping materials are on-site.
    g. Front property corners are clearly staked, and the service address visibly posted.
    h. Water main valves are marked or staked.
    i. Safety equipment and procedures are in place including trench shoring.
    j. The tapping location on the main is excavated and the water main surface is exposed and clean.
2. Taps to the main for 3-inch and larger service lines shall be wet taps made by a qualified contractor licensed and bonded with the District.
3. Domestic service lines connected to metallic water mains shall be electrically insulated by means approved by the District for insulating fittings or gaskets.

4. Care shall be taken to properly install corporation stops and provide enough slack in the service lines to protect against pullout.
5. When tapping mains, dig out bedding material and apply two to three wraps of adhesive tape completely around the polyethylene-encased pipe to cover the area where the tapping saddle and machine is to be mounted.
6. Multiple taps on the same side of the main shall be a minimum of 3-feet apart, measured longitudinally along the centerline of the main. Multiple taps on opposite sides of the main shall be staggered by a minimum of 2 1/2-feet, measured longitudinally along the centerline of the main. Taps shall not be made within 5-feet of any main line pipe fitting.
7. Corporation stops shall be used to connect the service line to the main without taking the main out of service.

F. Taps, Saddles, and Sleeves

1. Tapping saddles or sleeves shall be required for all taps on main lines.
2. No direct tapping of any main line materials shall be allowed without approval from District.
3. Taps and service lines shall be of a size which is adequate to supply all the requirements of the property being served as determined by the Owner's engineer. The recommended minimum sizes for service lines are shown in the table below:

Table 300- 2: Recommended Service Line Sizes

Tap Size (Inches)	Water Line Length		
	< 85 feet	85-100 feet	> 100 feet
3/4"	3/4"	1"	Minimum 2"
1"	1"	1 1/2"	
1 1/2"	1 1/2"	2"	
2"	2"	2"	

4. Tapping saddles with a tap size of 2-inch and smaller for DI pipe shall consist of a bronze body with two bronze straps. They shall be made by a corporation stop that is the same size as the service line.
5. Taps 1.5-inch and larger, shall be made with an existing tee or a tapping sleeve and a tapping valve. Whichever method is used, care shall be exercised to select sleeves and gaskets that are properly sized to fit the type and class of pipe to be tapped. Where tapping sleeves, 1.5-inch and larger are used a thrust block shall be placed behind the tapping sleeve to prevent possible damage to the main from pressure shocks that develop as valves are first opened.
6. Taps on CI or DI pipe may be tapped under pressure or wet.

G. Curb Stops, Valves, and Valve Boxes

1. Valve boxes, vault access lids, or other surface features of the water system that will be placed in paved areas shall not be placed in curb and gutter, concrete cross pans or edges of pavement wherever possible. Surface features of the water system shall be placed a

minimum of two (2) feet from outside edges of concrete curb and gutter pans, street cross pans, and edges of pavement.

2. Curb stops shall be clockwise closed operation.
3. Deviations to the curb stop installations, 1-inch and smaller, requested in writing by the Owner may be authorized by the Meter Inspection Technician.
4. Buried valves and curb stops shall be equipped with a CI valve box and foot piece. A roadway box shall be used when a 3/4-inch or 1-inch curb stop is placed in paved areas.
5. Valve Boxes:
    a. Buried gate valves shall be provided with a 6-inch CI valve box and large oval base. The valve box shall be of a design that shall not transmit shock or stress to the valve and shall have enough extension capability to be raised to the ground line.
    b. Valve boxes shall be installed so that the lid will be flush with the finished grade, unless otherwise specified by the District.
    c. The top section of the valve box shall be acceptable for use with a butterfly valve.
6. Check Valves:
    a. Check valves shall be installed on main line in the interior of the home or building.
    b. Check valves are required for meter installations where there is no BFP assembly downstream and at master meter locations.
    c. Check valves are not a substitute for BFP assemblies; however, they may be omitted from the meter installation in cases where a BFP assembly is within 150-feet of the meter.
7. Valve Reference Marker Posts:
    a. When valves are installed where adequate physical reference points are not available, as determined by the District, a valve reference marker post may be required.

H. Abandonment or Removal of Service Lines and Tap Cuts

1. It may become necessary to remove or abandon a service line or a stub-in due to redevelopment and changes in water requirements for the premises, or to relocate a service line due to changes in the configuration of the premises. An abandoned or relocated service line shall have the tap cut at the main or fire service line (close the corp stop) to ensure that it cannot be used to remove water from the system. Service line tap cuts shall be witnessed by the District.

I. Construction

1. The Contractor shall be a licensed plumber by the authority having jurisdiction to perform work in the public ROW. The Contractor shall have a current plumbing license to install service lines and shall be licensed and bonded with the District when working within the easement.

302.8 Cross Connection Control and Backflow Prevention (BFP):

A. General

1. The following Standards are to be used in conjunction with the District Rules and Regulations for Water Service.

B. The District is responsible for protecting its public water system from contamination due to backflow occurrences through residential, multi-family, irrigation, and/or commercial property water service connections in accordance with CDPHE Regulation 11. The District needs the

assistance and the cooperation of the public and licensees to ensure this responsibility is met. The District may request access to a property or facility to conduct an on-site cross-connection control audit.

The District requires the installation of a containment assembly on commercial property service lines. In high hazard applications, a reduced pressure zone (RPZ) BFP assembly shall be installed. In low hazard applications, a double check valve (DCV) BFP assembly may be installed at the discretion of the District.

Failure to comply with installation and annual testing requirements outlined here and in the District Rules and Regulations will result in suspension of service.

C. An approved BFP assembly shall be manufactured in accordance with AWWA C510 and C511 and meet USC FCCCHR specifications. Components in contact with potable water shall be certified to comply with NSF/ANSI 61 and NSF/ANSI 372. The BFP shall be selected and installed in accordance with the Construction Specifications.

D. Testing Requirements for BFP Assemblies Installed on Potable Water Services: The licensee is required to have a certified ABPA or ASSE tester inspect and test an existing or newly installed containment BFP assembly on dedicated water service lines, if applicable, upon installation and annually thereafter. Tests shall be conducted at the expense of the licensee. BFP assemblies shall be repaired or replaced at the licensee's expense when found to be defective. Records of tests, repairs, and replacements shall be kept by the licensee and a copy of the annual test provided to the District.

Installed BFP assemblies that fail to meet these requirements, but were approved assemblies at the time of installation, shall be excluded from the requirements if they have been properly maintained and pass annual testing. If the BFP assembly is replaced, the replacement shall be USC FCCCHR approved.

1. The tester is required to:
    a. Complete BFP assembly testing and submit test reports within 10 days of the District's setting of the meter and turning on of the water service.
    b. Submit a copy of the official ABPA or ASSE certification to the District each time the certification is renewed.
    c. Submit a copy of the test kit calibration certification annually.
    d. Complete the BFP assembly test report and submit a copy of the containment BFP assembly report to The District within 10 days. Incomplete or illegible test reports will not be accepted.
    e. Indicate containment or containment by isolation on the test report.
    f. Submit all test reports to the District's chosen backflow tracking system.
    g. Indicate the type of usage (i.e., domestic, irrigation, or fire) on the test report.
    h. Confirm the service address, BFP assembly serial number, and record the values on the test report.
    i. Contact the District for discrepancies regarding the meter or BFP assembly.
    j. Sign, date, and include the time of the test on the report.
2. Failed Assemblies:
    a. If the BFP assembly fails and cannot be repaired on the day of its failure, the District shall be notified by the certified ABPA or ASSE tester within 24 hours. A copy of the failed test report shall be submitted to the Cross-Connection Control Section within 3 days.

b. The Property Owner must repair or establish quote and timeline within 30 days of failed assembly. Repairs must be completed within 90 days. The Property Owner shall submit a passing test report to the District. Failure to comply may result in the suspension of water service.

c. If the premises has a high hazard BFP assembly and is deemed a threat to public health (via the private plumbing system), it is at the discretion of the District to suspend the dedicated water service line immediately. The Property Owner shall repair or replace the BFP assembly before water service is restored.

E. Exemptions:

1. Single-family residential customers are exempt from the District's cross-connection control requirements unless the premises is served by a fire suppression system or a dual water supply (such as a well, pond, etc.), or other hazards are identified by the District.

F. Stop and Waste Valves:

1. The District is no longer recommending the installation of wasting service valves.

302.9 Water Meters

A. General:

1. Water meters used in the District's system shall be provided by the District. The District will determine the type of meter to be installed at the time of the application based upon size, service requirements, location, and other conditions that may exist. The District may change the type of meter at any time based on the water usage patterns of the licensee.

a. Meters must have a minimum size of 5/8 inch by 3/4 inch with a lay length of 7.5 inches.

2. All service meters shall be owned and maintained by the District.

3. All District master meters shall be owned and maintained by the District and shall be connected to the District's meter reading software (WaterScope).

B. Meter installations

1. Meter installations will be inspected by The District.

2. Meters shall be the same size as the corporation stop or service tee and that portion of the service pipe between the meter and the corporation stop.

a. In some cases, the District allows fire service lines to be combined with the domestic service line. In such cases, the tap, corporation stop, meter, and whole service line may not be the same size.

C. Meter Setting

1. General:

a. The meter shall be installed in an approved coppersetter or yoke. The bypass line shall have a ball valve that may be locked in the closed position. Coppersetters for 1-inch and smaller meters shall include a lockable angle valve on the meter inlet. Coppersetters for 1 1/2-inch and 2-inch meters shall include lockable angle valves or ball valves on the meter inlet and outlet and a lockable ball valve on the bypass.

b. Meter shall be wall-mounted. Fabricated metal supports or jack stands shall be used to support 3-inch and larger.

c. To ensure safety, meter settings shall provide for electrical continuity in the event the meter is removed from the setting. There shall be an electrical continuity wire or strap

connecting the pipe on either side of the meter setting. The wire shall be made of copper with fittings suitable for bonding jumper and water pipe material.

2. Meter Setting

   a. All residential and commercial water meters shall be inside unless approved by District. Refer to the Standard Details.

   b. Outside meters, acceptable only for master meters and irrigation meters, shall be installed with the inlet and outlet spuds in a horizontal position and housed in a concrete or approved composite meter pit or vault. The meter shall sit horizontally with the meter register pointing up. Larger meters must be installed in vaults.

      a. Master meters may be installed in an underground vault

      b. Irrigation meters may be installed in a meter manhole with a 4-foot minimum diameter

   c. For all outside meter settings, install a curb stop 1 to 1.5 feet before the meter pit or vault. The meter setting shall include an angle valve or ball valve on the inlet side of the meter. Install a curb stop 2-feet before the meter vault. The meter setting shall include angle valves or ball valves on the inlet and the outlet sides of the meter. The bypass line shall have a ball valve that may be locked in the closed position.

D. Meter Bypass Lines

1. A bypass line is required for 1 1/2-inch and larger meters except those used for irrigation-only service.

2. Bypass lines shall contain an independent isolation valve and shall not contain tees, plugs, or other outlets through which water could be withdrawn. Bypass lines permit the customer to have water while the meter is being repaired or replaced and may only be activated by the District.

3. Bypass lines for 1 1/2-inch and 2-inch meters shall be integral to the meter yoke with an appropriately sized ball valve. Bypass lines for 3-inch and larger meters shall be connected to the main line at tees before and after the meter and shall include a gate valve with wheel operator.

4. Bypass lines shall be locked in the closed position when not in use.

302.10 Manholes, Vaults, and Pits

A. General:

1. Structures shall be designed to support applicable loads. Design calculations, drawings, and contract specifications shall be submitted to the District for review. Concrete used in structures shall be Class A.

2. Steel reinforcement shall be deformed bars or welded steel fabric.

B. Manholes

1. Manhole base beams shall be constructed of precast, reinforced concrete.

2. All manholes shall be designed so that all joints and corners are waterproof either by construction methods or after construction by the use of sealants.

3. The manhole roof shall be designed to support the street fill and traffic loading in accordance with AASHTO Standards.

4. Manholes shall not be installed in curbs, gutters, concrete pans or in the wheel path in the road.

5. Lids:
    a. All manhole lids shall be forged with the following: "Water". Manhole lids must be approved by District.
    b. Rings and covers shall be cast-iron. Manhole rings and covers shall be twenty-four (24) inch diameter manholes
    c. Surface patterns in the lids shall be drivable and smooth.
    d. The 24-inch CI manhole cover shall weigh approximately 165 lbs. The 24-inch CI ring shall weigh approximately 240 lbs. Composite lockable manhole rings may also be used and must be traffic rated if located within roads.

C. Meter Pits and Vaults

1. When approved, water meter vaults shall be located between the curb and detached walk wherever size permits.
2. 3/4-inch and 1-inch Meters:
    a. Meter settings for 3/4-inch and 1-inch meters shall be installed in meter pits with a 24-inch nominal diameter and a total depth of 52-inches minimum from grade. The pit shall consist of a 24-inch nominal diameter by 48-inch high cylinder of concrete or composite with a dome or bell housing holding an internal frost lid and a locking top lid.
    b. Rings shall be constructed of concrete and comply with the requirements of ASTM C 478.
    c. A CI dome or bell housing shall be mounted on the top of the pit. The dome or bell housing shall have a support for an interior frost lid and a rim for locking the meter pit cover. Composite and plastic domes are not permitted.
    d. The cap-type meter pit top lid shall be constructed of CI or an approved composite material. Lids shall be of the cap-type with a locking screw and bolt that provides a tight locking of the cover to the dome or bell housing of the meter pit. Lids shall withstand AASHTO HS 20 highway loading plus 25% impact not to exceed 20,000 lbs. When set in place of the dome, the top of the meter pit lid shall be set at ground line. The inner frost lid shall be high-density polyethylene.
        a. Meter pit lids shall be forged with the following: “Water”. Lids must be approved by District.
3. 1 1/2-inch and Larger Meters:
    a. Meter vaults shall be precast concrete from approved manufacturers. The roof and the walls of precast vaults shall be made waterproof after construction using sealants, membranes, or other approved methods. Access manholes shall be adjusted to be flush with the finished landscape grade or surrounding pavement.
    b. Circular vaults for 1 1/2-inch and 2-inch meters shall be 48-inch diameter and of sufficient depth to extend 1 1/2 feet to 2 feet deep below ground line of the service line. The wall thickness shall be at least 6-inches. The vault shall have a flat top with concrete grade rings supporting the manhole ring and 24-inch diameter manhole cover at ground line. When subject to traffic loads, vaults shall sit on reinforced concrete manhole.
    c. Rectangular vaults for 3-inch and larger meters shall be approved by the Meter Technician. Vaults shall be precast concrete from an approved Manufacturer. Vaults shall be designed to support the street fill and HS 20 traffic loading in accordance with AASHTO Standards.

d. Meter vault lids shall be ASTM A 48 Class 35B CI or composite manhole covers with a 24-inch lid set into a 36-inch outer diameter ring. The manhole lid shall be solid with one 2-inch hole to accommodate AMR/AMI devices specified by the District.

e. Meter vaults shall include copolymer polypropylene plastic steps cast into the side of the vault evenly spaced at 12-inch centers, maximum.

f. AMR/AMI devices shall be mounted through the CI manhole lid or outer ring, inside the vault with a composite cover, in a remote location on the side of a building, or on a pole, as directed by the Meter Technician.

D. Sump Pits for Vaults and Manholes

1. Concrete vaults and manholes with concrete bases shall have sump pits.

2. The minimum pit opening shall be 12” x 12” square and open to gravel.

3. A gravity drain line or sump pump shall be used in conjunction with a sump where telemetry equipment is to be installed. A sump pump is not permitted in a meter vault.

4. Sumps are required for vaults and manholes where there is seepage into existing vaults, in PRV installations at the discretion of the District.

E. Vent Pipes

1. Vent pipes shall be required on all vaults.

2. Vent pipes shall be field located at the nearest intersection of the street property line and the side lot line.

3. The above ground vent pipe shall be steel pipe,4-inch nominal diameter, in accordance with ASTM A 53. The vent screen shall be No. 12 or No. 16 stainless steel mesh. The below ground vent pipe shall be 6-inch, black steel pipe – Schedule 40 with threaded joints. A 2-inch to 4-inch threaded black steel coupling shall be used to connect the pipes at ground level.

302.11 Future Connections

A. Water utilities shall be stubbed out to the right-of-way or limits of property at all locations that are planned for future tie-ins. Other reasonable stub-outs or main extensions may be requested by the District based on knowledge of adjacent development. All fees shall be paid in advance.

B. Service stub-outs and main extensions shall be valved such that only one valve will need to be closed when the water line is extended. Depending on location, District may ask for a temporary blow-off at the end of a stubbed line.

C. The end of a service stub-out shall be marked in the field with a carbonite composite utility marker painted blue and labeled with the size and material of the water main extension.

D. The end of a main extension shall be marked in the field with properly marked carbonite composite utility marker.

E. Where possible, when a stub-out connection is installed to permit street paving or in advance of future development, it shall be located to provide a future connection that is in accordance with applicable standards at the time of activation. There is no assurance that any stub-out will meet the requirements for conversion to a service line at the time of activation. A licensee that installs a stub-out does so with the understanding that it shall be the responsibility of the licensee to modify, reconstruct, relocate, replace, or remove the stub-in, as necessary.

302.12 Water Demand

A. Water main design shall include consideration of providing water service to the development without compromising the surrounding water distribution system.

B. Per Capita Demand

1. In general, water demand shall be designed for the estimated maximum population in a specific area to be served.
2. Where future water infrastructure is planned, economic and engineering analysis of alternatives should accompany any request for service.
3. In determining the required water demand, the following factors shall be considered:
    a. Peak hourly water use
    b. Location of development within the water distribution system
    c. Pressure zone
    d. Depth of excavation
4. Water infrastructure shall be designed based on the type of unit or zone requiring water. The District uses metered water demand to model system demands. All development in commercial zones should provide demand calculations based on their own usage.
    a. The following table should be used exclusively for modeling proposed demand to the water distribution system and not for addressing the number of taps required for the proposed development. This data is intended to be used as an average demand approximation per single-family lot for each zone type in the District area. Please contact the District to confirm which zone the proposed development is located within.

Table 300- 3: Residential Water Modeling Demand Projection for Single-Family Lots

Zone Abbrv.	Zone Description	Average Day Flow (gpd)	Maximum Day Flow (gpd)
BR	Blue Residential	222	444
GR	Green Residential	111	222
GBR	Green Black Residential	95	190
GOR	Green Orange Residential	111	222
GRR	Green Red Residential	174	349
GYR	Green Yellow Residential	111	222
GWR	Greenwood Residential	111	222
IR	Independence Residential	111	222
OR	Orange Residential	95	190
RR	Red Residential	143	285
RYR	Red Yellow Residential	143	285
YR	Yellow Residential	127	253
YOR	Yellow Orange Residential	143	285

C. Peak Design Demand

1. Peak Hour demand must be calculated by multiplying the maximum day flow by the hourly peaking factor of 1.8.
2. Water mains must be designed to maintain adequate pressures for all hydrants and fixtures within the development area and surrounding distribution system pressure zone.

302.13 Fire Hydrants and Fire Service Lines

A. General:

1. The Responsible Party shall provide system improvements, including fire hydrants, for fire suppression as needed for the proposed development and its impact, if any, on adjacent properties as required by Evergreen Fire.
2. The required number of fire hydrants and their locations shall be coordinated with the EFPD and the District. As minimum general requirements, the number of fire hydrants, their location and spacing shall follow the latest edition of International Fire Code (IFC).
3. Private fire services for use on an internal fire suppression system shall extend from the valve on the main to the base of the riser flange in the building.
4. No horizontal or vertical bends or reducers shall be used in fire hydrant or fire sprinkler branch lines unless specifically approved by the District.
5. All fire hydrants shall be owned and maintained by the District.
6. An approved USC FCCCHR or ASSE BFP assembly shall be installed on water service connections that supply a fire protection system.

B. Hydrant Placement:

1. Hydrants shall be located at least one (1) foot inside the right-of-way or water utility easement and five (5) feet from the side lot line.
2. Hydrants shall be located a minimum of six (6) feet from edges of driveways to the center of the hydrant.
3. Installation of fences, signposts, landscaping or other obstructions shall in no way hinder the access or operation of the fire hydrant.
4. New fire hydrants must be fed by a minimum eight (8) inch main line from two (2) directions.
5. The fire hydrant branch line shall be set at a 90-degree angle to the street main. The hydrant shall be set at the end of the branch line facing the branch line.
6. Dead end mains
    a. Main line extensions, which are to be used for fire protection and are dead-ended shall not be longer than 500 feet. Extensions longer than 500 feet may require over sizing and approval by the District.
    b. Where dead-ends occur, they shall be provided with a fire hydrant if flow and pressure are sufficient, or with an approved flushing hydrant or blow-off for flushing purposes.
        a. No flushing device shall be directly connected to any sewer.
        b. Flushing devices shall be installed at the distal end of all dead-end lines.
    c. A dead-end main may only have one fire hydrant connected to it in cases where looping is not an alternative, except as specifically approved in writing by the District.
    d. Multiple fire protection appurtenances, including any combination of fire hydrants and fire service lines for any single project site, are not allowed on a dead-end main.

Additional consideration will be given in the case of single-family residential homes on a cul-de-sac where fire service lines are required.

7. Redundant hydrant installations and the unnecessarily high density of fire hydrants shall be avoided where existing hydrant function would be duplicated.
8. Fire hydrants shall be installed within dedicated streets or in easements. When the District determines it is not feasible for a hydrant to be installed in this manner, it shall be installed in an easement adjacent to the street. Fire hydrant easements shall have a minimum width of 20-feet. The easement shall extend a minimum of 5-feet beyond the center of the hydrant.

C. Public and private fire hydrants shall meet the District's Standards and Specifications:

1. Comply with American Water Works Association (AWWA) Specification C502
2. All fire hydrants shall be Super Centurion.
3. Open Direction: LEFT (counterclockwise)
4. Operating Nut: 1 ½-inch Pentagon (5-sided)
5. Painted red
6. Fire hydrant oil reservoir in bonnet shall be filled with oil.
7. Five and one-quarter (5-1/4) inch or larger valve opening, two (2) two and one-half (2-1/2) inch hose nozzles, one (1) pumper nozzle and six (6) inch or larger mechanical joint inlet.
8. All nozzles shall have National Standard threads

D. Fire Service Lines:

1. The size and material of fire service lines shall be determined by the EFPD and the persons responsible for the structure. The District will not size fire service lines.
2. Fire lines shall have an isolation valve at the main line.
3. Fire lines shall have an approved backflow prevention device.
4. Under no circumstances shall any size or manner of a tap be made on a fire hydrant or fire sprinkler branch line.
5. Under no circumstances shall any size or manner of a tap be made on a domestic service line for a fire service.
6. Fire service lines shall be considered privately owned and maintained from the connection of the service line into the isolation valve, continuing on to a building structure.
7. Fire service lines shall not be tapped off any portion of a fire hydrant lead.

303 CONSTRUCTION SPECIFICATIONS

303.1 General

A. Water mains, services and appurtenances shall be installed per the District's specifications and drawings. In general, materials, installations and testing shall be in accordance with established American Water Works Association (AWWA) standards.

303.2 Coordination of Work

A. Coordinate with District, Service Provider and EFPD of FFPD representatives for any impacts to the existing water system and provide advanced notice to impacted properties if applicable.

304 WATER DETAILS

A. The following is a list of standard details for water utility work that are part of the District Standards and Specifications:

D0.01	Typical Trench
D0.02	Utility Marker Post
D0.03	Trench Stop
D0.04	Concrete Encasement
D3.01	Fire Hydrant Profile
D3.02	Fireline Tracer Wire
D3.03	PRV Vault Plan View
D3.04	PRV Vault Cross Section
D3.05	2-inch Air-Vac Valve Installation
D3.06	Blow-Off Installation – Pipes Larger Than 12-inch
D3.07	Utility Crossing
D3.08	Master Meter Vault Assembly
D3.09	Service Line, Stop Box, and Inside Meter Installation
D3.10	Indoor Water Meter Plumbing
D3.11	Irrigation Meter Pit Assembly
D3.12	Buried Butterfly Valve
D3.13	Buried Gate Valve
D3.14	Floor Pipe Support
D3.15	Wall Penetration with Core Hole
D3.16	Pressure Gauge
D3.17	Mechanical Joint Restraint
D3.18	Concrete Thrust Block Detail
D3.19	Concrete Thrust Block Requirements
D3.20	Tapping Tee and Valve
D3.21	Polyethylene Wrap

THIS PAGE IS INTENTIONALLY BLANK

CHAPTER 400 SANITARY SEWER UTILITY

401 GENERAL PROVISIONS

401.1 General

A. These Standards and Specifications are promulgated by the District in accordance with the authority contained in the District Rules and Regulations.

401.2 Purpose

A. This Chapter pertains to all components of the sanitary sewer system. Designs are intended to provide safe, reliable sewer service to customers and serve the sewage treatment needs of customers in an efficient, cost effective and environmentally responsible manner.

B. All utilities must be clearly labeled on the plans and include the type, size, depth, etc.

401.3 General Specifications

A. General Process/Submittal Requirements:

1. The purpose of these Standards and Specifications are to provide general criteria for the design of sanitary sewer mains and appurtenances within the District sanitary sewerage service area. Any deviation from these standards must be approved by the District and additional documentation may be required. The District reserves the right for a submittal and review process as outlined in Chapter 200 for plan approval.

2. If construction has not commenced within one (1) year from District approval, the plans must be resubmitted for review and comment.

3. The District will establish and may amend procedures to be followed by the Responsible Party performing work on sanitary sewer lines. These procedures will include all requirements for documentation, submittals, fees, engineering design, construction, and acceptance.

401.4 Granting of Service

A. Sanitary sewer services shall be granted to an area, at the requestor's expense, after the following requirements have been determined. The District must have the capability and capacity to serve the proposed area, the region being served must be located within the District sanitary sewer service area, and the Responsible Party must show evidence of ownership of the property to be serviced. The request for service must be in compliance with stipulations contained in all utility agreements entered into by the District and the Rules and Regulations.

402 DESIGN CRITERIA

402.1 General

A. Sanitary sewer design and construction shall adhere to The District's criteria and standards. Additional criteria may be required by the District for the overall hydraulics of the wastewater collection system. The District may also have additional requirements based on the potential impact of proposed sewer facilities through affected public right-of-way or adjacent public infrastructure.

B. In general, sewer easements, proximity of sewer to other utilities, proximity of sewer within the Right-of-Way, and the location of sewer service lines shall comply with District standards.

C. Sanitary sewer mains and appurtenances shall be constructed in conformance with these Standards and Specifications and shall be designed by or under the direct supervision of a licensed P.E. licensed to practice in the State of Colorado.

D. Refer to Chapter 200 for construction drawing requirements related to sanitary sewer.

E. Utility marker posts must be utilized for projects in locations including ditches, unpaved roads, and across open country.

402.2 Sewer Location and Alignment

A. Sewer Location in Easements

1. A Non-Exclusive sewer easement dedicated to the District must be provided when the sewer is located outside of public right-of-way or outside of an easement within a subdivision that is dedicated to the public for utility purposes on the recorded plat of that subdivision. The easement width shall depend on location but shall be a minimum of twenty (20) feet. Sewer mains installed in easements shall ordinarily be located in the center of the easement unless stated otherwise in the easement documents and indicated in the District approved plans.

2. A combined sewer and water easement shall have a minimum width of thirty (30) feet, plus ten (10) feet for each added utility in the easement.

B. Sewer Proximity to Other Utilities

1. Sewer lines that parallel other utilities shall be located a minimum distance of ten (10) feet horizontally from water lines and five (5) feet horizontally from other utilities, as measured from outside diameter of pipe (OD) to OD. Where sewer lines cross water mains or other utilities, the sewer pipe must be a minimum vertical distance of eighteen (18) inches below the crossing pipe as measured OD to OD. If this distance is not feasible, the crossing must be designed and constructed to protect the utilities. The sewer line may be a minimum of eighteen (18) inches above the crossing pipe if C900 PVC or encased, as depicted in the District Standard Details. The design must be approved by the District.

2. If the minimum vertical separation cannot be achieved at a utility crossing, minimum protection shall consist of the installation of an impervious structural material. Sewer pipe shall be encased in concrete. The encasement on sewer line shall be at least six (6) inches thick around the entire pipe and shall extend ten (10) feet in either direction from the central point of utility crossing. In all cases, suitable backfill or other structural protection shall be provided to preclude settling and/or failure of the adjacent or perpendicular crossings.

3. Clearance from other utilities must be enough to facilitate future repairs to either utility line. A lateral distance of 10 feet should be maintained between sewer lines and other utilities, particularly gas and water lines.

402.3 Service Line Location and Alignment

A. Sanitary sewer service lines shall be designed on the shortest and straightest possible route.

B. Sanitary sewer service lines shall not enter manholes and must connect to the mains with a wye fitting at least five (5) feet from the outer diameter of sanitary sewer manholes.

C. Each structure and each subdivided lot shall be served by a separate line. Combined taps are not allowed.

D. Service lines shall be at least five (5) feet from the side property line, and no service line may be designed through any adjoining property. If possible, the service line should be located toward the low side of the lot. The service line owner may be required to gain a documented easement from the adjoining property.

E. If possible, service lines shall not extend beneath driveways or street intersections.

F. The minimum separation of sewer service from water service lines is ten horizontal (10) feet. If minimum horizontal separation cannot be achieved, the sewer line shall be concrete encased or otherwise protected with an impervious structural material approved by the District.

G. Service laterals for future development shall be extended at least ten (10) feet into the property or at least five (5) feet past the easement and shall be plugged or capped.

H. Cleanouts

1. Building sewer cleanouts shall be installed at intervals not to exceed 100 feet and/or for each aggregate change in direction 45 degrees or greater. Each cleanout must be inspected and approved by the District. Cleanouts must be the same size as the service size. Manholes must be installed on any building sewer greater than 6 inches in diameter (i.e. no cleanouts allowed).

   a. Above-grade PVC cleanouts shall not be accepted in roadways or sidewalks

   b. All cleanouts located in landscape areas are to have a protective cast iron riser and lid

      (a) Minimum Schedule 40

I. Ejector Systems/force service lines

1. When sewer service cannot be obtained under traditional gravity conditions the owner may request District approval the use of an ejector system and force service line. Force service lines less than 4 inches in diameter must connect to the public sanitary sewer through a standard tee or wye. The force service line must connect to the tee or wye in a manner to prevent leakage and to prevent sewage from entering the force service line when the main line sewer is flowing full. After the connection is inspected the connection must be concrete encased to prevent separation due to thrust. The connection must be specifically detailed and the District must approve the detail. Force service lines need to be installed at a minimum depth of three (3) feet to prevent freezing. The force service line must be protected against freezing when it is located less than three (3) feet below grade. If the force service line does not drain, it must be six (6) feet below grade or four (4) feet with two (2) inches of Blue Board insulation.

J. Size

1. The minimum allowable diameter from the main line to a building is four (4) inches. Sanitary services within a building's footprint shall adhere to the requirements set forth by the International Plumbing Code (IBC).

402.4 Manholes

A. Below grade design and construction of manholes will adhere to District's criteria. Manhole locations within the Right-of-Way and exposed portions of the manholes will adhere to additional criteria of this Chapter.

1. Manholes shall not be installed in curbs, gutters, concrete pans, sidewalks, or in the wheel path in the road. The District prefers manholes to be located within roadways when possible.

2. Lids

   a. All sanitary sewer lids shall be forged with the following: "Sanitary Sewer".

   b. Rings and covers shall be cast-iron. Manhole rings and covers shall be twenty-four (24) inch diameter manholes.

402.5 Future Connections

A. Sanitary utilities shall conclude at all junctions with a manhole unless approved by the District. Otherwise, utilities must be stubbed out to the right-of-way or limits of property at all locations that are planned for future tie-ins and must include a cleanout. Other reasonable stub-outs or main extensions may be requested by the District based on knowledge of adjacent development.

B. The end of a service stub-out shall be marked in the field with a painted green, carbonite composite utility marker reaching no less than four (4) feet above finished grade and labeled with the size, depth, and material of the sanitary service line and be sealed with a glued fitting.

C. All sanitary services shall be marked with an “S” chiseled into the concrete curb or other paved surface it crosses under.

402.6 Design Flow

A. Sewer main design shall include consideration of providing sewer service for the entire tributary area to the outfall point.

B. Seasonal groundwater depth should be taken into consideration regarding the design of the sanitary sewer system, including placement of all manholes.

C. Per Capita Flow/Capacity

1. In general, sewer capacities shall be designed for the estimated maximum population in a specific drainage area or area to be served.
2. Where future sewer infrastructure is planned, economic and engineering analysis of alternatives should accompany any request for service.
3. In determining the required capacity of sanitary sewer, the following factors shall be considered:
    a. Maximum hourly domestic sewage flow
    b. Additional maximum sewage or wastewater flow from non-residential dischargers
    c. Inflow and groundwater infiltration
        a. Include an additional 10% of peak sewage flow to account for inflow and infiltration (I/I)
    d. Topography of area
    e. Location of wastewater treatment facility
    f. Depth of excavation
4. Sewer infrastructure shall be designed based on the type of unit or zone producing sewer flows. The District uses metered water demand with an assumed ten percent (10%) irrigation loss to produce flows per legal lot. All development in commercial zones should provide flow calculations based on their own usage.
    a. The following table should be used exclusively for modeling proposed flows entering the sanitary sewer system and not for addressing the number of taps required for the proposed development. This data is intended to be used as an average flow approximation per single-family lot for each zone type in the District area. Please contact the District to confirm which zone the proposed development is located within.

Table 400- 1: Residential Sewer Modeling Flow Projection for Single-Family Lots

Zone Abbrv.	Zone Description	Average Day Flow (gpd)	Maximum Day Flow (gpd)
BR	Blue Residential	202	403
GR	Green Residential	101	202
GBR	Green Black Residential	86	173
GOR	Green Orange Residential	101	202
GRR	Green Red Residential	158	317
GYR	Green Yellow Residential	101	202
GWR	Greenwood Residential	101	202
IR	Independence Residential	101	202
OR	Orange Residential	86	173
RR	Red Residential	130	260
RYR	Red Yellow Residential	130	260
YR	Yellow Residential	115	230
YOR	Yellow Orange Residential	130	260

D. Peak Design Flow

1. Peak Hour flows must be calculated by multiplying the maximum day flow by the hourly peaking factor of 1.8.
2. Sanitary sewer must be designed to carry the peak discharge with the pipe being no more than eighty percent (80%) of maximum capacity (q/Q) for mains.
3. Sewers shall have capacity for peak hourly sewage flow and adequate velocity at minimum sewer flows.

E. Combined Sewer Interceptors

1. Combined sewers are not permitted. Storm water and underdrains must be separate and isolated from the sanitary sewer system so there is no combination of the flows. No storm water or ground water shall be introduced into the sanitary sewer collection system.

402.7 Sewer Design

A. The basis of design for all sewer projects within the District sanitary sewer jurisdiction shall comply with District details and design specifications and accompany the plan documents submitted for review. Additional computations or changes may be required after plan review. All sanitary sewer main construction within the District's sanitary sewer system, and all service line construction connecting to the District's sewer mains, shall be completed in accordance with these Standards and Specifications. The design specifications cover all sanitary sewer service line design, construction and repairs to existing facilities within the District.

B. Minimum Size

1. All gravity sewer mains shall be eight (8) inches or greater in diameter. Sewer service lines from residences or other facilities to District gravity sewer must be four (4) inches minimum.

C. Bury Depth

1. In general, sewers should be sufficiently deep to receive sewage from basements and to prevent freezing. Sewers shall not be installed at depths greater than fifteen (15) feet.

Where pipe has less than three (3) feet of cover, provisions shall be made to protect pipe from impact, loading and freezing.

D. Slope

1. All sewers shall be designed and constructed to give mean velocities (calculated with full pipe flow) of not less than two feet per second (2 fps) and no greater than ten feet per second (10 fps). The following table provides the minimum and maximum slopes allowable for the collection system. Whenever possible, sewers that are designed to carry an average design flow of less than 0.10 cfs (45 gpm) shall not be installed at a slope of less than 0.6%. Slopes within the following ranges are desirable:

Table 400- 2: Sanitary Sewer Slope Ranges per Pipe Size

Sewer Size	Minimum Slope (%)	Maximum Slope (%)
8 inch (20 cm)	0.40	7.5
12 inch (30 cm)	0.20	4.5
18 inch (46 cm)	0.11	2.5
24 inch (61 cm)	0.08	1.8

E. Alignment

1. All sewers shall be designed with straight pipe and uniform slope between manholes. The drop in a manhole shall be 0.2 feet for straight runs and for changes in direction.

F. Cleanouts and Basement Sump Pumps

1. All basement sump pumps intended to intercept groundwater shall be discharged to ground surface on the same property. Sump pumps shall not discharge to the sanitary sewer system.
2. Building sewer cleanouts shall be installed at intervals not to exceed 100 feet and/or for each aggregate change in direction exceeding 45 degrees.

G. Future Connections

1. Whenever future expansion of the system is anticipated, the stub out size and length will be at the discretion of the District.

402.8 Manholes

A. Location: Manholes shall be installed at the following points:

1. At the end of each line.
2. At all changes in grade, pipe size, or alignment.
3. At all sewer main intersections.
4. At distances, not greater than four hundred (400) feet. Greater manhole spacing may be permitted in special cases based on a review and authorization by the District.

B. All manhole exteriors shall be damp proofed.

C. Manholes shall be inspected by a District-appointed representative prior to backfill.

D. Cleanouts may not be substituted for manholes.

E. Changes in pipe size shall occur at manholes to maintain energy gradient or allow for changes in energy gradient within the manhole.

F. Where varying pipe sizes enter and exit a manhole, the crown invert elevations shall match.

G. Manhole Diameter

1. Manholes shall have a minimum of 48-inch barrels.

H. Drop Manholes

1. A drop manhole shall be provided when the sewer line entering a manhole is at an elevation of eighteen (18) inches or more above the manhole invert, or where flow velocities exceed fifteen (15) feet per second in the upstream pipe segment of a manhole. Where the difference in elevation between the incoming sewer and the manhole invert is less than eighteen (18) inches, the invert is required to be filleted (shaped) to prevent solids deposition/buildup.
2. Drop manholes shall be constructed with an outside drop connection. See Detail D4.02. Inside drop connections are allowed at the discretion of the District.
3. Drop manhole barrels shall be sized per the following table:

Table 400- 3: Sewer Drop Manhole Sizing

(Barrel Size to be based on largest of any pipe invert)

Pipe Size	Barrel Size
8-inch – 15-inch	48-inch
18-inch – 30-inch	72-inch

I. Flow Channel

1. The flow channel through manholes shall be made to conform in shape and slope to that of the sewer pipe.
2. Smooth, non-jagged surfaces are mandatory.
3. The flow channel shall be pre-formed or cast in place grout.

J. Water Tightness

1. Manholes on new sanitary lines shall be pre-cast concrete. Poured-in-place concrete may be used on an existing sewer line or as authorized by the District. Inlet and outlet pipes shall be joined to the manhole by a gasketed, flexible watertight connection.
2. Watertight manhole covers (bolt down manhole covers) shall be used wherever the manhole lids may be flooded by street runoff, high water or any other water source.

K. Rim Elevations and Manhole Markers

1. In paved roads, the manhole ring and cover shall be designed to final grade. In unpaved roads, the manhole ring and cover shall be designed to be six (6) inches below final grade.

L. Steps

1. Manhole steps shall be manufactured of reinforced polypropylene , spaced twelve (12) inch typical, sixteen (16) inch maximum on center, aligned away from invert.

M. Cones

1. All cones shall be eccentric. Each cone shall be rotated such that its opening is vertically aligned away from pipe openings thus maximizing the potential amount of manhole steps to the base of the manhole.

2. Only pre-cast manhole risers and cones shall be used and manufactured in accordance with ASTM Designation C-478 (Standard Specification for Circular Precast Reinforced Concrete Manhole Sections).

3. Risers may not be used if it causes the first step to be 16-inches below the cover. Add a barrel section as needed to maintain a maximum of 16-inches to the first step.

N. Inverted Siphons

1. The use of an inverted siphon will be evaluated on a case by case basis and will require approval from the District.

O. Manhole Testing

1. Negative air/vacuum test to ten (10) inches of mercury, time drop to nine (9) inches must be greater than one (1) minute depending on diameter and depth of manhole (1 minute minimum is standard)

402.9 Sewers in Relation to Waterways

A. Alignment

1. Sewers crossing waterways shall be designed to cross the waterway as perpendicular to the waterway flow as possible. Sewer systems shall be designed to minimize the number of waterway crossings.

B. Horizontal Location

1. Sewers located parallel or horizontal to waterways shall be located beyond the top banks of the natural floodway, and at a sufficient distance from any waterway to allow for the possible widening of the channel.

2. Sanitary sewer manholes may not be located within the limits of a detention pond.

C. Depth of Cover

1. The top of all sewers entering or crossing waterways shall be at a sufficient depth below the natural bottom of the waterway's bedrock to protect the sewer line. In general, the following cover requirements shall be met:

   a. One (1) foot of cover is required when the sewer is located in bedrock.

   b. Three (3) feet of cover is required in any material other than rock. In major waterways, more than three (3) feet of cover may be required due to anticipated scour depths and pending review from the District, Corps of Engineers and any other wetland authorities.

   c. In paved waterway channels, the top of the sewer line shall be placed three (3) feet below the bottom of the channel pavement and protected with a casing.

   d. Less cover will be approved only if the proposed sewer crossing will not interfere with any future improvements to the waterway. Reasons for requesting less cover shall be submitted for review by the District.

D. Materials

1. Sewers crossing a waterway shall be constructed of C900 PVC or other approved material. The pipe shall be constructed to remain watertight and free from changes in alignment or grade.

2. Material used to backfill the trench shall be as stated in the construction drawings and shall not cause settling. Construction documents shall call out construction requirements of the trench and backfill.

3. Controlled Low Strength Material (CLSM), i.e., a lean, sand-cement slurry or “flowable fill,” is the preferred method to prevent scour in utility trenches where groundwater is present.

E. Encasement of Pipe

1. All pipe installed through natural drainage ways must be concrete encased.
2. Pipe encasement will extend ten (10) feet beyond either top bank of the waterway, or two times the depth of the waterway past either bank of the water waterway, whichever is greater.

F. Aerial or Exposed Crossings

1. The District will not approve or allow these types of crossings:
   a. Aerial - suspended in air,
   b. Exposed crossings - not covered, pipe is visible.

402.10 Sewage Lift Stations

A. On a case by case basis, lift stations are allowed either within or outside the collection system only where specifically authorized by the District. The District will prohibit the installation of lift stations where such installations would be injurious to the operation, or future operation, of the District’s system. Lift stations are not recommended by the District, unless identified as necessary to the development, and must be designed as a regional facility with the ability to accommodate future flows.

B. All lift stations with capacities at 2,000 gallons per day (gpd) or greater are subject to Colorado Department of Health and Environment (CDPHE) Regulation 22.

C. The Developer shall be solely responsible for all costs associated with the design and construction of the lift station and force mains. This includes the cost of any easements, land acquisition, documents associated with permitting approval through CDPHE, and any other cost associated with the SDEA.

D. Where additional service area outside of the proposed development is anticipated, the District will require the lift station and associated improvements to provide capacity greater than what is necessary for the initial development. A reimbursement agreement may be appropriate in this condition.

E. Public lift stations are defined as any lift station serving more than one user and accepted by the public utility. Operations and maintenance activities shall be the responsibility of the District for all public pumping facilities only upon completion and acceptance of the proposed improvements. The Developer shall provide an operations and maintenance manuals and procedures for all equipment and processes associated with the pumping facility. The Developer shall meet with the District during the planning and design phases on equipment operations and maintenance requirements.

F. All new pumping facilities shall be monitored by the District’s Supervisory Control and Data Acquisition (SCADA) system.

G. Private lift stations are defined as any lift station serving only one user. Operations and maintenance responsibilities for private lift stations are the sole responsibility of the owner or private entity.

402.11 Silting and Erosion

A. Construction methods that minimize silting and erosion shall be employed.

B. The design engineer shall include in the project specifications the method(s) to be employed in the construction of sewers to control silting and erosion such that the land is restored back

to its original condition. Specifications shall require the cleanup, grading, seeding, and planting or restoration of all work areas to begin immediately upon the completion of construction.

402.12 Pretreatment

A. Pretreatment requirements shall adhere to the Rules and Regulations.

B. Pretreatment methods shall include the following:

1. Grease Interceptors

    a. Grease interceptors shall be required for all restaurants. The minimum volume of a grease interceptor is 750 gallons. Grease interceptors shall provide an access riser that may be used for sampling.

    b. Under-sink grease traps are not allowed

    c. Quarterly inspections measuring grease/grit depth shall be required depending on type of establishment. Repeat offenders may be subject to inspections at increased frequency and/or fines.

        a. Any time the grease trap is pumped, a manifest must be submitted to the District.

2. Sand Traps

    a. Sand traps shall be required for all car washes

C. Retrofits will be considered by the District on a case-by-case basis

D. Any commercial users planning to have high strength wastewater shall have a monitoring manhole before and after the pretreatment equipment. This applies to breweries, distilleries, etc.

403 CONSTRUCTION SPECIFICATIONS

403.1 General

A. All Sanitary Sewer Construction shall be completed in accordance with the Construction Specifications included in Appendix A.

404 SANITARY DETAILS

A. The following is a list of standard details for sanitary sewer work that are part of the District Standards and Specifications:

D0.01	Typical Trench
D0.02	Utility Marker Post
D0.03	Trench Stop
D0.04	Concrete Encasement
D4.01	Standard Manhole
D4.02	Sanitary Drop Manhole
D4.03	Sanitary Monitoring Manhole
D4.04	Manhole Ring, Steps, and Cover – Non-Bolted
D4.05	Manhole Ring and Cover – Bolted
D4.06	Manhole Base
D4.07	Manhole Base and Deflector
D4.08	Sanitary Cleanout
D4.09	Typical Service Connection
D4.10	Tapping Saddle
D4.11	Sanitary Pipe Encasement

APPENDIX A

CONSTRUCTION SPECIFICATIONS

THIS PAGE IS INTENTIONALLY BLANK

SECTION 33 10 00 FOR 6-DIGIT

SECTION 02510 FOR 5-DIGIT

WATER UTILITIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Buried pipe, fittings, hydrants, valves, appurtenances, and associated accessories for water distribution and transmission lines

B. Precast vaults

C. Disinfection of potable water piping

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM)
   1. A36 – Standard Specification for Carbon Structural Steel
   2. A48 – Standard Specification for Gray Iron Castings
   3. A53 – Standard Specification for Pipe, Steel, Black and Hot Dipped, Zinc Coated, Welded and Seamless
   4. A126 – Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings
   5. A185 – Standard Specification for Welded Steel Wire Fabric for Concrete Reinforcement
   6. A242 – Standard Specification for High-Strength Low-Allow Structural Steel
   7. A276 – Standard Specification for Stainless Steel Bars and Shapes
   8. A307 – Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60,000 PSI Tensile Strength
   9. A449 – Standard Specification for Hex Cap Screws, Bolts and Studs, Steel, Heat Treated, 120/105/90 ksi Minimum Tensile Strength, General Use
   10. A536 – Standard Specification for Ductile Iron Castings
   11. A674 – Standard Practice for Polyethylene Encasement for Ductile Iron Pipe for Water or Other Liquids
   12. A615 – Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
   13. A1011 – Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength
   14. B62 – Standard Specification for Composition Bronze or Ounce Metal Castings
   15. B88 – Standard Specification for Seamless Copper Water Tube
   16. B96 – Standard Specification for Copper-Silicon Alloy Plate, Sheet, Strip, and Rolled Bar for General Purposes and Pressure Vessels

17. B763 – Standard Specification for Copper Alloy Sand Castings for Valve Applications
18. C33 – Standard Specification for Concrete Aggregates
19. C136 – Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
20. C150 – Standard Specification for Portland Cement
21. C913 – Standard Specification for Precast Concrete Water and Wastewater Structures
22. C1227 – Standard Specification for Precast Concrete Septic Tanks
23. D429 – Standard Test Methods for Rubber Property-Adhesion to Rigid Substrates
24. D698 – Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kn-m/m3))
25. D1241 – Standard Specification for Materials for Soil-Aggregate Subbase, Base, and Surface Courses
26. D1248 – Standard Specification for Polyethylene Plastics Extrusion Materials for Wire and Cable
27. D1330 – Standard Specification for Rubber Sheet Gaskets
28. D1351 – Standard Specification for Thermoplastic Polyethylene Insulation for Electrical Wire and Cable
29. D1784 – Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
30. D1785 – Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
31. D2000 – Standard Classification System for Rubber Products in Automotive Applications
32. D2239 – Standard Specification for Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter
33. D2241 – Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)
34. D2467 – Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
35. D2454 – Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems
36. D2737 – Standard Specification for Polyethylene (PE) Plastic Tubing
37. D2774 – Standard Practice for Underground Installation of Thermoplastic Pressure Piping
38. D2837 – Standard Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials or Pressure Design Basis for Thermoplastic Pipe Products
39. D3035 – Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter
40. D3139 – Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
41. D3212 – Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
42. D3261 – Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing
43. D3350 – Standard Specification for Polyethylene Plastics Pipe and Fittings Materials

44. D3139 – Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
45. D3950 – Standard Specification for Strapping, Nonmetallic (and Joining Methods)
46. D4253 – Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table
47. D4254 – Standard Test Methods for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density
48. D6938 – Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)
49. E8 – Standard Test Methods for Tension Testing of Metallic Materials
50. F412 – Standard Terminology Relating to Plastic Piping Systems
51. F477 – Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe
52. F714 – Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Outside Diameter

B. American Water Works Association (AWWA)
1. B300 – Standard for Hypochlorites
2. B301 – Standard for Liquid Chlorine
3. B302 – Standard for Ammonium Sulfate
4. B303 – Standard for Sodium Chlorite
5. C104 – Standard for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings
6. C105 – Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems
7. C110 – Standard for Ductile-Iron and Gray-Iron Fittings
8. C111 – Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
9. C115 – Flanged Ductile-Iron Pipe with Ductile-Iron or Grey-Iron Threaded Flanges
10. C116 – Standard for Protective Fusion-Bonded Epoxy Coatings for Interior and Exterior Surfaces of Ductile-Iron and Gray-Iron Fittings
11. C150 – Standard for Thickness Design of Ductile-Iron Pipe
12. C151 – Standard for Ductile-Iron Pipe, Centrifugally Cast
13. C153 – Standard for Ductile-Iron Compact Fittings
14. C200 – Standard for Steel Water Pipe 6 In. (150 mm) and Larger
15. C203 – Standard for Coal-Tar Protective Coatings & Linings for Steel Water Pipes
16. C206 – Standard for Field Welding of Steel Water Pipe
17. C207 – Standard for Steel Pipe Flanges for Waterworks Service, Sizes 4 In. Through 144 In. (100 mm Through 3,600 mm)
18. C213 – Standard for Fusion-Bonded Epoxy Coatings and Linings for Steel Water Pipe and Fittings
19. C214 – Standard for Tape Coatings for Steel Water Pipelines
20. C219 – Standard for Bolted, Sleeve-Type Couplings for Plain-End Pipe
21. C500 – Standard for Metal-Seated Gate Valves for Water Supply Service
22. C502 – Standard for Dry-Barrel Fire Hydrants
23. C504 – Standard for Rubber-Seated Butterfly Valves
24. C509 – Standard for Resilient-Seated Gate Valves for Water Supply Service
25. C515 – Standard for Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Service
26. C550 – Standard for Protective Epoxy Interior Coatings for Valves and Hydrants

27. C600 – Standard for Installation of Ductile Iron Mains and Their Appurtenances
28. C604 – Standard for Installation of Buried Steel Water Pipe – 4 In. (100 mm) and Larger
29. C605 – Standard for Underground Installation of Polyvinyl Chloride (PVC) and Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe and Fittings
30. C651 – Disinfecting Water Mains
31. C700 – Standard for Cold-Water Meters – Displacement Type, Metal Alloy Main Case
32. C800 – Standard for Underground Service Line Valves and Fittings
33. C900-2016 – Standard for Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. Through 60 In. (100 mm Through 1,500 mm) for Water Transmission and Distribution
34. C901 – Standard for Polyethylene (PE) Pressure Pipe and Tubing 1/2 In. (13 mm) Through 3 In. (76 mm) for Water Service
35. C906 – Polyethylene (PE) Pressure Pipe and Fittings 4 in. (100 mm) Through 63 In. (1,600 mm) for Water Distribution and Transmission
36. M11 – Steel Pipe: A Guide for Design and Installation
37. M17 – Standard for Installation, Field Testing, and Maintenance of Fire Hydrants
38. M23 – Standard for PVC Pipe Design and Installation
39. M41 – Standard for Ductile-Iron Pipe and Fittings

C. Foothills Fire Protection District

D. National Fire Protection Agency (NFPA)

E. Colorado Department of Transportation (CDOT)

F. Occupational Safety and Health Administration (OSHA)

G. NSF International:
   1. Standard 60 – Drinking Water Treatment Chemicals – Health Effects
   2. Standard 61 – Drinking Water System Components – Health Effects

H. Surface Preparation Standards (SSPC)

I. American Welding Society (AWS):
   1. D1.1 – Structural Welding Code – Steel

J. National Association of Corrosion Engineers (NACE):
   1. SP0169 – Control of External Corrosion on Underground or Submerged Metallic Piping Systems
   2. SP0286 – Electrical Isolation of Cathodically Protected Pipelines

K. Uni-Bell PVC Pipe Association:
   1. Uni-Pub-8: Tapping Guide for PVC Pressure Pipe

L. Plastics Pipe Institute (PPI):

1. TR-4 – HDB / HDS / SDB / PDB / MRS Ratings for Thermoplastic Piping Materials or Pipe
2. TR-33 – Generic Butt Fusion Joining Procedure for Field Joining of Polyethylene Pipe
3. Handbook of Polyethylene Pipe
4. Material Handling Guide

M. Ductile Iron Pipe Research Association (DIPRA):
1. Thrust Restraint Design for Ductile Iron Pipe

N. American Railway Engineering and Maintenance-Of-Way Association (AREMA)

O. International Plumbing Code (IPC)

P. International Code Council (ICC)

Q. Underwriters' Laboratories (UL)

1.3 SUBMITTALS

A. Submit under provisions of front end specifications if provided by an engineer

B. Piping Shop Drawings: Provide piping layout and assembly drawings with fitting dimensions. Provide sufficient information to verify compliance with specifications

C. Precast Vault Shop Drawings: Provide sufficient data to verify compliance with the specifications and to illustrate construction and assembly of precast vault

D. Piping Product Data: Provide manufacturer's catalog information with dimensions, material and assembled weight. Indicate pressure ratings for pipe, fittings, valves
1. Pipe materials
2. Special, fitting, and coupling details
3. Joint restraint system
4. Valves
5. Laying and installation schedule
6. Specifications and data sheets
7. Affidavits of compliance for protective shop coatings and linings

E. Precast Vault
1. Product Data: Provide manufacturer catalog information on castings, grating, and accessories to indicate compliance with specifications of precast vault
2. Design Data: Include calculations prepared by precast manufacturer indicating design loads and material requirements for reinforcement

F. Manufacturer's Certificate: Certify that products meet or exceed specified requirements and applicable standards. Provide prior to shipment.

G. Test Reports: Submit reports of field pressure and disinfection tests

H. Test Reports: Indicate disinfection results comparative to specified requirements

1.4 PROJECT RECORD DOCUMENTS

A. Submit Shapefile to District based on final record construction documents

B. Accurately record actual locations of piping mains, valves, connections, top of pipe elevations, and any mapped or unmapped utilities

C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities

D. Disinfection report; record:
1. Type and form of disinfectant used
2. Date and time of disinfectant injection start and time of completion
3. Test locations
4. Initial and 24 hour disinfectant residuals (quantity in treated water) in parts per million (ppm) or milligram per liter (mg/L) for each outlet tested
5. Date and time of flushing start and completion
6. Disinfectant residual after flushing in ppm for each outlet tested

1.5 QUALITY ASSURANCE

A. Manufacturers shall be experienced in the design and manufacturing of materials specified herein for a minimum period of 5 years

B. All pipe of the same material [PVC, HDPE, steel, ductile iron, etc.], regardless of diameter, shall be supplied by a single manufacturer

C. Perform Work in accordance with AWWA C651, C652, C653, and the Colorado Department of Public Health and Environment (CDPHE), Jefferson County, and the District

D. Contractor shall conduct visual inspection before installation

E. Provide manufacturer's name and pressure rating marked on piping and valves

F. Provide piping complete with all fittings, jointing materials, supports, joint restraint system, and necessary appurtenances for watertight, fully operational water lines

1.6 REGULATORY REQUIREMENTS

A. Conform to all municipal codes and ordinances, laws and regulations of Jefferson County, the District, CDPHE, the notes and details on the Final Drawings and as specified herein, and CDPHE Stormwater Management and/or Construction Dewatering Permit

B. Conform to AWWA C651, C652, C653, as appropriate, and CDPHE Design Criteria for Potable Water Systems for performing the work of this Section

C. In case of apparent conflict, CDPHE requirements govern over these specifications

D. In absence of State and local regulations, International Plumbing Code applies

E. NFPA Compliance: Install fire water systems in accordance with NFPA 24 "Standard for the Installation of Private Fire Service Mains and Their Appurtenances"

F. UL Compliance: Provide fire hydrants that comply with UL 246 "Hydrants for Fire-Protection Service," and are listed by UL.

G. Contractor, not Owner, shall prepare, submit, pay, and otherwise obtain all necessary permits from all appropriate entities

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site under provisions specified by the manufacturer and front end specifications provided by the engineer

B. Delivery
   1. Ship rubber gaskets in cartons and store in a clean area away from grease, oil, ozone producing electric motors, heat and the direct sunlight

C. Storage
   1. Store pipe, fittings and gaskets in clean locations protected from environmental conditions such as: direct sunlight, mud, etc.
   2. Do not use pipe and fittings stored in direct sunlight for periods in excess of 18 months
   3. Store pipe on a flat surface which provides even support for the barrel with bell ends overhanging
      a. Do not stack pipe higher than 5 feet

D. Storage: Use the following precautions for valves, during storage:
   1. Do not remove end protectors unless necessary for inspection; then reinstall for storage
      a. Protect valves from weather by storing indoors or support valves off ground or pavement in watertight enclosures when outdoor storage is necessary

E. Handling
   1. Handle so as to insure installation in sound undamaged condition
   2. Use equipment, tools and methods for unloading, reloading, hauling and laying that do not damage pipe or cause an impact. Damaged pipe will be cause for rejection.
   3. Use hooks or straps with broad, well-padded contact surfaces for lifting sections of pipe

F. Preparation for Transport: Prepare valves, for shipping as follows: Ensure that valves are dry and internally protected against rust and corrosion. Protect valves against damage to threaded ends, flange faces, and weld ends. Set valves in best position for handling. Set valves closed to prevent rattling

G. Deliver and store valves and accessories in shipping containers with labeling in place in accordance with AWWA C500

H. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation

I. Seal valve ends to prevent entry of foreign materials into valve body

J. During loading, transporting and unloading, exercise care to prevent damage to material
   1. Use nylon slings only
   2. Do not drop pipe or fittings
   3. Do not roll or skid against pipe already on ground
   4. Repair any damage done to coating or lining
   5. Handle per manufacturer's recommendations
   6. Store rubber gaskets in cool dark location
   7. Store all material on wood pallets or timbers

K. Adequately tag or otherwise mark all piping, fittings, and valves as to size per AWWA C509 and C900

L. Shop coated materials shall be handled, transported, stored and shipped in a manner that will prevent damage to the coating and lining. Coating or lining damaged in handling or other operations shall be repaired to the approval of and at no additional cost to the Owner

M. Any damage to the pipe or the protective coating from any cause during the installation of the pipeline and before final acceptance by the Engineer shall be repaired in accordance with these Specifications and at no additional cost to the Owner

N. Precast Concrete Structures for PRV and Water Meters
   1. Transport and handle precast concrete units with equipment to protect from dirt and damage
   2. Do not place precast concrete units in position which will cause damage
   3. Handle precast concrete structures by means of lifting inserts. Do not move from manufacturer’s yard until curing is complete.

1.8 JOB CONDITIONS

A. All work which requires the interruption of active water service lines must be completed as quickly as possible in order to minimize inconvenience to customers and risk to the District

B. Underground Obstructions

1. Underground Obstructions known to Engineer are shown on Final Drawings
    a. Locations shown may prove inaccurate and other obstructions not known to Engineer may be encountered
    b. Contractor shall field locate and verify all obstructions where or not shown on the Final Drawings
2. Notify each utility owner and request utility be field located by surface reference at least 48 hours prior to trenching or excavation
3. Expose and verify size, location and elevation of underground utilities and other obstructions where conflicts might exist sufficiently in advance to permit changes in the event of a conflict
    a. Notify Engineer and Owner in case of a conflict
    b. In case of a conflict, the proposed work may be changed by Engineer
4. Maintain, protect, and support by shoring, bracing or other means existing utilities and appurtenances

C. Verify existing system operation, pressures, and valve settings (open or closed) prior to construction

PART 2 PRODUCTS

2.1 PIPE, FITTINGS, AND ACCESSORIES

A. Comply with District Standards and Standard Details

2.2 DUCTILE IRON PIPE (FOR WATER MAINS)

A. Ductile Iron Pipe (DIP) is preferred pipe material for water mains.

B. Shall be in accordance with AWWA C115, C150, and C151 except as otherwise specified or indicated on the Final Drawings

C. Manufacturers
1. U.S. Pipe
2. American Cast Iron Pipe Company
3. Griffin Pipe Products Company
4. Or accepted substitution

D. Pipe: ANSI A21.51/AWWA C151:
1. Class 51 or 52, pressure rating 350 psi
2. For push-on joints, mechanical joints, restrained mechanical joints, or restrained joints: Class 51, single gasket
3. Lining: cement mortar, AWWA C104
4. External coating for buried pipe: asphaltic coating, 1 mil

E. Fittings: Ductile iron compact fittings: ANSI A 21.53/AWWA C153
1. Working pressure rating: 350 psi rating
2. Joint: Mechanical joints with restraints

3. Coating:
    a. Exterior: AWWA C111, Asphalt coated
    b. Interior: AWWA C104 and C111, lined with double thickness cement seal coated
4. Tapping Sleeve and Tapping Valve: Complete assembly, including tapping sleeve, tapping valve, and bolts and nuts. Use sleeve and valve compatible with tapping machine.
    a. Tapping Sleeve: Cast-iron or ductile-iron 2-piece bolted sleeve with flanged outlet for new branch connection. Sleeve may have mechanical joint ends with rubber gaskets or sealing rings in sleeve body. Use sleeves that mate with size and type of pipe material being tapped. Outlet flange shall be of a size required for branch connection.

F. Joints
1. Mechanical joints: ANSI A21.11/AWWA C111
    a. Bolts and nuts: High strength, low alloy steel, "Cor-Ten" or approved substitution
2. Mechanical joints with tie rods
    a. Tie rods: ASTM A307, galvanized entire length
    b. Steel pipe spacers: ASTM A53 , standard weight galvanized
    c. Washers: ASTM A27 plain steel, galvanized
    d. Plastic plugs: As recommended by pipe manufacturer
3. Push-on joints: ANSI A21.11/AWWA C111
    a. Pressure rated 350 psi
    b. Lubricant: Heavy vegetable soap solution suitable for potable water contact
4. Gaskets: EPDM gaskets in conformance with AWWA C111. Natural rubber is not acceptable.
    a. Pressure rated 350 psi
5. Threaded connections: ANSI B1.20.3 NPT: provide boss or tapping saddle at all tapped connections
6. Mechanical couplings:
    a. Dresser, Style 38
    b. Rockwell, 411
    c. Romac, 501
    d. Or accepted substitution
7. Insulated Mechanical Couplings:
    a. Dresser, Style 39
    b. Rockwell, Style 416
    c. Romac, IC501
    d. Or accepted substitution
8. Mechanical joints with restraint device
    a. Provided for all ductile iron fittings
    b. 360° serration lock engagement type
    c. Nuts and bolts torqued to requirements of manufacturer
    d. Working pressure rated at 350 psi minimum
    e. Glands color coded: Black
    f. Manufacturers:
        i) EBBA Iron Inc., Meg-a-Lug Series 1100
        ii) Uni-Flange Corporation, 1400 Series

iii) Romac Industries Inc., RomaGrip™
iv) Or accepted substitution

2.3 PVC PIPE – 4" TO 12" DIAMETER

A. DIP is preferred pipe material for water mains and transmission lines. Use of PVC pipe to be approved by District on a case-by case basis.

B. Manufacturers:
1. JM Eagle
2. North American Pipe Corporation
3. Diamond Plastics Corporation
4. Vinyltech Corporation
5. Or accepted substitution

C. Pipe material: AWWA C900, DR 18 except as otherwise specified or indicated on the Final Drawings

D. Marking: Identification markings on pipe shall conform to AWWA C900

E. Fittings: Ductile iron compact fittings: ANSI A 21.53/AWWA C153
1. Working pressure rating: 350 psi rating
2. Joint: Mechanical joints with restraints
3. Coating:
a. Exterior: AWWA C111
b. Asphalt coated interior: AWWA C104 and C111, lined with double thickness cement and seal coated

F. Joints: ASTM D3139, integral bell or mechanical joint
1. Push-on joints: pipe to pipe joints, except as otherwise specified or indicated on Final Drawings. Push on joints are not permitted on fittings or valves
a. Integral bell type with elastomeric gaskets, ASTM F477 factory installed
b. Suitable for buried service
c. Gaskets:
i) Material: Virgin SBR rubber suitable for potable water conforming to AWWA C111
ii) Lubricant shall be suitable for potable water contact
2. Restraint device for PVC push on joint
a. Restraint material: ASTM A536 , ductile iron
b. A split ring shall be used behind the pipe bell. A serrated ring shall be used to grip the pipe, and a sufficient number of bolts shall be used to connect the bell ring and the gripping ring
c. Nuts and bolts torqued to requirements of manufacturer
d. Pressure rating consistent with pipe pressure rating
e. Restraint coatings shall be consistent with manufacturer's standard
f. Manufacturers:
i) EBAA Iron Inc. "Series 1600"

ii) Romac Industries "Series 611"
iii) Or accepted substitution

3. Mechanical joint restraint
    a. Provide mechanical joint restraint for all ductile iron fittings connecting to PVC pipe
    b. Restraint devices for shall consist of multiple gripping wedges incorporated into a follower gland meeting the applicable requirements of ANSI/AWWA A21.10/C110
    c. Pressure rating consistent with pipe pressure rating
    d. Restraint coatings shall be consistent with manufacturer's standard
    e. Manufacturer:
        i) EBAA Iron "MEGALUG 2000 PV"
        ii) Romac Industries "Roma-Grip"
        iii) Or accepted substitution

G. Couplings
1. Mechanical couplings:
    a. Dresser Style 38
    b. Rockwell 411
    c. Romac Industries 501
    d. Smith Blair 461
    e. Or accepted substitution
2. Insulated Mechanical Couplings:
    a. Dresser Style 39
    b. Romac Industries IC501
    c. Or accepted substitution
3. Transition Couplings:
    a. Rockwell 415
    b. Dresser Style 39
    c. Romac Industries TC400
    d. Smith Blair 413
    e. Or accepted substitution
4. Glands color coded: Black

H. Couplings for connection between dissimilar water distribution pipe materials
1. Material: Ductile Iron, ASTM A536 Grade 65-45-12
2. End Rings: Ductile Iron, ASTM A536
3. Gaskets: Virgin SBR rubber suitable for potable conforming to AWWA C111
4. Bolts and Heavy Hex Nuts: UNC 5/8" rolled threads with black finish.
5. Manufacturer:
    a. JCM
    b. EJ Prescott
    c. EBAA Iron, Inc.
    d. Or accepted substitution

2.4 PVC PIPE – 14” TO 48” DIAMETER

A. DIP is preferred pipe material for water mains and transmission lines. Use of PVC pipe to be approved by District on a case-by case basis.

B. Manufacturers
   1. JM Eagle
   2. North American Pipe Corporation
   3. Diamond Plastic Industries
   4. Vinyltech Corporation
   5. Or accepted substitution

C. Pipe: AWWA C900, DR 21 except as otherwise specified or indicated on the Final Drawings

D. Marking: Identification markings on pipe shall conform to AWWA C900

E. Fittings: Ductile iron fittings, ANSI A 21.53/AWWA C153 or ANSI A21.10/AWWA C110
   1. Working pressure rating: 250 psi rating
   2. Joint: mechanical joints with restraints
   3. Coating:
      a. Exterior: AWWA C111
      b. Asphalt coated interior: AWWA C104 and C111, lined with double thickness cement and seal coated

F. Joints: ASTM D3139, integral bell or mechanical joint
   1. Push-on joints: pipe to pipe joints, except as otherwise specified or indicated on Final Drawings. Push on joints are not permitted on fittings or valves
      a. Integral bell type with elastomeric gaskets, ASTM F477 factory installed
      b. Suitable for buried service
      c. Gaskets:
         i) Material: Virgin SBR rubber suitable for potable conforming to AWWA C111
         ii) Lubricant shall be suitable for potable water contact
   2. Restraint device for PVC push on joint
      a. Restraint material: ASTM A536, ductile iron
      b. A backup ring shall be used behind the PVC bell. A restraint ring, incorporating a plurality of individually-actuating gripping surfaces, shall be used to grip the pipe, and a sufficient number of bolts shall be used to connect the bell ring and the gripping ring
      c. Pressure rating consistent with pipe pressure rating
      d. Restraint coatings shall be consistent with manufacturer's standard
      e. Manufacturers:
         i) EBAA Iron Inc. "Series 2800"
         ii) Romac Industries "Series 470"
         iii) Or accepted substitution
   3. Mechanical joint restraint

a. Provide mechanical joint restraint for all ductile iron fittings connecting to PVC pipe
b. Restraint devices for shall consist of multiple gripping wedges incorporated into a follower gland meeting the applicable requirements of ANSI/AWWA A21.10/ C110
c. Pressure rating consistent with pipe pressure rating
d. Restraint coatings shall be consistent with manufacturer's standard
e. Manufacturer:
i) EBAA Iron "MEGALUG 2000 PV"
ii) Romac Industries "Roma-Grip"
iii) Or accepted substitution

G. Couplings
1. Mechanical couplings:
a. Dresser Style 38
b. Rockwell 411
c. Romac Industries 501
d. Smith Blair 461
e. Or accepted substitution
2. Insulated Mechanical Couplings:
a. Dresser Style 39
b. Romac Industries IC501
c. Or accepted substitution
3. Transition Couplings:
a. Rockwell 415
b. Dresser Style 39
c. Romac Industries TC400
d. Smith Blair 413
e. Or accepted substitution
4. Glands color coded: Black

H. Couplings for connection between dissimilar water distribution pipe
1. Material: Ductile Iron, ASTM A536 Grade 65-45-12
2. End Rings: Ductile Iron, ASTM A536
3. Gaskets: Virgin SBR rubber suitable for potable conforming to AWWA C111
4. Bolts and Heavy Hex Nuts: UNC 5/8" rolled threads with black finish.
5. Manufacturer:
a. JCM
b. EJ Prescott
c. Or accepted substitution

2.5 PVC SADDLE TAP

A. Provide saddle tap for connection to air release/vacuum breaker combination valves as shown on the Final Drawings

B. Use tapping saddle manufactured specifically for C900 PVC pipe with stainless steel wide band straps, nuts and washers

C. Manufacturer:
   1. Mueller
   2. Or accepted substitution

2.6 HDPE PIPE (FOR WATER MAINS)

A. DIP is preferred pipe material for water mains. Use of HDPE pipe to be approved by District on a case-by case basis.

B. Manufacturers
   1. JM Eagle
   2. High Country Fusion
   3. Performance Pipe
   4. WL Plastics
   5. ISCO Pipe
   6. Or accepted substitution

C. Material
   1. The pipe shall be manufactured from a PE 4710 resin compound listed with the Plastic Pipe Institute (PPI) as TR-4.
   2. The resin material shall be in accordance with ASTM D3350 with a minimum cell classification of 445574C/E.
   3. This resin material shall have a Long Term Hydrostatic Strength of 1600 PSI when tested in accordance to ASTM D2837.
   4. Pipe dimensions shall be in accordance with ASTM D3035 as a minimum.
   5. The final compounded material shall contain a minimum of 2% carbon black
   6. The pipe shall contain no recycled material except that generated by the pipe manufacturer in their own plant from resin compound of the same specification and raw material supplier. The pipe shall be homogeneous throughout and free of visible cracks, holes, foreign inclusions, voids, or other injurious defects.
   7. Pipe shall have a manufacturing standard of ASTM F714 and be manufactured by an ISO 9001 certified manufacturer.
   8. All pipes and fittings shall be suitable for use as pressure conduits, listed as NSF 14, and per AWWA C906 Pressure Class (PC) 100 have a nominal burst value of three and one-half times the Working Pressure Rating (WPR) of the pipe and/or fitting
   9. The pipe shall be DR11 unless noted otherwise on the Final Drawings

D. Fittings
   1. All fittings shall be PE 4710 HDPE, minimum Cell Classification of 445574C/E as determined by ASTM D3350, and approved for use by AWWA.
   2. All fittings shall be of the same base resin as the pipe.
   3. All fittings shall have a working pressure rating equal to the pipe unless otherwise specified in the plans.

4. All fittings shall be homogeneous throughout and free of visible cracks, holes, foreign inclusions, voids, or other injurious defects.
5. Butt Fusion Fittings
    a. Molded butt fusion fittings shall be in accordance with ASTM D3261 and shall be manufactured by injection molding, a combination of extrusion and machining, or fabricated from HDPE pipe conforming to this specification.
6. Compression Type Mechanical Coupling
    a. Suitable for joining HDPE to HDPE, HDPE to PVC, or HDPE to DIP
    b. Factory coat coupling internally and externally with a fusion bonded epoxy
    c. Reinforce HDPE pipe with a split ring type stiffener in pipe bore
        i) Size stiffeners for size of HDPE pipe being joined
        ii) Supply feature that prevents stiffener from sliding completely into pipe
        iii) Size stiffeners for length of mechanical coupling and not to extend outside of body of mechanical coupling
        iv) Mark stiffener with pipe diameter
        v) Factory coat stiffeners internally and externally with fusion bonded epoxy
    d. Use seal and restraint type coupling. Requirements for type of couplings are specified herein or shown on the Final Drawings
        i) Approved Manufacturers:
        ii) JCM, Industries
        iii) Sur-Grip
        iv) Romac
        v) Or accepted substitution

E. Transition Couplings: One piece assembly
1. One end being HDPE pipe with butt fusion joining technique
2. Other end being either steel or brass pipe threaded suitable for connecting ductile iron, threaded fittings, or threaded valves
    a. Approved Manufacturers:
        i) Central Plastics Company
        ii) Industrial Pipe Fittings, Inc.
        iii) Or accepted substitution

F. Pipe fittings and flanged connections, to be joined by thermal butt-fusion, shall be of the same type, grade, and class of polyethylene compound and supplied from the same raw material supplier.

G. Sidewall fusions for connections to outlet piping shall be performed in accordance with HDPE pipe and fitting manufacturer's specifications. The heating irons used for sidewall fusion shall have an inside diameter equal to the outside diameter of the HDPE pipe being fused. The size of the heating iron shall be ¼ inch larger than the size of the outlet branch being fused.

H. Socket fusion, hot gas fusion, threading, solvents, and epoxies will not be used to join HDPE pipe.

I. Flange Gaskets

1. Flange gaskets shall be full-faced and shall be in accordance with ASTM D1330
2. Flange gasket drilling pattern shall conform to ANSI B16.1/B16.5
3. Flange gaskets shall be 1/16” thick for flanges up to 14” diameter. 1/8” thick gaskets shall be provided for flanges over 14” diameter
4. Gasket material shall be EPDM

2.7 COPPER TUBING – 3 INCHES OR LESS (FOR SERVICE LINES)

A. Manufacturers:
   1. Mueller
   2. Or accepted substitution

B. Copper Tube: ASTM B88; Type K, soft-annealed temper with flared connections.
   1. Fittings: Wrought-copper solder-joint fittings, ANSI B16.22; soldered joints, pressure type. Compression fitting will not be accepted.

2.8 POLYETHYLENE TUBING (FOR SERVICE LINES)

A. Service lines shall be Polyethylene (PE) or Cross-linked Polyethylene (PEX) Copper Tube Size (CTS) potable water tubing
   1. Service line pipe sizes are indicated on the Final Drawings.
   2. PE
      a. Manufacturers:
         i) Centennial Plastics, Inc.
         ii) Or accepted substitution
      b. Resin formulation: PE 3608
      c. Cell Classification of 4345464C per ASTM D2239 and ASTM D2737
      d. Hydrostatic Design Basis (HDB)
         i) HDB: 1600 psi @ 73.4 °F
         ii) HDB: 800 psi @ 140 °F
      e. Joining:
         i) Shall be by butt-fusion (HDPE) or compression fitting (PEX)
         ii) All personnel conducting butt-fusion should be experienced and follow guidelines published by the pipe manufacturer or by PPI in TR-33
   3. PEX
      a. Resin Formula: PEX 5206 (PEX-A) or PEX 5306 (PEX-B)
      b. Piping shall be PEX-A 5206 manufactured from crosslinked polyethylene materials with a cell classification in accordance with ASTM F876 and AWWA C-904-22
         i) Materials shall be third-party certified to meet ANSI/NSF61, ANSI/NSF372, and comply with ASTM F2023
      c. PEX service lines shall conform to ASTM F877
      d. Hydrostatic Design Basis (HDB) per PPI TR-4
         i) HDB: 1250 psi @ 73 °F
         ii) HDB: 800 psi @ 180 °F
      e. Joining:

i) Fittings and joining to be at the discretion of the contractor and follow manufacturer recommendations and ASTM standards for the appropriate fitting type

B. Installing:
1. To be direct buried
2. Buried pipe must be supported by proper embedment material as shown on the Final Drawings
3. Refer to PPI's "Handbook of Polyethylene Pipe" and follow all local, state, and/or federal guidelines

C. Safe Handling:
1. To safely handle and store PE pipe, refer to PPI's "Material Handling Guide"

D. Disinfection:
1. Disinfection of service line should follow specifications herein

E. Testing:
1. All pipe shall be hydrostatically tested after installation as specified herein.

2.9 SERVICE LINE ACCESSORIES

A. Corporation Stops: AWWA C800, Bronze body and ground key plug. Threaded inlet and outlet matching service piping material
1. Bronze body and ground key plug. Threaded inlet and outlet matching service piping material.
2. Manufacturers:
a. Mueller, H-15013
b. Ford, FB1000G
c. A.Y. McDonald, 4701BQ or 4701BT
d. Or accepted substitution

B. Curb Stops: 2" bronze body and ground key plug. Threaded inlet and outlet matching service piping material.
1. Manufacturers:
a. Mueller
b. Ford
c. Or accepted substitution

C. Curb box: Arch pattern base, coal tar coated extensions. Include 1 inch tapped hole with a centered plug having a 5/8-inch hexagon nut. Include cover with lettering "WATER." Fireline covers to include cover with lettering "FIRE".
1. Manufacturers:
a. A.Y. McDonald, 5607 with 5601-1 lid
b. Or accepted substitution

D. Service Clamps: Complete assembly, including double strap service clamp, corporation stop, and bolts and nuts. Use service clamp and stop compatible with drilling machine.

1. Cast iron or ductile iron with gasket and AWWA C800 threaded outlet for corporation stop, and threaded end straps.
2. Manufacturers:
    a. Mueller Co.
    b. Romac Industries, Inc.
    c. Or accepted substitution

E. Meter box (to be used for irrigation meters only)
1. 24-inch diameter meter box with minimum 0.30-inch thick PVC shell for 3/4" or 1" meter with a 1.5” antenna hole. Meter vault to be use for any meters larger than 1”.
2. Lid: cast-iron with closed cell insulating pad
3. Provide with shell extensions as required to satisfy bury depth requirements
4. Manufacturers:
    a. Mueller Co.
    b. Hunt
    c. Ford
    d. Or accepted substitution

2.10 CATHODIC PROTECTION

A. Polyethylene encasement
1. Provide encasement for all ductile iron pipe, fittings, restrained mechanical joints and valves
2. High-density, cross-laminated polyethylene film (minimum 4 mil) or linear low-density polyethylene film (min 8mil)
3. Polyethylene flat tube: meet appropriate minimum width for size of pipe installed per AWWA C105, Method A, secured with polyethylene compatible adhesive tape
4. Flat sheet polyethylene: Provide wrapping odd shaped appurtenance following C105, secured with polyethylene compatible adhesive tape
5. Joint tape: Self-sticking, PVC or polyethylene, 2-inch wide, 10 mils thick
    a. Manufacturer:
        i) Chase "Chasekote 750"
        ii) Kendall "Polyken 900"
        iii) 3M "Scotchrap 50"
        iv) Or accepted substitution
6. Strapping: Nonmetallic, water resistant, ASTM D3950

B. Field applied tape encasement: AWWA C214
1. Primer: Polyken #927
2. Tape: Polyken #930 or #934
3. Apply primer and Polyken wrap for harness rods

2.11 PIPE ACCESSORIES

A. Underground Type Plastic Line Identification Marker
1. Manufacturer’s standard permanent, continuous-printed plastic tape with metallic core, intended for direct-burial service; not less than 6-inch wide x 4 mils thick.

Provide colored (green/blue/yellow) tape with black printing reading “CAUTION WATER LINE BURIED BELOW.” Provide identification markers of one of the following: Potable Water, Non-Potable Water (Purple Pipe)

a. Allen Systems, Inc.
b. Emed Co., Inc.
c. Seton Name Plate Corp.
d. Or accepted substitution

B. Corrosion Control for DIP
1. Rust inhibitive primer:
    a. Tnemec "Series 77H Chem-Prime"
    b. Or accepted substitution
2. Rust preventative compound:
    a. Houghton "Rust Veto 344"
    b. Rust-Oleum "R-9"
    c. Or accepted substitution

C. Tracer Wire
1. Provide tracer wire for all pipes
2. All tracer wire shall be 12 AWG solid copper wire coated with 45 mil Type HMW - PE blue insulation compliant with ASTM D1351 specifically designed for direct burial in corrosive soil or water
3. UL listed

D. Tracer Wire Test Stations for all pipe
1. 4-inch with locking lid
2. Manufacturers:
    a. CP Test Services
    b. Glenn Series "Glenn-4"
    c. Or accepted substitution

E. Carrier Pipe in Casing Pipe
1. Pipe Spacers
    a. Pipe bands shall be fabricated of a minimum of 14 gauge 304 stainless steel
        i) Steel strapping shall be in accordance with ASTM A36
    b. Hardware:
        i) Bolts: 5/16-inch stainless-steel flange bolts
2. Insulators
    a. Polyethylene casing insulator band and skids with stainless-steel bolts
3. End Seals
    a. Fabricated of EPDM or neoprene
    b. Durometer hardness: 60
    c. Minimum thickness: 1/8 inch
    d. Hardware: 304 stainless steel with worm screws
    e. Manufacturers
        i) Advance Products & Systems, Inc.
        ii) Pipeline Seal & Insulator, Inc.

iii) Or accepted substitution

2.12 GATE VALVES – 3" TO 12" AND ACCESSORIES

A. Manufacturers:
   1. Mueller
   2. American AVK
   3. American Flow Control
   4. Or accepted substitution

B. AWWA C509, Iron body, bronze trim, two O-ring stem seals, non-rising stem with square nut, single wedge, resilient seat, mechanical joint ends, extension stem, and extension valve box, pressure rating of 250 psi. For installation in horizontal or near horizontal pipe lines
   1. Non-adjustable elastomeric stem seals
      a. Adjustable packing glands are not permitted
   2. Direct operation of stem from above via 2-inch square nut
      a. No gear box provided
   3. Rotation: Counterclockwise to open with the word "OPEN" and an arrow indicating the direction to open cast on valve body or operating nut

C. Rotation: Valves shall open left and be clearly marked
   1. Provide the word "OPEN" and an arrow indicating the direction to open cast on valve body or operating nut.
   2. Contractor to confirm nut size with the District

D. Valve stem material: ASTM B763, UNS alloy C99500 minimum yield strength of 40,000 psi
   1. Valve stem extensions: Provide valve stem extensions as necessary for proper valve operation with a 7 foot key with tee handle and 2” nut
   2. Provide one (1) key to Owner prior to project closeout

E. Extension stems
   1. Provide where indicated on the Final Drawings, specified, or required for proper operation and for buried valves.
   2. Non-rising stems
      a. Solid steel shafting with O.D. not less than O.D. of valve stem or galvanized steel pipe with I.D. not less than O.D. of valve stem
      b. Connected to the valve by a flexible socket coupling
      c. All other connections pinned
      d. Extend stem to within 6-inch of grade
      e. Provide spacers to center stem in valve box
      f. Provide wrench nut

F. Coating
   1. AWWA C550 and NSF 61 certified
   2. Minimum 8 mils dry film thickness

3. Fusion bonded epoxy applied to all ferrous metal surfaces after cleaning surfaces of grease, dirt and moisture, and performing near-white blast cleaning following SSPC-SP10
4. Do not coat fasteners or machined surfaces subject to contact and relative movement against other surfaces during operation of valve or other surfaces where such coating would compromise proper installation or functionality of valve

G. Valve boxes, depth as required for valve
1. Three piece cast iron (complying with ASTM A48, Class 20A) adjustable screw type, 5.25-inch diameter, minimum thickness of 3/16 inch
2. Box, cover, and base coated by dipping in asphalt varnish.
3. Cover marked with word, “WATER.”
4. Provide extension piece to permit 6-inch adjustment above finish grade
5. Manufacturers:
   a. Tyler Pipe Company "Series 6860 with #160 oval base"
   b. East Jordan Iron Works "8560 Series"
   c. Tyler Union "6860 Series"
   d. Or accepted substitution

2.13 PRESSURE REDUCING VALVE (PRV)/PRESSURE SUSTAINING VALVE (PSV)

A. Manufacturer:
1. OCV
2. Cla-Val
3. Or accepted substitution

B. Follow standard detail for PRV vault design.

C. Valve Materials
1. Coating: epoxy-coated
2. Trim (i.e. disc guide, seat, cover bearing): Stainless Steel type 303

D. Features to be included
1. Isolation Valve
2. Flow Control (opening and/or closing - to be verified for each project)
3. Check valves with isolation valve
4. Strainer (to be verified for each project)

2.14 BUTTERFLY VALVES – 14" TO 36" (DIRECT BURY) AND ACCESSORIES

A. Manufacturers:
1. Pratt
2. Milliken
3. Or accepted substitution.

B. AWWA C504 Class 150B for direct bury service
1. Valve body shall be constructed of cast iron ASTM A126 Class B and conform to AWWA C504 in terms of laying lengths and minimum body shell thickness

2. Mechanical joint ends following AWWA C111
3. Valve disc shall be cast iron or ductile iron furnished with Type 316 stainless steel seating edge to mate with rubber seat on body
    a. Valve disc shall seat in position at 90 degrees to pipe axis and shall rotate 90 degrees between full-open and tight-closed position. Install valves with valve shafts horizontal and convex side of disc facing anticipated direction of flow
    b. Disc shall not creep or flutter under service conditions
4. Seat: Buna-N-Rubber
    a. 16-inch to 18-inch: Bonded seats that meet ASTM D429 Method B
    b. 24-inch and larger: Seats retained in the valve body by mechanical means without metal retainers or other devices located in the flow stream
    c. Retaining hardware for seats: type 304 or 316 stainless steel. Nuts and screws used with clamps and discs for rubber seats shall be held securely with locktight, or other approved method, to prevent loosening by vibration or cavitation effects
5. Valve Shaft: type 304 SS, ASTM A276
    a. Shaft bearings: stainless steel in accordance with AWWA C504. Design valve shaft to withstand 3 times amount of torque necessary to open valve
    b. Packing: Standard self adjusting and wear compensating, split-V type, and replaceable without removing actuator assembly
6. Actuators:
    a. Provide manual actuators for single project, from same manufacturer
    b. Shaft connecting actuator to valve body must be fully enclosed. Bonnet and extension to be fully enclosed and water tight
    c. Provide bonnet extensions, as required, between valve body and actuator. Space between actuator housing and valve body shall be completely enclosed so that no moving parts are exposed to soil or elements
    d. Provide actuators for valves with size based on line velocity of 12 feet per second and unidirectional service.
        i) Equip with gear manual actuator
        ii) Fully enclosed, traveling-nut type. Traveling nut shall engage alignment grooves in the housing
        iii) Traveling nut actuator shall be self-locking and designed to transmit twice the required actuator torque without damages to faces of gear teeth or contact faces of nut
    e. Oil-tight and watertight actuator housing for valves, specifically designed for buried service and factory packed with suitable grease
    f. Equipped with 2-inch actuator nut
    g. Rotation: Counterclockwise to open with the word "OPEN" and an arrow indicating the direction to open cast on valve body or operating nut
    h. Valve operating key: Provide one (1) for project, 7 foot length with tee handle and 2” nut
7. Coating
    a. Follow AWWA C550 and NSF 61

b. Coat interior and exterior ferrous surfaces of valve with epoxy suitable for potable water conditions: in accordance with AWWA C550 and coating manufacturer's recommendations
c. Provide three coats of two component, high-build epoxy with minimum dry film thickness of 12 mils

C. Extension stems
1. Provide as specified for buried valves with operating nuts more than 4.5 feet below grade
2. Non-rising stems
a. Solid steel shafting with O.D. not less than O.D. of valve stem or galvanized steel pipe with I.D. not less than O.D. of valve stem
b. Connected to the valve by a flexible socket coupling
c. All other connections pinned
d. Extend stem to within 6-inch of grade
e. Provide spacers to center stem in valve box
f. Provide wrench nut

D. Valve boxes, depth as required for valve
1. Three piece cast iron (complying with ASTM A48, Class 20A) adjustable screw type, 5.25-inch diameter, minimum thickness of 3/16 inch
2. Box, cover, and base coated by dipping in asphalt varnish.
3. Cover marked with word, “WATER.”
4. Provide extension piece to permit 6-inch adjustment above finish grade
5. Manufacturers:
a. Tyler Pipe Company "Series 6860 with #160 oval base"
b. East Jordan Iron Works "8560 Series"
c. Tyler Union "6860 Series"
d. Or accepted substitution

2.15 VALVE INSERTION

A. Manufacturers:
1. Romac
2. Or accepted substitution

B. Resilient wedge designed for use in potable water systems

C. The design shall allow the valve to be installed into an existing pressurized pipeline while maintaining constant pressure and service as usual. The valve shall be equipped with a standard handwheel operator.

D. Valve Construction:
1. The ductile iron body, bonnet, and wedge shall provide a strength and pressure rating that meets or exceeds the requirements of AWWA C515
2. Valve shall be ductile iron construction and meet ASTM A536 Grade 65-45-12

3. Chemical and modularity tests shall be performed as recommended by the Ductile Iron Society, on a per ladle basis. Testing for tensile, yield and elongation shall be done in accordance with ASTM E8
4. Sizes 12" and smaller must be capable of working on Cast/Grey Iron or Ductile Iron Class A, B, C and D without changing either top or bottom portion of split valve body
5. 250 psi maximum working pressure. The pressure rating markings must be cast into the body of the insert valve.
6. After the installation of the insert valve body on to the existing pipe, a pressure test of 1.1 times that of the contents shall be sustained for 15 minutes. Once the pressure test is affectively achieved, the insert valve body must not be moved in accordance with AWWA Standards. If the insert valve is moved the pressure test must be completed again. The insert valve must not be moved or re-positioned once the pressure test is achieved.

E. Resilient Wedge Gate Assembly:
1. The construction of the resilient wedge shall comply with AWWA C509 requirements
2. The ductile iron wedge shall be fully encapsulated with EPDM rubber by a high pressure and high temperature compression or injection mold process
3. The resilient wedge shall seat on the valve body and not the pipe to obtain the optimum seating and flow control results. The resilient wedge shall be totally independent of the carrier pipe.
4. The resilient wedge shall not come into contact with the carrier pipe or depend on the carrier pipe to create a seal
5. Pressure equalization on the down or upstream side of the closed wedge shall not be necessary to open the valve
6. The wedge shall be symmetrical and seal equally well with flow in either direction
7. The resilient wedge must ride inside the body channels to maintain wedge alignment throughout its travel to achieve maximum fluid control regardless of high or low flow pressure or velocity
8. The resilient wedge must have more support than the operating stem as the resilient wedge enters and exits the water (fluid) way

F. Fusion-Bonded Epoxy:
1. The insert valve is fully epoxy coated on the interior and the exterior. The fusion-bonded coating is applied prior to assembly so that even the bolt holes and body-to-bonnet flange surfaces are fully epoxy coated
2. Valve shall be coated with a minimum of 8 mils epoxy in compliance with AWWA C550 and certified to ANSI/NSF-61

G. Gaskets and Triple O-Ring Stem Seals:
1. This insert valve features triple O-Ring stem seals. One O-Ring is located above, and two O-Rings are located below the thrust collar.
2. The lower two O-Rings provide a permanently sealed lubrication chamber that will make the valve easier to operate over a longer period of time. The upper O-Ring ensures that sand, dirt or grit cannot enter the valve to cause damage to the lower O-Rings. This is especially important for buried and sewage service applications.

3. Side flange seals shall be of the O-Ring type of either round, oval, or rectangular cross- sectional shape

H. Valve Stem & Thrust Washers:
   1. The gate valve stem and wedge nut shall be copper alloy in accordance with AWWA C515
   2. The NRS stem must have an integral thrust collar in accordance with AWWA C515. Two-piece stem collars are not acceptable. The wedge nut shall be independent of the wedge and held in place on three sides by the wedge to prevent possible misalignment.
   3. Two thrust washers are used. One is located above, and one is located below the stem thrust collar. Two thrust washers ensure easy operation at all times.
   4. NRS with AWWA standard turns.
   5. Operated by 2" square wrench nut according to ASTM A126 CL.B – open counter-clockwise.

I. Hardware:
   1. Bolting materials shall develop the physical strength requirements of ASTM A307 with dimensions conforming to ANSI B18.2.1.

J. Extended Life Value:
   1. The stuffing box, operating stem and resilient wedge (complete bonnet and all moving parts) shall be removable, repairable and or replaceable under pressure. In other words, even while the valve is fully pressurized in the system all moving components can be removed under pressure. In the event the valve stem is broken or damaged the bonnet can be removed under pressure.
   2. Internal pressure equalization system assures the safe entry and removal of the valve bonnet during initial installation as well as future maintenance

K. Split Restraint Devices:
   1. Shall consist of multiple gripping wedges incorporated into a follower gland meeting the applicable requirements of ANSI/AWWA C110/A21.10
   2. The devices shall have a working pressure rating of 350 psi for 4-12 inch. Ratings are for water pressure and must include a minimum safety factor of 2 to 1 in all sizes
   3. Chemical and modularity tests shall be performed as recommended by the Ductile iron Society, on a per ladle basis. Three test bars shall be incrementally poured per production shift as per U.L. specifications and ASTM A536. Testing for tensile, yield and elongation shall be done in accordance with ASTM E8.
   4. Gland body wedges and wedge actuating components shall be cast from grade 65-45-12 ductile iron material in accordance with ASTM A536
   5. Mechanical joint restraint shall require conventional tools and installation procedures per AWWA C600, while retaining full mechanical joint deflection during assembly as well as allowing joint deflection after assembly.
   6. Proper actuation of the gripping wedges shall be ensured with torque limiting twist off nuts. Set screw pressure point type hardware shall not be used.
   7. Restraint devices shall be listed by Underwriters Laboratories and Approved by Factory Mutual (3" through 12" inch size)

2.16 AIR RELEASE AND VACUUM BREAKER COMBINATION VALVES

A. Manufacturers:
   1. Vent-o-mat "RBX"
   2. GA "Figure CAV"
   3. Val-Matic "200C Series"
   4. APCO "140C Series"
   5. Or accepted substitution

B. Provide combination air release and vacuum breaker valves as indicated on the Final Drawings
   1. Provide integral type that functions as both an air release and a vacuum breaker valve
   2. Provide a shutoff valve
      a. 2" and smaller valve size: ball valve
      b. Larger than 2" valve size: gate valve

2.17 RESTRAINED COUPLING ADAPTER

A. Manufacturers:
   1. EBAA Iron, Inc.
   2. JCM Industries
   3. Romac
   4. Or accepted substitution

B. General:
   1. Must meet or exceed AWWA C219
   2. Used to transition between dissimilar pipe materials in 3” to 12”as indicated on the Final Drawings
   3. Rated for 250 psi working pressure
   4. Contractor to verify pipe material and diameter of all existing distribution pipelines

C. Sleeve and Flanges:
   1. Ductile iron per ASTM A536

D. Gasket:
   1. Nitrile Butadiene Rubber (NBR, Buna-N) per ASTM D2000
   2. Gasket temperature range -40^{o}F to 212^{o}F (-40^{o}C to 100^{o}C)
   3. Gasket suitable for water, salt solutions, mild acids, bases, and sewage

E. Bolts:
   1. 5/8” corrosion resistant, high strength low alloy oval neck track head bolts per ASTM A242 / ANSI 21.11 / AWWA C111 and heavy hex nuts per A563 or equal.
   2. Optional hardware: Stainless Steel 18-8 Type 304 or 316, Epoxy Coated Alloy Hardware, Powercron 590-534 black cationic electrocoat

F. Finish:
   1. Corrosion resistant shop coat paint primer
   2. Optional fusion applied epoxy coating per ANSI/AWWA C213

2.18 LINE STOPS

A. Manufacturers:
   1. Hydra-Stop, Hydra-Stopper
   2. JCM Industries
   3. Or accepted substitution

B. Body: Carbon Steel in accordance with ASTM A36

C. Flange: Class D Carbon Steel in accordance with AWWA C207, recessed for tapping valve

D. Cover Flange: Cast Steel

E. Bolts: Stainless Steel, Type 304

F. Finish: Corrosion resistant primer and epoxy coating

2.19 BLOW-OFF DRAIN

A. Provide blow-off drains where indicated on the Final Drawings and as shown in the Details

2.20 FIRE HYDRANT

A. Fire hydrants to be provided for installation where indicated on the Final Drawings

B. Manufacturers:
   1. Mueller
   2. Or accepted substitution

C. General
   1. Fire hydrants shall meet or exceed AWWA C502; latest revision
   2. Hydrants shall be manufactured and tested in ISO 9001 certified facility
   3. Fire hydrants shall be rated for a working pressure of 250 psi
   4. A Higbee cut (blunt start) will be provided on the lead thread of the outlet nozzles, nozzle caps, seat ring, drain ring, and thrust nut.
   5. Fire hydrants shall be of the compression type, opening against system pressure and closing with system pressure

D. Main Valves and Drain
   1. The main valve and drain shall be of one piece construction and completely encapsulated with EPDM.
   2. Fire hydrants shall have a minimum 5-1/4 main valve opening.
   3. Fire hydrants shall open left and be clearly marked.
   4. The EPDM shall be permanently vulcanized to the main valve.
   5. The main valve shall provide complete closing of the drains after 4 to 5 turns.

6. During initial stages of opening, the drains shall momentarily flush outward to remove any debris in the drain ports, in order to provide complete draining upon closing of the hydrant main valve.
7. The drain ring assembly shall be replaceable without removing the hydrant from the connecting pipe or having to dig.
8. Valve facings shall be of nontoxic materials suitable for potable water service.

E. Stems
1. Upper hydrant stems shall be made of stainless steel
2. Hydrant shall have one breakaway flange and stem coupling located 3-inches above finished grade.

F. Operating Nut
1. Operating nuts shall be one-piece bronze design with upper and lower anti-friction washers for ease of operation.
2. A protective weather shield shall be installed over the operating nut.
3. Operating nut shall be 1-1/2 inch and pentagon shape

G. Nozzles
1. Pumper nozzles shall be 4-1/2 inch NH / NST threaded.
2. Fire hydrants shall have two 2-1/2 inch hose connection outlets NH/NST threaded.
3. Nozzles shall be of the 1/4 turn bayonet lug style, secured with a stainless steel locking screw.
4. Caps shall have 1-1/2 inch pentagon shape nuts.
5. Nozzle caps shall be chained to hydrant.

H. Lubrication
1. A lubrication port shall be provided for application of lubricant without disassembly of the bonnet section.
2. The reservoir shall be filled with NSF/FDA approved food grade grease or oil at the manufacture's facility.
3. Valve stem seals shall be an o-ring type with not less than two o-rings below the thrust nut and two o-rings above the thrust nut.
4. O-ring and gaskets shall be made of an NBR rubber to help prevent the effects of permeation.

I. Protective Coatings
1. All ferrous parts except the lower barrel and those parts made of stainless steel shall be fusion bonded epoxy coated red
2. All epoxy coatings shall meet the requirements of ANSI/AWWA C550 (latest edition).
3. The lower barrel shall be coatings shall be in accordance with manufacturer specifications
4. A bury line shall be marked on the lower barrel below the break flange to indicate proper installation depth. Bury depth will be clearly stenciled on the standpipe section.
5. Shop paint exterior of hydrants red

J. Shoe
   1. End connections shall be 6 inch mechanical joint unless specified
   2. Mechanical joints shall comply with AWWA C111

K. Break Flange and Couplings
   1. All fire hydrants shall be of the traffic Breakaway type and allow 360-degree rotation of the fire hydrant to position the pumper nozzle in the desired direction
   2. The break flange segments shall be located under the upper barrel flange to prevent the segments from falling into the lower barrel when the hydrant is struck

L. Warranty
   1. All fire hydrants shall be covered by a manufactured warranty for a minimum of 10 years for defects

M. Hydrant Gravel: Hydrant gravel shall be well graded crushed stone or gravel, conforming to AASHTO #67 gradation as listed below:

Sieve Size	Percent Passing
1”	100
3/4”	90-100
3/8”	20-55
No. 4	0-10
No. 8	0-5

2.21 CORROSION CONTROL

A. Shop paint all ferrous metal surfaces of valves and accessories, both interior and exterior for corrosion protection, epoxy interior coating for potable water contact.

B. Manufacturer's standard paint will be acceptable if it is functionally equivalent and compatible with specified field coatings

C. Exterior bituminous coating or asphalt varnish: Manufacturer's Standard epoxy coal tar

D. Ductile-iron Pipe and Fittings Shop lining: Cement-lined, AWWA C104/C205

E. Rust inhibitive primer: Tnemec "Series 77H Chem-Prime" or accepted substitution

F. Rust preventative compound: Houghton "Rust Veto 344", Rust-Oleum "R-9", or accepted substitution

2.22 PIPE BEDDING

A. Pipe Bedding: As specified in the District Standard Details

B. Pipe Embedment: Graded gravel
   1. Comply with the Final Drawings and requirements herein for pipe embedment for public utilities.

2. Squeegee

Sieve Size	Percent Passing by Weight
3/8”	100
No. 4	85-100
No. 8	30-70
No. 16	5-40
No. 30	0-15
No. 50	0-10
No. 100	0-5
No. 200	<1

3. Crusher Fines – AASHTO M 80

Sieve Size (Inch)	Percent Passing by Weight
¾”	100
No. 4	30 - 100
No. 50	10 - 60
No. 200	5 - 20

4. Drain Gravel
   a. Crushed rock, granular material with a maximum size of 1-1/2 inch.
   b. Minimum 50% passing No. 4 sieve, maximum 5% retained on No. 200 sieve
5. Refer to Foundation or Underdrain specification for perforated pipe bedding requirements

C. Compacted Trench Backfill
   1. Job excavated material finely divided, free of debris, organic material, and stones larger than 6 inches in greatest dimension without masses of moist, stiff clay, or topsoil
   2. In upper 18 inches, no rock or rock excavated detritus, larger than 6 inches except with specific approval from Geotechnical Engineer.
   3. No rock greater than 3 inches in greatest dimension within 3 feet of top of pipe
   4. Graded gravel: as specified or shown on the Final Drawings for pipe embedment

2.23 ACCESSORIES – MISCELLANEOUS

A. Valve Accessories
   1. Extension stems
      a. Provide where indicated on drawings, specified, or required for proper operation and for buried valves.
      b. Non-rising stems
         i) Solid steel shafting with O.D. not less than O.D. of valve stem or galvanized steel pipe with I.D. not less than O.D. of valve stem
         ii) Connected to the valve by a flexible socket coupling
         iii) All other connections pinned, keyed, or socket

c. Stem guides
    i) Cast iron, bronze brushed, adjustable in two (2) directions
    ii) If extension stem length exceeds 10 feet or the weight exceeds 50 lbs., design top guide to carry the stem weight and provide a collar on the stem to bear against the thrust guide
    iii) Max spacing:
    Non-rising stems: 100 times stem O.D.
    Rising stems: 60 times stem O.D.
    Ten foot maximum
d. Buried valves
    i) Extend stem to within 1.0 foot of grade.
    ii) Provide spaces to center stem in valve box
    iii) Provide wrench nut

2. Valve boxes
    a. Provide for all buried valves
    b. Boxes shall consist of a cast iron cover, lid, and base castings. No slip type boxes shall be allowed
    c. Type: Cast iron or ductile iron, extension sleeve (screw) type
    d. Minimum thickness: 3/16 inch at any point
    e. Coating: Bituminous varnish
    f. Cast appropriate name designation of service in cover.
    g. Shaft shall be ductile iron and minimum diameter of 5-1/4"
    h. An appropriate word designating the valve service type on the cover
    i. Manufacturer:
        i) Neenah Foundry Company
        ii) Tyler Company
        iii) Mueller Company
        iv) Or accepted substitution
3. For valve installations with operating nuts over 5 five below grade, extend stem to 4.5 feet of final grade. Provide spacers to center stem in valve box.

B. Concrete for Thrust Blocks: constructed of “Class B” Concrete as defined by CDOT Construction Specifications with maximum water to cement ratio of 0.63 by weight and 28-day compressive strength of 3,000 psi

C. Anchorages: Provide anchorages for tees, wyes, crosses, plugs, caps, bends, valves and hydrants. After installation, apply full coat of asphalt or other acceptable corrosion-retarding material to surfaces of ferrous anchorages.
1. Clamps, straps and washers: Steel, ASTM A506
2. Rods: Steel, ASTM A575
3. Rod Couplings: Malleable-iron, ASTM A197
4. Bolts: Steel, ASTM A307
5. Cast-Iron Washers: Gray-iron, ASTM A126

2.24 DISINFECTION CHEMICALS

A. Calcium and sodium hypochlorite shall conform to AWWA B300 and B301

B. Store hypochlorite in a cool, dark place away from flammable materials

2.25 PRECAST CONCRETE VAULT

A. Manufacturers:
   1. Oldcastle Precast
   2. Front Range Precast Concrete
   3. Or accepted substitution

B. Materials
   1. Reinforcement
      a. Reinforcing Steel: ASTM A615 Grade 60
      b. Welded Wire Fabric: ASTM A185
   2. Concrete:
      a. Cement: ASTM C150, Portland Cement, Type II
      b. Aggregates: ASTM C33, free of deleterious substances
      c. Minimum compressive strength: ASTM C39, 4500 psi minimum at 28 days
   3. Precast Sections
      a. Specification: ASTM C1227
      b. Minimum wall thickness: 6 inch
      c. Grade rings as required
   4. Gaskets: ASTM C923
      a. Mastic: FS SS-S-210A, "RAM-NEK" or accepted substitution
      b. Rubber: Neoprene, 40± 5 hardness when measured by ASTM D2240, Type A durometer
   5. Castings: ASTM A48 with asphalt varnish coating hot dip applied at foundry, 6 mils thick
   6. Vault Access Steps: Steel bar, 1/2 inch Grade 60, drop-front type, with polypropylene coating applied by manufacturer, Type MA Industries, Inc. "PS2-PF" or accepted substitution
   7. Reference details for access into underground vault structures
   8. Pipe Penetrations:
      a. Cast-a-Seal gasket
      b. Link-Seal
      c. Or accepted substitution
   9. Rock Subbase: 1-1/2 inch minus, well-graded gravel over compacted subgrade
   10. Water: Clean and free of deleterious substances

C. Fabrication
   1. Vault Section
      a. Precast concrete dimensions as shown on plans
      b. Precast lid: Same or greater reinforcement and wall thickness with capability for H20 loading
      c. Joints: Shiplap or tongue and groove with double mastic gaskets, each joint to set equally and tightly
      d. Access opening: Minimum 24 clear
      e. Pipe connection: As indicated on the Final Drawings

f. Pipe knockout: As indicated on the Final Drawings

2. Grating and Metal Frame: As specified on the Final Drawings

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify locations and inverts or tops of pipe for connections to existing system as well as crossings with other utilities as indicated on the Final Drawings. Report any discrepancies to Engineer

B. Carefully examine pipe and fittings for cracks, damage to linings, and other defects prior to installation

C. Remove all defective piping from site and replace

D. Examine areas for weak or structural defects or deviations beyond allowable tolerances for piping clearances that adversely affect excavation and quality of Work

E. Start installation only when conditions are satisfactory

3.2 PERFORMANCE - GENERAL

A. Perform work in a safe and proper manner with appropriate precautions against hazard

B. Provide adequate working space and clearances for work performed within excavations and for installation and removal of utilities

C. Contain all construction activity on the designated site and within the limits of work. Cost of restoration of site will be the responsibility of the Contractor

D. Contractor to verify quantities to perform all earthwork required according to the Final Drawings, including but not limited to, additional import or export required to handle compaction, pavement subgrade preparation, and pipe bedding

E. Contractor shall take precautions to limit the removal of or damage to existing pavements, multi-use paths sidewalks, curbs, lawns, shrubbery, trees, hedges, walls, fences, buildings, or other existing improvements to the least practicable amounts and shall replace or restore such improvements to their original location and condition after the excavation has been backfilled and compacted

3.3 PROTECTION OF EXISTING UTILITIES AND STRUCTURES

A. Excavation and backfill operations shall be performed in such a manner to prevent cave-ins of excavations or the undermining, damage or disturbing of existing utilities and structures or of new work

B. Backfill shall be placed and compacted so as to prevent future settlement or damage to existing utilities and structures and new work

C. Any excavations improperly backfilled or where settlement occurs shall be reopened to the depth required then refilled with approved materials and compacted, and the surface restored to the required grade and condition, at no additional costs to the Owner

D. Any damage due to excavation, backfilling, or settlement of the backfill, or injury to persons or damage to property occurring as a result of such damage shall be the responsibility of the Contractor. All costs to repair such damage, in a manner satisfactory to the Engineer, shall be borne by the Contractor at no additional expense to the Owner

3.4 SITE PREPARATION

A. Clear all site areas within the limits of work of grasses, roots, brush, and other objectionable material and debris

B. Remove all waste materials from site and dispose. Stockpile all acceptable grubbings for reuse in revegetation areas.

C. Remove debris including all demolished trees, underbrush, stumps, roots and other combustible materials from site and dispose of off-site; on-site burning is not permitted

3.5 DEWATERING

A. Comply with CDPHE Dewatering Requirements

B. Dewatering discharge to surface waterways requires CDPHE dewatering permit. Contractor must obtain dewatering permit and comply with discharge requirements therein, if necessary

3.6 PIPE PREPARATION

A. Ream pipe and tube ends and remove burrs

B. Remove scale and dirt, on inside and outside, before assembly

C. Cut ends of metallic pipe, recoat with coating approved for potable water service and compatible with manufacturer's coatings.

3.7 PRECAST CONCRETE VAULT PREPARATION

A. Verify items provided by other section of Work are properly sized and located

B. Verify that built-in items are in proper location, ready for roughing into Work

C. Verify excavation for vault is correct

D. Excavation, Backfill, Subgrade Compaction: Refer to Section 31 00 00 for requirements

E. Rock Subbase
   1. Remove water and place 6-inch minimum depth
   2. Vibrate for compaction
   3. Level top to accept precast sections with uniform bearing all around
   4. If material below vault is unsuitable, excavate as directed by the Engineer and backfill to grade with 1-1/2 inch minus rock and compact

3.8 PLACING PRECAST SECTIONS

A. Thoroughly clean joints of sections to place gasket material

B. Place gasket material on base or lower section to ensure watertight fit between lower precast section and upper precast section

C. Fill inside and outside of joint completely with non-shrink grout and trowel smooth

D. Cure non-shrink grout using approved methods as recommended by manufacturer

3.9 PREFORMED GASKETS

A. Remove and replace vault sections which have chipped or cracked joints

B. Thoroughly clean section joints

C. Install gasket in conformance with manufacturer's recommendations

D. Only use primer furnished by gasket manufacturer

3.10 PIPE EMBEDMENT

A. Embed pipes above and below the bottom of pipe as indicated on the Drawings and as specified herein

B. Granular embedment
   1. Spread and surface grade granular embedment to provide continuous and uniform support beneath pipe at all points between pipe joints.
      a. Level bottom layer at proper grade to receive and uniformly support pipe barrel throughout length
      b. Barrel of pipe will have a bearing for its full length
   2. Form depressions under each joint to permit the proper jointing. No part of joint will be in contact with trench when pipe is placed in position
   3. After grading, aligning, and placing pipe in final position, and shoring home, deposit and compact sufficient embedment under and around each side of the pipe to hold the pipe in proper position and alignment during subsequent operations
   4. Place and compact embedment material uniformly and simultaneously on both sides of pipe to prevent displacement
   5. Complete embedment promptly after jointing operations and approval to proceed by Engineer

6. Granular embedment compaction by slicing with shovel or vibrating
    a. Maximum uncompacted thickness of layers: 6 inch
7. Compacted embedment will be compacted to 90 percent maximum density per ASTM D1557
    a. Maximum uncompacted depth thickness of horizontal layers: 8 inch

C. Arch and concrete encasement
1. Include in locations indicated on Drawings or where over-width trench conditions need correction as approved by Engineer
2. Install and form as indicated on Drawings or as specified
3. Concrete will have a 28-day minimum 3,000 psi compressive strength

D. Do not backfill until tests and inspections have been made and backfilling is authorized by Engineer. Use care in backfilling to avoid damage or displacement of pipe systems

3.11 TRENCH BACKFILL

A. Backfilling will be conducted in a continuous manner to prevent damage to the pipe and its coating and kept as close to the pipe laying operation as possible. Backfilling procedures will be in accordance with additional requirements, if any, of local authorities or private right-of-way agreements.

B. Compacted backfill
1. Provide full depth of trench above embedment at all locations
2. Beneath pavements, surfacing, driveways, curbs, gutters, walks or other surface construction or structures
3. In street or highway shoulders
4. Beneath fills and embankments

C. Where the trench for one pipe passes beneath the trench of another pipe, compact the backfill for the lower trench to the bottom of the upper trench

D. Site excavated materials
1. Place job excavated materials in 8 inches maximum uncompacted thickness, uniform layers
2. Increased layer thickness may be permitted for incohesive material if Contractor demonstrates to Engineer's satisfaction that specified compacted density will be achieved
3. Use methods and equipment appropriate to the material to be compacted to prevent transmission of damaging shocks to pipe
4. Thoroughly compact each layer to meet the moisture and compaction specifications herein.

3.12 PIPE INSTALLATION

A. Comply with the District standards, details, and specifications. Use the manufacturer’s recommendations if the District standards do not specifically apply.

B. Install PVC Pipe in accordance with AWWA M23 and AWWA C605

C. Install Ductile Iron Pipe in accordance with AWWA C600

D. Install Ductile Iron Fittings in accordance with AWWA M41

E. Route pipe as indicated on the Final Drawings

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

G. Install as specified or in accordance with the manufacturer's recommendations

H. Cutting Pipe
   1. Cut pipe to measurement taken at the site, not from the Final Drawings
   2. Cut pipe neatly without damage to pipe
   3. Cut smooth, straight, and at right angles to pipe axis
   4. Dress and bevel end of cut pipe to remove roughness and sharp corners
   5. Cut pipe with saw or abrasive wheel
   6. Follow state and federal safety regulations pertaining to cutting asbestos concrete pipe as necessary

I. Provide an isolation or shutoff valve and union at the water connections to each fixture and unit of equipment, whether shown on the Final Drawings or not

J. Install pipe to indicated elevations. Maintain minimum 6.0 feet depth of ground cover and maintain minimum grade for drainage. Establish elevations of buried piping to ensure minimum cover is achieved. Maximum depth of 7.0 feet is allowed to avoid a local high point unless shown otherwise on the plans. Add additional soil in areas of future fill to provide minimal cover at all times. Report any variations from plan to Owner and Engineer
   1. Provide air release valve at all high points and blow-offs or hydrant at all low points. Coordinate locations and details with Engineer.
   2. Where minimum depth cannot be maintained, provide a minimum of 2 inch of specified insulation board per 1 foot of cover not provided. Contractor must have Owner and Engineer approval prior to installation.
      a. Place insulation board over bedding material for the width of the trench

K. Install pipe to allow for expansion and contraction without stressing pipe or joints

L. Protect from lateral displacement by placing embedment evenly on both sides of pipe

M. Do not lay pipe in water. Maintain groundwater level a minimum of 12 inches below pipe to be installed. Do not lay pipe under unsuitable weather or trench conditions

N. Make changes in horizontal, vertical, and curved alignment shown on the Final Drawings by using joint deflections in the amount permissible by manufacturer and shown on the Final Drawings

O. Do not bend pipe

P. Deflect pipe at joints

Q. Do not deflect PVC pipe at connection to ductile iron fittings

R. Form and place concrete for thrust blocks at each elbow or change of direction of pipe main as indicated on the Final Drawings

S. Utility crossings
   1. Whenever possible, lay water mains over sanitary and storm sewers to provide vertical separation of at least 18-inch between invert of water main and crown of sewer
   2. If standard crossing detail is not available and above separation cannot be met, provide one continuous length of watertight sewer pipe 20' long centered on water main with joints between different pipes encased in 6-inch minimum of concrete and extending 6-inch either side of joint or encase sewer pipe in 6-inch of concrete completely around pipe, for not less than 10' either side of water main
   3. Water Mains Passing Under Sanitary Sewers: If vertical separation is less than 18-inch, provide structural support for sewer. Provide concrete encasement where water lines pass under sanitary sewer line. Reference detail shown on the Final Drawings

T. Maintain a minimum 10 feet of horizontal separation and 18 inches of vertical separation between water main and storm or sanitary sewer lines in accordance with the CDPHE
   1. Provide concrete encasement if these clearances cannot be achieved and when water line is below sanitary sewer line

U. Tracer wire and marker tape
   1. Install tracer wire continuous over top of pipe
   2. Install tracer wire test stations at maximum 500 LF of water line per the District requirements. Locate test station at fire hydrants, gate valves, or special test station locations in a valve box
   3. Terminate tracer wire following drawing details
   4. Tape tracer wire to top of pipe using PVC tape every 4 feet along the pipe, and on each side of fitting
      a. Tape: minimum 2 inches wide and wrapping full circumference of pipe
   5. Install identification /warning marker tape in fill area of trench above all water lines

V. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system

W. Install access fittings to permit disinfection of water system, subject to approval by Engineer

X. Backfill trench in accordance to specifications herein

Y. Protect pipe from floatation or movement until completely backfilled and put into service

3.13 WATER MAIN CONNECTIONS

A. Comply with the District standards, details, and specifications. Coordinate with the District and fire department representatives for any impacts to the existing water system and provide advanced notice to impacted properties if applicable.

B. Connect to water main per plans and referenced standards or details.

3.14 JOINTS

A. Make pipe joints carefully and neatly

B. Connect piping in accordance with manufacturer's recommendations

C. Push-on joints
   1. Lay pipe with bell ends facing the direction of laying except when Engineer authorizes reverse laying
   2. Assembly of PVC plain end into bell: follow PVC pipe manufacturer's recommendation
   3. For PVC pipe, Contractor to ensure that pipe is not inserted into the bell ends beyond the push line
      a. Utilize EBAA Mega-Stop bell protection, or approved substitution, if necessary, to ensure previously laid pipe joints are not impacted by ongoing installation
   4. Lubricate joint surfaces immediately before completing the joint
   5. Bevel spigot ends of field cut piping
   6. Groove spigot ends of field cut restrained joint piping if required by joint system
   7. Install restrained joints following manufacturer's recommendations

D. Mechanical joints
   1. Before assembling joint, clean both bell and plain end of rust and foreign matter
   2. Assemble joint following AWWA C111, C600, C605 and as specified
   3. Lubricate gasket and install in accordance with manufacturer's instructions
   4. If an effective seal is not obtained, disassemble joint, clean thoroughly, and reassemble
   5. Do not over tighten bolts to compensate for poor installation
   6. Carefully align holes in mechanical joints with restraint device to permit installation of the harness bolts
   7. Install mechanical joint pieces so the mechanical joint holes straddle the top centerline for horizontal piping, or the side centerline for vertical piping

3.15 PROTECTIVE COATING

A. Provide polyethylene tube encasement on all buried ductile iron fittings, valves, and fire hydrant extensions
   1. Encase ductile iron fittings and valves in polyethylene per AWWA C105, Method A, secured with polyethylene compatible adhesive tape. Overlap polyethylene onto PVC pipe a minimum of 6 inches

2. Before backfilling, inspect polyethylene for rips, punctures and other damage and repair following AWWA C105

B. Coat exposed ferrous metal surfaces of joints, couplings, and uncoated steel with primer and tape coating system after installation. Do not coat stainless steel or high strength low alloy steel nuts and bolts
   1. Surface Preparation: Clean surfaces of rust, scale, soil, mud, oil, grease, and other contaminants by hand or power tool following SSPC-SP2 or SP3 and other appropriate means as recommended by coating manufacturer Remove excess moisture and provide surface dryness as recommended by coating manufacturer
   2. Application: Apply primer in uniform manner to clean and dry surfaces following coating manufacturer's recommendations
      a. Fill complex and irregular surfaces with appropriate mastic or filler tape to eliminate bridging; then apply tape/wrap to primed and filled surfaces following coating manufacturer's recommendations.
      b. When coating restraining rods or strapping, apply tape wrap longitudinally
      c. Where metal being coated enters concrete, overlap coating onto concrete by minimum of 2 inches after placement of concrete
   3. Inspection: After field coating of specified items, conduct visual inspection to verify complete coverage has been accomplished.
      a. Repair damaged or incompletely coated surfaces following coating manufacturer's recommendations

C. Metal Surfaces not Protected by Poly Wrap
   1. Coat all steel clamp rods, bolts, and other metal accessories used in tapping saddles, anchorages, cut ends of pipe, follower rings and bolts or joint harnesses subject to submergence or contract with the earth and not concrete encased, but including pipe fittings and bolts in polyethylene tube protection
   2. Apply 2 coats of coal tar paint to clean, dry metal surfaces, allow first coat to dry before applying second coat

D. Metal Harness Rods
   1. Provide field applied primer and Polyken tape wrap

3.16 CONCRETE ENCASEMENT

A. Provide where indicated on the Final Drawings

B. Comply with the District standards, details, and specifications.

C. Suitably support and block pipe and anchor against flotation

3.17 VALVES AND HYDRANTS INSTALLATION

A. Carefully inspect valve before installation. Clean interior. Operate valve to determine parts in proper working order, with valves seating and drain valve operating properly. Set plumb and center stem in valve box and securely brace into place. Comply with AWWA C600 and referenced standards

B. Center and plumb valve box over valve. Set box cover flush with finished grade.
   1. Backfill and compact under and around valve boxes to ensure no vertical loads are transmitted to valve operators or bonnets

C. Comply with AWWA M17 for fire hydrant installation. Install with gate valve and provisions for drainage

D. Install valves, hydrants, and accessories in accordance with the manufacturer's recommendations and in accordance with referenced standards and specifications.

E. Add hydrant oil to bonnet per manufacturer requirements.

F. Hydrants and valves to be set plumb on solid bearing surface

G. Locate hydrant flange a minimum of 3" and maximum 6" above adjacent finished grade or flush with the adjacent top of curb. Contractor to verify final grade or adjust flange height upon the completion of final grading

H. Drainage shall be provided at the base of the hydrant by placing rock from the bottom of the trench to at least 12 inches above the barrel flange of the hydrant and to a distance of 12 inches around the elbow. The minimum distance from the bottom of the trench to the bottom of the hydrant elbow shall be 6 inches. The minimum amount of rock placed shall be 1/3 cubic yard

3.18 VALVE INSTALLATION

A. Comply with the District standards, details, and specifications

B. Carefully inspect valve before installation. Clean interior. Operate valve to determine parts in proper working order, with valves seating and drain valve operating properly. Set plumb and center stem in valve box and securely brace into place. Comply with AWWA C600 and referenced standards.

C. Provide concrete collar for installations within landscaped areas

D. Protect valve box and cover during paving operations and clean any excess concrete, or asphalt, or road base from valve box and cover to ensure visibility and proper operation

3.19 INSERTION VALVE INSTALLATION

A. Install according to Manufacturer's suggested procedures
   1. Clean the area of the pipeline that is to receive the insert valve
   2. Prepare the insert valve for assembly onto the pipeline per Manufacturer's recommendations
   3. Install the two insert valve body halves on the pipeline
   4. Bolt two body halves of insert valve together. Tighten bolts per Manufacturer's recommendations.
   5. After body bolts have been tightened, confirm that the insert valve is level

6. Install mechanical joint gaskets to insert valve and complete assembly using split mechanical joint restraints
7. Attach temporary insertion valve. A test port shall be attached and the assembly should be pressure tested.
8. Prepare tapping machine for mounting to temporary valve.
9. Tapping machine shall be mounted to the temporary isolation valve with chip flushing valve attached.
10. After completing the tap, close temporary isolation valve.
11. Remove tapping machine and cut out pipeline section.
12. Prepare insertion valve bonnet for live line insertion and attach to valve insertion tool per Manufacturer's recommendations
13. Position and attach valve insertion tool to temporary insertion valve. Confirm proper orientation of valve bonnet.
14. Open temporary isolation valve and advance travel of the bonnet to the body of the insert valve
15. Install six set pins to secure bonnet to insert valve body
16. Once set pins are in place, release the bonnet from the insertion tool
17. Use insertion tool blow off valve to release water with insertion tool housing and remove insertion tool from temporary insolation valve
18. Remove temporary isolation valve
19. Install O-Ring between valve body and bonnet to seal connection

3.20 TAPPING

A. Tapping shall be performed using standard tapping saddles designed for use on ductile iron piping in accordance with AWWA C600. Tapping shall be performed only with use of tap saddles or sleeves. NO DIRECT TAPPING WILL BE PERMITTED unless approved by the District.

B. All connections requiring a larger diameter than that recommended by the pipe supplier, should be made with a pipe connection as specified and indicated on the Final Drawings.

3.21 WATER SERVICES

A. Water services are to be connected to the new water main per the Final Drawings and District Standards

B. Water services are to be tapped per the Contract Drawings. Direct taps are not permitted.

3.22 THRUST BLOCKS

A. Installation:
1. Thrust blocks shall be constructed at bends and fittings that require support due to unbalanced line thrust. Care shall be taken to ensure that outlets, cover bolts, nuts, clamps, and other fittings are accessible. A bond breaker shall be placed between the pipe and the thrust block to aid in future removal. If a large thrust block is to be placed, it shall be separated into sections by a suitable material. Bearing surface areas are minimum areas to bear against the undisturbed trench wall. If the soil bearing

capacity is insufficient to provide adequate support based on minimum bearing areas established by Drawing Details, then the minimum bearing area shall be increased to a size that shall ensure support restraint. In every instance, the thrust block shall bear against undisturbed earth

2. Before placing concrete, equipment used in the mixing and transport shall be cleaned. Debris, water, or ice shall be removed from the area to be occupied by concrete. Concrete shall not be placed on frozen subgrade. Concrete shall be placed only in the presence of the Owner or Engineer unless inspection is waived prior to the placement

B. Formwork for Thrust blocks:
   1. Forming for concrete thrust blocks and anchors shall be done by bulkheading around the shape of the thrust block or anchor with wood, burlap sacks, or reinforced paper sacks that are filled with sand or earth. Sacks shall be constructed of a size easily handled when full and left in place in the trench. Wood forms shall be removed before backfilling.
   2. Horizontal struts or braces required for trench shoring shall not remain in concrete thrust blocks. Prior to placing concrete, the forms and ditch bank will be inspected and approved by Owner or Engineer
   3. When concrete is deposited against the ground without the use of forms, the ground shall be thoroughly moistened or other provisions made to prevent the ground from drawing water in from the concrete

C. Thrust block Curing Time:
   1. Newly placed concrete shall be allowed to set undisturbed for a minimum of 24 hours

D. Compaction of Fill Over Thrust blocks
   1. Backfill may be placed over thrust blocks once the surface has set sufficiently and they are able to resist the weight of the backfill. However, tamping or compacting shall not be allowed above the thrust block for a minimum of 24 hours after placement

E. Hydrostatic testing shall not be conducted until thrust blocks have fully cured, a minimum of 7 days

3.23 ABANDONMENT

A. Cap ends of main as shown. Place required concrete blocking as shown on drawing details

B. Where mains are to be abandoned and removed to a fitting or valve, cut and plug main at fitting or valve
   1. When shown on the Final Drawings, remove fire hydrants and valves, including lead joint tees when encountered; salvage and deliver removed fire hydrants and valves to the District
   2. Pipe, fittings, and other appurtenances that are removed, but are not required to be salvaged become property of Contractor
      a. Remove and dispose of offsite

3.24 ERECTION TOLERANCES

A. Establish invert elevations as shown on the Final Drawings

B. Construct pipe within manufacturer’s tolerances of horizontal and vertical deflection. Refer to District for allowable deflections at joints and fittings.

3.25 FIELD QUALITY CONTROL

A. Comply with the District standards, details, and specifications. Test each line at the Contractor's expense in the presence and to the satisfaction of the District inspectors or Engineer.

B. Field inspection and testing will be performed under provisions set forth by the referenced standards

C. Test each line at the Contractor's expense in the presence and to the satisfaction of Owner or Engineer at a maximum of 1,000 foot intervals

D. Water Line Disinfection
   1. Comply with AWWA C651 and provide Engineer and Owner with results.
   2. Flush water lines prior to disinfection, except when tablet method is used. Acceptable chlorine disinfectants are calcium hypochlorite granules, sodium hypochlorite solutions, and calcium hypochlorite solutions, and calcium hypochlorite tablet. Calcium hypochlorite tablets shall be attached by an adhesive meeting the requirements of NSF/ANSI 61.
   3. After the pipe is filled with water and chlorine, the chlorinated water shall be held in contact with the pipe for 24 hours. At the end of the 24 hour period, the water in the pipeline shall be tested by the local health authority having jurisdiction, or their designated representative, to ensure a residual chlorine content in compliance with the District requirements. The pipeline shall then be thoroughly flushed with dechlor tablets using a a dechlorinating diffuser to remove the heavily chlorinated water. This activity requires a permit from the CDPHE WQCD prior to flushing. Comply with all provisions of the permit. Care shall be taken in flushing the pipeline to prevent property damage and danger to the public. Discharges of water from blowoff assemblies or other appurtenances shall be contained or discharged in a manner approved by the District and the CDPHE.
   4. For fire lines, flush piping complying with NFPA 24
   5. If water in pipe does not meet the governing agency requirements, repeat disinfection procedure until acceptable. Furnish copies of acceptance forms from governing agency to Owner and Engineer.

E. Valve Testing
   1. Conduct pressure and leakage tests on all newly installed valves
   2. Furnish all necessary equipment and material and make all connections to the pipe, as required. The Engineer shall monitor the tests.

F. Hydrostatic Pressure Tests

1. Provide all necessary pumping equipment, piping connections, pressure gauges with maximum of 5 psi increments, and other required equipment, facilities, and materials
2. All water used for pressure testing must be potable and delivered in acceptable containers
3. Immediately locate and replace all pipe fittings, valves, pipe joints, and other materials found to be defective with new and acceptable material
4. If tests indicate work does not meet specified requirements, remove work, replace, and retest at no cost to Owner
5. Procedure
    a. Disconnect all fixture devices and other accessories which may be damaged by the specified test pressure
    b. Plug or cap ends as required
    c. Bleed system to eliminate all air from system
    d. No pressure testing shall be permitted until all concrete thrust blocks have adequate curing time to reach design strength, 7 day minimum
    e. Notify Owner and Engineer 48 hours prior to testing
    f. Test for 2 hours with no more than 5 psi pressure loss
    g. Leakage is the quantity of water added to a test section to maintain test pressure ±5 psi:

$$L = \frac{S \times D \times (P)^{0.5}}{133{,}200}$$

Where:
L = allowable leakage in gallons per hour
S = length of pipe tested, in feet
D = nominal diameter of pipe, in inches
P = average test pressure during test, psig

6. Hydrostatic Test Conditions: At lowest point in the line or section under test pressure or operating pressure, whichever is greater. Contractor to submit test pressure procedures 3 weeks prior to performing pressure tests. Test pressures procedures shall meet one of the following criteria:
    a. For operating pressures greater than 100 psi, the test pressure shall be 1.5Xs the operating pressure of the pipe
    b. For operating pressures less than 100 psi, the test pressure shall be a minimum of 150 psi
7. While the test pressure is maintained, an examination shall be made of the pipeline and any leaks located and repaired. Pipe or fittings found to be faulty shall be removed and replaced. Leakage is not allowed through the bonnet of the line valve. A valve leaking through the bonnet may be repaired in place or removed and replaced. Cutting and replacement of pavement as well as excavation and backfilling may be necessary when locating and repairing leaks discovered during pressure testing.
8. After visible leaks are stopped, repeat procedure beginning at 3.13.D.5 of this section

G. PVC Water Pipe Continuity Testing
1. Test tracer wire for continuity, in the presence of Owner and Engineer, after backfill is complete and before Substantial Completion

2. Notify Owner and Engineer five working days in advance to schedule testing
3. Continuity test to consist of locating the PVC water pipe with an electronic-type pipe locator
4. If test is negative for continuity, repair or replace as necessary to achieve continuity

H. Bac-T Testing
1. After completion of water line disinfection, District shall collect Bac-T samples to ensure pipe has been properly disinfected and submit results to Engineer
2. If water line fails Bac-T sampling, any repeat disinfection and Bac-T testing will be at the Contractor's expense
3. The Contractor shall receive District approval before placing a water line in service

3.26 CLEANING

A. Verify that piping has been cleaned and inspected

B. Verify that piping has been successfully pressure tested and flushed

C. Perform scheduling and disinfection activity with start-up, testing, adjusting, demonstration procedures, including coordination with related systems

3.27 DISINFECTION

A. Provide and attach required equipment to perform the work of this Section

B. Tablet, continuous, or slug disinfection may be followed in accordance with AWWA C651

C. The preferred method is continuous disinfection, summarized as follows:
1. Inject treatment disinfectant, free chlorine in liquid form into piping system to obtain 50 to 80 ppm residual
2. Bleed water from outlets to ensure distribution and test for disinfectant residual
3. Maintain disinfectant in system for 24 hours
4. If final disinfectant residual tests less than 25 ppm, repeat treatment
5. Flush, circulate and clean until residual equal to that of incoming potable water or 1.0 mg/L is achieved

D. Replace permanent system devices removed for disinfection

3.28 FINAL FLUSHING

A. Maintain a flushing velocity of 2.5 feet per second in piping

B. Collect chlorinated water for proper disposal and/or dechlorinate to less than 0.1 ppm free chlorine prior to discharge in accordance with State, County, and local regulations

C. District to provide and pay for flushing water

3.29 DISINFECTION FIELD QUALITY CONTROL

A. After final flush, and before main or equipment is placed in service, District to collect water samples from representative points along the main [or from the equipment] and field test for chlorine residual

B. Chlorine residual shall be within 50 percent of the chlorine residual prevailing in the source

C. If initial disinfection fails to provide satisfactory samples, repeat disinfection until satisfactory samples have been obtained

3.30 DISINFECTION TESTING AND ACCEPTANCE

A. The District will perform Bac-T sampling and testing after pipes have been disinfected and flushed as specified herein

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

C. The Contractor shall pay for services of the District (certified laboratory) to complete Bac-T testing

3.31 FINAL ACCEPTANCE

A. Comply with the District standards, details, and specifications for placing water line in service

B. The inside of all pipe, valves, and fittings shall be smooth, clean, and free from blisters, loose mill scale, sand, and dirt when connected.
   1. Wire brush, if necessary, wipe clean and keep joint contact surfaces clean until connection is complete

C. Drain all test water from the new pipe system prior to placing in service

D. Provide water tap locations (x, y, z) shown on the Final Drawings

E. Provide operation and maintenance manuals for air and line valves and fire hydrants

F. Provide final reports to Engineer for:
   1. Bac-T results
   2. Residual chlorine tests
   3. Hydrostatic tests for each section or pipe
   4. Tracer wire continuity test

3.32 SITE PIPING SCHEDULE (NOTE TO USER:// A FULL SITE PIPING SCHEDULE SHALL BE PROVIDED WITH THE SPECIFICATIONS FOR ALL DISTRICT PROJECTS AS OUTLINED IN THE EXAMPLE TABLE BELOW. ALL HIGHLIGHTED PORTIONS OF THIS TEXT SHOULD BE DELETED OR MODIFIED FOR THE FINAL PRODUCT)

A. Install pipes as scheduled in the pipe schedule provided below [*Engineer to modify highlighted portions of the schedule below for project requirements. Highlighted examples provided for reference.*]

Description	Size (inches)	Material	Working Pressure (psi)
Water Main	6	DIP	100
Water Service Line	2	Copper	100

3.33 VALVE SCHEDULE, VALVES LARGER THAN 2-INCHES (NOTE TO USER:// A FULL VALVE SCHEDULE SHALL BE PROVIDED WITH THE SPECIFICATIONS FOR ALL DISTRICT PROJECTS AS OUTLINED IN THE EXAMPLE TABLE BELOW. ALL HIGHLIGHTED PORTIONS OF THIS TEXT SHOULD BE DELETED OR MODIFIED FOR THE FINAL PRODUCT)

A. Install valves as scheduled in the valve schedule provided below [*Engineer to modify schedule below for project requirements. Highlighted examples provided for reference.*]

B. The following abbreviations are used in the valve schedule:
1. MJ: Mechanical Joint
2. FL: Flanged Joint
3. GV: Gate Valve
4. SG: Slide Gate Valve
5. PV: Plug Valve
6. BFV: Butterfly Valve

Item No.	Type	Size (inches)	Area Location	Type of Installation	Bury Depth (ft)	Valve End Connection
1	PV	4	Call out Station Location	Direct Bury	6	MJ & MJ
2	GV	6	Call out Station Location	Direct Bury	6	MJ & MJ
3	GV	6	Call out Station Location	Direct Bury	6	MJ & MJ
4	GV	10	Call out Station Location	Direct Bury	6	MJ & MJ
5	GV	10	Call out Station Location	Direct Bury	6	MJ & MJ

END OF SECTION

SECTION 33 33 00 FOR 6-DIGIT

SECTION 02530 FOR 5-DIGIT

SANITARY SEWERAGE SYSTEM

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Polyvinyl chloride (PVC), SDR35, non-pressure pipe for gravity sanitary sewer with all jointing materials, fittings, and other appurtenances required for a complete installation.

B. C900 Polyvinyl chloride (PVC) pressure pipe for sanitary sewer force main or crossings with all jointing materials, fittings, and other appurtenances required for a complete installation.

C. All precast manholes complete with steps, ring and cover as required

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM):
1. A48 – Standard Specification for Gray Iron Castings
2. A126 – Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings
3. A185 – Standard Specification for Welded Steel Wire Fabric for Concrete Reinforcement
4. A307 – Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60,000 PSI Tensile Strength
5. A615 – Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
6. C33 – Standard Specification for Concrete Aggregates
7. C150 – Standard Specification for Portland Cement
8. C443 – Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
9. C478 – Standard Specification for Circular Precast Reinforced Concrete Manhole Sections
10. C497 – Standard Test Methods for Concrete Pipe, Manhole Sections, or Tile
11. C913 – Standard Specification for Precast Concrete Water and Wastewater Structures
12. C923 – Standard Specification for Resilient Connectors Between Reinforced Concrete manhole Structures, Pipes, and Laterals
13. C1227 – Standard Specification for Precast Concrete Septic Tanks
14. C1619 – Standard Specification for Elastomeric Seals for Joining Concrete
15. C1821 – Standard Practice for Installation of Underground Circular Precast Manhole Structures
16. D698 – Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3))

17. D1248 – Standard Specification for Polyethylene Plastics Extrusion Materials for Wire and Cable
18. D1330 – Standard Specification for Rubber Sheet Gaskets
19. D1351 – Standard Specification for Thermoplastic Polyethylene Insulation for Electrical Wire and Cable
20. D1784 – Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC)
21. D1785 – Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
22. D2122 – Standard Test Method for Determining Dimensions of Thermoplastic Pipe and Fittings
23. D2240 – Standard Test Method for Rubber Property – Durometer Hardness
24. D2321 – Standard Specification for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
25. D2466 – Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40
26. D2774 – Standard Specification for Underground Installation of Thermoplastic Pressure Piping
27. D2837 – Standard Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials or Pressure Design Basis for Thermoplastic Pipe Products
28. D3034 – Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings
29. D3035 – Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter
30. D3139 – Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
31. D3212 – Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
32. D3261 – Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing
33. D3350 – Standard Specification for Polyethylene Plastics Pipe and Fittings Materials
34. F412 – Standard Terminology Relating to Plastic Piping Systems
35. F477 – Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe
36. F714 – Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Outside Diameter
37. F679 – Standard Specification for Poly(Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings
38. F1055 – Standard Specification for Electrofusion Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene and Crosslinked Polyethylene (PEX) Pipe and Tubing
39. F2164 – Standard Specification for Field Leak Testing of Polyethylene (PE) and Crosslinked Polyethylene (PEX) Pressure Piping Systems Using Hydrostatic Pressure

B. American Water Works Association (AWWA):
   1. C104 – Standard for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings

2. C105 – Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems
3. C111 – Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
4. C115 – Standard for Flanged Ductile-Iron Pipe with Ductile-Iron or Grey-Iron Threaded Flanges
5. C150 – Standard for Thickness Design of Ductile-Iron Pipe
6. C151 – Standard for Ductile-Iron Pipe, Centrifugally Cast
7. C504 – Standard for Rubber-Seated Butterfly Valves
8. C512 – Standard for Air Release, Air/Vacuum, and Combination Air Valves for Water and Wastewater Service
9. C600 – Standard for Installation of Ductile Iron Mains and Their Appurtenances
10. C900 – Standard for Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. Through 12 In. (100 mm Through 300 mm), for Water Transmission and Distribution
11. C905 – Standard for Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 In. Through 48 In. (350 mm Through 1,200 mm), for Water Transmission and Distribution
12. M23 – PVC Pipe: Design and Installation

C. Colorado Department of Transportation (CDOT)

D. Occupational Safety and Health Administration (OSHA)

E. National Association of Corrosion Engineers (NACE):
1. SP0169 – Control of External Corrosion on Underground or Submerged Metallic Piping Systems
2. SP0286 – Electrical Isolation of Cathodically Protected Pipelines

F. Plastics Pipe Institute (PPI):
1. TR-4 – HDB / HDS / SDB / PDB / MRS Ratings for Thermoplastic Piping Materials or Pipe
2. TR-33 – Generic Butt Fusion Joining Procedure for Field Joining of Polyethylene Pipe
3. Handbook of Polyethylene Pipe
4. Polyethylene Piping Systems Field Manual for Municipal Water Applications
5. Material Handling Guide

1.3 SUBMITTALS

A. Submit under provisions of front end specifications if provided by an engineer

B. Shop Drawings: Provide piping layout and assembly drawings with fitting dimensions. Provide sufficient information to verify compliance with specifications.

C. Product Data: Provide manufacturer's catalog information with dimensions, material and assembled weight.
1. Pipe materials
2. Special, fitting, and coupling details
3. Gasket materials

4. Valves
5. Laying and installation schedule
6. Specifications and data sheets
7. Affidavits of compliance for protective shop coatings and linings

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements and applicable standards. Provide prior to shipment.

E. Test Reports: Submit reports for low pressure air test of pipes

F. TV Inspection Files:
1. Submit videos and reports
2. For rehabilitation work, show cured liner, connections to mains, and reestablished service connections after relining work is complete

1.4 PROJECT RECORD DOCUMENTS

A. Submit Shapefile to District based on final record construction documents

B. Accurately record actual locations of piping mains, valves, connections, invert elevations, and any mapped or unmapped utilities

C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with the District and CDPHE Stormwater and/or Groundwater Discharge Permit, notes on the drawings and as specified herein.

B. Manufacturers shall be experienced in the design and manufacturing of materials specified herein for a minimum period of 5 years

C. All pipes of the same material [C900 PVC, SDR 35 PVC, etc.], regardless of diameter, shall be supplied by a single manufacturer

D. Perform Work in accordance with the Colorado Department of Public Health and Environment (CDPHE) and Jefferson County

E. Contractor shall conduct visual inspection before installation

F. Provide manufacturer's name and pressure rating marked on piping and valves

G. Provide piping complete with all fittings, jointing materials, supports, joint restraint system, and necessary appurtenances for watertight, fully operational sewer lines

1.6 REGULATORY REQUIREMENTS

A. Conform to all municipal codes and ordinances, laws and regulations of Jefferson County, the District, CDPHE, the notes and details on the Final Drawings and as specified herein, and CDPHE Stormwater Management and/or Construction Dewatering Permit

B. In case of apparent conflict, CDPHE requirements govern over these specifications

C. Contractor, not Owner, shall prepare, submit, pay, and otherwise obtain all necessary permits from all appropriate entities

1.7 DELIVERY, STORAGE AND HANDLING

A. Deliver, store, protect and handle products to site under provisions specified by the manufacturer and front end specifications provided by the engineer

B. During loading, transporting and unloading, exercise care to prevent damage to material
   1. Use nylon slings only
   2. Do not drop pipe or fittings
   3. Do not roll or skid against pipe already on ground
   4. Repair any damage done to coating or lining
   5. Handle per manufacturer's recommendations
   6. Store rubber gaskets in cool dark location
   7. Store all material on wood pallets or timbers

C. Shop coated materials shall be handled, transported, stored and shipped in a manner that will prevent damage to the coating and lining. Coating or lining damaged in handling or other operations shall be repaired to the approval of and at no additional cost to the Owner

D. Any damage to the pipe or the protective coating from any cause during the installation of the pipeline and before final acceptance by the Engineer shall be repaired in accordance with these Specifications and at no additional cost to the Owner

E. Pipe
   1. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation
   2. PVC pipe has reduced flexibility and impact resistance as temperatures approach and drop below freezing. Extra care should be used in handling PVC pipe during cold weather
   3. Do not store PVC pipe uncovered in direct UV light
   4. Pipe stored along the trench side shall be suitably supported off the ground to avoid damage to the coating

F. Valves
   1. Prepare valves for shipping as follows:
      a. Ensure that valves are dry and internally protected against rust and corrosion

b. Protect valves against damage to threaded ends, flange faces, and weld ends
c. Seal valve ends to prevent entry of foreign materials into valve body
d. Set valves in best position for handling
e. Set valves closed to prevent damage

2. Deliver and store valves and accessories in shipping containers with labeling in place
3. Storage: Use the following precautions for valves during storage:
   a. Do not remove end protectors unless necessary for inspection; then reinstall for storage
   b. Protect valves from weather by storing indoors or support valves off ground or pavement in watertight enclosures when outdoor storage is necessary

G. Precast Concrete Structures
1. Transport and handle precast concrete units with equipment to protect from dirt and damage
2. Do not place precast concrete units in position which will cause damage
3. Handle precast concrete structures by means of lifting inserts. Do not move from manufacturer's yard until curing is complete.

1.8 JOB CONDITIONS

A. All work which requires the interruption of active sanitary sewer service lines must be coordinated by the contractor to be completed without disruption of sewer service to any customer (via pumping, temporary piping, etc.). If down time of the sewer service is required, this must be coordinated with the District prior to commencing work.

B. Underground Obstructions
1. Underground Obstructions known to Engineer are shown on the Final Drawings
   a. Locations shown may prove inaccurate and other obstructions not known to Engineer may be encountered
   b. Contractor shall field locate and verify all obstructions where or not shown on the Final Drawings
2. Notify each utility owner and request utility be field located by surface reference at least 48 hours prior to trenching or excavation
3. Expose and verify size, location and elevation of underground utilities and other obstructions where conflicts might exist sufficiently in advance to permit changes in the event of a conflict
   a. Notify Engineer and Owner in case of a conflict
   b. In case of a conflict, the proposed work may be changed by Engineer
4. Maintain, protect, and support by shoring, bracing or other means existing utilities and appurtenances

PART 2 PRODUCTS

2.1 PIPE, MANHOLES, AND ACCESSORIES

A. Comply with District Standards and Standard Details.

2.2 PVC GRAVITY SANITARY SEWER PIPE (NON-PRESSURE)

A. SDR35 PVC is the District's preferred pipe material for gravity sanitary sewer lines.

B. Pipe and fittings: ASTM D3034, Type PSM, SDR 35, non-pressure pipe
   1. Cell classification: ASTM D1784
   2. Pipe length: 12-20 feet standard manufactured length for construction

C. Joints: ASTM D3212 and F477 - Rubber gasket with one compression gasket ring, integral bell and spigot type
   1. Designed to hold pipe in alignment, provide flexibility, separate the ends of pipe lengths, resist applied earth pressures, and provide fluid tightness
   2. Rubber rings: ASTM F477

2.3 SOURCE QUALITY CONTROL

A. Identification Marks: Clearly and permanently marked at not greater than 5-foot intervals with pipe diameter, PVC cell classification (if applicable, manufacturer, plant, shift, ASTM, date designations and service designation

B. Testing per ASTM D3034
   1. Test products not manufactured in the U.S. at an acceptable laboratory in the U.S.

2.4 C900 PVC PRESSURE PIPE OR FOR CROSSINGS – 4" TO 12" DIAMETER

A. C900 PVC is the District's preferred pipe material for water crossings and sanitary sewer force mains.

B. Manufacturers:
   1. JM Eagle
   2. Georg Fischer Piping Systems
   3. North American Pipe Corporation
   4. Diamond Plastics Corporation
   5. Vinyltech Corporation
   6. Or accepted substitution

C. Pipe: AWWA C900, DR 18 except as otherwise specified or indicated on the Final Drawings

D. Marking: Identification markings on pipe shall conform to AWWA C900

E. Fittings: Ductile iron compact fittings: ANSI A 21.53/AWWA C153
   1. Working pressure rating: 350 psi rating
   2. Joint: Mechanical joints with restraints
   3. Coating:
      a. Exterior: AWWA C153, Asphalt coated
      b. Interior: AWWA C104 and C153, lined with double thickness cement seal coated

F. Joints: ASTM D3139, integral bell or mechanical joint
   1. Push-on joints: pipe to pipe joints, except as otherwise specified or indicated on the Final Drawings. Push on joints are not permitted on fittings or valves
      a. Integral bell type with elastomeric gaskets, ASTM F477 factory installed
      b. Suitable for buried service
      c. Gaskets:
         i) Material: Virgin SBR rubber suitable for potable water conforming to AWWA C111
         ii) Lubricant shall be suitable for potable water contact
   2. Restraint device for PVC push on joint
      a. Restraint material: ASTM A536 , ductile iron
      b. A split ring shall be used behind the pipe bell. A serrated ring shall be used to grip the pipe, and a sufficient number of bolts shall be used to connect the bell ring and the gripping ring
      c. Nuts and bolts torqued to requirements of manufacturer
      d. Pressure rating consistent with pipe pressure rating
      e. Restraint coatings shall be consistent with manufacturer's standard
      f. Manufacturers:
         i) EBAA Iron Inc. "Series 1600"
         ii) Romac Industries "Series 611"
         iii) Or accepted substitution
   3. Mechanical joint restraint
      a. Provide mechanical joint restraint for all ductile iron fittings connecting to PVC pipe
      b. Restraint devices for shall consist of multiple gripping wedges incorporated into a follower gland meeting the applicable requirements of ANSI/AWWA A21.10/C110
      c. Pressure rating consistent with pipe pressure rating
      d. Restraint coatings shall be consistent with manufacturer's standard
      e. Manufacturer:
         i) EBAA Iron "MEGALUG 2000 PV"
         ii) Romac Industries "Roma-Grip"
         iii) Or accepted substitution

G. Couplings
   1. Mechanical couplings:
      a. Dresser Style 38
      b. Rockwell 411
      a. Romac Industries 501
         b. Smith Blair 461
      c. Or accepted substitution
   2. Insulated Mechanical Couplings:
      a. Dresser Style 39
      a. Romac Industries IC501
      b. Or accepted substitution
   3. Transition Couplings:
      a. Rockwell 415

b. Dresser Style 39
a. Romac Industries TC400
b. Smith Blair 413
c. Or accepted substitution
4. Glands color coded: Black

H. Couplings for connection between dissimilar water distribution pipe materials
1. Material: Ductile Iron, ASTM A536 Grade 65-45-12
2. End Rings: Ductile Iron, ASTM A536
3. Gaskets: Virgin SBR rubber suitable for potable conforming to AWWA C111
4. Bolts and Heavy Hex Nuts: UNC 5/8" rolled threads with black finish.
5. Manufacturer:
a. JCM
b. EJ Prescott
c. Or accepted substitution

2.5 PVC PRESSURE PIPE OR FOR CROSSINGS – 14” TO 24” DIAMETER

A. C900 PVC is the preferred pipe material for water crossings and sanitary sewer force mains.

B. Manufacturers
1. JM Eagle
2. North American Pipe Corporation
3. Diamond Plastic Industries
4. Vinyltech Corporation
5. Or accepted substitution

C. Pipe: AWWA C905, DR 21 except as otherwise specified or indicated on the Final Drawings

D. Marking: Identification markings on pipe shall conform to AWWA C905

E. Fittings: Ductile iron fittings, ANSI A 21.53/AWWA C153 or ANSI A21.10/AWWA C110
1. Working pressure rating: 250 psi rating
2. Joint: mechanical joints with restraints
3. Coating:
a. Exterior: AWWA C153
b. Asphalt coated interior: AWWA C104 and C153, lined with double thickness cement and seal coated

F. Joints: ASTM D3139, integral bell or mechanical joint
1. Push-on joints: pipe to pipe joints, except as otherwise specified or indicated on the Final Drawings. Push on joints are not permitted on fittings or valves
a. Integral bell type with elastomeric gaskets, ASTM F477 factory installed
b. Suitable for buried service
c. Gaskets:

i) Material: Virgin SBR rubber suitable for potable conforming to AWWA C111
ii) Lubricant shall be suitable for potable water contact

2. Restraint device for PVC push on joint
   a. Restraint material: ASTM A536, ductile iron
   b. A backup ring shall be used behind the PVC bell. A restraint ring, incorporating a plurality of individually-actuating gripping surfaces, shall be used to grip the pipe, and a sufficient number of bolts shall be used to connect the bell ring and the gripping ring
   c. Pressure rating consistent with pipe pressure rating
   d. Restraint coatings shall be consistent with manufacturer's standard
   e. Manufacturers:
      i) EBAA Iron Inc. "Series 2800"
      ii) Romac Industries "Series 470"
      iii) Or accepted substitution
3. Mechanical joint restraint
   a. Provide mechanical joint restraint for all ductile iron fittings connecting to PVC pipe
   b. Restraint devices for shall consist of multiple gripping wedges incorporated into a follower gland meeting the applicable requirements of ANSI/AWWA A21.10/ C110
   c. Pressure rating consistent with pipe pressure rating
   d. Restraint coatings shall be consistent with manufacturer's standard
   e. Manufacturer:
      i) EBAA Iron "MEGALUG 2000 PV"
      ii) Romac Industries "Roma-Grip"
      iii) Or accepted substitution

G. Couplings
   1. Mechanical couplings:
      a. Dresser Style 38
      b. Rockwell 411
      c. Romac Industries 501
      d. Smith Blair 461
      e. Or accepted substitution
   2. Insulated Mechanical Couplings:
      a. Dresser Style 39
      b. Romac Industries IC501
      c. Or accepted substitution
   3. Transition Couplings:
      a. Rockwell 415
      b. Dresser Style 39
      c. Romac Industries TC400
      d. Smith Blair 413
      e. Or accepted substitution
   4. Glands color coded: Black

H. Couplings for connection between dissimilar water distribution pipe

1. Material: Ductile Iron, ASTM A536 Grade 65-45-12
2. End Rings: Ductile Iron, ASTM A536
3. Gaskets: Virgin SBR rubber suitable for potable conforming to AWWA C111
4. Bolts and Heavy Hex Nuts: UNC 5/8" rolled threads with black finish.
5. Manufacturer:
    a. JCM
    b. EJ Prescott
    c. Or accepted substitution

2.6 PIPE ACCESSORIES

A. Underground Type Plastic Line Marker
1. Manufacturer's standard permanent, continuous-printed plastic tape with metallic core, intended for direct-burial service; not less than 6-inch wide x 4 mils thick. Provide green tape with black printing reading "CAUTION SANITARY SEWAGE LINE BURIED BELOW." Provide identification markers of one of the following:
    a. Allen Systems, Inc.
    b. Emed Co., Inc.
    c. Seton Name Plate Corp.
    d. Or accepted substitution

B. Tracer Wire for Buried Pipe
1. Provide tracer wire for all pipe
2. All tracer wire shall be 12 AWG solid copper wire coated with 45 mil Type HMW - PE insulation compliant with ASTM D1351 specifically designed for direct burial in corrosive soil or water
3. UL listed

C. Tracer Wire Test Stations
1. 4-inch with locking lid
2. Manufacturers:
    a. CP Test Services
    b. Glenn Series "Glenn-4"
    c. Or accepted substitution

D. Corrosion Control
1. Rust inhibitive primer:
    a. Tnemec "Series 77H Chem-Prime"
    b. Or accepted substitution
2. Rust preventative compound:
    a. Houghton "Rust Veto 344"
    b. Rust-Oleum "R-9"
    c. Or accepted substitution

2.7 AIR RELEASE AND VACUUM BREAKER COMBINATION VALVES

A. Manufacturers:

1. Val-Matic “Model 801A”
2. Dezurik/APCO "Series 440 SCAV"
3. Or accepted substitution

B. Provide combination air release and vacuum breaker valves as indicated on the Final Drawings
   1. Provide single body type that functions as both an air release and a vacuum breaker valve
   2. Valves shall be manufactured and tested in accordance with AWWA C512
   3. Provide a shutoff valve and transition piece from HDPE to NPT threaded connection on valve
      a. Ball valve: compatible with butt fusion, HDPE fitting

C. General
   1. Usage: Recommended for service up to a pressure rating indicated by Final Drawings
   2. Bodies and covers:
      a. Gray iron meeting requirements of ASTM A126 Class B
      b. Globe style of 1-inch valves to increase float clearance and reduce clogging
   3. Exterior coating: universal alkyd primer
   4. Valve cleanout: 2" NPT
   5. Valve drain connection: 1" NPT
   6. Inlet and Outlet:
      a. Inlet: NPT, 2-inch on 1-inch valves
      b. Outlet: NPT equal to valve size, 1-inch
   7. Internals:
      a. Metal internal parts only
      b. Float sensitive skirt provided
      c. Float, plug, guide shafts, and bushings: Type 316 stainless steel
      d. Resilient seats: Buna-N

2.8 ECCENTRIC PLUG VALVES

A. Manufacturers:
   1. DeZurik
   2. Henry Pratt Company
   3. Milliken
   4. Val-Matic Valve and Manufacturing Corporation
   5. Or accepted substitution

B. Provide plug valves as indicated on Final Drawings

C. General
   1. Quarter-turn non-lubricated eccentric plug valves
   2. Resilient faced plug
   3. Valves with vane type seat rings are not acceptable
   4. Valve ends to match connecting piping
      a. Buried: Mechanical joint, ANSI A21.11/AWWA C111

b. Flanged: 125 lb, ANSI B16.1
c. Screwed valve ends shall be to the NPT standard

5. Minimum Working Pressure Rating:
   a. 175 psi
6. Opening motion eccentric, lifting plug away from body seat
7. Valve alignment
   a. Valve shall be installed so that the plug is horizontal and rotates upward as the valve opens
   b. Valve shall be installed with seat on low pressure side of valve
8. Provided with fully adjustable plug position stops
9. Plugs shall be eccentric type with no backing ring or frame
10. Valve body cavity shall be smooth without protrusions or baffles
11. Valve body plainly marked to indicate seat end
12. Valve packing adjustment accessible without removing actuator from valve

D. Valve Materials
1. Plug and body: Cast iron, ASTM A126, Class B
2. Resilient plug facing or replaceable style body seats shall be synthetic rubber, neoprene, or Buna N compound suitable for use with water and wastewater applications
3. Seat rings shall be threaded, or welded of corrosion-resistant stainless steel (18-8), nickel, or Monel conforming to AWWA C504
4. Sprayed or plated mating seat surfaces are not acceptable
5. Bearings shall be replaceable. Sleeve type and thrust bearings in the upper and lower journals shall be corrosion-resistant stainless steel or bronze
6. Shaft seals shall be multiple O-ring, self-adjusting U-cup or chevron type packing conforming to AWWA C504
7. Pull-down packing is not acceptable
8. Shaft seals shall be field adjustable or replaceable without valve disassembly
9. Plug seat: Chloroprene (Neoprene)
10. Packing: Acrylonitrile Butadiene V-Type Cup
    a. Dual U-cup
11. Upper thrust bearing: TFE
12. Body seat: Welded-in overlay seat of no less than 90% nickel
13. Upper and lower trunnion bearings: Sleeve type, 18-8 stainless steel
14. Valves complete with epoxy coating on the interior and exterior, manufacturer's standard corrosion resistant coating shall be acceptable

E. Testing
1. Valves shall be capable of drip-tight shut-off up to the full leak test rating
   a. Test and certify pressure capacity in the reverse direction

2.9 HATCH

A. Manufacturers:
1. Bilco
2. Or accepted substitution

B. Provide hatches as indicated on Final Drawings

C. Performance Characteristics
   1. Cover shall be reinforced to support a minimum live load of 300 psf with a maximum deflection of 1/150th of the span
   2. Operation of the cover shall be smooth and easy with controlled operation throughout the entire arc of opening and closing
   3. Operation of the cover shall not be affected by temperature
   4. Entire hatch, including all hardware components, shall be highly corrosion resistant

D. Cover
   1. Cover shall be 1/4" aluminum diamond pattern

E. Frame
   1. Channel frame shall be extruded aluminum with bend down anchor tabs around the perimeter

F. Hinges
   1. Shall be specifically designed for horizontal installation and shall be through bolted to the cover with tamperproof Type 316 stainless steel lock bolts and shall be through bolted to the frame with Type 316 stainless steel bolts and locknuts

G. Drain Coupling
   1. Provide a 1-1/2” drain coupling as indicated on Final Drawings

H. Lifting Mechanism
   1. Manufacturer shall provide the required number and size of compression spring operators enclosed in telescopic tubes to provide, smooth, easy, and controlled cover operation throughout the entire arc of opening and to act as a check in retarding downward motion of the cover when closing
   2. The upper tube shall be the outer tube to prevent accumulation of moisture, grit, and debris inside the lower tube assembly
   3. The lower tube shall interlock with a flanged support shoe fastened to a formed 1/4" gusset support plate

I. A removable exterior turn/lift handle with a spring loaded ball detent shall be provided to open the cover and the latch release shall be protected by a flush, gasketed, removable screw plug

J. Hardware
   1. Hinges: Heavy forged Type 316 stainless steel hinges, each having a minimum 1/4" diameter Type 316 stainless steel pin, shall be provided and shall pivot so the cover does not protrude into the channel frame
   2. Cover shall be equipped with a hold open arm which automatically locks the cover in the open position
   3. Cover shall be fitted with the required number and size of compression spring operators. Springs and spring tubes shall be Type 316 stainless steel

4. A Type 316 stainless steel snap lock with a fixed handle shall be mounted on the underside of the cover
5. Hardware: Shall be Type 316 stainless steel throughout
6. Ladder Up post

K. Finishes
1. Factory finish shall be mill finish aluminum with bituminous coating applied to the exterior of the frame

2.10 MANHOLES

A. Precast Concrete Units:
1. Manufacturers:
a. Rinker Materials
b. Oldcastle Infrastructure
c. Copeland
d. Or accepted substitution
2. Specification: ASTM C478
3. Minimum wall thickness: greater of 5 inch or 1/12 of internal diameter
4. Reinforced
5. Grade rings as required

B. Precast Units: Use concrete that will attain a 28-day compressive strength of not less than 4500 psi with a cement content of not less than 6 sacks per cu. yd. Openings to be precast per plan. Sawcut in field only if no other option.
1. Manhole sections must be precast. Manhole bases may be cast-in-place when necessary.

C. Manhole Steps: Steel bar, 1/2 inch Grade 60, drop-front type, with polypropylene coating applied by manufacturer, Type MA Industries, Inc. "PS2-PF" or approved substitution

D. Vault/Manhole Sections
1. Precast concrete dimensions as shown on plans
2. Minimum manhole inside diameter: 48 inch
3. Precast lid and Cones: Same or greater reinforcement and wall thickness as vault or manhole section with capability for H20 loading
4. Vault Joints: Shiplap or tongue and groove with double mastic gaskets, each joint to set equally and tightly
5. Manhole Joints: Keylock type with double mastic gaskets, each joint to set equally and tightly
6. Access opening: Minimum 24 clear or as indicated
7. Pipe connection: As indicated on Drawings
8. Pipe knockout: As indicated on Drawings
9. Precast concrete, monolithic base OR cast-in-place base. Manhole sections must be precast.
10. Manhole steps: 12 inch on center, vertical alignment above largest bench or open area

E. Grating and Metal Frame: As specified on Final Drawings

2.11 ACCESSORIES

A. Plugs and Caps: Use pipe plugs or caps provided by the pipe manufacturer and approved by the Engineer for pipe stuboutsft

B. Cleanouts: Provide as indicated, pipe extension to grade with ferrule and countersink cleanout plug. Provide round cast-iron access frame over cleanout, with heavy duty secured scoriated cover with lifting device cast with the word “SANITARY”

C. Reinforcement:
1. Reinforcing Steel: ASTM A615 Grade 60
2. Welded Wire Fabric: ASTM A185

D. Concrete: Refer to Division 3 Specifications if applicable
1. Minimum compressive strength: ASTM C39, 4500 psi at 28 days
2. Cement: ASTM C150, Portland Cement, Type II
3. Aggregates: ASTM C33, free of deleterious substances

E. Gaskets and Plastic Sealing Compound
1. Mastic: FS SS-S-210A, "RAM-NEK" or approved substitution
2. Rubber: Neoprene, 40+5 hardness when measured by ASTM D2240, Type A durometer
3. Compression Gaskets: ASTM C443
4. Boot Connectors: ASTM C923
   a. Flexible rubber boots shall provide a watertight seal between the pipe and concrete structure.
   b. Z-LOK connector by A-LOK Products, Inc. or approved substitution

F. Frames and Castings: ASTM A48 with asphalt varnish coating hot dip applied at foundry, 6 mils thick Class 30b

G. Manhole Rings and Covers
1. Cast iron, heavy duty traffic type, ASTM A48, Class 35B. Grind bearing surfaces to ensure flat, true surfaces
2. Covers to seat at all points on ring
3. Covers to be cast with "SANITARY" in 2" tall flush letters
4. Provide type as indicated on the Final Drawings

H. Manhole Height Adjustment: Use precast concrete grade rings

I. Rock Subbase: 1-1/2 inch minus, well-graded gravel over compacted subgrade

J. Water: Clean and free of deleterious substances

K. Grout: Provide under provisions of Division 3 Specifications

2.12 GROUT MANUFACTURERS

A. Non-Shrink, Non-Metallic Grout
   1. Master Builders: Masterflow 928
   2. Burke: Non-Ferrous Non-Shrink
   3. M.R. Meadows: Sealtight 588
   4. Sonneborn: Sonogrout G.P.
   5. Tamms: Tammsgrout 621
   6. Sika: SikaGrout 212
   7. Or accepted substitution

B. Epoxy Grout
   1. Burke: BurkEpoxy Anchoring Grout
   2. L&M Inc.: Epogrout
   3. Sika: Sikadur 42, Grout Pack
   4. Or accepted substitution

2.13 PIPE BEDDING

A. Pipe Bedding: As specified in the District Standard Details

B. Pipe Embedment: Graded gravel
   1. Comply with the Final Drawings and requirements herein for pipe embedment for public utilities.
   2. Squeegee

Sieve Size	Percent Passing by Weight
3/8”	100
No. 4	85-100
No. 8	30-70
No. 16	5-40
No. 30	0-15
No. 50	0-10
No. 100	0-5
No. 200	<1

   3. Crusher Fines – AASHTO M 80

Sieve Size (Inch)	Percent Passing by Weight
3/4	100
No. 4	30 - 100
No. 50	10 - 60
No. 200	5 - 20

   4. Drain Gravel
      a. Crushed rock, granular material with a maximum size of 1-1/2 inch.

b. Minimum 50% passing No. 4 sieve, maximum 5% retained on No. 200 sieve
5. Refer to Foundation or Underdrain specification for perforated pipe bedding requirements

C. Compacted Trench Backfill
1. Job excavated material finely divided, free of debris, organic material, and stones larger than 12 inches in greatest dimension without masses of moist, stiff clay, or topsoil
2. In upper 18 inches, no rock or rock excavated detritus, larger than 6 inches except with specific approval from Geotechnical Engineer.
3. No rock greater than 3 inches in greatest dimension within 3 feet of top of pipe
4. Graded gravel: as specified or shown on the Final Drawings for pipe embedment

PART 3 EXECUTION

3.1 INSPECTION

A. Examine pipe and fittings and do not use individual sections containing cracks, dents, abrasions, and other defects

3.2 INSTALLATION OF PVC GRAVITY SANITARY SEWER PIPE (NON-PRESSURE)

A. Trenching, Pipe Embedment, Backfill, and Compaction: See Section 02300

B. Install pipe in accordance with ASTM D2321 as modified herein or on the Final Drawings

C. Cutting
1. Cut and bevel ends in accordance with manufacturer's standard recommendations
2. Machine cut ends smooth and square to proper dimensions
3. Do not cut with a cold chisel, iron pipe cutter, flame or any other method that may fracture the pipe or leave ragged, uneven edges
4. Remove burrs and wipe off all dust and dirt from jointing surfaces

D. Pipe Laying
1. Inspect pipe and accessories for cracks and other defects before lowering into trench
2. Repair or replace any defective, damaged or unsound pipe
3. Remove all dirt and foreign material from the inside of pipe before laying
4. Check bedding for firmness and uniformity of surface immediately before laying each section of pipe
5. Carefully lower pipe, fittings, valves, and accessories into the trench with derricks, ropes, and other suitable equipment to prevent damage
6. Do not dump or drop pipe or accessories into trench
7. Lay to lines and grades indicated on Final Drawings or as specified
a. Lay piping beginning at a low point of system, true to line and grade with unbroken continuity of invert.
b. Closely joint to form a smooth flow line

c. Place bell end or groove ends of piping facing upstream
d. Maximum length of pipe that can be used without exceeding the allowable deflection at a coupling shall be determined
e. Maximum deflection at flexible couplings as recommended by the manufacturer
f. Maximum deflection at a joint: As recommended by the manufacturer

8. Utilize implements, tools, and facilities as recommended by the manufacturer
9. Keep pipe clean during and after laying
10. Close all open ends with watertight expandable type sewer plugs or test plugs
11. Remove and relay any pipe which has floated
12. Do not lay pipe when
    a. There is water in the trench
    b. Trench conditions are unsuitable
    c. Weather conditions are unsuitable
13. Use acceptable adaptors at manhole and structure connections to provide a watertight seal and flexibility; provide a short length of pipe outside each connection
14. Protect from lateral displacement by placing and compacting bedding material under provisions of Section 02300

E. Jointing
1. Assemble in accordance with the manufacturer's instructions
2. Wipe clean pipe ends, gasket and gasket groove before inserting gasket
3. Apply lubricant furnished by the pipe manufacturer to the gasket and the outside of the spigot end
4. Utilize an assembly tool as recommended by the manufacturer to center the sleeve over the spigot end
5. Insert the spigot end to the reference mark
6. Check gasket location after assembly with a suitable gage
    a. Gasket locations to be the distance from the sleeve and recommended by the coupling manufacturer for their full circumference
    b. If not within the required limits, disassemble and reassemble the joint

F. Fittings
1. Install utilizing standard methods
2. Lower into trench with rope or other means to prevent damage
3. Attach rope around the exterior
4. Do not attach rope through the interior
5. Carefully connect to pipe or other facility
6. Check joint to insure a sound and proper joint

3.3 GENERAL PIPE INSTALLATION

A. Inspect pipe and accessories for defects before lowering into trench

B. Replace any defective, damaged or unsound pipe

C. Cutting Pipe
1. Cut pipe to measurement taken at the site, not from the drawings

2. Cut pipe neatly without damage to pipe or cement lining
3. Cut smooth, straight, and at right angles to pipe axis
4. Dress and bevel end of cut pipe to remove roughness and sharp corners
5. Cut pipe with saw, abrasive wheel or pipe cutter designed specifically for the pipe material

D. Installation Requirements

E. Group piping with other site piping work whenever practical

F. Install pipe to indicated elevations. Adjust to maintain minimum 6 feet depth of bury and maintain minimum grade for drainage and also allow for all air to be released at high points

G. Comply with District standards and specifications. Use the manufacturer's recommendations if the District standards do not specifically apply.

H. Install PVC Pipe in accordance with AWWA M23 and AWWA C605

I. Install Ductile Iron Fittings in accordance with AWWA M41

J. Route pipe as indicated on plan and profile drawings

K. Install pipe to allow for expansion and contraction without stressing pipe or joints

L. Protect from lateral displacement by placing embedment evenly on both sides of pipe

M. Make changes in horizontal, vertical, and curved alignment shown on drawings by using joint deflections in the amount permissible by manufacturer and shown on drawings

N. Do not bend pipe

O. Deflect pipe at joints

P. Do not deflect PVC pipe at connection to ductile iron fittings

Q. Slope pipe and position drain at low points

R. Protect from lateral displacement by placing embedment evenly on both sides of pipe as specified in Section 02300

S. Do not lay pipe in water. Maintain groundwater level a minimum of 12 inches below pipe to be installed. Do not lay pipe under unsuitable weather or trench conditions

T. Lay pipe with bell ends facing the direction of laying except when Engineer authorizes reverse laying

U. Form and place concrete for thrust blocks at each elbow or change of direction of pressurized force main

V. Install tracer wire continuous over top of pipe. Tracer wire shall be Type THHN, AWG size #12, UL listed with a single copper conductor, PVC insulation, and nylon jacket. Test stations at post hydrants shall be CP Test Services, Glenn Series Glenn-4 with locking lid, or approved equal. Install pipeline marker strip (tape) in trench above all pipelines

W. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system

X. Carefully lower pipe, fittings, and accessories into the trench with slings, ropes, and other suitable equipment to prevent damage. Do not dump or drop pipe or accessories into trench

Y. Joint to form true and smooth line

Z. Remove any pipe not making a good fit

AA. Begin pipe laying at the lowest point unless reverse laying is accepted by Engineer

BB. Utilize implements, tools and facilities as recommended by the manufacturer if required to remove debris

CC. During construction, close all open ends with watertight expandable type plugs
1. At the end of each day's operations
2. Whenever pipe ends are left unattended
3. Deposit adequate backfill on pipe to prevent flotation
4. Do not use wood, burlap or other similar temporary plugs

DD. Utility crossings
1. Whenever possible, lay water mains over sanitary and storm sewers to provide vertical separation of at least 18-inch between invert of water main and crown of sewer
2. If standard crossing detail is not available and above separation cannot be met, provide one continuous length of watertight sewer pipe 20' long centered on water main with joints between different pipes encased in 6-inch minimum of concrete and extending 6-inch either side of joint or encase sewer pipe in 6-inch of concrete completely around pipe, for not less than 10' either side of water main
3. Water Mains Passing Under Sanitary Sewers: If vertical separation is less than 18-inch, provide structural support for sewer. Provide concrete encasement where water lines pass under sanitary sewer line. Reference the District Standards, Details, and the Final Drawings.

EE. Tracer wire and marker tape
1. Install tracer wire continuous over top of pipe
2. Install tracer wire test stations at maximum 500 LF of sanitary sewer line. Locate test station at special test station locations in a valve box
    a. Contractor may bring tracer wire up into manholes and it it around the first ladder rung in lieu of a special test station as long as the manhole is easily accessed and not located in a roadway
3. Terminate tracer wire following drawing details

4. Tape tracer wire to top of pipe using PVC tape every 4 feet along the pipe, and on each side of fitting
    a. Tape: minimum 2 inches wide and wrapping full circumference of pipe
5. Install identification /warning marker tape in fill area of trench above all water lines

FF. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system

GG. Install access fittings to permit disinfection of water system, subject to approval by Engineer

HH. Backfill trench in accordance to specifications herein

II. Protect pipe from floatation or movement until completely backfilled and put into service

JJ. Remove and re-lay any pipe which has floated

3.4 INSTALLATION OF HATCH

A. The installer shall comply with the hatch Manufacturer's installation instructions

3.5 MANHOLE PREPARATION

A. Verify items provided by other section of Work are properly sized and located

B. Verify that built-in items are in proper location, ready for roughing into Work

C. Verify excavation for manholes is correct

D. Excavation, Backfill, Subgrade Compaction: Refer to Section 02300 for requirements

E. Rock Subbase
1. Remove water and place 6-inch minimum depth
2. Vibrate for compaction
3. Level top to accept precast sections with uniform bearing all around
4. If material below vault is unsuitable, excavate as directed by the Engineer and backfill to grade with 1-1/2 inch minus rock and compact

3.6 PLACING MANHOLE

A. Place manhole sections plumb and level

B. Clean ends of sections and place double mastic gasket

C. Fill inside and outside of joint completely with non-shrink grout and trowel smooth

D. Set cover rings and covers level without tipping, to correct elevations or set cover rings and covers with slight tip to match cross slope of finished surface where directed by Engineer

E. Completed manholes shall be rigid and watertight

F. Coordinate with other sections of work to provide correct size, shape, and location

G. For cast-in-place bases:
   1. Place base pad, trowel top surface level to accept precast manhole section with uniform bearing all around
   2. Place sufficient non-shrink grout on base to ensure watertight fit between first manhole section and base of place first manhole section directly in wet concrete

3.7 PREFORMED GASKETS

A. Remove and replace manhole sections which have chipped or cracked joints

B. Thoroughly clean section joints

C. Install gasket in conformance with manufacturer's recommendations

D. Only use primer furnished by gasket manufacturer

3.8 MANHOLE INVERT

A. Place concrete in bottom of manhole and form smooth transition. Trowel smooth and brush for non-skid finish. Slope bench 1 inch per foot for drainage to invert.

B. Invert shape to conform to radius of pipe it connects

C. Remove all rough sections or sharp edges which tend to obstruct flow or cause material to snag. Remove all grout droplets from invert

D. Construct in conformance with the Final Drawings

3.9 MANHOLE RINGS AND COVERS

A. Place rings in bed of non-shrink grout on top of manholes

B. Ensure no infiltration will enter manhole at this location

C. Carry non-shrink grout over flange of

D. Set manhole ring and cover elevations in accordance with the District Standards

E. Use precast grade rings for height adjustment of manhole ring and cover

3.10 CONNECTION TO EXISTING MANHOLES

A. Maintain flow at all times

B. Prior approval of proposed method for maintaining flow must be obtained from Engineer

C. Cover area around new pipe with non-shrink grout and or waterstop gasket to ensure a watertight structure

D. Make connection during low flow periods

E. The contractor shall core drill the existing manhole as necessary to insert a “Kor-N-Seal or approved gasket and new sewer pipe.

F. The existing concrete foundation bench shall be ground to the cross-section of the new pipe in order to form a smooth, continuous invert similar to what would be formed in a new concrete base. Portland cement grout shall be used as necessary to smoothly finish the new invert.

3.11 NEW MANHOLE CONNECTIONS TO ACTIVE SEWER LINES

A. When connecting to an active line, the connecting manhole shall be poured in place, Class "B” 4,500 psi concrete with a minimum thickness of eight inches (8) below the flow line of the pipe and four inches (4) above the crown is required.

B. Manhole inverts shall be formed to the full diameter of the pipe to insure full and unobstructed flow. Each pipe must extend no more than four (4) inches into the manhole wall to a formed concrete invert.

C. Pre-cast bases may be used when specifically authorized by the District. Pipes extended through manholes and cut to form an invert are not acceptable without prior written permission from the District.

3.12 FIELD QUALITY CONTROL – PIPE

A. General
1. Utilize pressures, media and pressure test durations as specified on Piping Schedules
2. Isolate equipment which may be damaged by the specified pressure test conditions
3. Perform pressure test using calibrated pressure gauges and calibrated volumetric measuring equipment to determine leakage rates. Select each gauge so that the specified test pressure falls within the upper half of the gauge's range. Notify District 48 hours prior to each test. Pressure test to be performed by contractor or third party.
4. Completely assemble and test new piping systems prior to connection to existing pipe systems
5. Acknowledge satisfactory performance of tests and inspections in writing to Engineer prior to final acceptance
6. Provide all necessary equipment and perform all work required in connection with the tests and inspections
7. Bear the cost of all testing and inspecting, locating and remedying of leaks and any necessary retesting and re-examination

B. Testing methods and criteria
1. Ductile iron pipe systems: Test ductile iron pipe in accordance with the latest version of AWWA C600. Per AWWA C600, the allowable leakage in gallons per hour from buried ductile iron pipe systems shall be less than the length of pipeline tested in feet,

times the nominal diameter of the pipe in inches, times the square root of the average test pressure during the leakage test in pounds per square inch (gauge), divided by 133,200. The duration of each leakage test shall be two hours. The equation for computing the allowable leakage is:

i) $L = (SDP^{0.5})/133,200$

Where:
L = allowable leakage, in gallons per hour
S = length of the pipe tested, in feet
D = nominal diameter of the pipe, in inches
P = average test pressure during the leakage test, in psi

2. Polyethylene (PE) pressure pipe systems: Test PE pressure pipe in accordance with the latest version of ASTM F2164. For PE pipe, pressurize the test section to the system test pressure and maintain this pressure for four hours by adding make-up water. After this initial expansion phase, reduce the test pressure by 10 PSI and stop adding make-up water. If the test pressure remains steady (within 5% of the target value) for one hour, no leakage is indicated
3. Unless otherwise specified, the allowable leakage in gallons per hour from other buried liquid piping systems shall be less than the length of pipeline tested in feet, times the nominal diameter of the pipe in inches, times the square root of the average test pressure during the leakage test in pounds per square inch (gauge), divided by 133,200. The duration of each leakage test shall be two hours. The equation for computing the allowable leakage is:

i) $L = (SDP^{0.5})/133,200$

Where:
L = allowable leakage, in gallons per hour
S = length of the pipe tested, in feet
D = nominal diameter of the pipe, in inches
P = average test pressure during the leakage test, in psi

4. The following liquid piping systems shall have zero allowable leakage at the specified test pressure throughout the specified duration:
   a. Exposed piping
   b. Buried insulated piping
   c. Buried or exposed piping carrying liquid chemicals
5. Hydrostatic pressure testing
   a. For buried piping: Perform testing after backfill and proper compaction of trenches. Where lines are installed under roadways and parking areas, perform tests after completion of final grade preparation and prior to application of surface courses. Notify Engineer at least 48 hours prior to testing. Provide temporary restraints for expansion joints for additional pressure load under test. Isolate equipment in piping system with rated pressure lower than pipe test pressure by valves or blind flanges
6. Low pressure air test
   a. Check pneumatic plugs for proper sealing
   b. Place plugs in line at each manhole and inflate to 25 PSIG

c. Introduce low pressure air into sealed line segment until air pressure reaches 4 PSIG greater than ground water that may be over the pipe. Use test gauge conforming to ANSI B40.1 with 0 to 15 PSI scale and accuracy of 1 percent of full range
d. Allow 2 minutes for air pressure to stabilize
e. After stabilization period (3.5 PSIG minimum pressure in pipe) discontinue air supply to line segment
f. Acceptable time for loss of 0.5 PSIG of air pressure in plastic pipe shall be:

	Minimum Time for 0.5 PSIG Loss in Plastic Pipe (minutes: seconds)								
Pipe Size	≤100 Feet	150 Feet	200 Feet	250 Feet	300 Feet	350 Feet	400 Feet	450 Feet	500 Feet
4 Inch	1:53	1:53	1:53	1:53	1:53	1:53	1:53	1:53	1:53
6 Inch	2:50	2:50	2:50	2:50	2:50	2:50	2:51	3:12	3:34
8 Inch	3:47	3:47	3:47	3:47	3:48	4:26	5:04	5:42	6:20
10 Inch	4:43	4:43	4:43	4:57	5:56	6:55	7:54	8:54	9:53
12 Inch	5:40	5:40	5:42	7:08	8:33	9:58	11:24	12:50	14:14
15 Inch	7:05	7:05	8:54	11:08	13:21	15:35	17:48	20:02	22:16
18 Inch	8:30	9:37	12:49	16:01	19:14	22:26	25:38	28:51	32:03
21 Inch	9:55	13:05	17:27	21:49	26:11	30:32	34:54	39:16	43:38
24 Inch	11:24	17:57	22:48	28:30	34:11	39:53	45:35	51:17	56:59
27 Inch	14:25	21:38	28:51	36:04	43:16	50:30	57:42	64:54	72:07
30 Inch	17:48	26:43	35:37	44:31	53:25	62:19	71:13	80:07	89:02

NOTE: If there has been no (zero psi) drop after 1 hour of testing, the test section shall be accepted and the test completed

h. For pipe lengths not shown in the above table, use the two nearest pipe lengths to estimate the minimum time necessary for a 0.5 PSIG loss
i. For concrete pipe 24" and smaller refer to ASTM C-924 for acceptable test procedures and times
j. For concrete pipe 24" and larger refer to ASTM C-1103 for acceptable test procedures and times

7. If an air test is not possible, the Contractor may reach out to the District for case-by-case approval to perform a hydrostatic test in lieu of an air test

C. TV Inspection will be provided as requested by District and approved by the Engineer at the expense of the Contractor. Digital video files to be provided with reach noted, footage, inverts, and manhole number at each end, and pipe size and type

D. All sewer lines shall be inspected visually to verify accuracy of alignment and freedom from debris and obstructions. The full diameter of the pipe should be visible when viewed between consecutive manholes. The method of test shall be closed circuit television.

3.13 FIELD QUALITY CONTROL – MANHOLES

A. Test all manholes:
1. Vacuum test:

a. Plug all inlets and outlets in such a manner as to prevent displacement of plugs
b. Install and operate vacuum tester head assembly in accordance with equipment specifications and manufacturer instructions
c. Attach the vacuum pump assembly to the proper connection on the test head assembly. Ensure that vacuum inlet/outlet valve is closed
d. Inflate sealing element to twice the pressure test to be used. Do not over inflate
e. Start vacuum pump assembly engine and allow preset RPM to stabilize
f. Open vacuum inlet/outlet valve and evacuate manhole to 5-inches Hg (mercury)
g. Close vacuum inlet/outlet valve, disconnect vacuum pump and monitor vacuum. Record time for vacuum to drop from initial 5 inches Hg to 4 inches Hg.
h. Acceptance for 5 foot diameter manhole is when the time to drop from 5 inches Hg to 4 inches Hg meets or exceeds requirements as defined below:

Maximum Allowable Vacuum Drop		
Manhole Depth Rim to Invert	**Manhole Diameter in feet**	**Time for Vacuum to Drop 1 inch Hg**
10 feet or less	4	120 seconds
10 feet to 15 feet	4	150 seconds
15 feet to 25 feet	4	180 seconds

i. Adjust time to drop from 5 inches Hg to 4 inches Hg for other manhole diameters as follows:
   i) 4 foot diameter manhole: Subtract 30 seconds from time shown above
   ii) 6 foot diameter manhole: Add 30 seconds to time shown above
j. Repair all manholes that fail leakage test and retest until manhole passes test at no additional cost
k. If joint mastic or gasket is displaced during vacuum test, disassemble manhole and replace seal
l. If the manhole fails the initial test, necessary repairs shall be made with a non-shrink grout while the vacuum is still being drawn, Retesting shall proceed until a satisfactory test is obtained.

2. All testing shall be witnessed by Engineer. Contractor shall provide a minimum of 48 hours notice to Engineer prior to testing.

3.14 CLEANUP AND RESTORATION

A. Restore pavements, curbs and gutters, utilities, and other improvements to condition equal to or better than before work began and to satisfaction of Engineer.

B. Deposit waste material in designated waste areas and disposal site graded and shaped.

3.15 FINAL ACCEPTANCE

A. Comply with District standards and specifications for placing sewer line in service

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

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

C. Provide record drawings with manhole number, invert and rim elevations, and location (x, y, z) for each service connection

D. Shapefile to be provided to the District based on record construction documents

E. Provide test report for tracer wire continuity

F. Provide pipe and manhole tests and results

G. Provide video files of TV inspection

3.16 SITE PIPING SCHEDULE (NOTE TO USER:// A FULL SITE PIPING SCHEDULE SHALL BE PROVIDED WITH THE SPECIFICATIONS FOR ALL DISTRICT PROJECTS AS OUTLINED IN THE EXAMPLE TABLE BELOW. ALL HIGHLIGHTED PORTIONS OF THIS TEXT SHOULD BE DELETED OR MODIFIED FOR THE FINAL PRODUCT)

A. Install pipes as scheduled in the pipe schedule provided below [*Engineer to modify highlighted portions of the schedule below for project requirements. Highlighted examples provided for reference.*]

Description	Size (inches)	Material	Working Pressure (psi)
Sanitary Sewer Main	10	SDR 35 PVC	Gravity
Stream Crossing: Sewer Main	2	C900 PVC	Gravity
Force Main	6	C900 PVC	10

3.17 VALVE SCHEDULE, VALVES LARGER THAN 2-INCHES (NOTE TO USER:// A FULL VALVE SCHEDULE SHALL BE PROVIDED WITH THE SPECIFICATIONS FOR ALL DISTRICT PROJECTS AS OUTLINED IN THE EXAMPLE TABLE BELOW. ALL HIGHLIGHTED PORTIONS OF THIS TEXT SHOULD BE DELETED OR MODIFIED FOR THE FINAL PRODUCT)

A. Install valves as scheduled in the valve schedule provided below [*Engineer to modify schedule below for project requirements. Highlighted examples provided for reference.*]

B. The following abbreviations are used in the valve schedule:

Item No.	Type	Size (inches)	Area Location	Type of Installation	Bury Depth (ft)	Valve End Connection
1	PV	4	Call out Station Location	Direct Bury	6	MJ & MJ
2	PV	6	Call out Station Location	Direct Bury	6	MJ & MJ
3	PV	6	Call out Station Location	Direct Bury	6	MJ & MJ

END OF SECTION

SECTION 33 33 01 FOR 6-DIGIT

SECTION 02540 FOR 5-DIGIT

CURED-IN-PLACE PIPE – MAINS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. These Specifications include the minimum requirements for the rehabilitation of sanitary sewer pipelines by the installation of Cured-In-Place Pipe (CIPP) within the existing, deteriorated pipe. Work shall include the cleaning and flushing of existing sanitary sewers prior to installation of CIPP.

B. The rehabilitation of sanitary sewer pipelines shall be done by the installation of a resin-impregnated flexible tube which, when cured, shall be continuous and tight-fitting throughout the entire length of the original pipe. The CIPP shall extend the full length of the original pipe and provide a structurally sound, jointless and water-tight new pipe within a pipe. The Contractor is responsible for proper, accurate and complete installation of the CIPP using the system selected by the Contractor. Ground water may be present in the existing sanitary sewer. Service connections shall be reestablished after the CIPP is cured.

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM):
1. D256 – Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics
2. D543 – Standard Test Method for Resistance of Plastics to Chemical Reagents
3. D638 – Standard Test Method for Tensile Properties of Plastics
4. D790 – Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
5. D1248 – Standard Specification of Polyethylene Plastics Molding and Extrusion Materials
6. D1682 – Test Methods for Breaking Load and Elongation of Textile Fabric
7. D1693 – Standard Test Method for Environmental Stress-Cracking of Ethylene Plastics
8. D1785 – Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
9. D2122 – Determining Dimensions of Thermoplastic Pipe and Fittings
10. D2657 – Standard Practice for Heat-Joining Polyolefin Pipe and Fittings
11. D2837 – Standard Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials or Pressure Design Basis for Thermoplastic Pipe Products
12. D2990 – Tensile, Compressive, and Flexural Creep and Creep Rupture of Plastics
13. D3350 – Standard Specification for Polyethylene Plastics Pipe and Fittings Materials
14. D3567 – Standard Practice for Determining Dimensions of Reinforced Thermosetting Resin Pipe (RTRP) and Fittings

15. D5260 – Standard Classification for Chemical Resistance of Poly(Vinyl Chloride) (PVC) Homopolymer and Copolymer Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
16. D5813 – Standard Specification for Cured-In-Place Thermosetting Resin Sewer Piping Systems
17. F1216 – Standard Practice for Rehabilitation of Existing Pipelines and Conduits by the Inversion and Curing of a Resin-Impregnated Tube
18. F1533 – Standard Specification for Deformed Polyethylene (PE) Liner
19. F1606 – Standard Practice for Rehabilitation of Existing Sewers and Conduits with Deformed Polyethylene (PE) Liner
20. F1743 – Standard Practice for Rehabilitation of Existing Pipelines and Conduits by Pulled-in-Place Installation of Cured-in-Place Thermosetting Resin Pipe (CIPP)
21. F1867 – Standard Practice for Installation of Folded/Formed Poly(Vinyl Chloride) (PVC) Pipe Type A for Existing Sewer and Conduit Rehabilitation
22. F1871 – Standard Specification for Folded/Formed Poly(Vinyl Chloride) Pipe Type A for Existing Sewer and Conduit Rehabilitation
23. F2019 – Standard Practice for Rehabilitation of Existing Pipelines and Conduits by the Pulled in Place Installation of Glass Reinforced Plastic (GRP) Cured-in-Place Thermosetting Resin Pipe (CIPP)

1.3 SUBMITTALS

A. Shop Drawings and Product Data
   1. Manufacturer
   2. Sufficient data to verify compliance with the specifications and to illustrate construction and assembly of the products
   3. Detailed specifications and data describing materials used
   4. Indicate liner dimensions for each pipe size to be relined
   5. Complete description of proposed wet-out procedures

B. Manufacturer's Installation Instructions
   1. Submit detailed description of liner placement and curing procedures for piping.
   2. Include description of procedures for sealing liner material at manholes and reestablishing service connections.
   3. Submit manufacturer's requirements for receiving, handling, and storage of materials.

C. Manufacturer's Field Start-up Report
   1. Indicate personnel present and actual tests procedures that were performed by manufacturer's representative
   2. Manufacturer to submit field verification of proper assembly

D. Contractor's procedures and materials for service renewal

E. Digital Video Discs (DVDs):
   1. Submit video recordings of piping sections as follows:
      a. Show cured liner and reestablished service connections after relining Work is complete

1.4 COORDINATION

A. Coordinate Work of this Section with users connected to the system.

B. Notify home owners and businesses at least 48 hours in advance of expected disruption of sanitary service.

C. Limit disruption of service to individual properties to one-time occurrence for maximum of eight hour

D. Do not disrupt customer service between hours of 5:00 P.M. and 8:00 A.M.

E. Provide and maintain temporary facilities, including piping and pumps, to meet District requirements

1.5 PROJECT RECORD DOCUMENTS

A. Accurately record actual locations of piping mains and services that include CIPP liner. Indicate pipe inverts and top of pipe elevations

B. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum five years' documented experience

B. Installer: Company specializing in performing work of this section with minimum five years' documented experience in installation of liner materials and licensed or certified by manufacturer

1.7 DELIVERY, STORAGE, AND HANDLING

A. The Contractor shall be responsible for the delivery, storage, and handling of products. No products shall be shipped to the job site without the approval of the District.

B. Keep products safe from damage. Promptly remove damaged products from the job site. Replace damaged products with undamaged products. Protect material from moisture.

1.8 EXISTING CONDITIONS

A. Verify field measurements prior to fabrications

B. Indicated field measurements on Shop Drawings

1.9 WARRANTY

A. Material Warranty

1. All CIPP liners shall be certified by the manufacturer for specified material properties for the repair. The manufacturer shall warranty the liner to be free from defects in raw materials for ten years from the date of installation. During the warranty period, any defects which affect the integrity, strength or water tightness of the installed pipe shall be repaired at the contractor's expense.

B. Installation Warranty
   1. The Installer shall guarantee the CIPP liner against defects in installation and workmanship for the period of one (1) year commencing with the date of substantial completion of the CIPP system

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. CIPP Liner
   1. Saertex-Multicom
   2. Insituform Technologies, Inc.
   3. LMK Technologies, LLC
   4. Or accepted substitution

2.2 DESIGN CONSIDERATIONS

A. CIPP shall be designed in accordance with ASTM F1216 and D5813

B. CIPP design for the main sheet shall assume no bonding to the original pipe

C. The resin saturated main sheet must place the resin in full contact with the host pipe. The cured liner must provide coating on the interior of the lateral piping for an improved flow rate.

D. The liner must be smooth and have an average roughness coefficient “n” factor of 0.013 or lower.

2.3 GENERAL

A. The CIPP liner shall be constructed of materials and methods that provide a jointless and continuous structurally sound liner able to withstand all imposed static, and dynamic loads on a long-term basis.

B. Design lining material to have sufficient structural strength to support dead loads, live loads, and groundwater load imposed, assuming existing pipe cannot share loading or contribute to structural integrity of liner.

C. Field measurements of the existing pipe diameters, ovality and length shall be taken.

D. Pipe liner shall be capable of installation with water in the carrier pipe and surrounding groundwater.

E. The flexible tube shall be fabricated to a size that when installed will neatly fit (minimum 99.75%) the internal circumference of the existing sanitary sewer lines (including services). Allowance shall be made for circumferential stretching during insertion so that the final cured product is snug against the wall of the host pipe.

F. The minimum length shall be that deemed necessary by the Contractor to effectively span the distance from the inlet to the outlet of the respective manholes unless otherwise shown or specified. The Contractor shall verify the lengths in the field before impregnation.

2.4 CURED-IN-PLACE-LINER

A. Unless otherwise specified, the Contractor shall furnish a general purpose, unsaturated, polyester or thermosetting vinyl esther resin and catalyst system compatible with the reconstruction inversion process that provides cured physical strengths specified herein, and complies with ASTM D5813, F1216, F1743, and F2019.

B. Liner material shall be manufactured with resins pre-impregnated within the liner to eliminate the possibility of air bubbles and voids. Resin shall be a corrosion-resistant polyester or vinyl ester resin and catalyst system that, when properly cured within tube composite, meets requirements of ASTM F1216, F1743, and F2019

C. The liner thickness shall be sized for a minimum hydrostatic load of 8.0 feet and maximum depth of earth cover as measured in the field. The hydrostatic load shall be increased to the manhole depth plus 1.0 foot for bury depths in excess of 8.0 feet.

D. The finished pipe liner in place shall be fabricated from materials which when complete is chemically resistant to and will withstand internal exposure to domestic sewage having a pH range of 5 to 11 and temperature of 150ºF.

E. Minimum Design Criteria:
1. Minimum flexural strength: 4,500 PSI
2. Initial Modulus of Elasticity: 250,000 PSI
3. Nominal CIPP Thickness: 0.118 in – 0.236 in (3 mm – 6 mm)

2.5 HYDROPHILIC GASKET SEAL

A. The rubber joint seal shall be an extended hydrophilic rubber compounded from chloroprene (Neoprene) rubber and a hydrophilic resin, which expands on contact with water.

B. The rubber joint seal shall be bonded with adhesive on one face to hold it in place during assembly.

C. On contact with water, the rubber shall swell by up to 10 times its original volume if necessary and mold itself to completely fill any gaps and exert pressure evenly to ensure the seal. High compression or bolt up forces shall not be necessary for a complete and watertight seal.

D. Hydrophilic rubber joint seals shall be installed at all manhole walls for all lining products.

E. The mainline tube shall include a seamless molded flange shaped gasket attached to the main liner tube at the connection or four molded hydrophilic O-rings at the mainline termination ends.

F. The gaskets must be a minimum of 2.5mm thick and must retain this consistent thickness under installation pressures.

G. The hydrophilic gasket seals must be manufactured in a controlled factory environment with strict quality control and quality assurance protocols.

H. A liquid sealant, adhesives or other fluid like materials having paste like consistency will not be accepted.

2.6 SOURCE QUALITY CONTROL

A. Inspect extruded material for defects and physical properties according to ASTM D1785. Verify liner material is homogeneous and free of defects, cracks, holes, blisters, protrusions, foreign materials, or other deleterious faults.

B. Marking:
   1. For testing purposes, mark each production lot with identical marking number.
   2. Mark each reel of folded PVC pipe at intervals not to exceed 5 feet with coded number identifying manufacturer, size, cell class, machine, shift, and date when liner was extruded.

C. Chemical and Physical Testing: Test cured samples according to ASTM D5260

PART 3 EXECUTION

3.1 PREPARATION

A. Cleaning: Clean existing sewer pipes of debris, sedimentation, and mineral deposits with high-velocity cleaner, bucket and scraper, root saws, rolling or balling units, or other appropriate means.

B. Bypassing Sewage:
   1. Set up bypassing pump system to isolate each section of piping for relining.
   2. Maintain bypass pumping until lining is totally formed and service connections reestablished.

C. The interior of the pipeline shall be carefully inspected to determine the location of any condition that shall prevent proper installation, such as roots, severe offsets, and collapsed or crushed pipe sections. Experienced personnel trained in locating breaks, obstacles, and service connections by closed circuit television shall perform inspection of pipelines.

3.2 ACCESS SAFETY

A. Prior to entering access areas such as manholes, an excavation pit, performing inspection or cleaning operations, an evaluation of the atmosphere to determine the presence of toxic or flammable vapors or lack of oxygen shall be undertaken in accordance with local, state, or federal safety regulations

3.3 SANITARY SEWER REHABILITATION PROCEDURES

A. Pipe Rehabilitation (CIPP) for limits between manholes, or as shown.

B. Sewer lines with no indication for either pipe rehabilitation (CIPP) or full replacement are to have no work performed on them.

C. Where practicable, liners should be installed in continuous runs where there are two or more continuous manhole segments. This is especially desirable to connect several short manhole segments with a continuous lining.

D. Pipe rehabilitation with cured in place thermosetting resin pipe (CIPP) methods must adhere to ASTM F1216 and F2019 for pulled in place installation.
   1. Work includes installation of continuous lengths of homogeneous resin impregnated flexible tube cured tight to existing pipe wall with UV curing, pressurized steam, or in accordance with the manufacturer's recommendations.
   2. Work includes:
      a. Field air testing
      b. Point repair prior to lining where necessary

E. Contractor Responsibilities Include:
   1. Contractor to install the specified system must be responsible for complete performances of such, including, but not limited to:
      a. Materials
      b. Application
      c. Quality Control
   2. Contractor will supply owner with documentation showing past installation experience and licensing prior to construction
   3. Contractor prequalification may be required by individual product manufacturers.
   4. Contractor shall inspect all surfaces and sewers prior to construction and notify owner of any discrepancies or disparities that may interfere with proper preparation or installation. Recent video inspections of the existing sanitary sewer lines are available upon request.
   5. Contractor must comply with all requirements of the manufacturer
   6. Contractor is responsible for all quality assurance testing of systems after construction.
   7. Contractor is responsible for all sewage bypass equipment and traffic control.
   8. Contractor is to verify all existing utilities prior to digging for replacement.
   9. After the liner has been installed, as directed by District, existing services shall be temporarily reinstated to 95% of the original opening.

a. This shall be done without excavation in pavement areas, and in the case of non-man-entry pipes, from the interior of the pipeline by means of a 360-degree television camera and a cutting device that reestablishes the service connection.
b. When a remote cutting device is used and a cleanout is available, then a mini-camera down the service shall also be used to assist the operator in cutting or trimming.
c. Restored openings should be neatly and smoothly cut without rough edges. Care must be exercised not to damage the CIPP or the existing main or lateral pipes.
d. Connections should not be over-cut as this could damage the pipe, break the CIPP watertight seal and/or interfere with future lining of the lateral. Any damage to the liner or lateral while reinstating services will be repaired by a hat or injection sealing method, no grouting will be allowed and no separate payment shall be made for such repair.

3.4 FINISHED CIPP

A. It shall be a homogenous CIPP liner assembly from manhole to manhole.

B. The CIPP shall be smooth with minimal wrinkling and shall increase flow rate capacity.

C. The profile of the hydrophilic molded gaskets should be visible and verifiable during post-video inspection on liners 6mm or thinner thickness.

D. The CIPP shall be free of dry spots, lifts, and delamination.

E. The CIPP shall include a textile taper at each end providing a smooth transition to the host mainline liner for accommodating video equipment and maintaining proper flow in the mainline.

F. After the work is completed, the installer will provide the owner with video footage documenting the repair and the visual markings on the CIPP liner assembly identifying the building address.

3.5 TESTING

A. After installation every liner shall be TV inspected with a camera as soon as practical to verify proper installation. The rate of travel shall not exceed 30 feet per minute. The footage meter count shall be clearly visible. At each restored service, the camera shall come to a complete stop and the service shall be panned. The footage meter count shall be clearly visible. Perform a test on the sewer line as specified below.

B. The wall thickness shall be measured in accordance with the applicable sections of ASTM Test Method D5813 and D3567.

C. Flexural strength and flexural modulus of elasticity shall be determined in accordance with ASTM D-790.

D. Porosity test shall be conducted in accordance with APS Water Porosity Standard.

E. After installation or during the curing/installation process, Contractor shall conduct a mainline integrity pressure test. The test must demonstrate CIPP mainline is watertight.
   1. The Contractor shall furnish all necessary equipment to conduct the test. An acceptable method is a low-pressure air test, conducted as follows:
   2. Pressurize the test section to 4.0 psi and hold above 3.5 psi for not less than 2 minutes. Add air if necessary to keep the pressure above 3.5 psi. At the end of this 2-minute stabilization period, note the pressure (must be 3.5 psi minimum) and begin the timed period. If the pressure drops 0.5 psi in less than the time given in the table below, the section of pipe shall have failed the test.
   3. When the prevailing groundwater is above the sewer being tested, test pressure shall be increased 0.43 psi for each foot that the water table is above the invert of the sewer.

Sewer Diameter (Inches)	Minimum Test Time per 100 ft. (seconds)
8	72
10	90
12	108
18	144

   4. If the time for the pressure to drop 0.5 psi is 125 percent or less of the time given in the table, the line shall immediately be re-pressurized to 3.5 psi and the test repeated.
   5. The pressure gage used shall be supplied by the Contractor and have minimum divisions of 0.10 psi and be oil filled.

3.6 EXECUTIONOF WORK

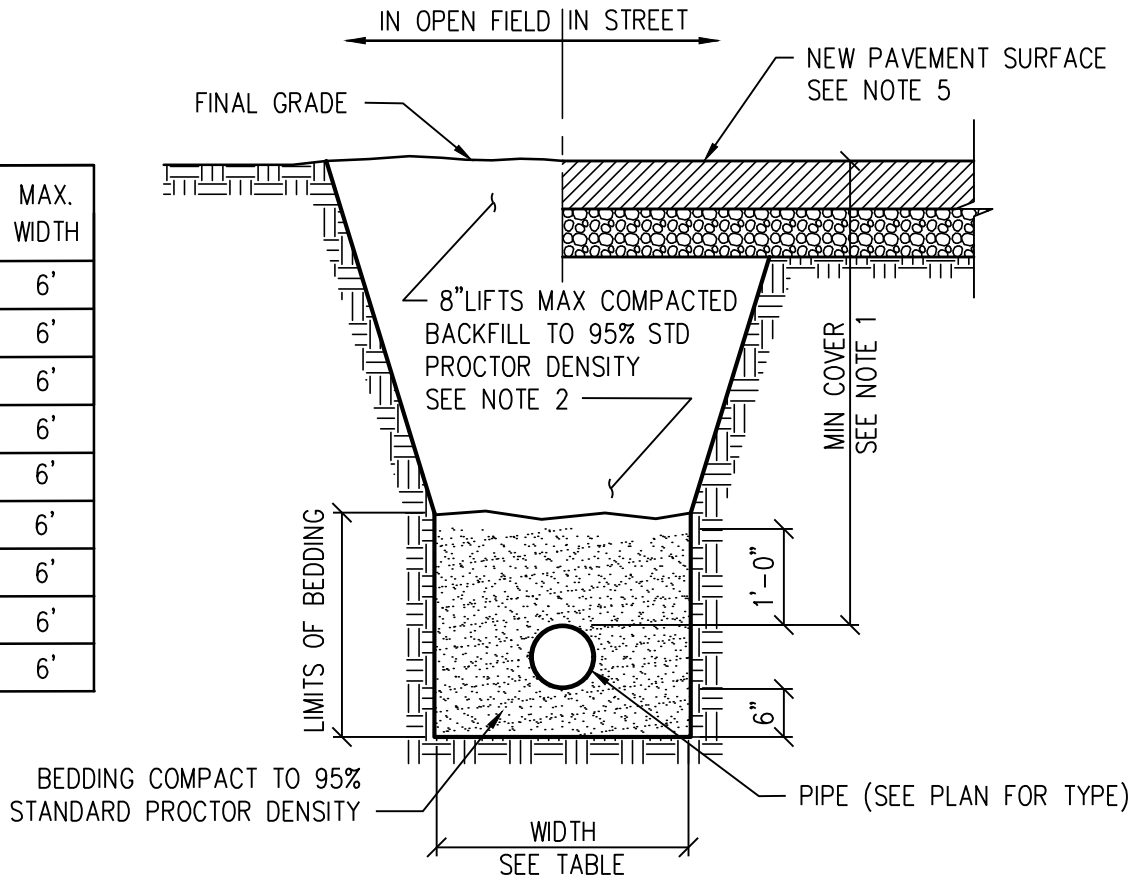
A. All sewer services connected to the main shall be reinstated after the sewer main has been lined or replaced due to defects. The Contractor shall note that not all sewer lines segments have been televised in their entirety due to obstructions blocking further entry, etc. These obstructions shall be cleared to allow TV viewing of the entire segment length before lining is commenced. Existing sanitary sewer segments may be broken and contribute considerable ground water to the sewer main or contain considerable amounts of grease, roots or other debris.

END OF SECTION

APPENDIX B
STANDARD DETAILS

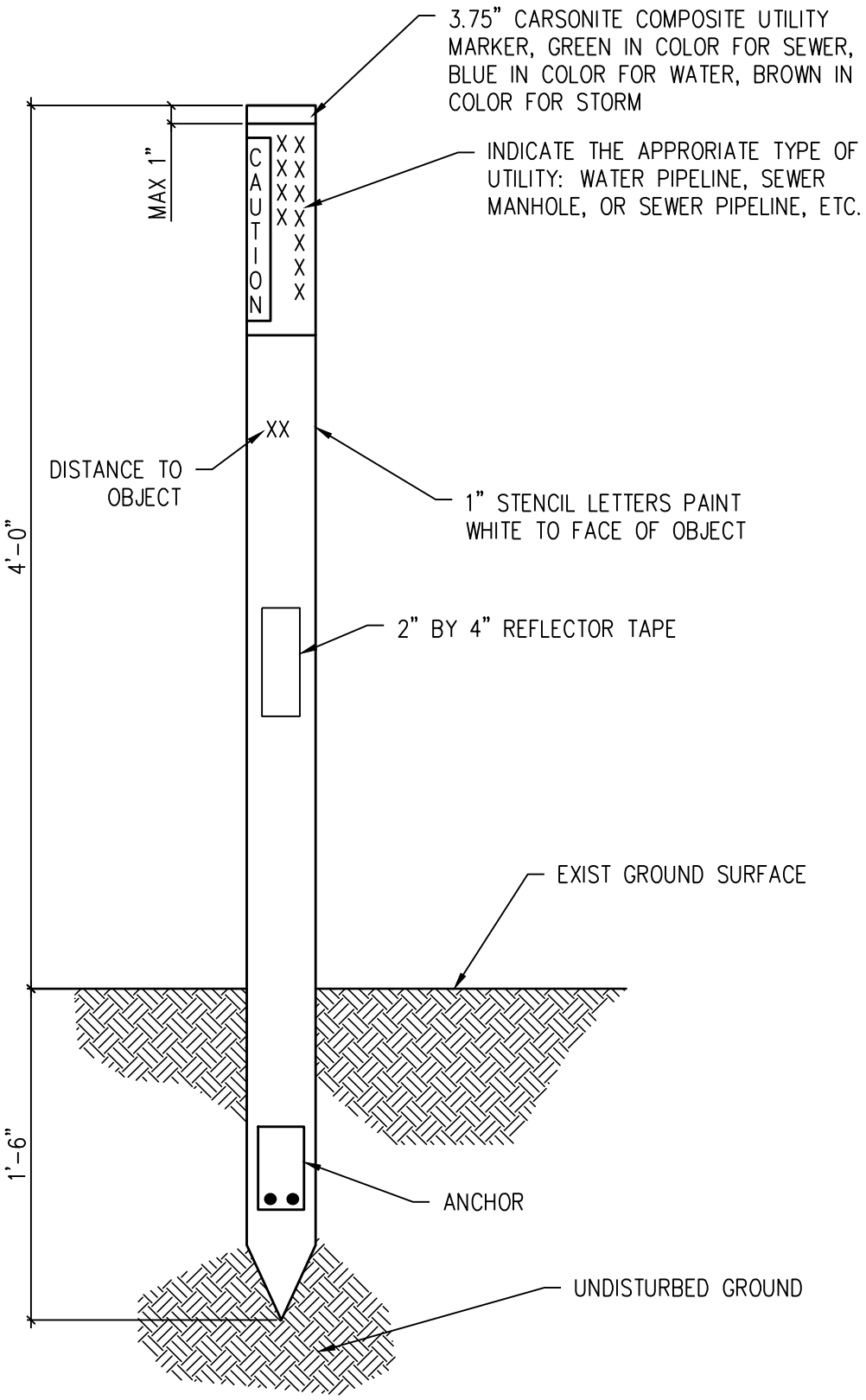
THIS PAGE IS INTENTIONALLY BLANK

PIPE DIA.	MIN. WIDTH	MAX. WIDTH
UP TO 4"	1'-4"	6'
6"	1'-6"	6'
8"	1'-8"	6'
12"	2'-4"	6'
15"	2'-7"	6'
16"	2'-8"	6'
18"	2'-10"	6'
20"	3'	6'
24"	3'-4"	6'



NOTES:

1. MINIMUM COVER 6' FOR WATER AND 3' FOR SANITARY SEWER. MAXIMUM BURY DEPTH 15' FOR WATER AND SEWER
2. IF UNSTABLE MATERIALS ARE FOUND IN TRENCH BOTTOM, OVER EXCAVATE 12" BELOW STD EMBEDMENT AND FILL WITH 3/4" CRUSHED ROCK, COMPACTED TO 95%
3. IF TRENCH EXCAVATED WIDER THAN ALLOWED, A CONCRETE CRADLE SHALL BE PLACED FROM TRENCH BOTTOM TO PIPE SPRINGLINE
4. TRENCH TO BE BRACED OR SHEETED AS NECESSARY FOR THE SAFETY OF THE WORKERS AND THE PROTECTION OF OTHER UTILITIES IN ACCORDANCE WITH COUNTY, STATE AND FEDERAL SAFETY REGULATIONS
5. PAVING SHALL MATCH EXISTING DEPTH AND COMPLY WITH LOCAL JURISDICTION REQUIREMENTS



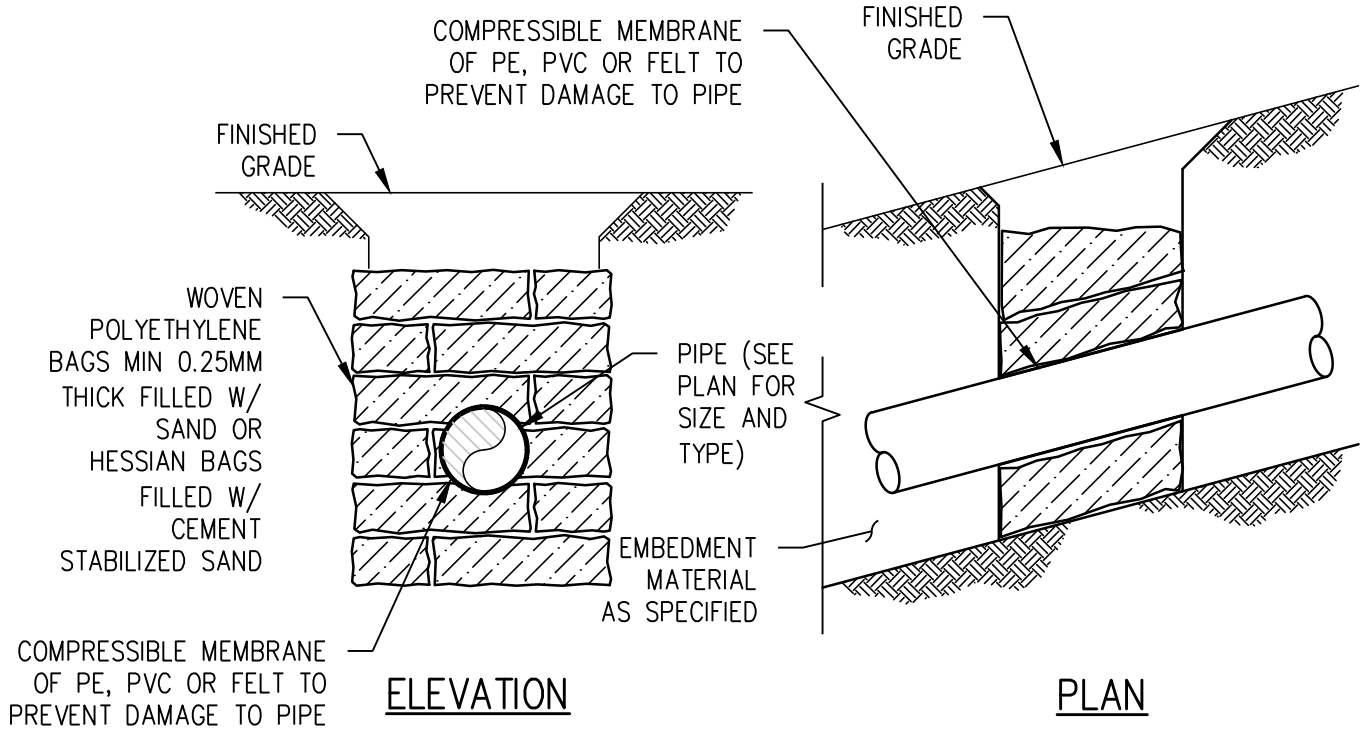
EMD

DISTRICT STANDARD DETAILS

UTILITY MARKER POST

D0.02

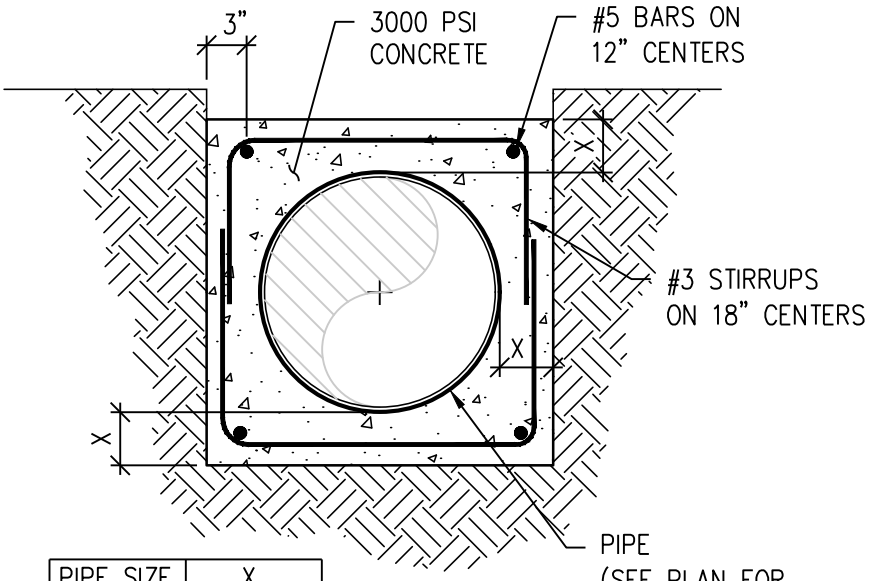
FEB 2025



REQUIREMENT TRENCHSTOPS		
GRADE (%)	REQUIREMENT	SPACING(S) IN FEET
>5	TRENCHSTOP	S=500/GRADE%

NOTES:

1. FLOWABLE FILL MATERIAL MAY BE USED WITH APPROVAL OF DISTRICT ENGINEER



PIPE SIZE	X
6"	4"
8"	4"
12"	4"
18"	5"
24"	6"
36"	6"

NOTE:

SEE TABLE FOR THICKNESS OF CONCRETE ENCASEMENT.

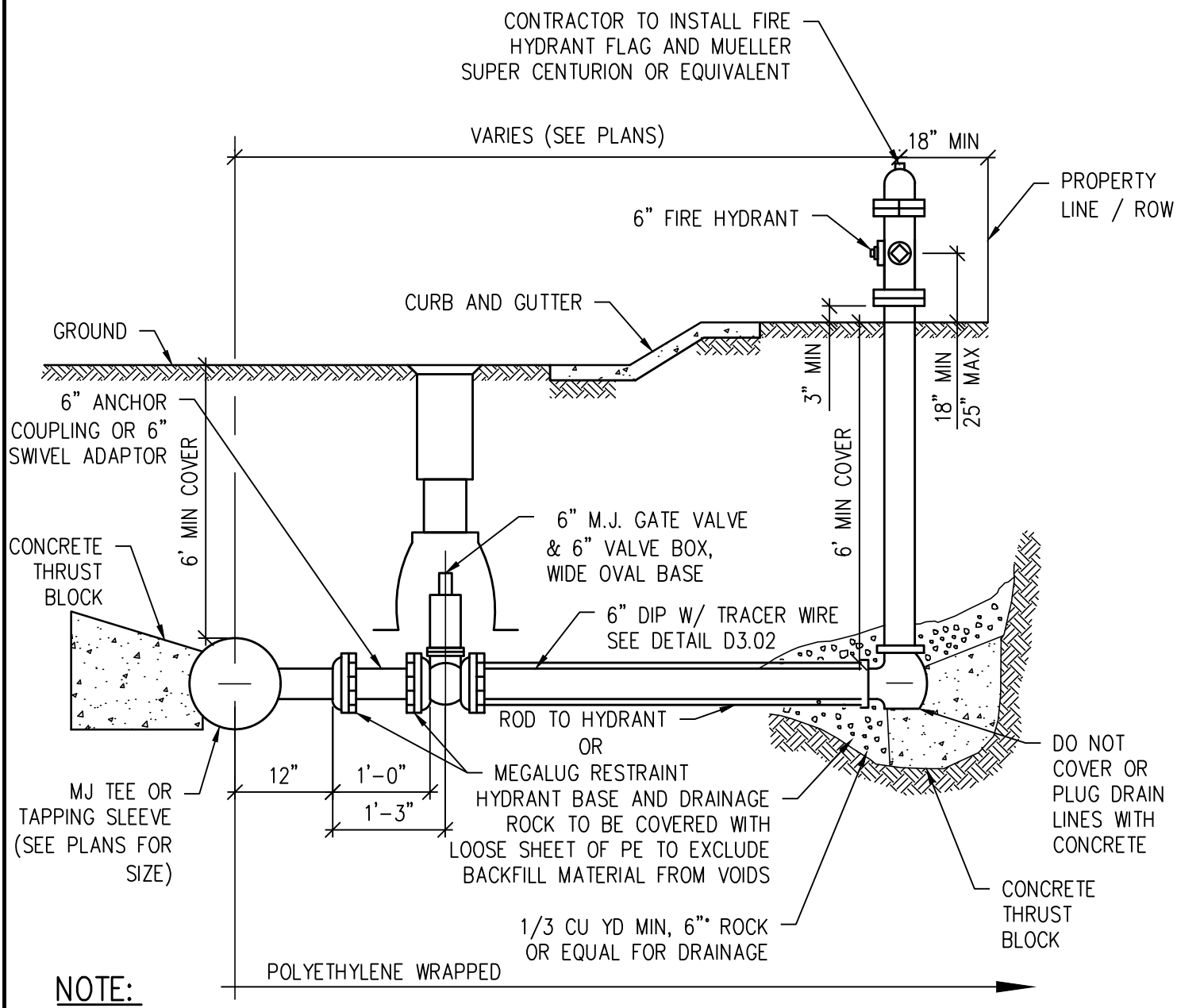
EMD

DISTRICT STANDARD DETAILS

CONCRETE ENCASEMENT

D0.04

FEB 2025



NOTE:

1. HYDRANT SHALL HAVE A FIVE (5') FOOT CLEAR ZONE ON EACH SIDE (TEN (10') FOOT EASEMENT AROUND) WITH A MINIMUM OF FIVE (5') FEET FROM DRIVEWAYS
2. PUMPER NOZZLE SHALL FACE THE PUBLIC RIGHT-OF-WAY OR REQUIRED FIRE ACCESS ROADWAY
3. NO PORTION OF THE FIRE HYDRANT MAY PROTRUDE INTO SIDEWALK AREA
4. MAIN VALVE OPENING IN THE HYDRANT SHALL BE NO LESS THAN FIVE (5") INCHES IN DIAMETER
5. NO HORIZONTAL OR VERTICAL BENDS ARE ALLOWED IN FIRE HYDRANT BRANCH OR SPRINKLER LINES
6. NO WATER SERVICE MAIN TAPS SHALL BE MADE TO A DISTRIBUTION MAIN WITHIN FIVE (5') FEET OF A FIRE HYDRANT BRANCH MAIN
7. ALTERNATE TO THE ABOVE, FASTEN MJ VALVE DIRECTLY TO A MJ ANCHOR TEE (ALSO CALLED SWIVEL TEE)

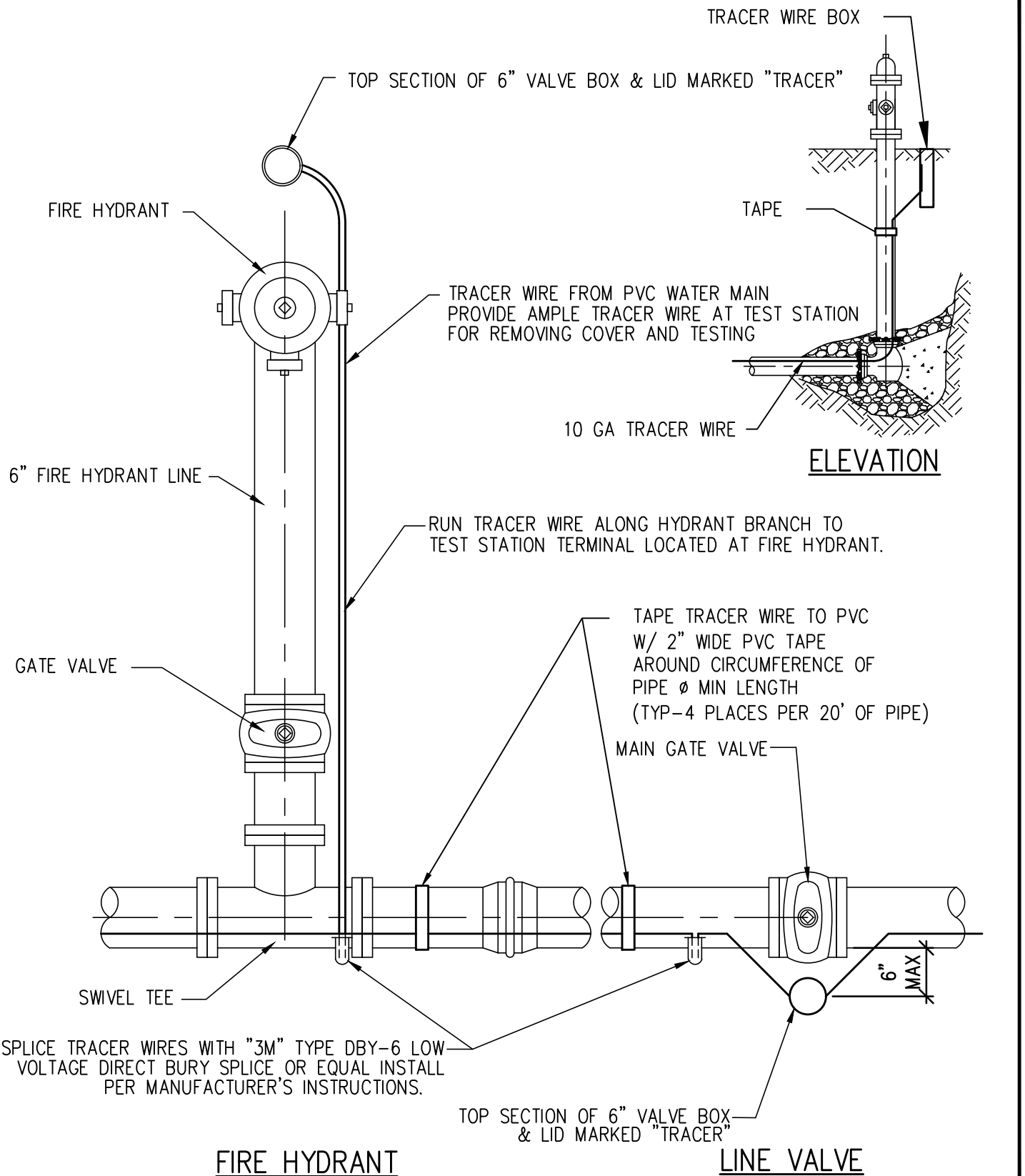
EMD

DISTRICT STANDARD DETAILS

FIRE HYDRANT PROFILE

D3.01

FEB 2025



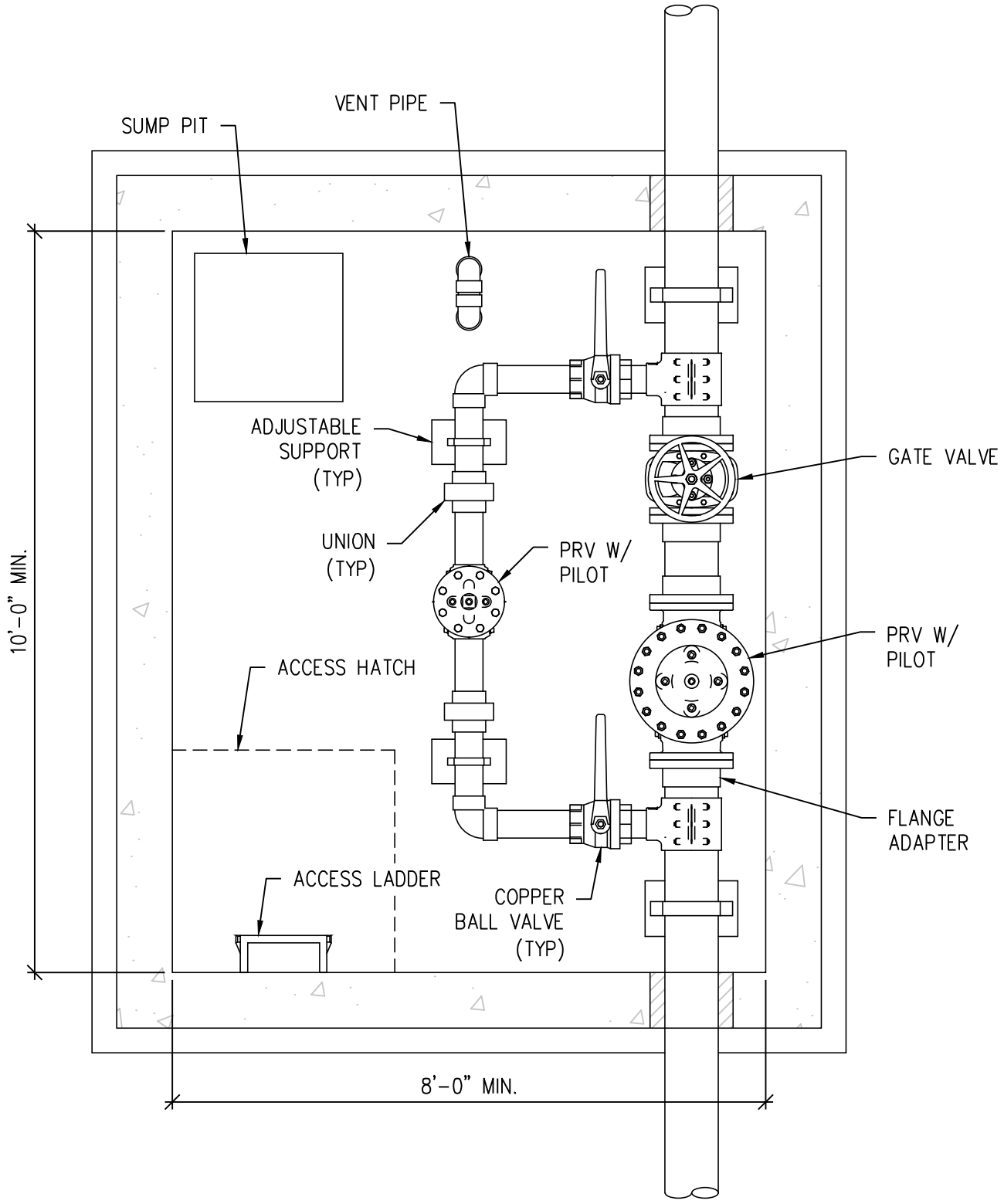
EMD

DISTRICT STANDARD DETAILS

FIRE HYDRANT TRACER WIRE

D3.02

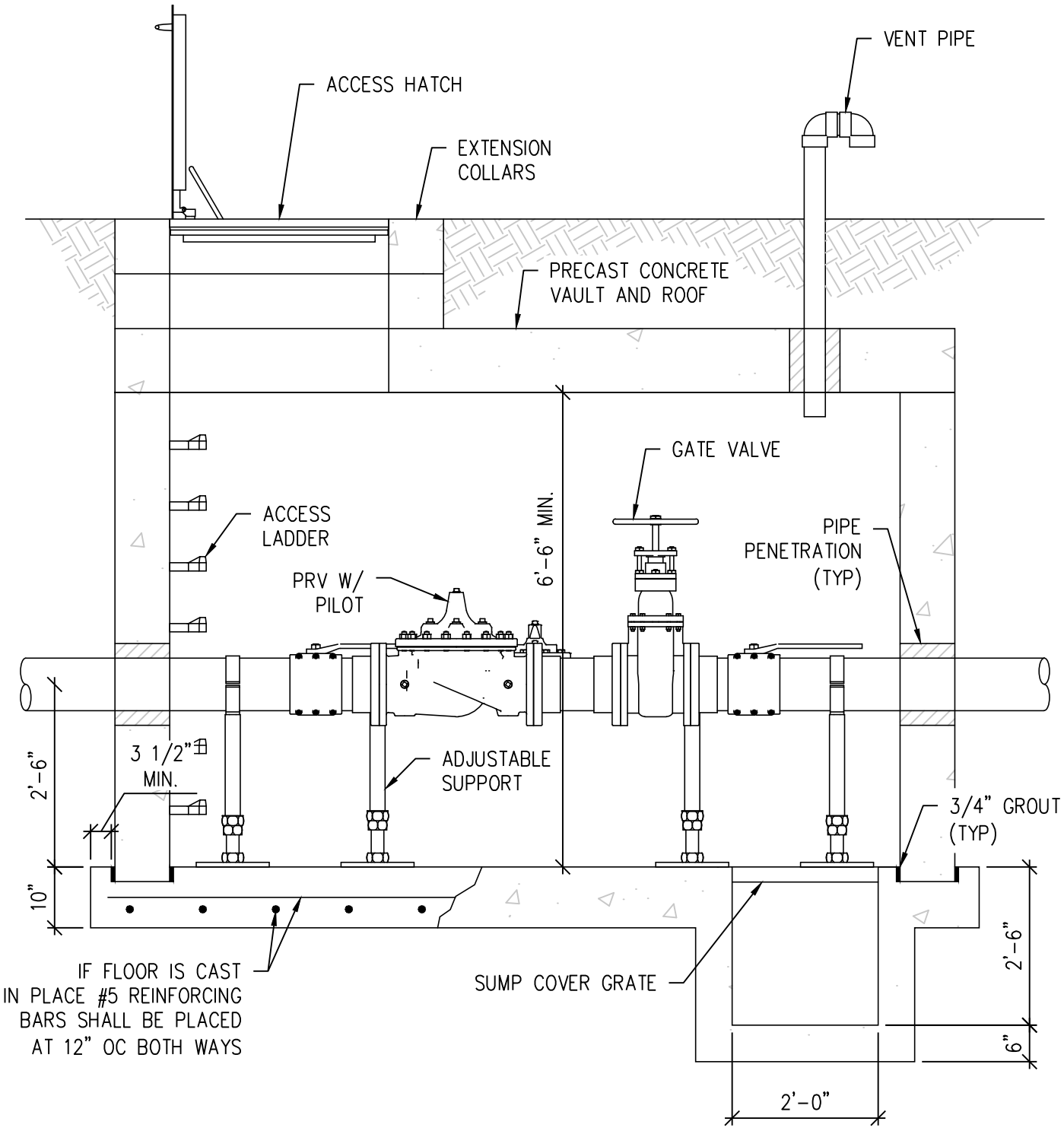
FEB 2025



NOTES:

1. IF LOCATED IN AREAS WITH VEHICULAR TRAFFIC, TRAFFIC RATED MANHOLE LIDS AND RISERS MAY BE ACCEPTED.

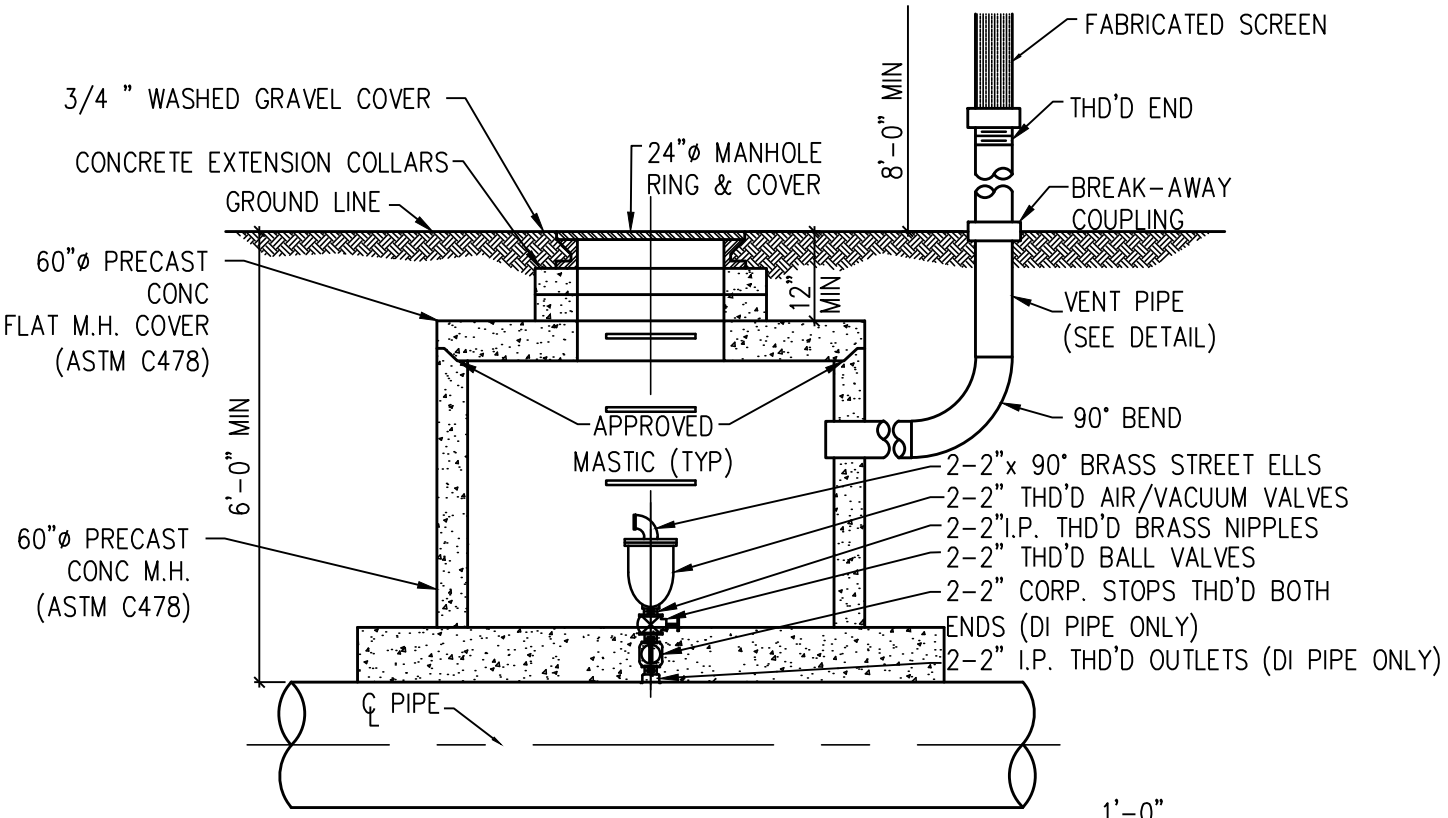
EMD	DISTRICT STANDARD DETAILS	D3.03
	PRV VAULT PLAN VIEW	FEB 2025



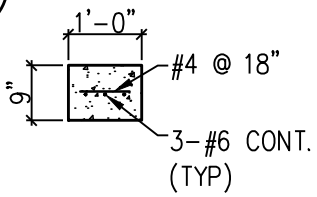
NOTES:

1. IF LOCATED IN AREAS WITH VEHICULAR TRAFFIC, TRAFFIC RATED MANHOLE LIDS AND RISERS MAY BE ACCEPTED.

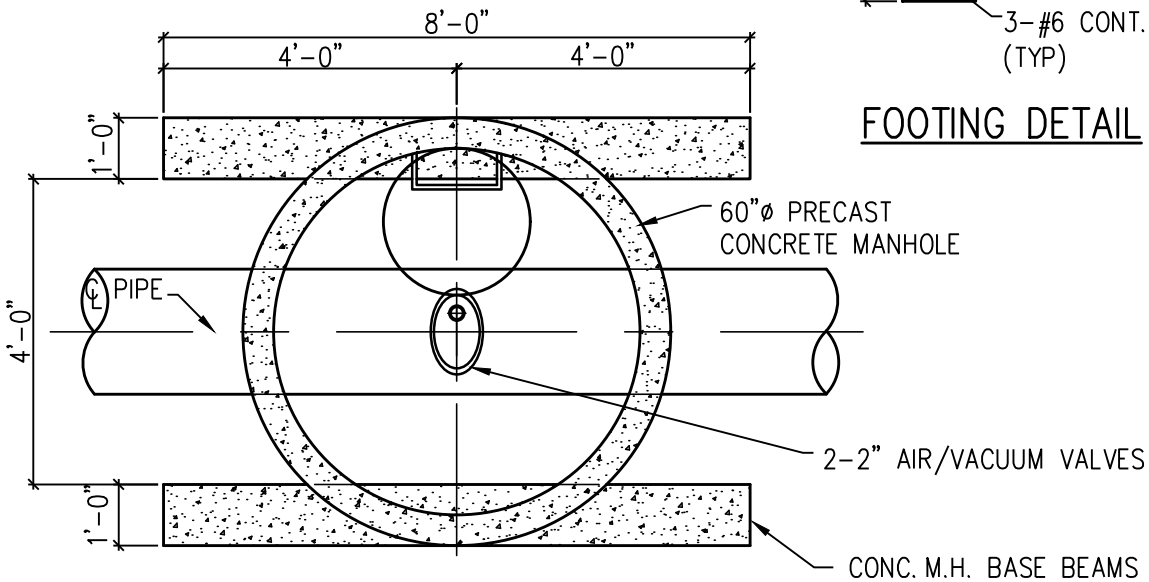
EMD	DISTRICT STANDARD DETAILS	D3.04
	PRV VAULT CROSS SECTION	FEB 2025



ELEVATION



FOOTING DETAIL



PLAN

NOTES:

1. ONLY ONE AIR VACUUM VALVE REQUIRED ON 12-INCH PIPE AND SMALLER
2. THE DISTANCE BETWEEN RUNGS, CLEATS, AND STEPS SHALL NOT EXCEED 12 INCHES AND SHALL BE UNIFORM THROUGHOUT THE LENGTH OF THE LADDER.
3. MANHOLE STEPS ARE REQUIRED IN PRECAST CONCRETE MANHOLES
4. VENT PIPE IS TO BE OF EQUAL SIZE AS VALVE
5. MANHOLE LID AND RISER TO BE TRAFFIC-RATED IF INSTALLED IN ROADS OR DRIVABLE AREAS

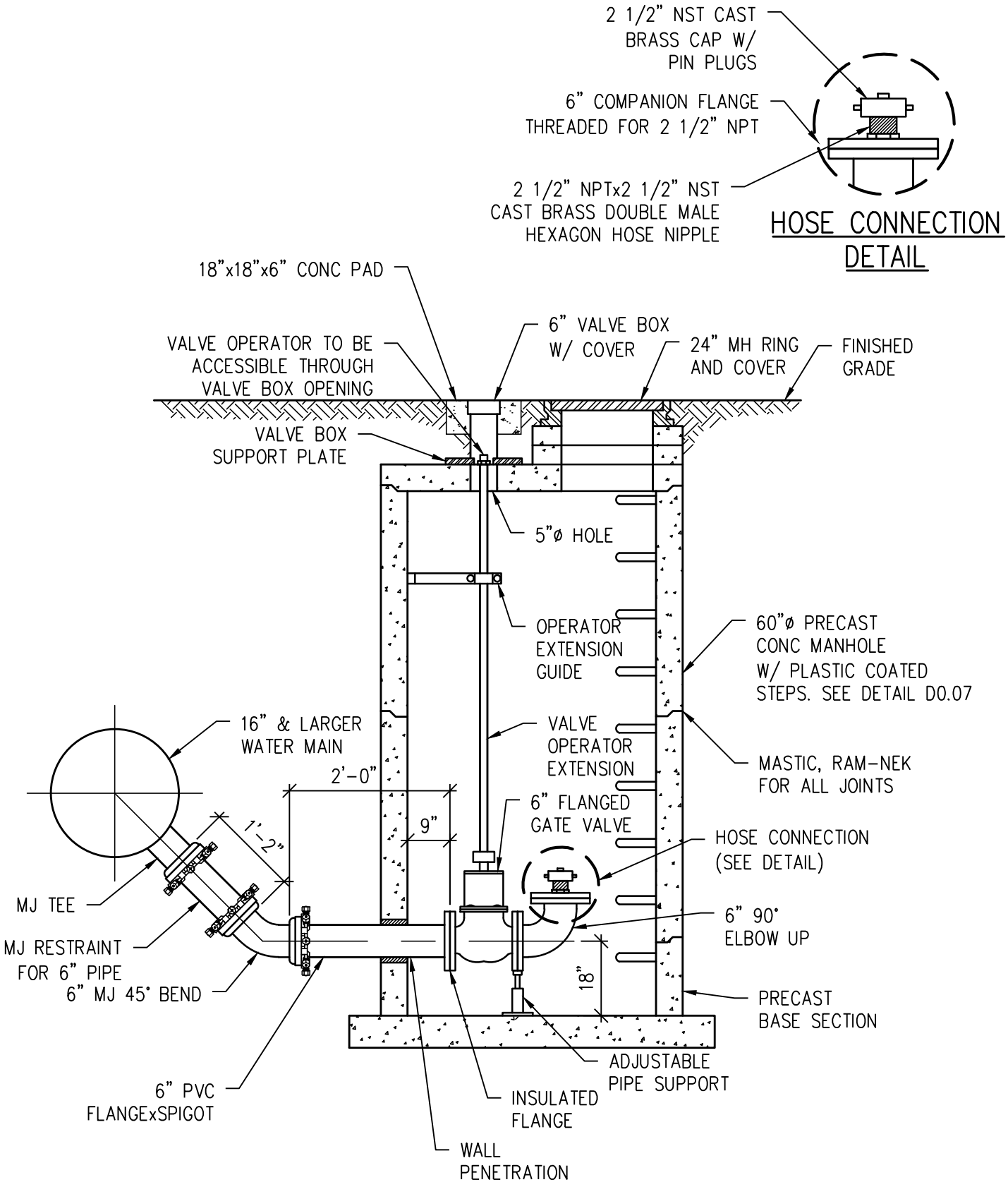
EMD

DISTRICT STANDARD DETAILS

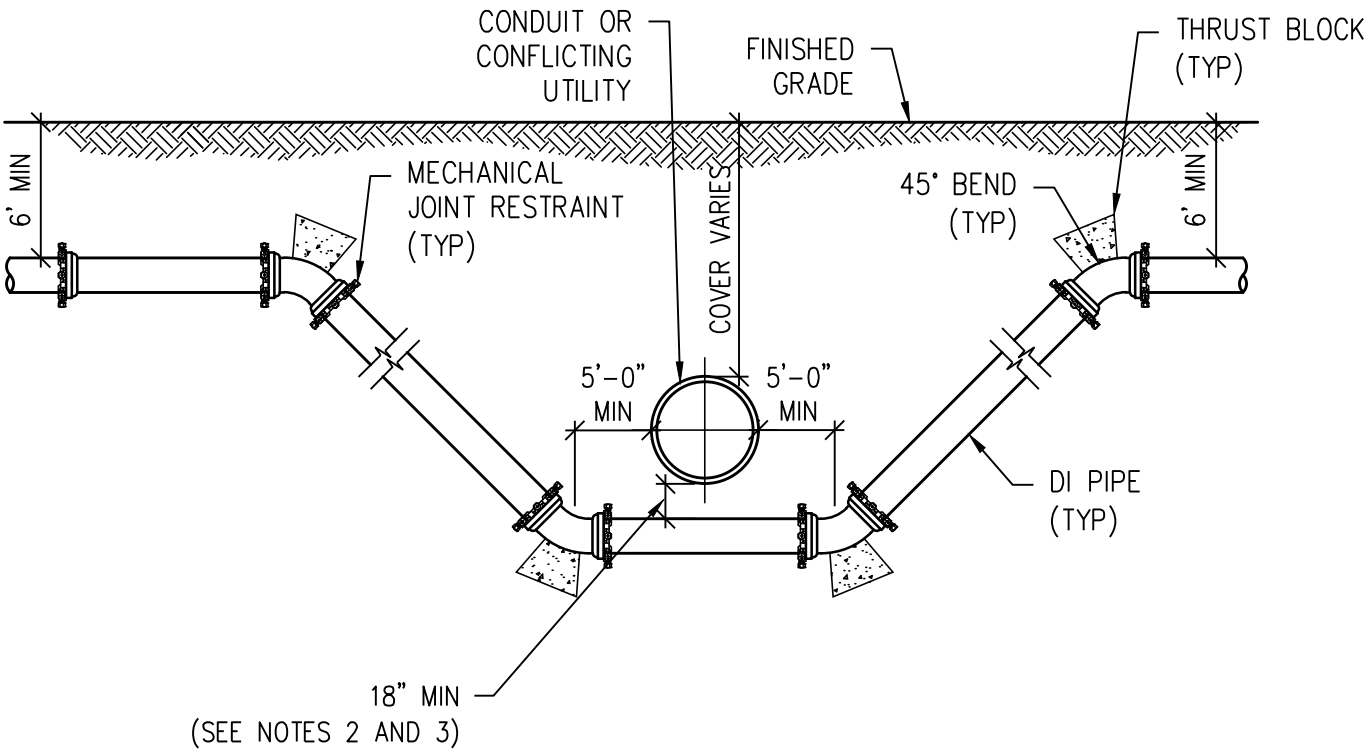
2-INCH AIR-VAC VALVE INSTALLATION

D3.05

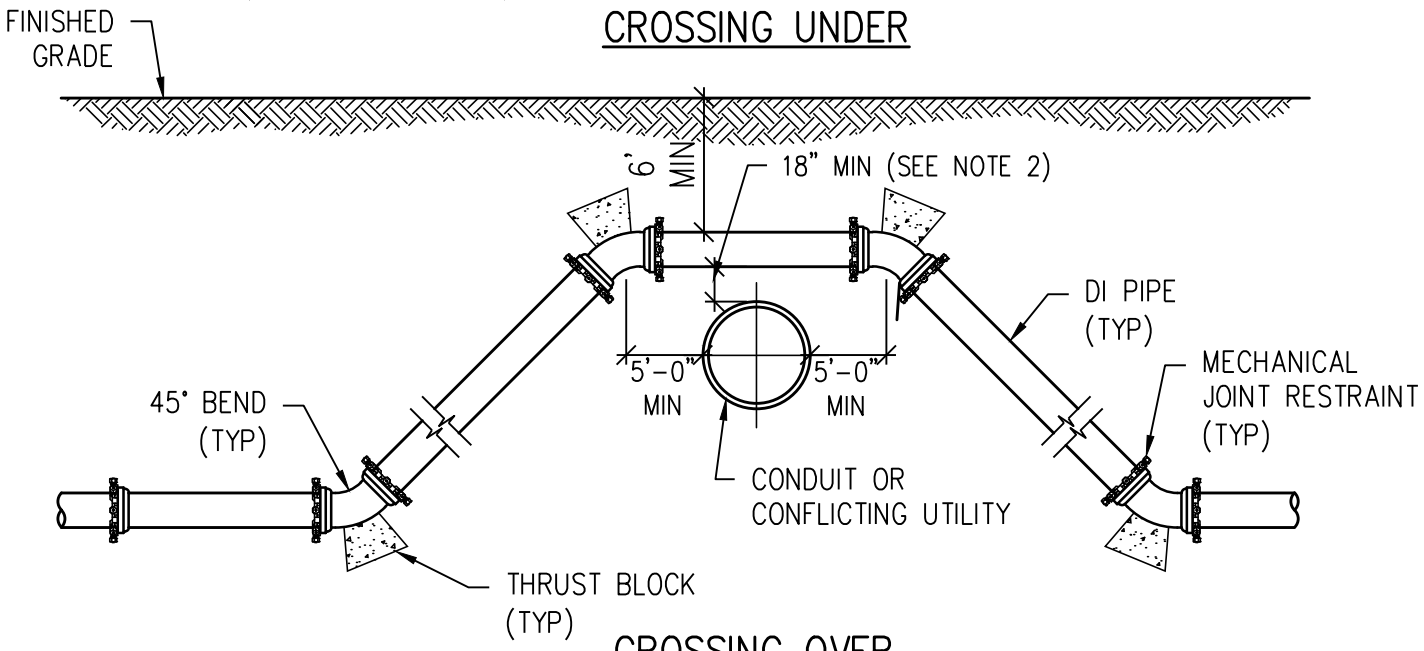
FEB 2025



EMD	DISTRICT STANDARD DETAILS	D3.06
	BLOW-OFF INSTALLATION – PIPES LARGER THAN 12-INCH	FEB 2025



CROSSING UNDER

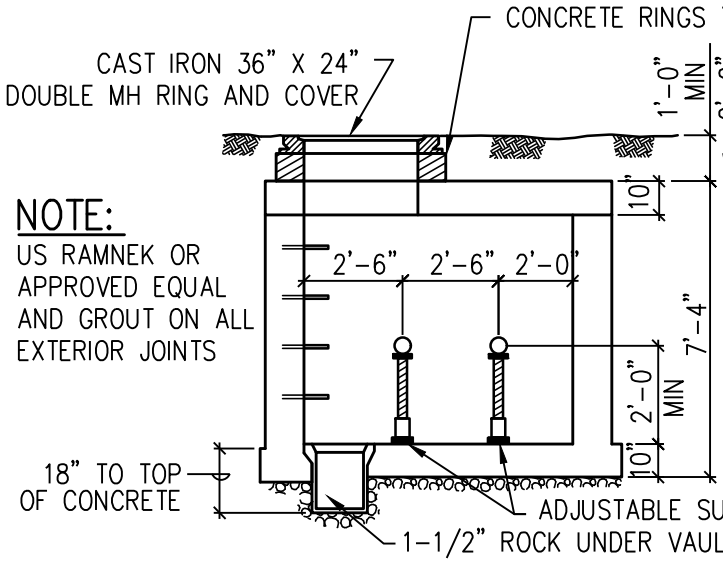


CROSSING OVER

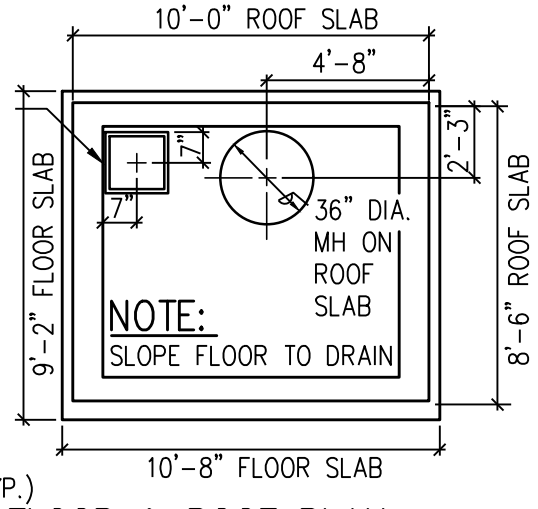
NOTES:

1. CENTER WATER MAIN AT CROSSING TO POSITION JOINTS AS FAR FROM CROSSING AS POSSIBLE
2. WITH 18" MIN SEPARATION FROM SEWER CROSSING, PROVIDE EITHER 1) CONCRETE ENCASEMENT 10' ON BOTH SIDES OF SEWER PIPE OR 2) REPLACE SEWER PIPE WITH PRESSURE RATED PVC 10' ON BOTH SIDES OF PIPE CROSSING

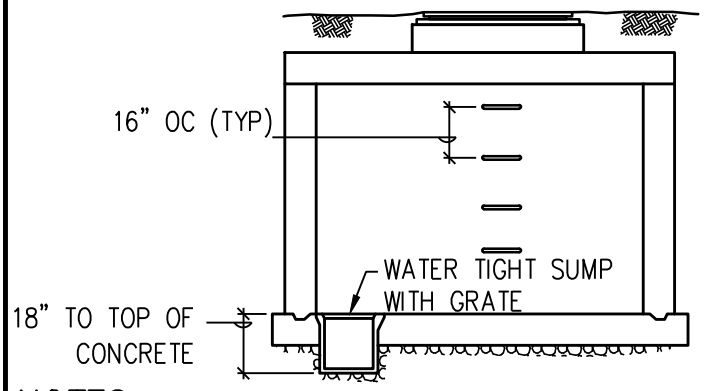
EMD	DISTRICT STANDARD DETAILS	D3.07
	UTILITY CROSSING	FEB 2025



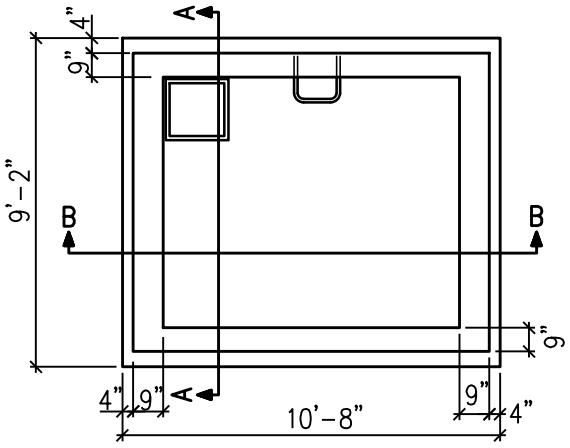
SECTION A



FLOOR & ROOF PLAN



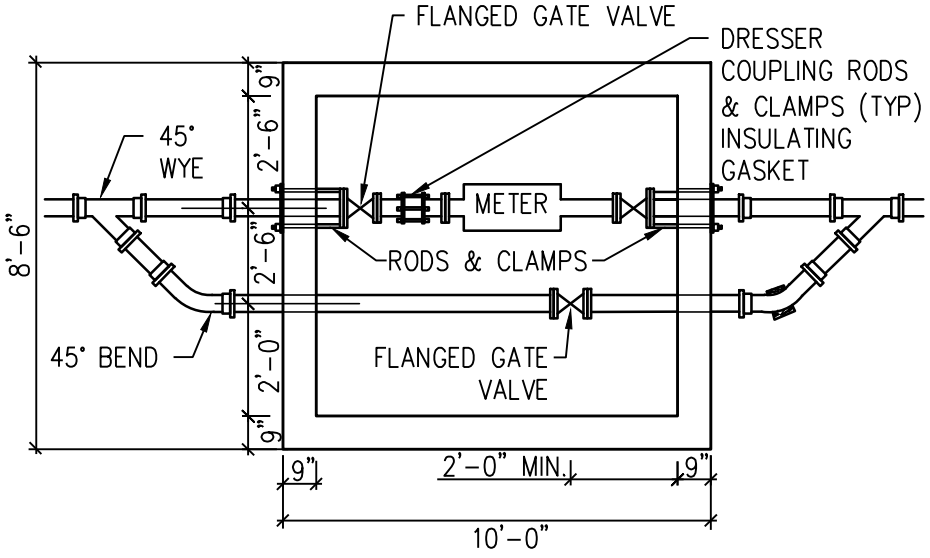
SECTION B



VAULT PLAN

NOTES:

1. ALL MATERIALS, INSTALLATION AND CONSTRUCTION OF METER VAULT ASSEMBLY SHALL BE IN ACCORDANCE WITH CITY OR DISTRICT STANDARDS AND SPECIFICATIONS, TO INCLUDE METER, PIPING, FITTINGS, VALVES, VAULT AND APPARATUS ITEMS.
2. DOMESTIC SERVICE MUST BE INSTALLED BY LICENSED PLUMBER OR WATER SERVICE CONTRACTOR.
3. REFER TO REMOTE READOUT DETAIL IF REQUIRED.
4. BYPASS LINE REQUIRED FOR 1-1/2 INCH AND LARGER METERS EXCEPT THOSE USED FOR IRRIGATION ONLY.
5. PROVIDE ADJUSTABLE SUPPORTS FOR METER AND BY-PASS



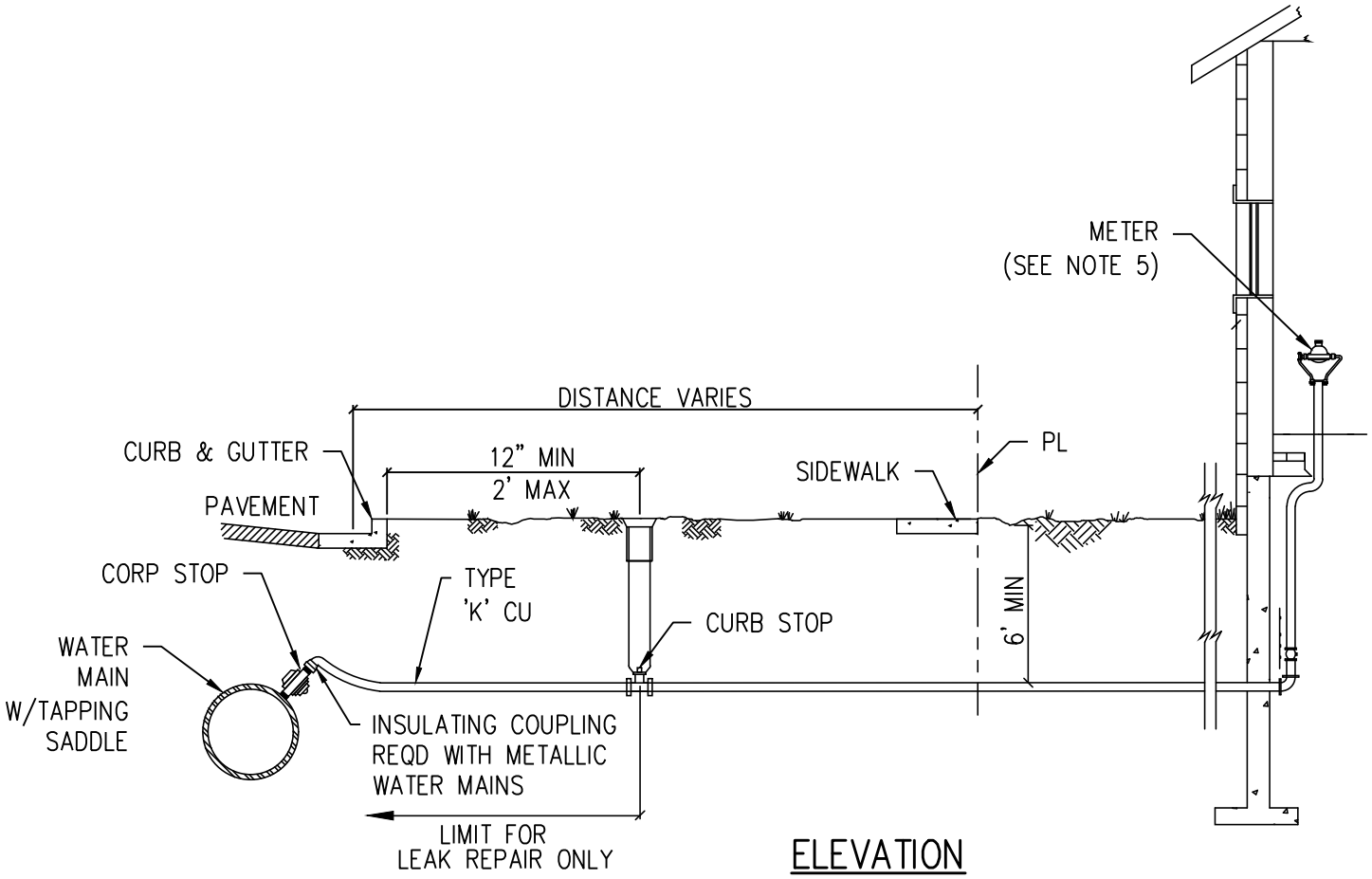
EMD

DISTRICT STANDARD DETAILS

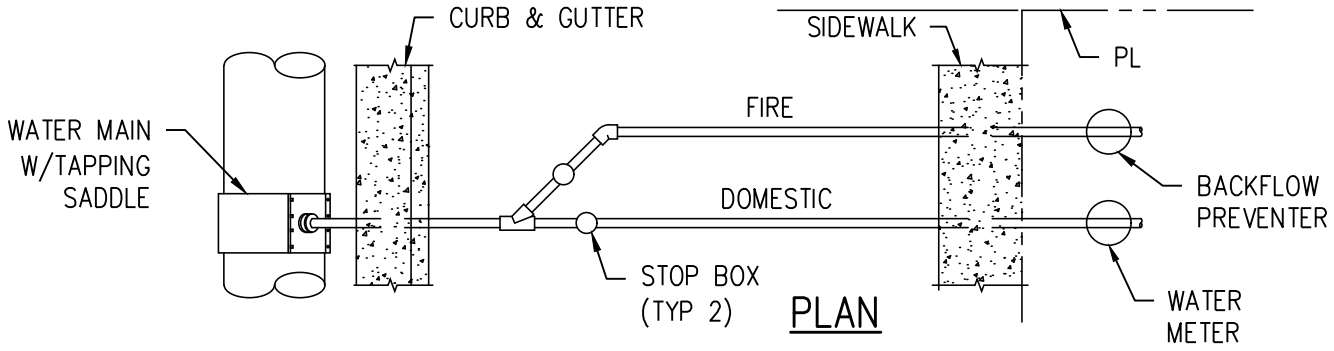
MASTER METER VAULT ASSEMBLY

D3.08

FEB 2025



ELEVATION



PLAN

NOTES:

1. STOP BOX SHALL BE LOCATED AS CLOSE TO CURB AS POSSIBLE, IN A LANDSCAPED AREA 24" FROM THE INLET SIDE OF THE METER UNLESS PRIOR APPROVAL IS OBTAINED FROM THE DISTRICT. FOR A CURB STOP LOCATED BENEATH PAVEMENT, USE A ROADWAY BOX OVER STANDARD STOP BOX WITH A BOND BREAKER. THE CURB STOP CANNOT BE LOCATED BENEATH PARKING AREAS.
2. 2 FT CLEAR FROM THE STOP BOX LID FOR PLANTINGS, SHRUBS, AND BUSHES.
3. 7 FT CLEAR FROM STOP BOX LID TO PROPERTY LINE.
4. DISTRICT STAFF SHALL APPROVE THE LOCATION OF THE WATER METER WITHIN THE RESIDENCE PRIOR TO INSTALLATION OF THE WATER METER. THE DISTRICT SHALL PROVIDE THE WATER METER.

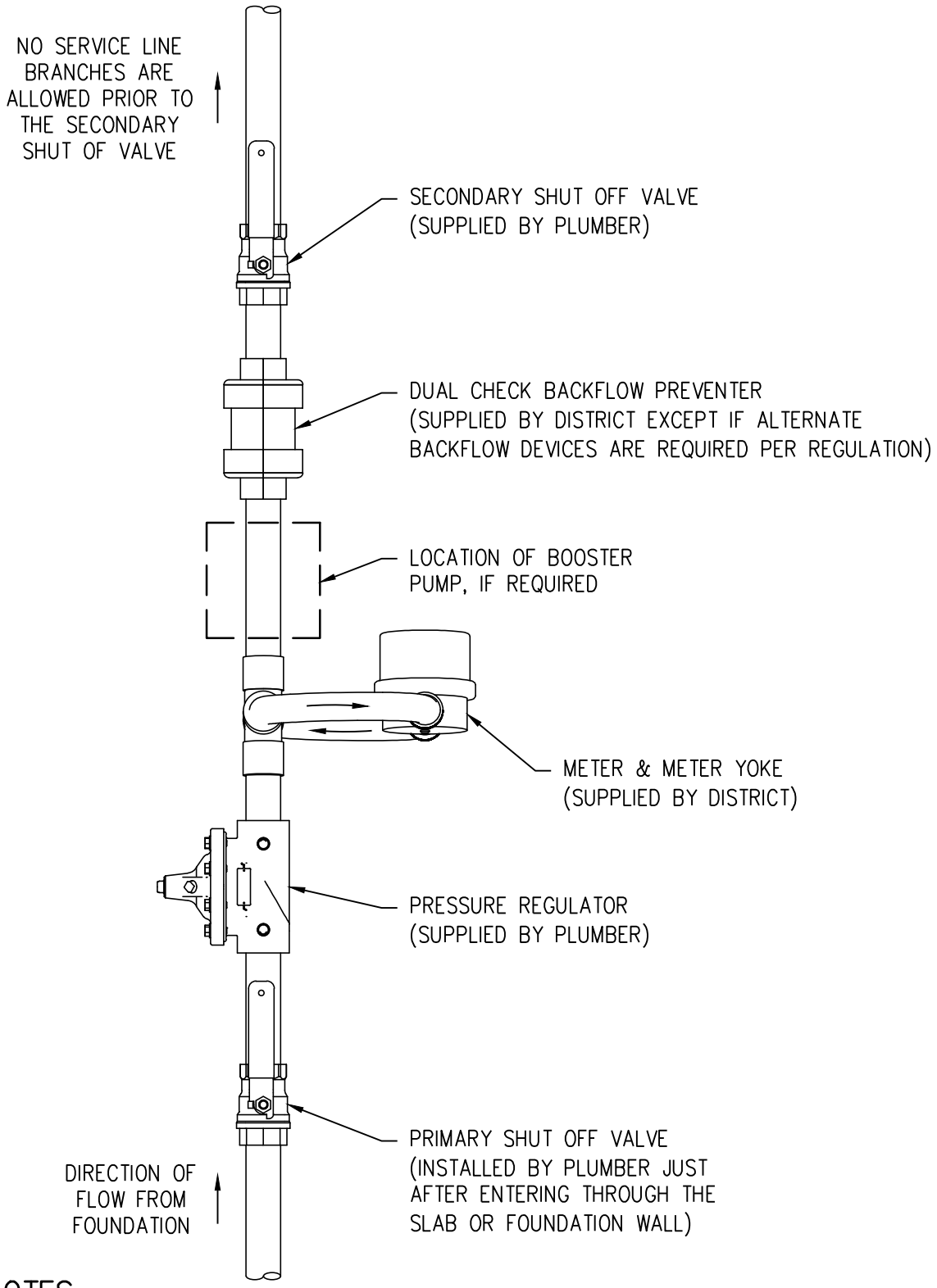
EMD

DISTRICT STANDARD DETAILS

SERVICE LINE, STOP BOX AND INSIDE METER INSTALLATION

D3.09

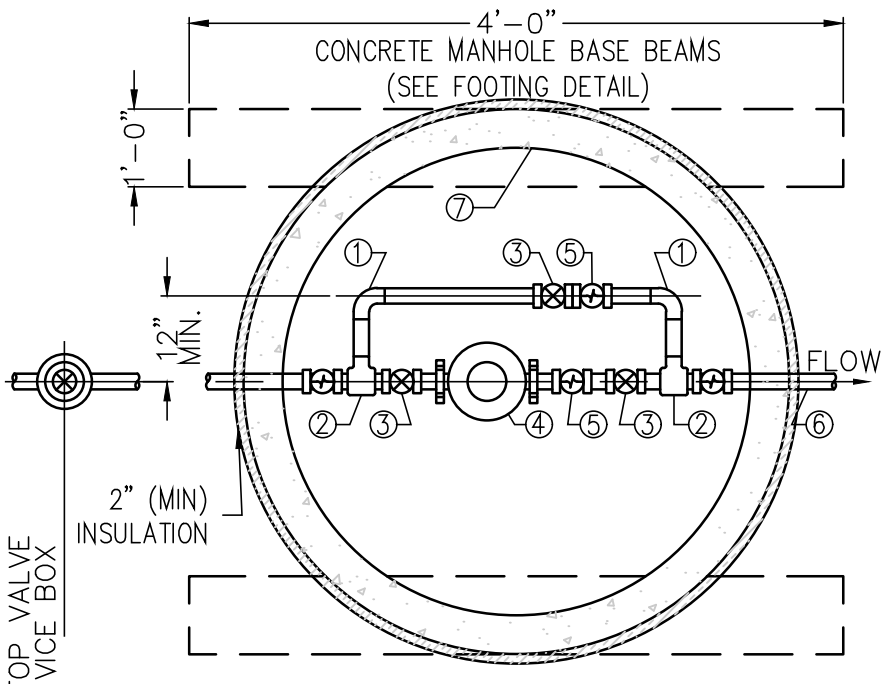
FEB 2025



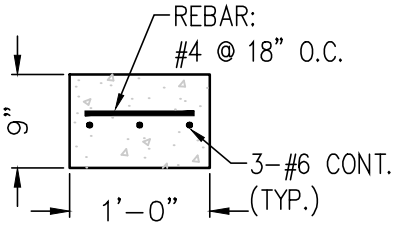
NOTES:

1. DUAL CHECK BACKFLOW PREVENTER MUST BE INSTALLED AFTER THE BOOSTER PUMP (IF ANY) DUE PRESSURE LOSS.

EMD	DISTRICT STANDARD DETAILS	D3.10
	INDOOR WATER METER PLUMBING	FEB 2025

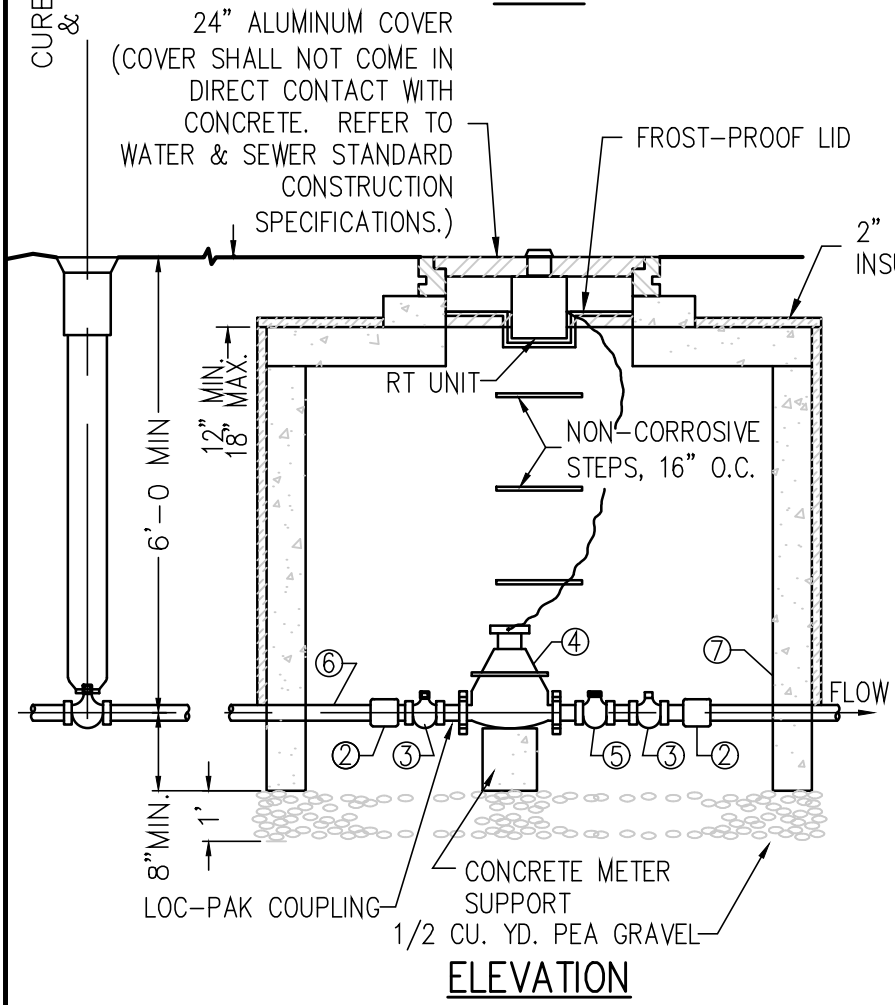


PLAN



FOOTING DETAIL

① – 90° ELL
② – TEE
③ – CURB STOP W/LOCK WING
④ – METER UNIT
⑤ – APPROVED SINGLE CHECK VALVE
⑥ – TYPE K COPPER TUBING
⑦ – 48" CONCRETE MANHOLE



ELEVATION

NOTES:

1. MANHOLE BASE BEAMS SHALL BE REQUIRED FOR ALL INSTALLATIONS.
2. A 48" DIA. MANHOLE PIT WILL ACCOMMODATE 1 1/2" & 2" SPLIT CASE METERS (LARGER PIT MAY BE REQUIRED DEPENDING ON CONDITIONS.)
3. JOINTS INSIDE METER VAULT SHALL BE EITHER THREADED OR SOLDERED W/SOLDER APPROVED FOR LEAD-FREE POTABLE WATER SYSTEMS.
4. INSULATION SHALL BE EITHER BLANKET/WRAP OR BOARD TYPE.
5. METER VAULTS LOCATED WITHIN TRAFFIC AREAS SHALL BE HS-25 LOAD RATED.
6. A SINGLE CHECK VALVE MY BE LOCATED BETWEEN BY-PASS AND EDGE OF PIT IF ROOM PERMITS INSTEAD OF TWO DOUBLE CHECK VALVES.
7. ALTERNATE BACKFLOW PREVENTION MY BE REQUIRED, DEPENDING ON HAZARD, & MAY BE LOCATED IN STRUCTURES BEING SERVED.

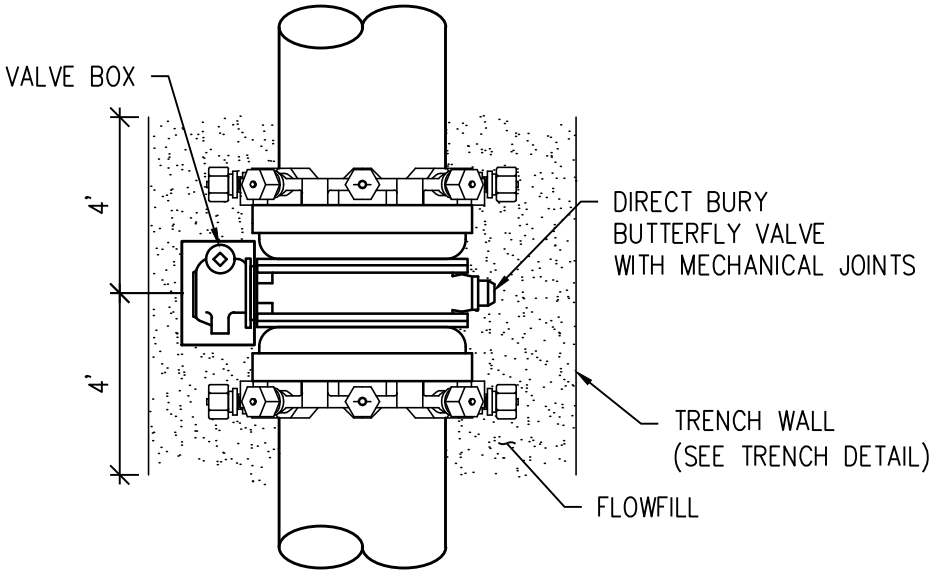
EMD

DISTRICT STANDARD DETAILS

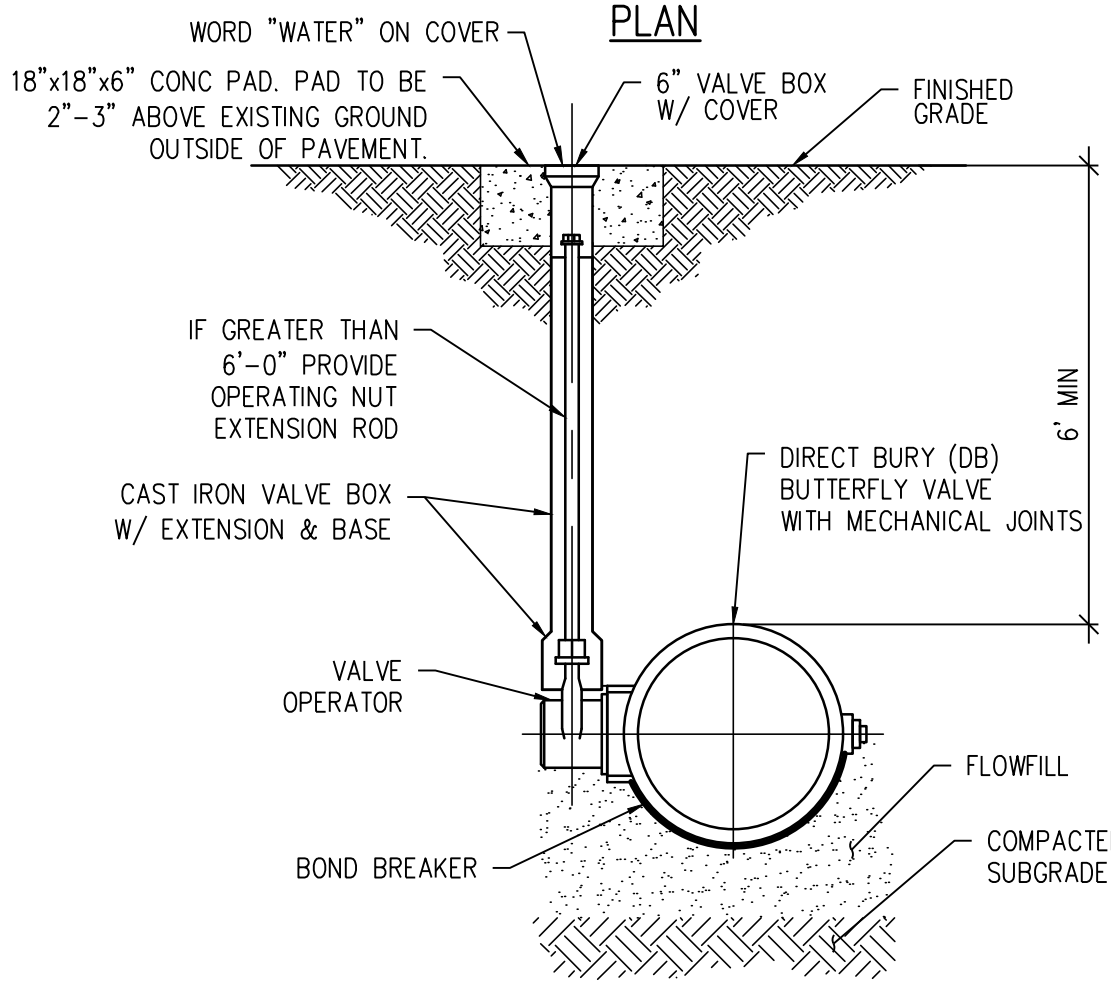
IRRIGATION METER PIT ASSEMBLY

D3.11

FEB 2025



PLAN

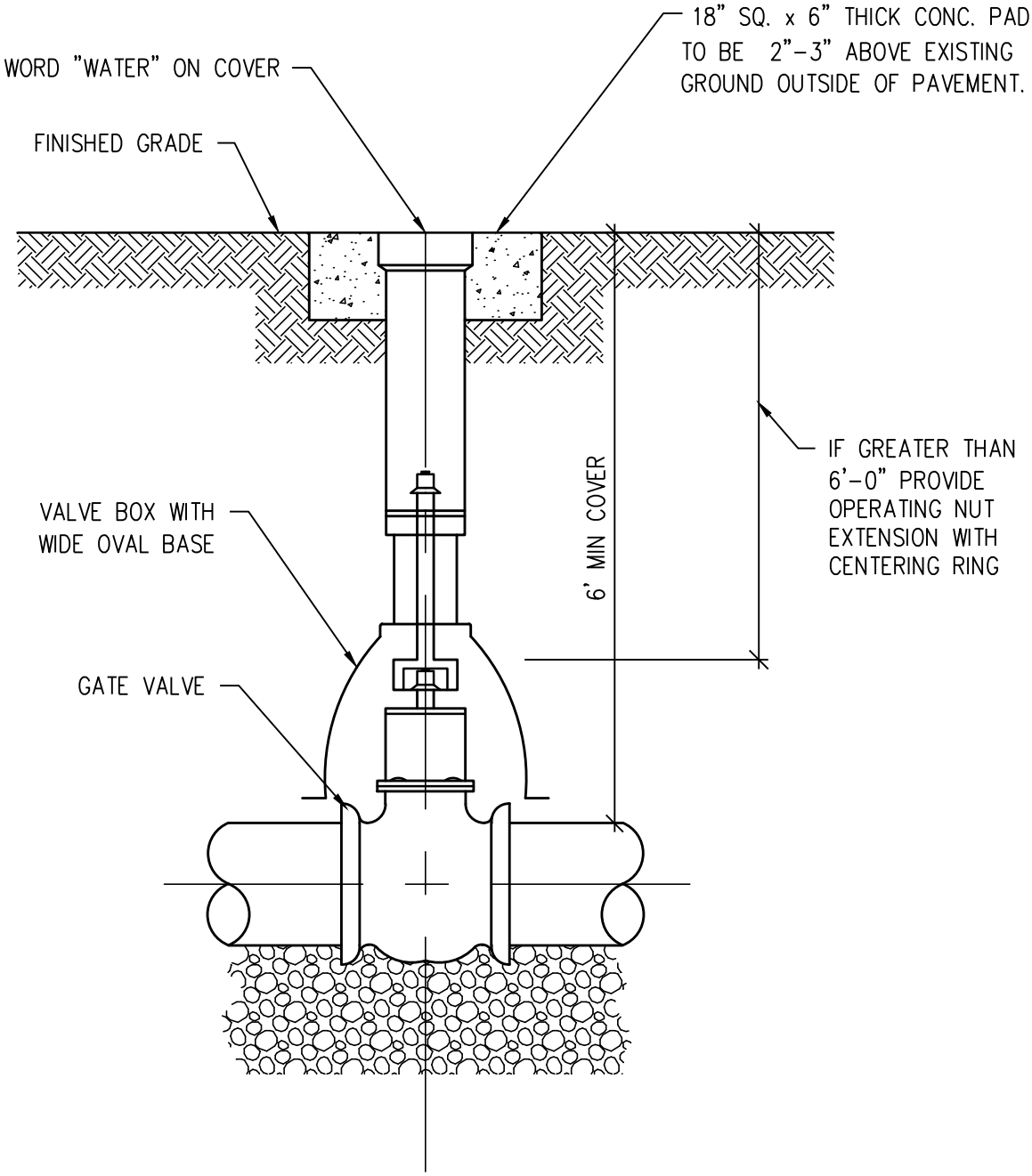


ELEVATION

NOTES:

1. ELEVATION FOR TOP OF COVER, PLACED IN PAVEMENT, SHALL BE SET IN ACCORDANCE WITH PAVING REQUIREMENTS OF LOCAL JURISDICTION.

EMD	DISTRICT STANDARD DETAILS	D3.12
	BURIED BUTTERFLY VALVE	FEB 2025



NOTES:

1. CARE SHALL BE TAKEN WHEN INSTALLING VALVES ON LINES TO ASSURE PROPER SUPPORT OF THE VALVES.
2. WOOD BLOCKS OR 3/4" WASHED ROCK TO BE INSTALLED UNDER THE VALVE TO PROVIDE PROPER SUPPORT WHERE REQUIRED.
3. VALVES SHALL NOT BE PLACED IN CONCRETE CROSS PANS.
4. ELEVATION FOR TOP OF COVER, PLACED IN PAVEMENT, SHALL BE SET IN ACCORDANCE WITH PAVING REQUIREMENTS OF LOCAL JURISDICTION.

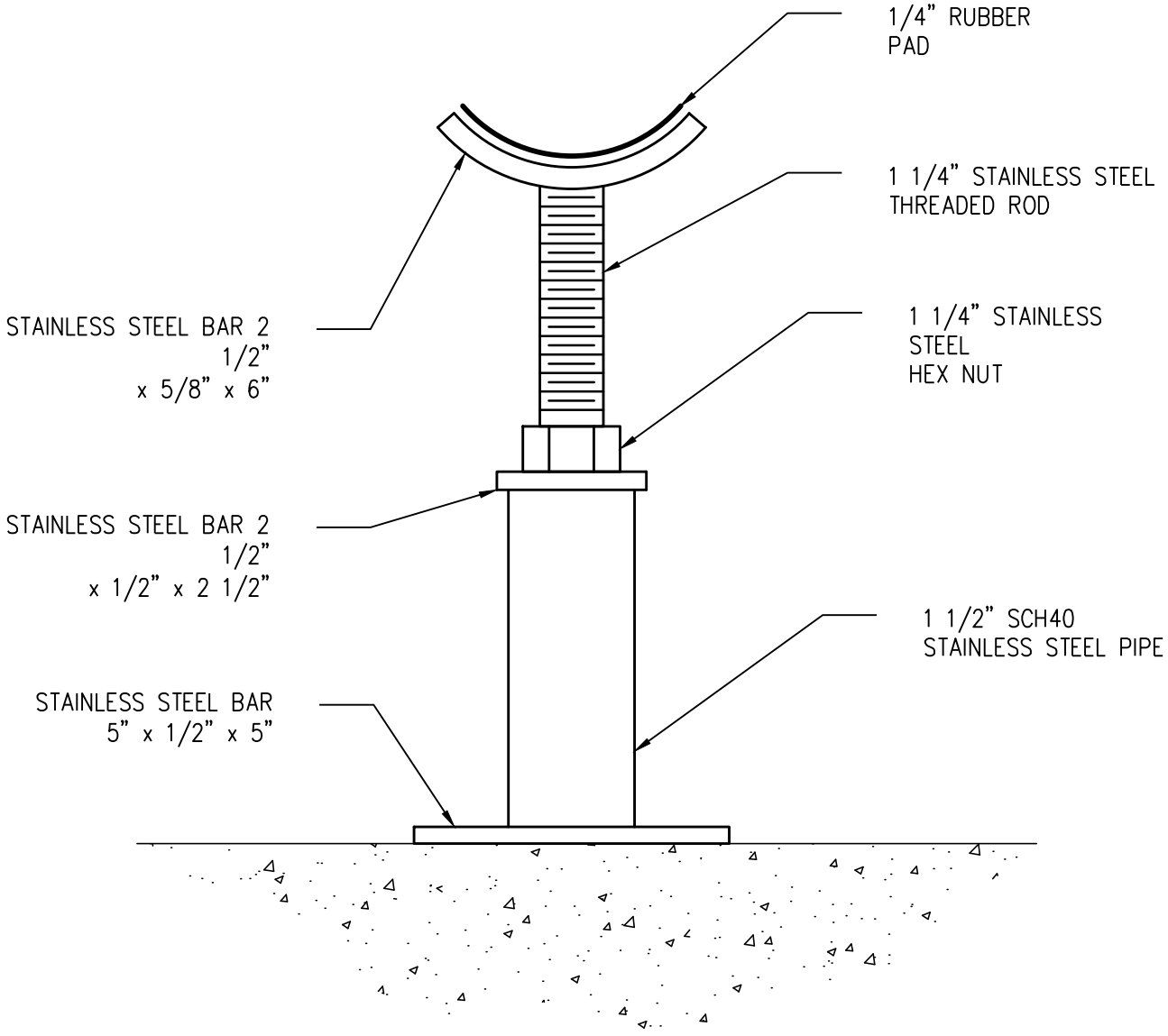
EMD

DISTRICT STANDARD DETAILS

BURIED GATE VALVE

D3.13

FEB 2025



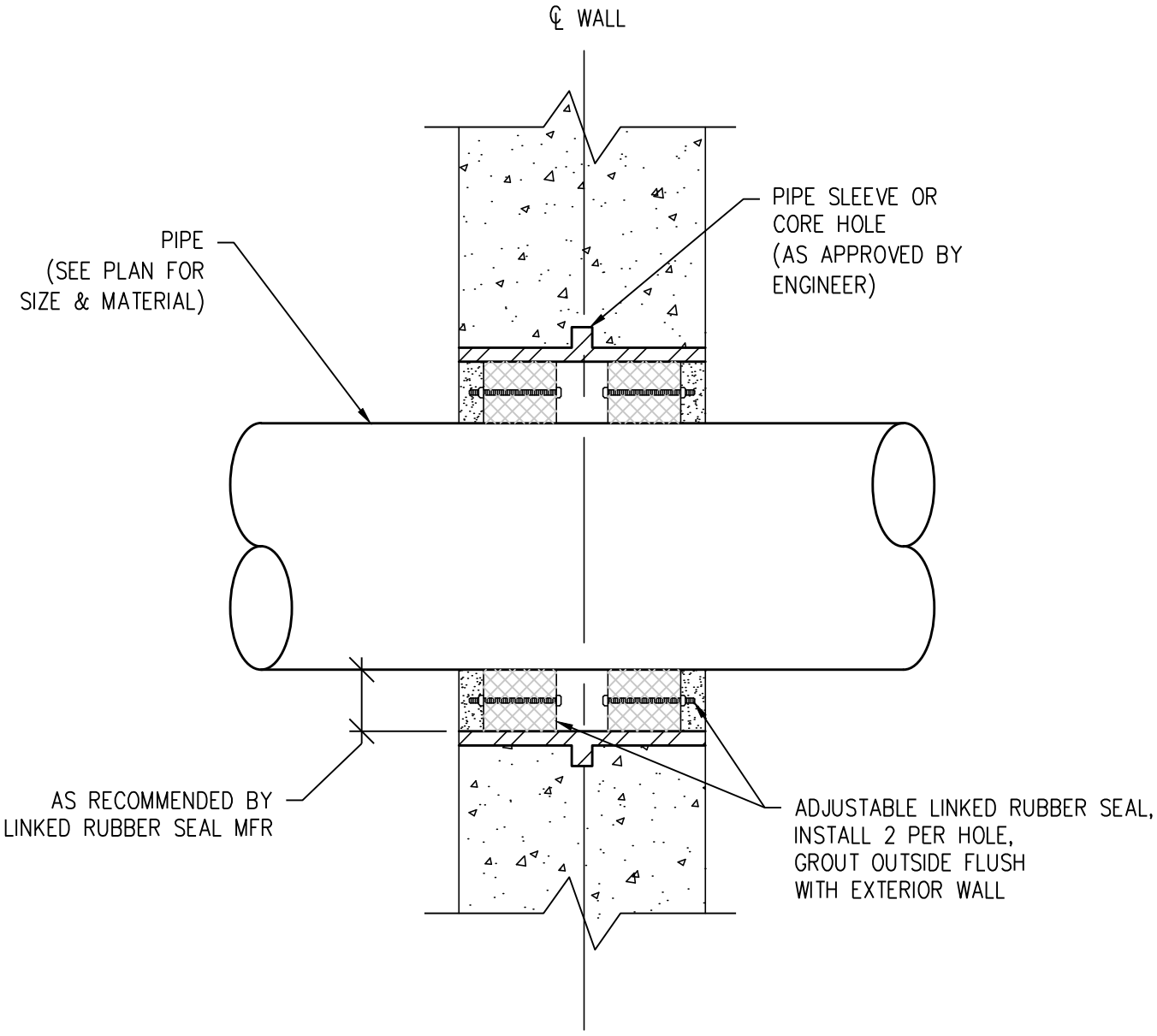
EMD

DISTRICT STANDARD DETAILS

FLOOR PIPE SUPPORT

D3.14

FEB 2025



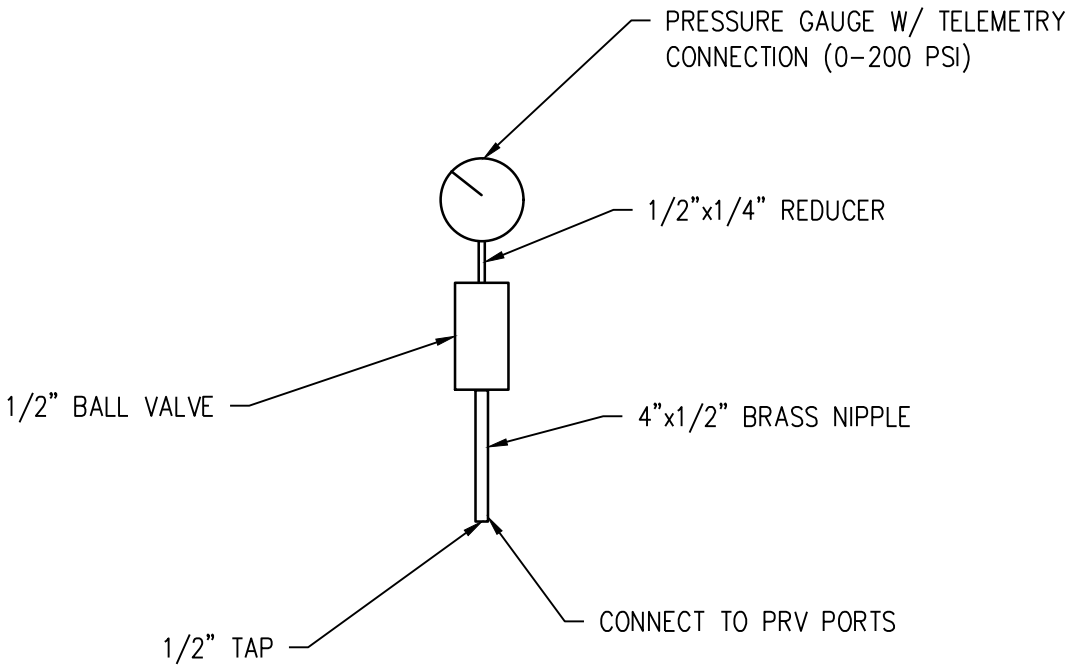
EMD

DISTRICT STANDARD DETAILS

WALL PENETRATION WITH CORE HOLE

D3.15

FEB 2025



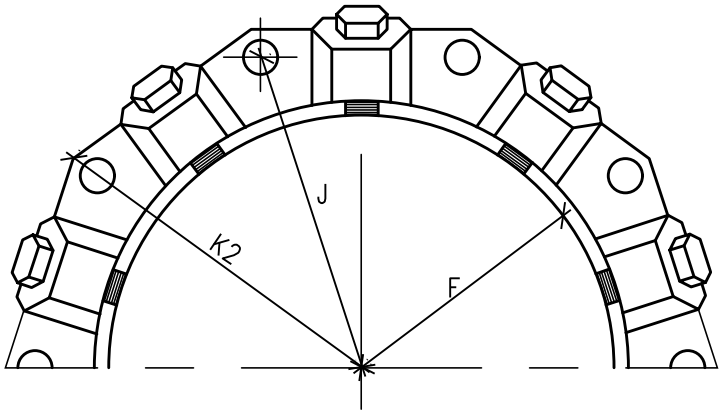
EMD

DISTRICT STANDARD DETAILS

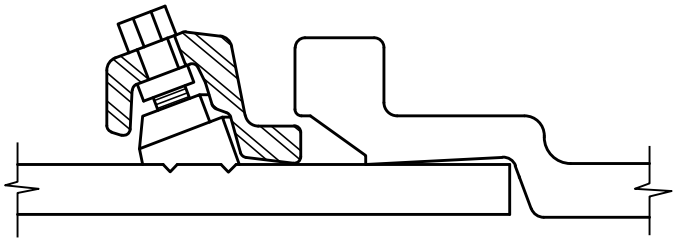
PRESSURE GAUGE

D3.16

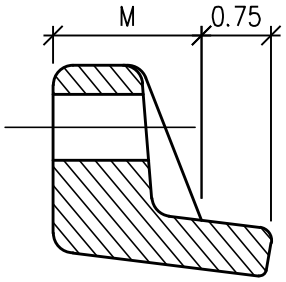
FEB 2025



MECHANICAL JOINT RESTRAINT



WEDGE DETAIL



BOLT HOLE DETAIL

	NOMINAL PIPE SIZE	NO. OF BOLTS	NO. OF WEDGES	K2 INCHES	J INCHES	F INCHES	M INCHES	
PVC	4"	2	2					PVC
	6"	6	3	11.12	9.50	7.00	0.88	
	8"	6	4	13.37	11.75	9.15	1.00	
	10"	8	6	15.62	14.00	11.20	1.00	
	12"	8	8	17.88	16.25	13.30	1.25	
DI	4"	4	2					DI
	6"	6	3	11.12	9.50	7.00	0.88	
	8"	6	4	13.37	11.75	9.15	1.00	
	10"	8	6	15.62	14.00	11.20	1.00	
	12"	8	8	17.88	16.25	13.30	1.25	
	16"	12	12	22.50	21.00	17.54	1.56	
	20"	14	14	27.00	25.50	21.74	1.69	

DIMENSIONS

NOTE:

1. BASED ON "MEGA LUG" PIPE RESTRAINT SYSTEM BY EBAA IRON
2. OTHER MECHANICAL JOINT RESTRAINT DEVICES MUST BE APPROVED BY DISTRICT ENGINEER BEFORE INSTALLATION.

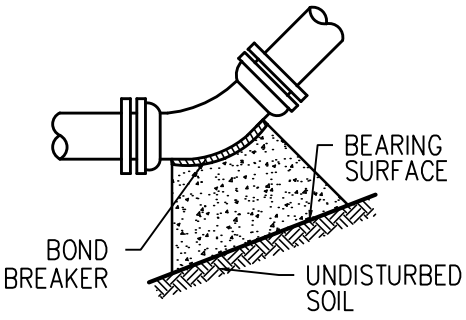
EMD

DISTRICT STANDARD DETAILS

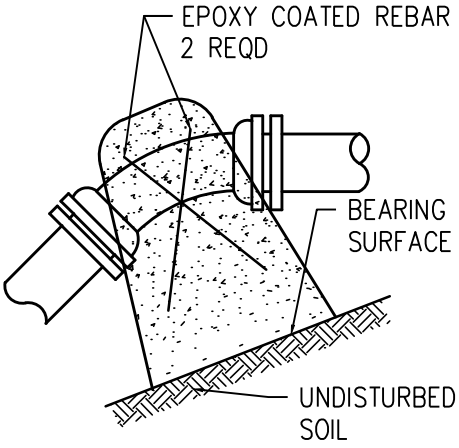
MECHANICAL JOINT RESTRAINT

D3.17

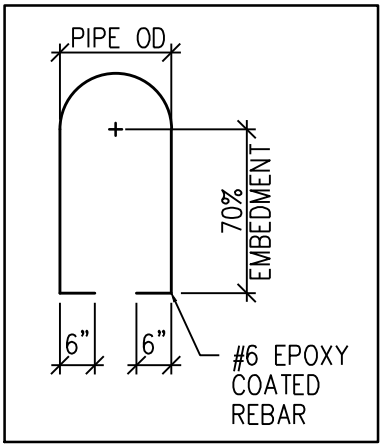
FEB 2025

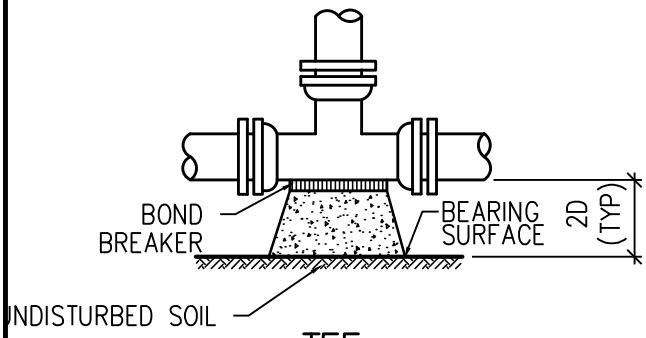


UPWARD BEND

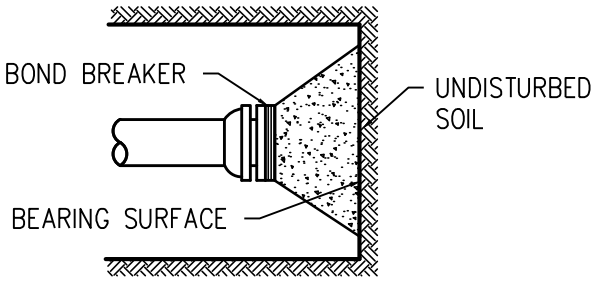


DOWNWARD BEND

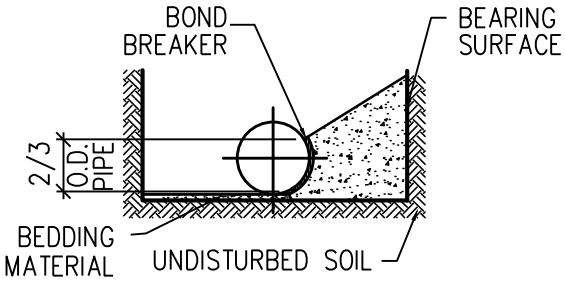




TEE



DEAD END



TYPICAL CROSS SECTION

NOTES:

1. BEARING SURFACES SHOWN IN CHART ARE MINIMUM
2. BASED ON 150 PSI INTERNAL PIPE PRESSURE PLUS WATER HAMMER
3. 6", 8", &12" WATER HAMMER = 110 PSI
4. 16", 20" AND 24" WATER HAMMER = 70 PSI
5. BASED ON 3000 PSI SOIL BEARING CAPACITY
6. THRUST BLOCK SHALL NOT INTERFERE W/MECHANICAL JOINT BOLT OPERATION

SIZE OF PIPE	SURFACE AREA (SQ FT)	
	TEE OR DEAD END	90° BENDS
4"	1.50	2.0
6"	3.00	4.5
8"	5.25	8.0
12"	11.25	17.0
16"	19.00	27.00
20"	25.00	35.50
24"	36.00	51.00

MINIMUM BEARING SURFACE AREA
(IN SQUARE FEET)

EMD

DISTRICT STANDARD DETAILS

CONCRETE THRUST BLOCK DETAIL

D3.18

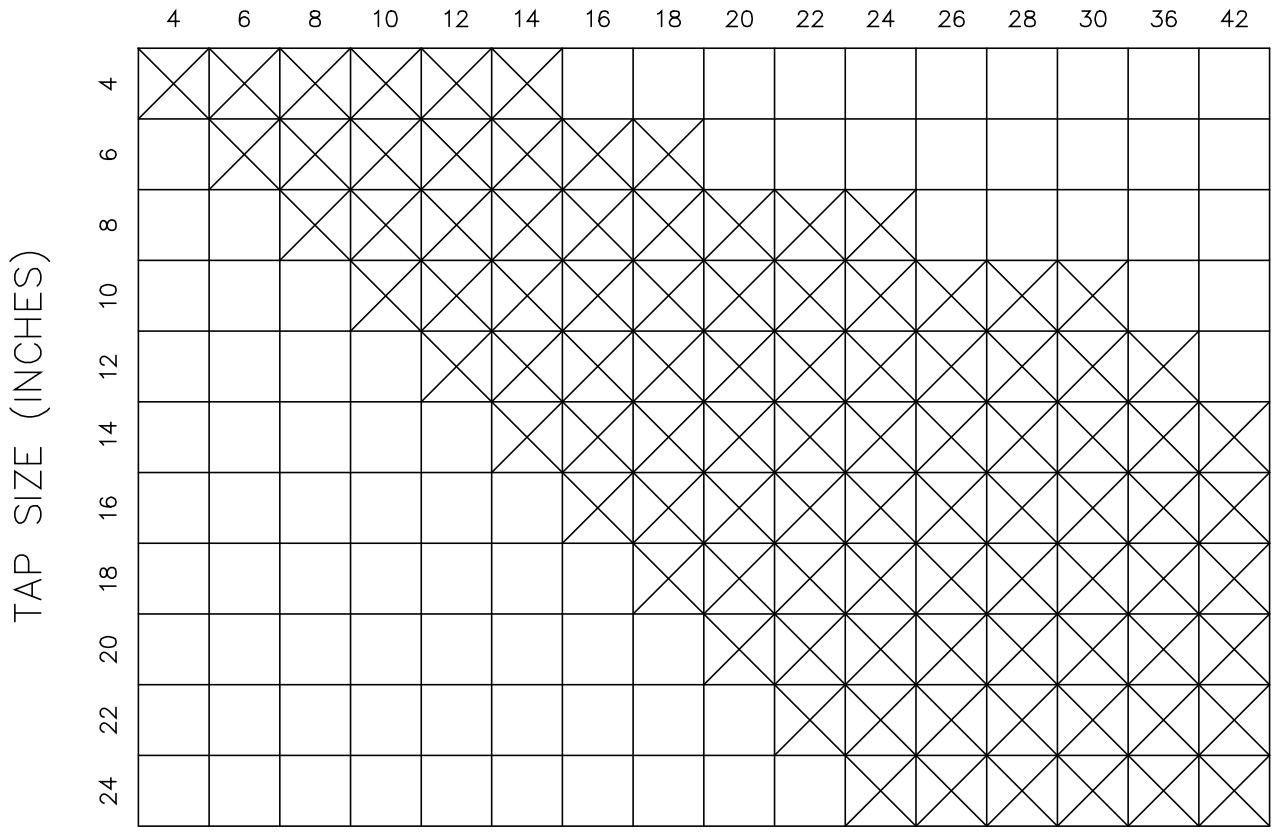
FEB 2025

CONCRETE THRUST BLOCKS

WATER MAIN AND TAP SIZE COMBINATIONS WHICH REQUIRE A CONC THRUST BLOCK BEHIND THE MAIN AT THE TAPPING SLEEVE OR SADDLE

ALL WATER MAINS

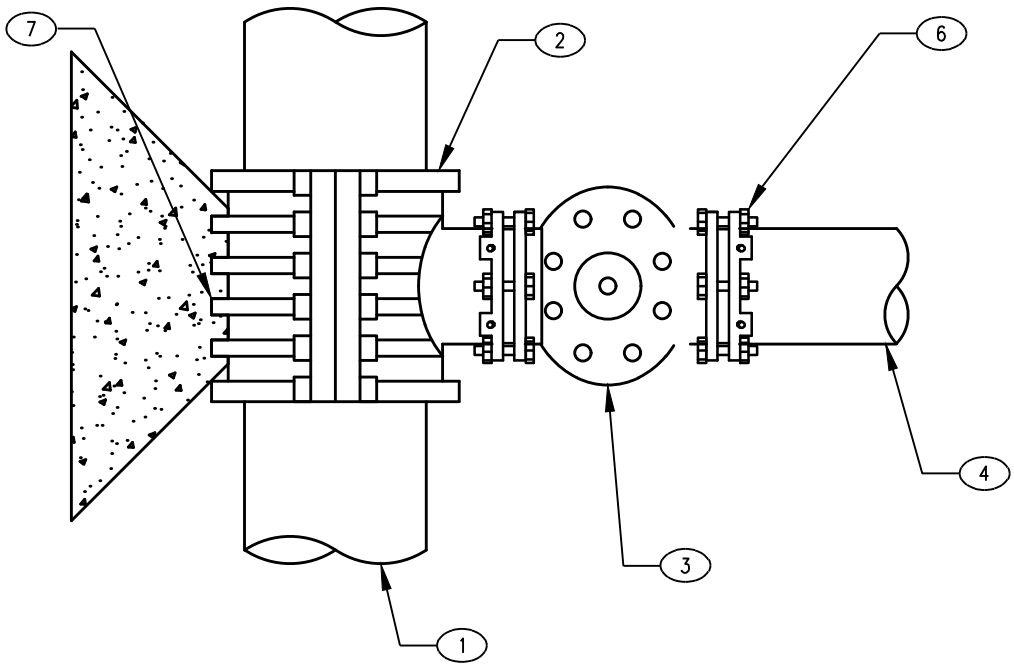
☒ INDICATED CONC THRUST BLOCK REQD



NOTES:

1. ANY THRUST BLOCK REQUIREMENTS FOR WATER MAIN AND TAP SIZED COMBINATIONS OTHER THAN THOSE SHOWN ABOVE WILL REQUIRE SPECIAL DESIGN APPROVAL BY THE DISTRICT ENGINEER

EMD	DISTRICT STANDARD DETAILS	D3.19
	CONCRETE THRUST BLOCK REQUIREMENTS	FEB 2025



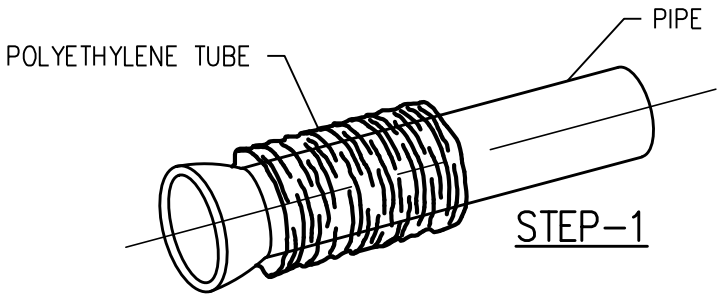
DETAILS:

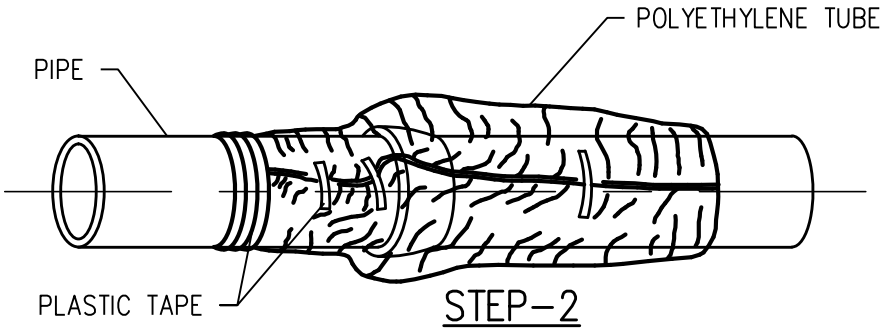
1. EXISTING MAIN
2. FABRICATED STEEL TAPPING SLEEVE WITH EPOXY SHOP COATING, STAINLESS STEEL BOLTS AND NUTS
3. TAPPING VALVE
4. DOUBLE SPIGOT PIPE
5. CONCRETE THRUST BLOCK (SEE THRUST BLOCK DETAIL)
6. MECHANICAL JOINT RESTRAINT
7. BOND BREAKER BETWEEN CONCRETE AND WET TAP SADDLE–8 MIL POLYETHYLENE

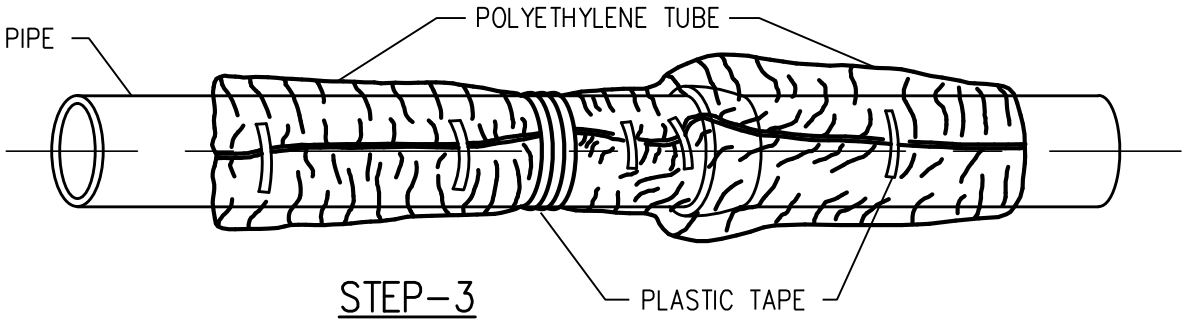
NOTES:

1. DISTRICT MUST BE NOTIFIED AT LEAST 48 HOURS BEFORE TAPPING
2. A DISTRICT REPRESENTATIVE MUST BE ONSITE DURING TAPPING.

EMD	DISTRICT STANDARD DETAILS	D3.20
	TAPPING TEE AND VALVE	FEB 2025







FIELD INSTALLATION–POLYETHYLENE WRAP

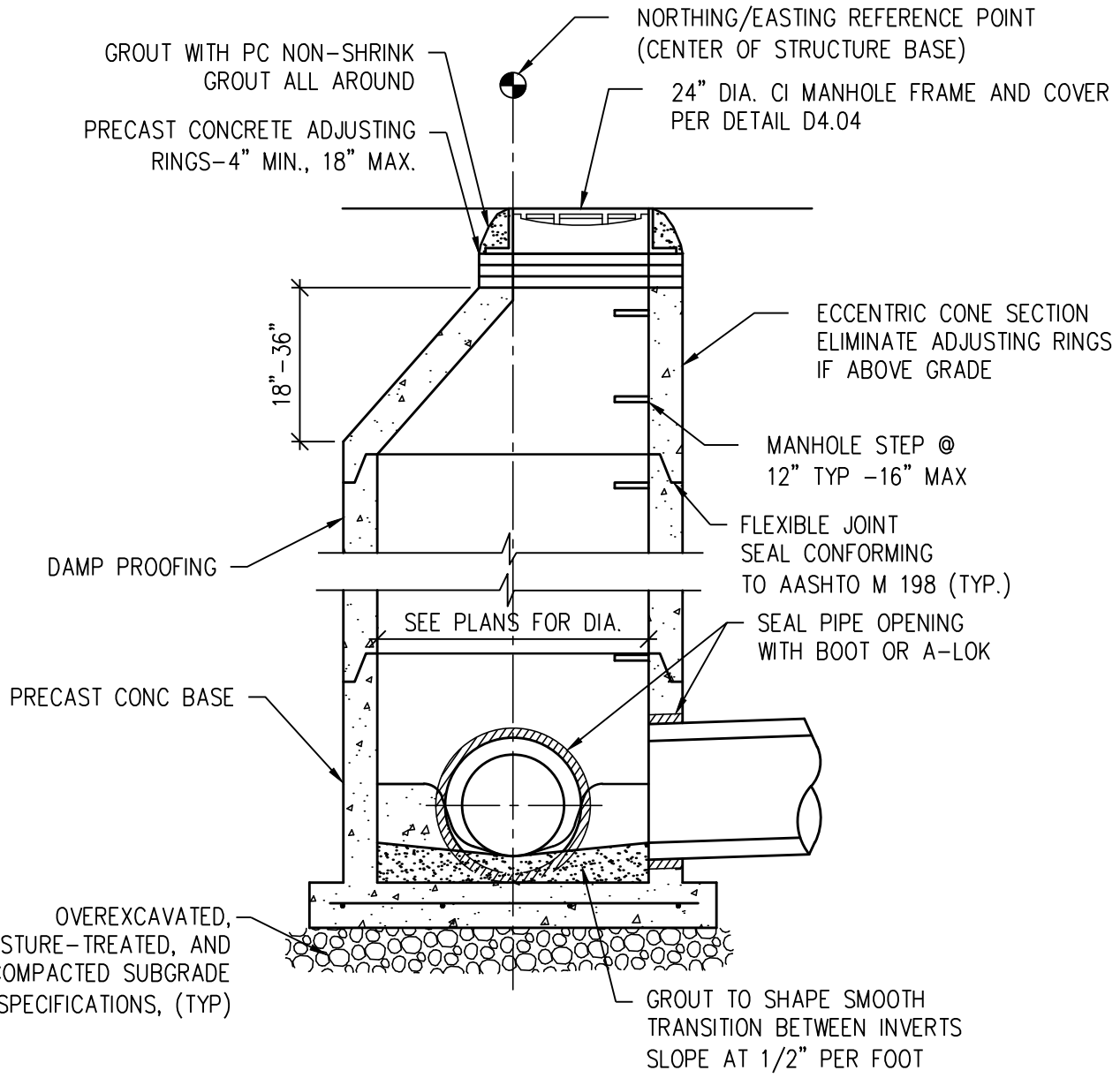
STEP–1 PLACE TUBE OF POLYETHYLENE MATERIAL AROUND PIPE PRIOR TO LOWERING PIPE INTO TRENCH

STEP–2 PULL THE TUBE OVER THE LENGTH OF THE PIPE. TAPE TUBE TO PIPE AT JOINT FOLD MATERIAL AROUND THE ADJACENT SPIGOT END AND WRAP WITH THREE CIRCUMFERENTIAL TURNS OF TWO–INCH WIDE PLASTIC TAPE TO HOLD PLASTIC TUBE AROUND SPIGOT END

STEP–3 ADJACENT TUBE OVERLAPS FIRST TUBE AND IS SECURED WITH PLASTIC ADHESIVE TAPE. THE POLYETHYLENE TUBE MATERIAL COVERING THE PIPE WILL BE LOOSE. EXCESS MATERIAL AND SHOULD BE NEATLY DRAWN UP AROUND THE PIPE BARREL, FOLDED INTO AN OVERLAP ON TOP OF THE PIPE AND HELD IN PLACE BY MEANS OF PIECES OF THE PLASTIC TAPE AT APPROXIMATELY THREE TO FIVE FOOT INTERVALS

NOTE:

1. ALL RODDING TO BE ENCASED IN POLYETHYLENE SEPARATED FROM THE PIPE



NOTES:

1. SINCE ALL PIPE ENTRIES INTO THE BASE ARE VARIABLE, THE DIMENSIONS SHOWN ARE TYPICAL. ACTUAL DIMENSIONS AND QUANTITIES FOR CONCRETE AND REINFORCEMENT SHALL BE AS REQUIRED IN THE WORK.
2. THE MANHOLE RING FRAME SHALL BE SET IN A BED OF GROUT. THE FRAME SHALL BE SURROUNDED WITH A CEMENT GROUT IN UNPAVED AREA, OR A CONCRETE COLLAR IN PAVED AREA.
3. DESIGN OF BOX BASE IS BASED ON STRAIGHT RUNS OF PIPE OR CHANGE IN DIRECTION OF LESS THAN 45°. SPECIAL DESIGN IS REQUIRED FOR 45° OR GREATER.
4. STEPS SHALL BE REQUIRED WHEN THE MANHOLE DEPTH EXCEEDS 3 FT.-6 IN.
5. ALL PIPE ENTRIES INTO THE BASE OF MANHOLE SHALL BE CONNECTED BY OPEN CHANNELIZATION. DETAILS SHOWN ARE TYPICAL FOR INSTALLATIONS WITH ALL INVERTS OF SAME RELATIVE ELEVATION. FOR EXCESSIVE ELEVATION DIFFERENCE BETWEEN INVERTS, SPECIAL BASE/CHANNEL DETAILS WILL BE SHOWN ON THE PLANS.
6. STUB-OUTS SHALL EXTEND 2 FT. MINIMUM BEYOND OUTSIDE WALL OF MANHOLE AND BE SATISFACTORILY PLUGGED.
7. THE SLOPE OF THE MANHOLE COVER SHALL MATCH THE ROADWAY PROFILE AND CROSS SLOPE.
8. BASE SLABS SHALL BE POURED MONOLITHICALLY WITH BOTTOM RISER SECTION.

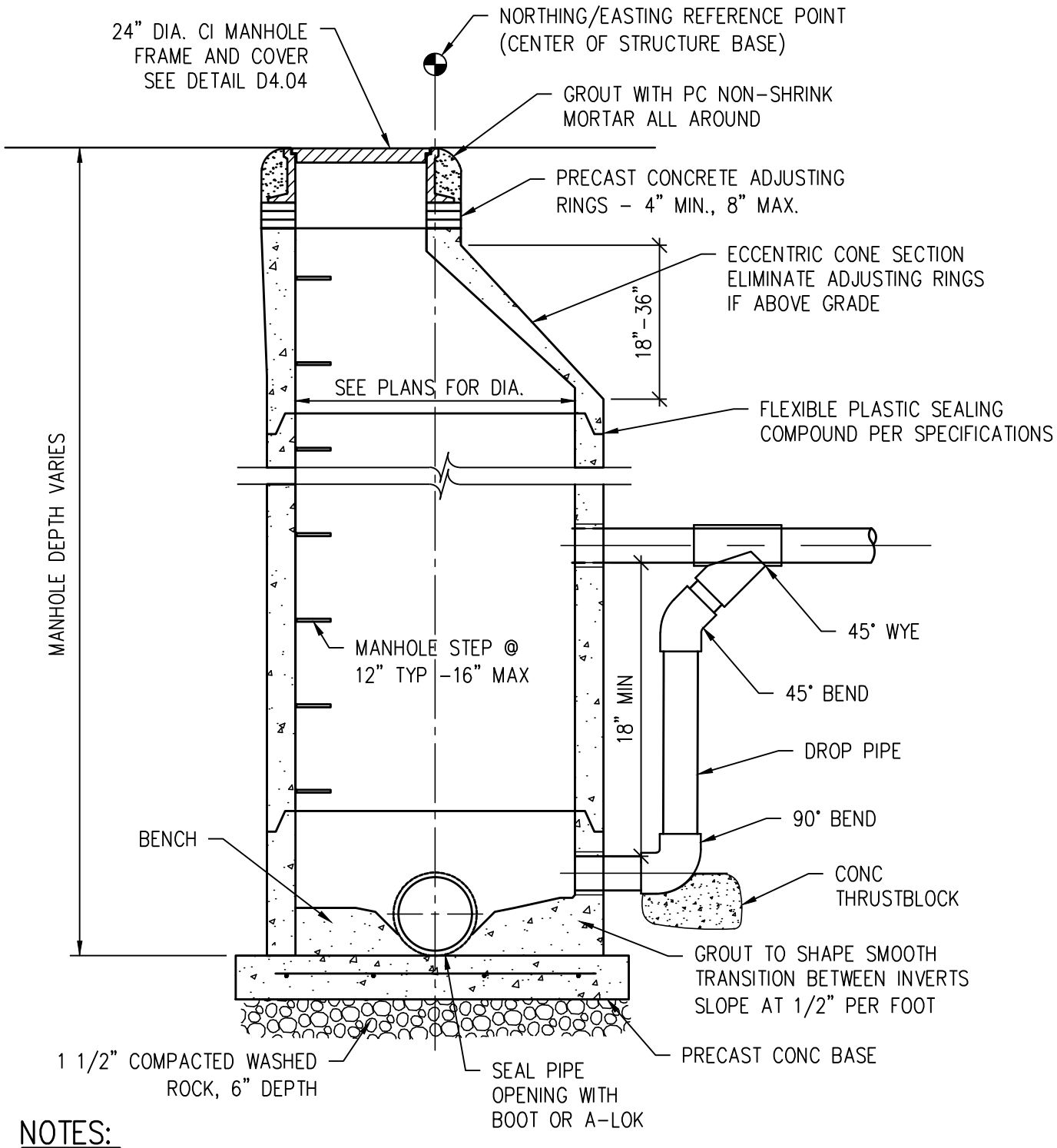
EMD

DISTRICT STANDARD DETAILS

STANDARD MANHOLE

D4.01

FEB 2025



NOTES:

1. SHAPING FOR SMOOTH MANHOLE INVERTS MUST BE DONE BY FORMING OR SHAPING BASE CONCRETE.
2. BLOCK-OUTS WHEN APPROVED SHALL EXTEND A MAX OF 6" PAST MANHOLE OD AND BE SATISFACTORILY PLUGGED AND SEALED.
3. CONCRETE MANHOLES BASES MAY BE POURED IN PLACE ONLY WITH PRIOR DISTRICT APPROVAL.
4. ALL MORTAR SHALL BE MIXED WITH A TYPE II CEMENT.
5. BENCH MUST HAVE A BRUSHED, NON-SKID SURFACE.

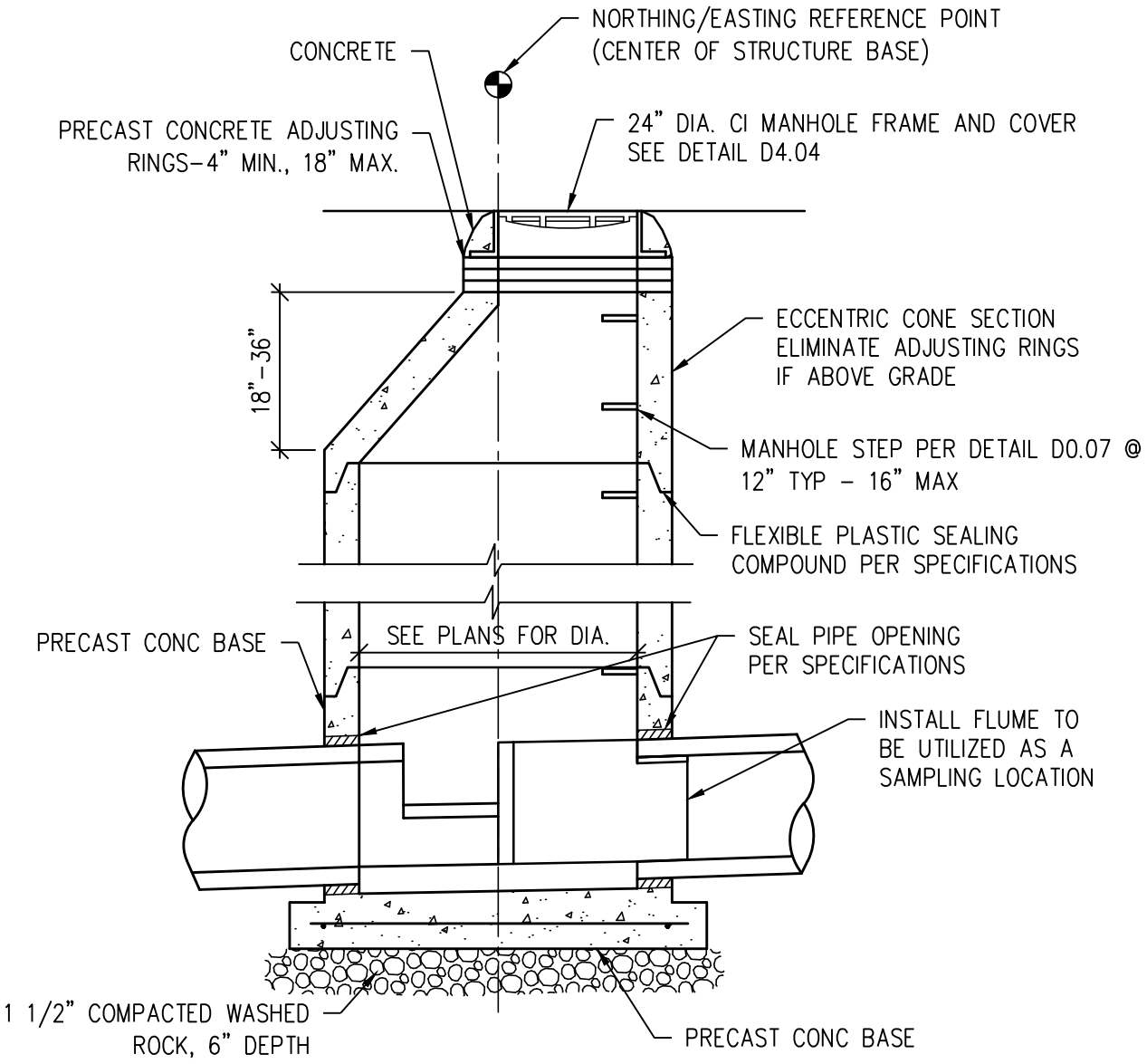
EMD

DISTRICT STANDARD DETAILS

SANITARY DROP MANHOLE

D4.02

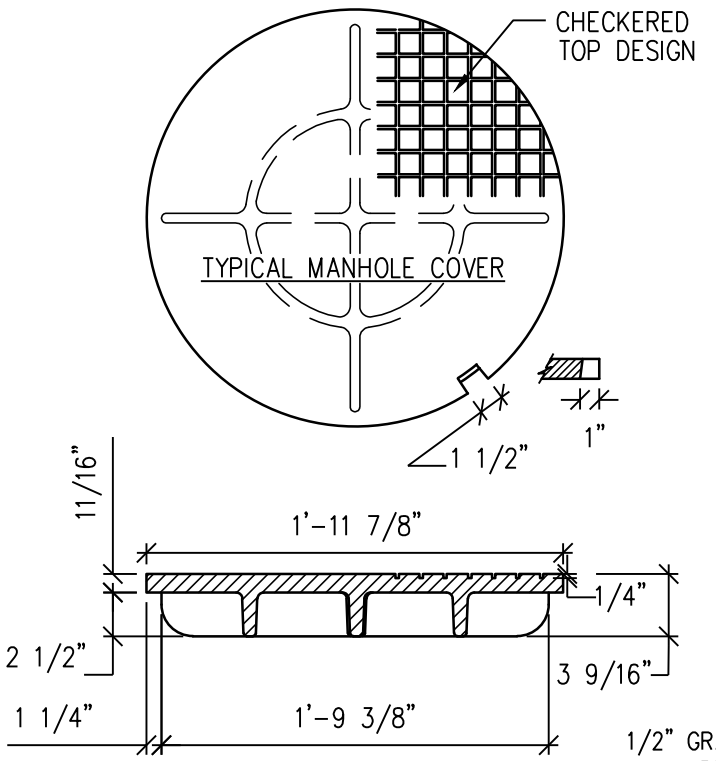
FEB 2025

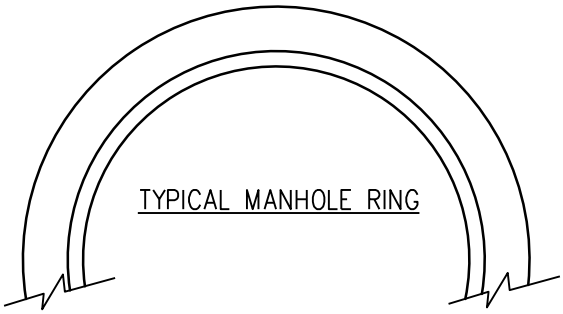


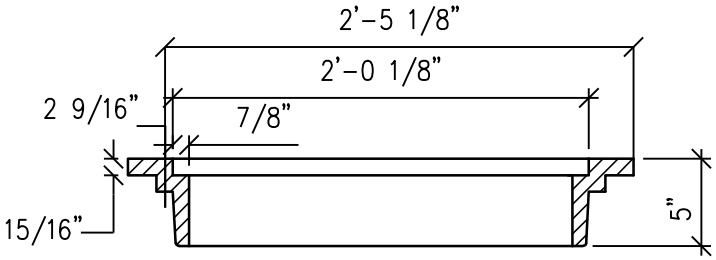
NOTES:

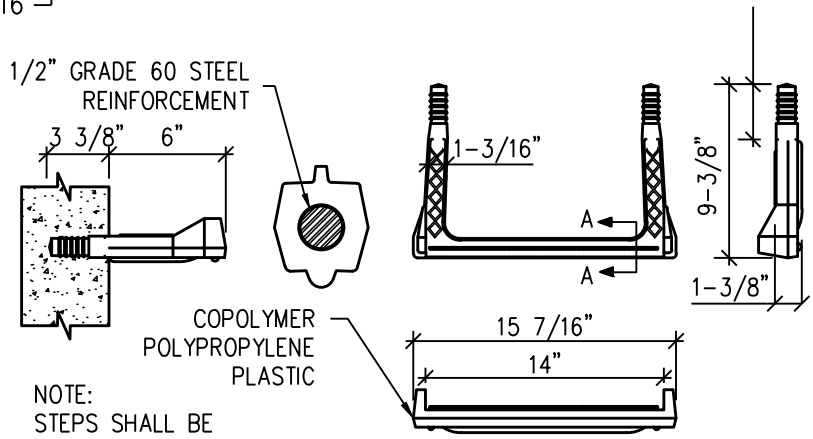
1. MANHOLES SHALL BE SEALED WATERTIGHT. NO GROUT ALLOWED. MANHOLE EXTERIORS SHALL BE DAMP–PROOFED.
2. DROP THROUGH MANHOLE TO BE EQUAL TO SLOPE OF SURROUNDING PIPE. FOR FLUME INSTALLATIONS, FLUME MUST BE SET LEVEL.
3. MONITORING MANHOLE TO BE LOCATED OUTSIDE OF PUBLIC RIGHT–OF–WAY, ON DISCHARGER'S PROPERTY. THE MANHOLE MUST BE SAFELY AND INDEPENDENTLY ACCESSIBLE FOR DISTRICT USE AT ALL TIMES.
4. FOR MANHOLE DEPTHS LESS THAN FOUR FEET FROM RIM TO TOP OF BENCH, VERTICAL MANHOLE BARRELS OR MINIMUM 30–INCH BY 30–INCH PRECAST BOX WITH PRECAST FLAT TOP SECTIONS ARE REQUIRED.
5. DESIGN AND LOCATION OF MONITORING MANHOLE SUBJECT TO DISTRICT APPROVAL.
6. THERE SHALL NOT BE ANY BENDS, DROP MANHOLES, FLOW JUNCTIONS, CHANGES IN PIPE DIAMETER, ETC., WITHIN 25 PIPE DIAMETERS UPSTREAM OR DOWNSTREAM OF THE MANHOLE.

EMD	DISTRICT STANDARD DETAILS	D4.03
	SANITARY MONITORING MANHOLE	FEB 2025









NOTES:

1. 24" DIA CI MANHOLE FRAME AND COVER WITH ASTM DESIGNATION A-48 CLASS 35B (UNPAINTED)
2. LETTERING ON COVER SHALL REFLECT MANHOLE DESIGNATION (SANITARY SEWER OR WATER)
3. ALL BEARING SURFACES TO BE MATCHED
4. TOTAL MINIMUM WEIGHT APPROXIMATELY 400 LBS CAST IRON ONLY
5. LIFTING NOTCH SHALL NOT EXTEND PAST INSIDE FACE OF RING SEAT
6. MIN FRAME WEIGHT 235 LBS, MIN LID WEIGHT 165 LBS NEENAH R - 1706, OR EQUAL

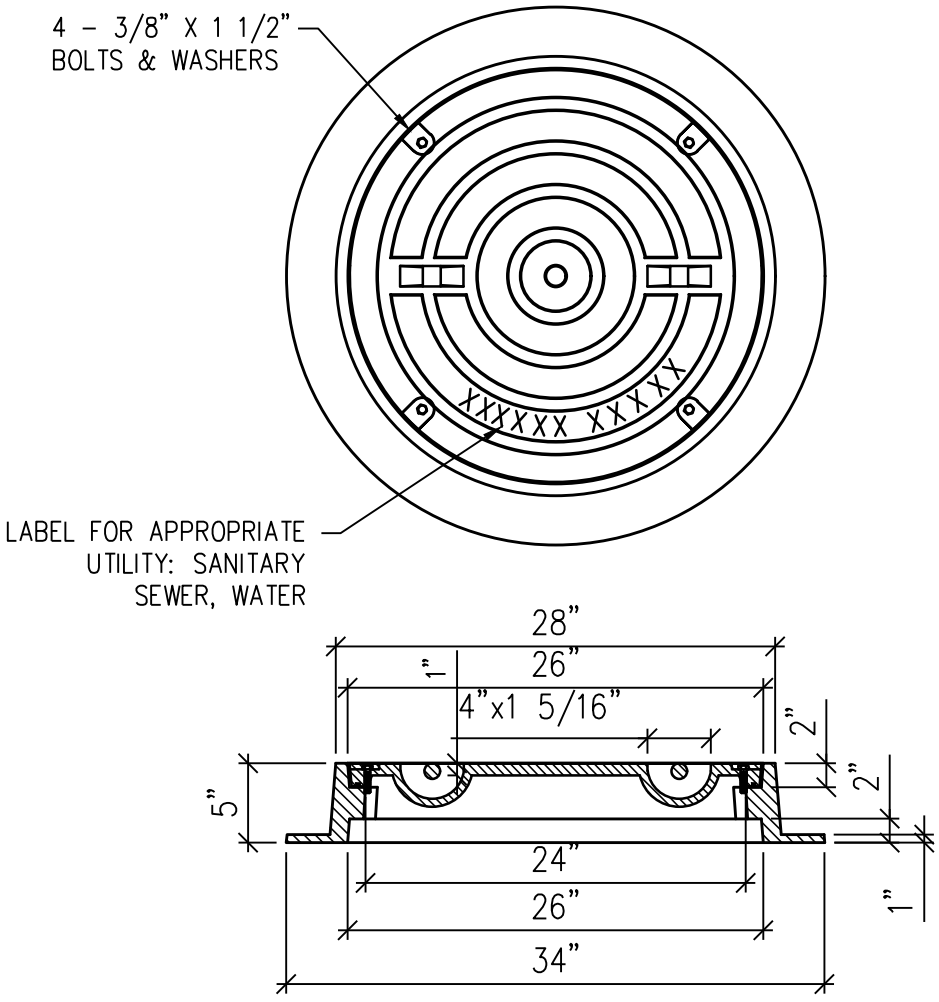
EMD

DISTRICT STANDARD DETAILS

MANHOLE RING, COVER, AND STEPS - NON-BOLTED

D4.04

FEB 2025



NOTES:

1. RING AND COVER SHALL BE IRON
2. LETTERING ON COVER SHALL REFLECT MANHOLE DESIGNATION (SANITARY SEWER)
3. COVER SHALL BE BOLTED, WATER RESISTANT IF LOCATED IN 100 YEAR FLOOD PLAIN, BACK YARDS, OPEN SPACE AND/OR DITCHES BELOW GROUND OR AS SPECIFIED BY THE TOWN
4. MANHOLE LID AND RING SHALL BE FURNISHED WITH MACHINED HORIZONTAL BEARING SURFACES
5. COVER IS BOLTED TO FRAME
6. MANHOLE LID AND RING SHALL BE FURNISHED WITH GASKET

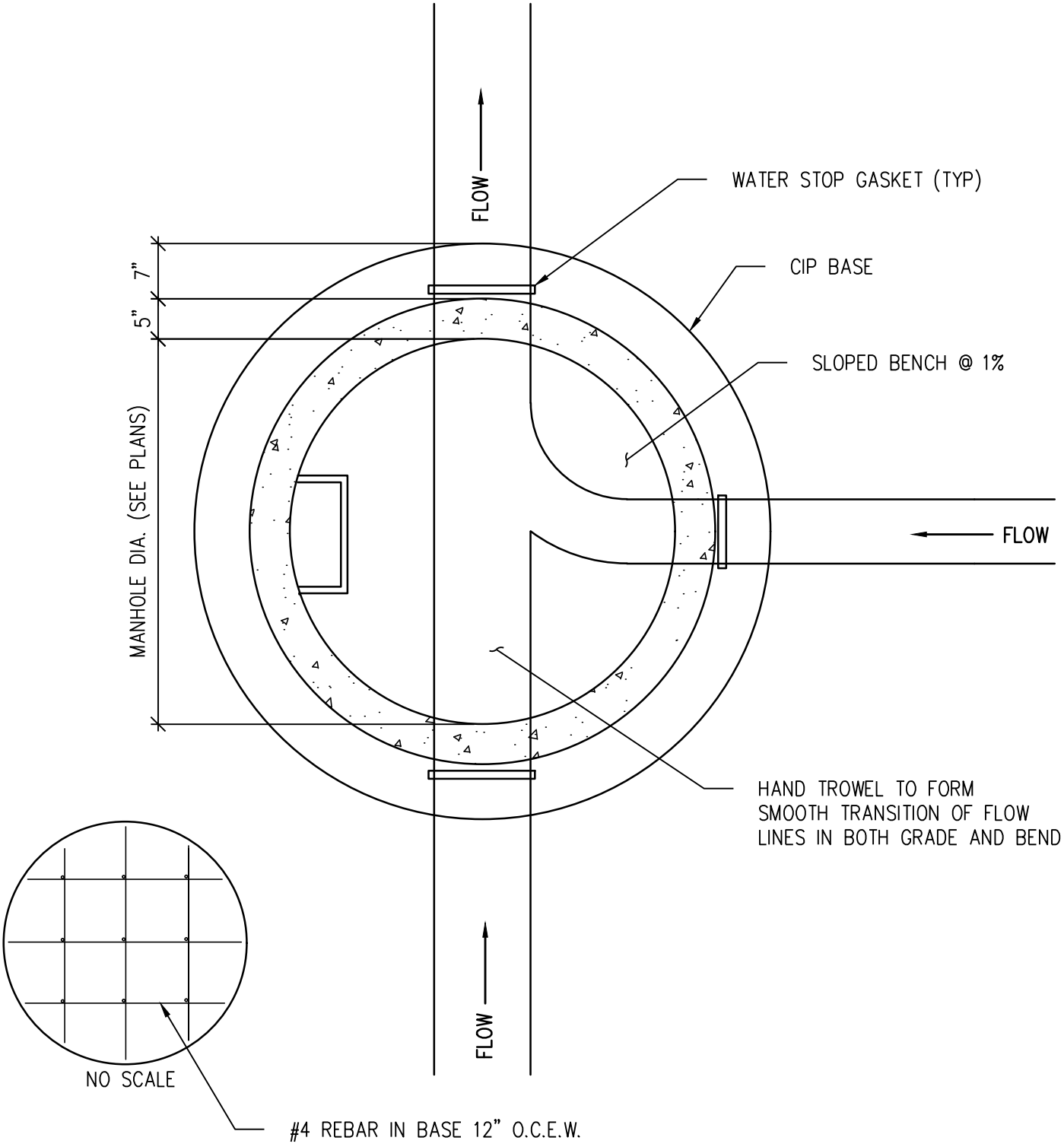
EMD

DISTRICT STANDARD DETAILS

MANHOLE RING AND COVER – BOLTED

D4.05

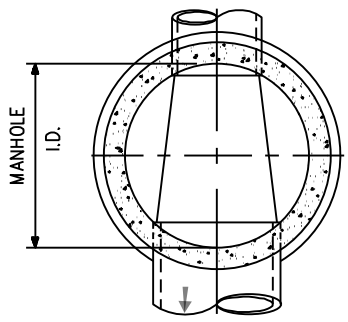
FEB 2025



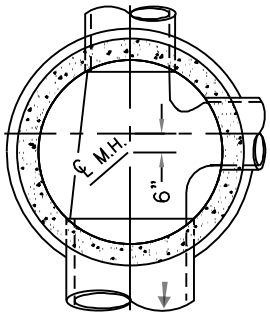
NOTES:

1. MINIMUM FLOW DIRECTION CHANGE 90 DEGREES

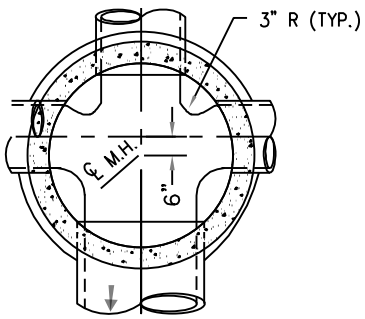
EMD	DISTRICT STANDARD DETAILS	D4.06
	MANHOLE BASE	FEB 2025



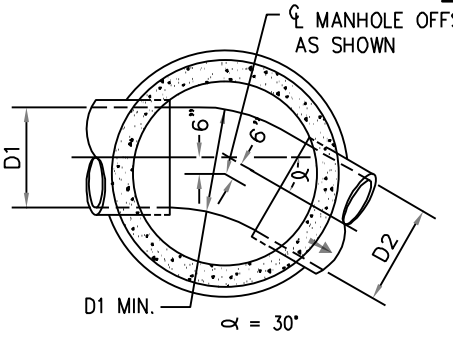
THROUGH MANHOLE



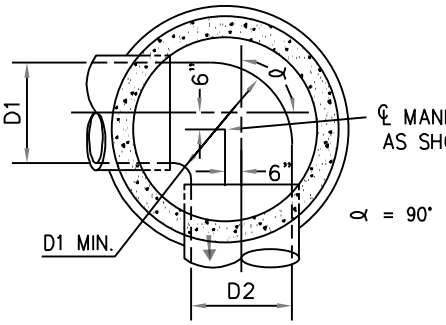
THROUGH MANHOLE
ONE COLLECTION LINE



THROUGH MANHOLE
TWO COLLECTION LINES

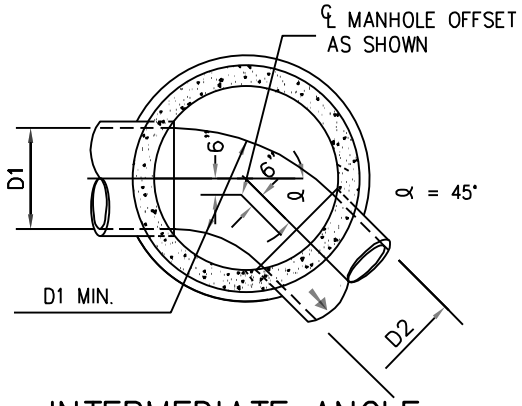


INTERMEDIATE ANGLE

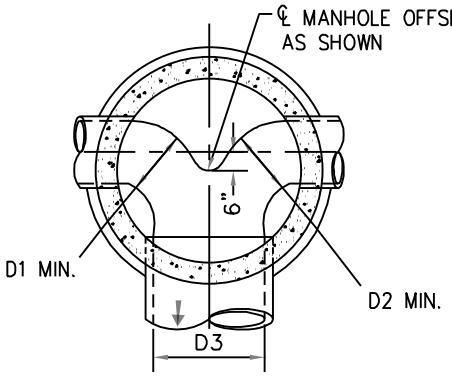


SHARP ANGLE

CURVED DEFLECTOR "POINTS" SHALL EXTEND COMPLETELY ACROSS THE OPPOSED LATERALS AS SHOWN.



INTERMEDIATE ANGLE



OPPOSED LATERALS

CURVED DEFLECTOR "POINTS" SHALL EXTEND ACROSS THE CENTERLINE OF THE OPPOSING PIPES AS SHOWN.

NOTES:

1. PIPE INVERT ELEVATION AND DROP THROUGH MANHOLES SHALL BE IN CONFORMANCE WITH THE REVIEW AND SIGNED CONSTRUCTION PLANS. THE INTENTION IS TO PROMOTE SMOOTH, NON-TURBULANT FLOW THROUGH THE MANHOLES BY KEEPING THE LARGER LINES LOWER IN THE MANHOLE AND BRINGING THE SMALLER LINES IN SLIGHTLY HIGHER.
2. MAX INSIDE DROP THROUGH ANY MANHOLE SHALL BE 18 INCHES
3. MIN DROP THROUGH ANY MANHOLE SHALL BE 0.2 FEET FOR STRAIGHT RUNS AND FOR CHANGES IN DIRECTION
4. ALL INVERT DEFLECTORS SHALL BE CURVED IN SHAPE TO PROVIDE SMOOTH FLOW TRANSITIONS AS SHOWN IN THIS DETAIL
5. MINIMUM ANGLE BETWEEN THE CENTERLINE OF ANY INCOMING PIPE AND THE CENTER OF THE OUTGOING PIPE SHALL BE 90 DEGREES

EMD

DISTRICT STANDARD DETAILS

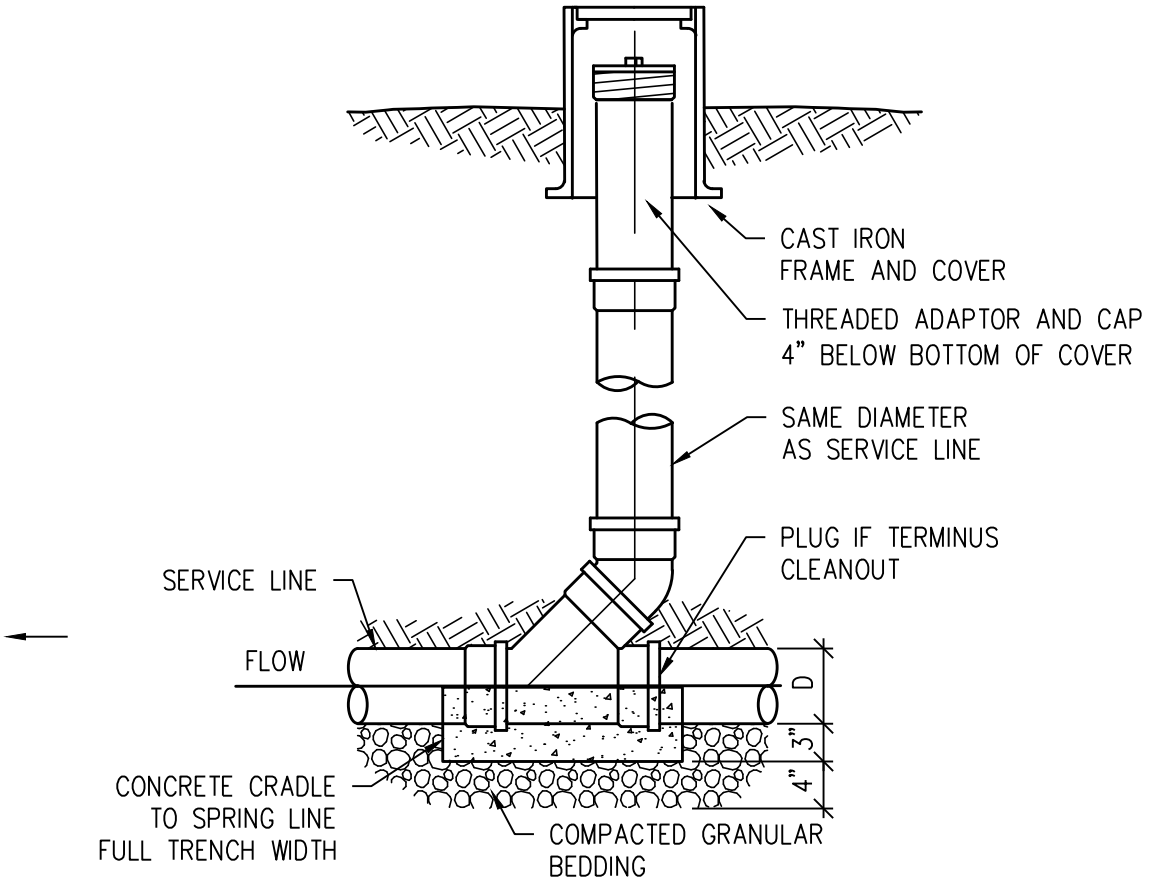
MANHOLE BASE AND DEFLECTOR

D4.07

FEB 2025

CAST IRON COVER IN PAVEMENT AND LANDSCAPE AREAS BRASS COVER IN WALKS AND PLAZAS. COVERS SHALL BE NONPERFORATED WITH "SANITARY" FORGED ON THE TOP

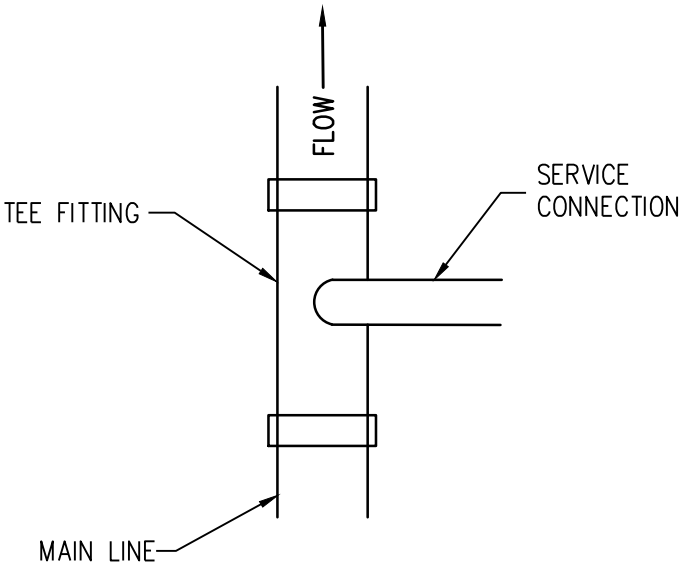
PLAN VIEW



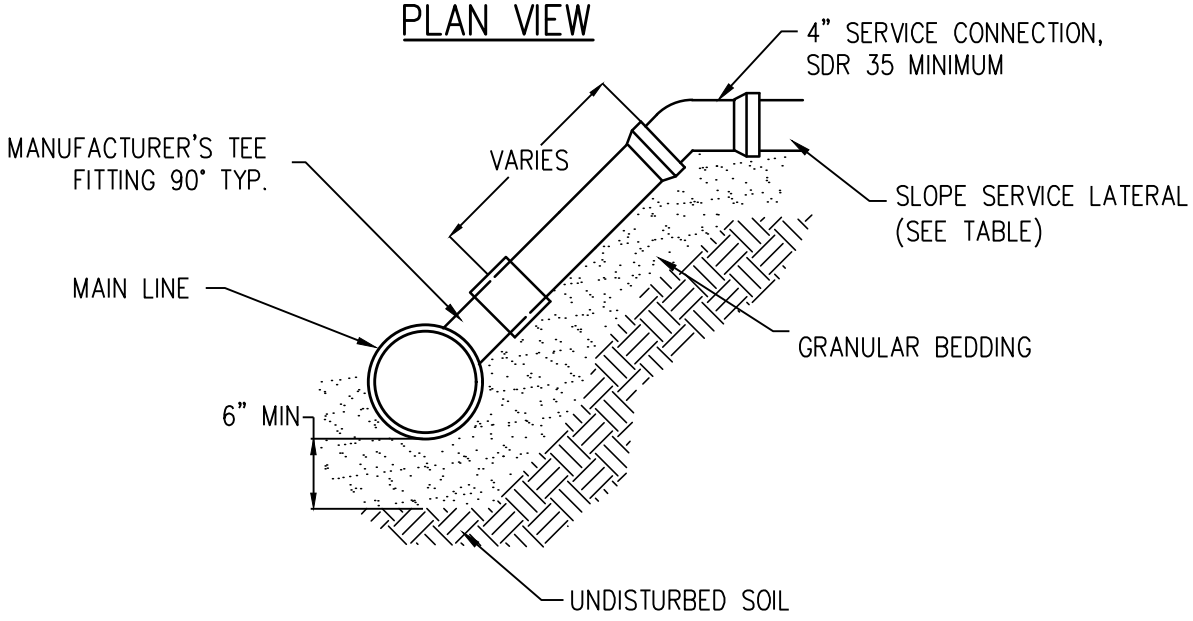
NOTES:

1. CLEANOUT SHALL BE CONSTRUCTED SO THAT SURFACE LOAD WILL NOT BE TRANSFERRED TO MAIN.
2. SERVICE LINE CLEANOUT MAY BE INSTALLED APPROXIMATELY 5 FEET OUTSIDE THE BUILDING FOUNDATION.
3. A CLEANOUT IS REQUIRED ON ALL SERVICE LINES EVERY 100 FEET, AT EVERY "Y" OR AFTER A COMBINED TOTAL 135 DEGREES OF BEND.

EMD	DISTRICT STANDARD DETAILS	D4.08
	SANITARY CLEANOUT	FEB 2025



PLAN VIEW

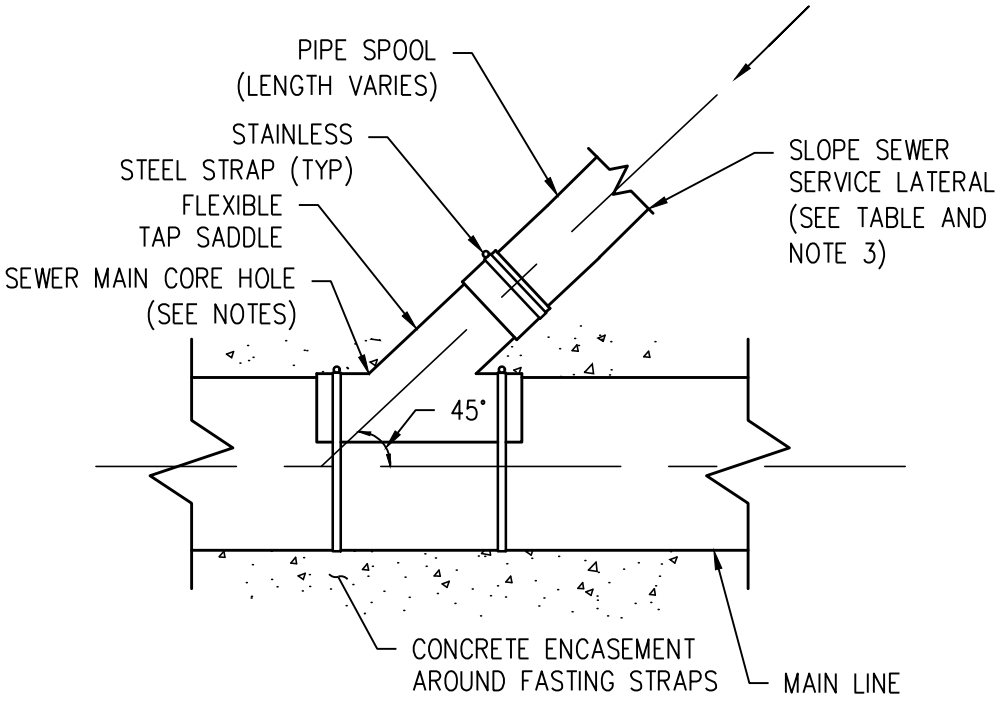


PIPE SIZE (INCHES)	MINIMUM SLOPE (INCH PER FOOT)
2 1/2 OR LESS	1/4
3 TO 6	1/8
8 OR LARGER	1/16

NOTES:

1. USE SDR 35 TEE. WYES NOT ALLOWED.

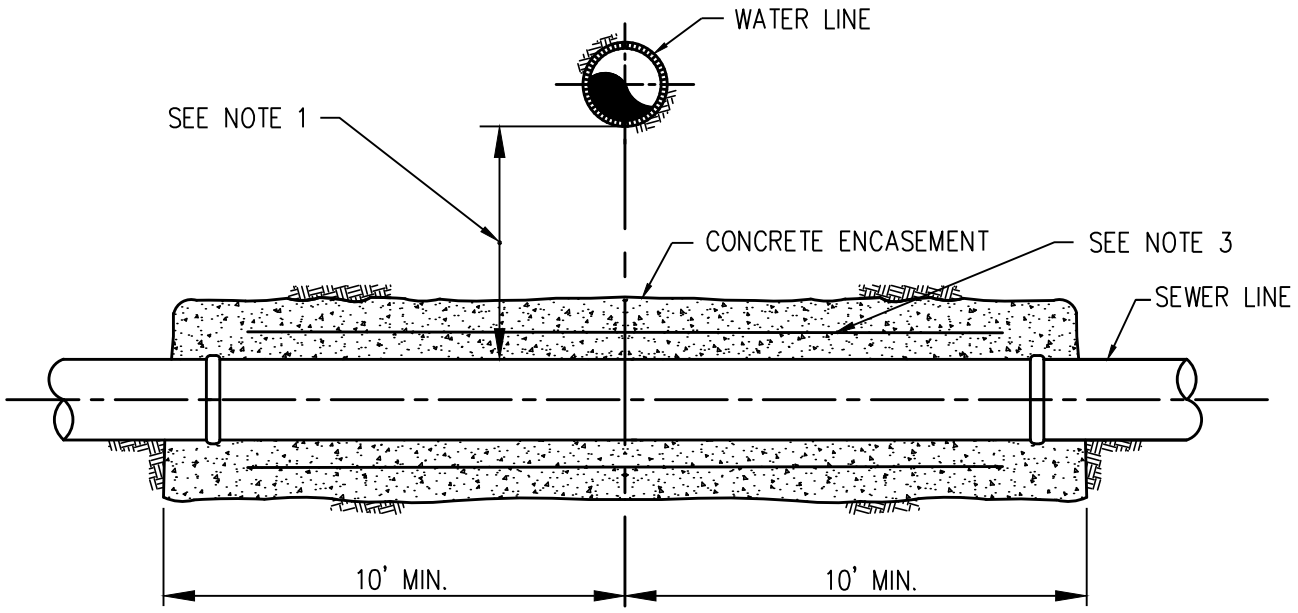
EMD	DISTRICT STANDARD DETAILS	D4.09
	TYPICAL SERVICE CONNECTION	FEB 2025



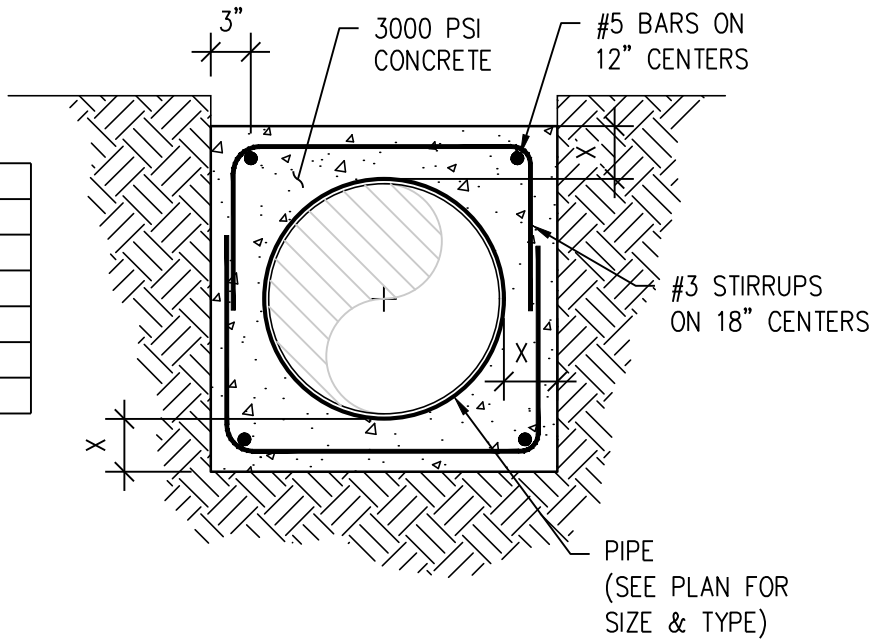
PIPE SIZE (INCHES)	MINIMUM SLOPE (INCH PER FOOT)
2 1/2 OR LESS	1/4
3 TO 6	1/8
8 OR LARGER	1/16

NOTES:

1. APPROVED TAPPING SADDLE TO BE USED FOR NEW SERVICES TO EXISTING MAINS SHALL BE TEES. PIPE PENETRATIONS SHALL BE MECHANICALLY DRILLED.
2. TAPHOLE MUST BE ABOVE THE SPRINGLINE.
3. SEWER SERVICE LINES FROM 3" TO 6" THAT ARE WITHIN THE ROW SHALL HAVE A MINIMUM SLOPE OF 1/8-INCH PER FOOT PER INTERNATIONAL PLUMBING CODE
4. SERVICES SHALL NOT BE CLOSER THAN 5 FT. FROM EACH OTHER ON THE MAIN.
5. AN INSERTA TEE MAY BE AN ACCEPTABLE SUBSTITUTION AS APPROVED BY THE DISTRICT.
6. DOUBLE BANDED STAINLESS STEEL SADDLE BY PLASTIC TRENDS W/ RUBBER BOOTED/ GASKETED SADDLE



PIPE SIZE	X
6"	4"
8"	4"
12"	4"
18"	5"
24"	6"
36"	6"



NOTES:

1. CONCRETE ENCASEMENT WILL BE REQUIRED WHEN CLEAR VERTICAL DISTANCE FROM WATER LINE IS LESS THAN 1'6" OR HORIZONTAL DISTANCE IS LESS THAN 10' BETWEEN PARALLEL LINES
2. CONCRETE ENCASEMENT REQUIRED IN ALL CASES WHERE SEWER LINE IS ABOVE WATER LINE
3. MINIMUM WIDTH AND DEPTH ARE 12" + PIPE O.D.

EMD

DISTRICT STANDARD DETAILS

SANITARY PIPE ENCASEMENT

D4.11

FEB 2025

APPENDIX C
MAIN EXTENSION AGREEMENTS

THIS PAGE IS INTENTIONALLY BLANK

APPLICATION AND AGREEMENT FOR EXTENSION OF WATER MAINS

APPLICATION AND AGREEMENT FOR EXTENSION OF WATER MAINS

THIS APPLICATION AND AGREEMENT (the "Agreement") is made and entered into in duplicate original between _____ (hereinafter referred to as Applicant), whose address is _____ and whose telephone number is _____, and **EVERGREEN METROPOLITAN DISTRICT,** a quasi-municipal corporation of the State of Colorado (hereinafter referred to as "District"), and whose address is 30920 Stagecoach Blvd. Evergreen, CO 80439, and whose telephone number is 303-674-4112.

Applicant's Engineer is _____ whose address is _____, and whose telephone number is _____.

District Engineer is _____, whose address is _____, and whose telephone number is _____.

WITNESSETH:

WHEREAS, Applicant is the owner of a tract of land legally described as: See Attached Exhibit A.

WHEREAS, in order to provide water service to said tract or a portion thereof, it is necessary for Applicant to extend water lines and related transmission and distributing facilities (hereinafter referred to as "Project"), and to connect the same into District's existing water distribution system; and

WHEREAS, Applicant and District desire to execute this Agreement covering basic understandings between the parties hereto with regard to the Project.

NOW, THEREFORE, in consideration of the mutual promises and covenants contained herein, Applicant and District hereby agree as follows:

1. **Effective Application.** This Agreement shall become a binding contract between the parties hereto upon execution by the Applicant and the District.

2. **Water Service.** This Agreement does not guarantee that water service will be available to the Project or any part thereof. Water service is dependent upon inclusion of the subject property into the District or a distributor contract service area. If this has been done, the District will be able to provide water service in accordance with the District Rules and Regulations as amended from time to time (the "Regulations"). However, if this has not been accomplished, then the property must first be included into the District or a distributor contract service area before service can be provided. With this caveat, water taps are, as of the date of this Agreement, available and must be purchased at the District office prior to the institution of water service to any property. The availability of water taps is subject to water supply limitations and other restrictions set forth in the Regulations.

3. **Description of Work.** Applicant covenants that the Project shall be constructed in accordance with the Regulations, including but not limited to, easement and right-of-way requirements, if applicable, and in

accordance with the plans and construction notes approved by the District Engineer, any additions or modifications made thereto by said Engineer, and all District specifications. Applicant agrees to furnish or cause to be furnished at his own cost and expenses, all labor, equipment, power, materials, supplies and all other things necessary to perform and complete the Project in a good, expeditious and workmanlike manner.

4. **Independent Investigation.** Applicant represents that he has read thoroughly all plans, notes and specifications and that he has thoroughly examined the Project site and ascertained for itself all soil, geological, ground water and other conditions to be encountered and which might affect the construction, operation and future maintenance of the Project. Applicant agrees that he enters into the work contemplated hereunder relying on his own investigation and information and not on any statements or representations, if any, that have been made by the District, its officers, agents or employees. It is understood and agreed that a review of the plans of the Applicant by or on behalf of the District is only for the purposes of the District and in no way relates to an approval of the material used, an approval of the end product of the Applicant's work, or a release of the Applicant's obligation to comply with the District's rules and specifications.

5. **Conditional Acceptance - Title.** The District will conditionally accept the Project after it determines that the Project has been constructed and connected into the District's water distribution system in accordance with the approved plans, construction notes and specifications and after the District has received certified compaction test results, as-constructed drawings for the entire Project, a verified total cost of the Project and acceptable documentation of the release of all mechanics liens and other encumbrances against or affecting the Project (generally referred to as "Conditional Acceptance"). Conditional Acceptance shall be effective as of the date the District provides written notice of Conditional Acceptance. No water taps nor physical connections to the Project shall be allowed, nor will permits be issued for such connections, until the District has conditionally accepted the Project as herein provided.

5.1 Facility Ownership. As of the date of Conditional Acceptance, all of Applicant's right, title and interest in and to the constructed Project, including all mains, pipelines, valves, and related parts and materials which compromise the completed Project, shall immediately pass to and vest in the District, subject, however, to Applicant's warranty obligation for maintenance and repair as provided herein. This Agreement constitutes and shall be deemed a transfer and conveyance of the Project by the Applicant to the District effective as of the date of Conditional Acceptance. **Prior to commencement of work on the Project, the Applicant will provide a performance bond in the amount of ten (10) percent of the total Project cost, naming the District as the obligee, to insure completion of punch list items which may be necessary for the District to conditionally and/or finally accept the Project. If, for any reason, the Applicant has not completed the punch list items necessary for Conditional and/or Final Acceptance, if applicable, the District will suspend issuance of letters of availability and water tap sales until all items have been completed. Further, if the punch list items have not been completed sixty (60) days from the date of written notification by the District, the District may, in coordination with the bonding company, complete the punch list items.**

5.2 Title Warranty. Applicant agrees that the completed Project shall be transferred to the District free and clear of all liens and encumbrances, and Applicant agrees to **WARRANT AND DEFEND** the conveyance of such property to the District, its successors and assigns, against all and every person or persons whomsoever. If, after the date of Conditional Acceptance, the District determines that title to the Project and/or easements and rights-of-way has not been effectively conveyed to the District, Applicant agrees that he will do whatever is necessary, at its expense, to effectuate the transfer and conveyance of the Project to the District.

6. **Maintenance and Repairs.** Applicant shall, as described in this Paragraph 6, be responsible for correcting and repairing all defects in the completed Project (hereinafter referred to as "Corrective Maintenance") and for any necessary maintenance of the completed Project, until the same is finally

accepted for maintenance by the District. The Applicant understands that the District will own, operate and use the Project and related facilities subject to the Applicant's responsibility to perform the following measures during the one-year Corrective Maintenance period.

6.1 Guarantee. Applicant guarantees all equipment, materials, supplies, and work furnished to the Project against defective construction and workmanship for a period of one (1) year from the date of Conditional Acceptance of the Project by the District, or until the Project is finally accepted for maintenance by the District, whichever period is longer.

6.2 Corrective Maintenance. Applicant shall correct, repair or replace any part or parts of the completed Project, which the District determines were not constructed in accordance with the approved plans, construction notes and specifications, or which the District determines to be defective or of poor or non-workman quality. In addition, Applicant shall correct any soil subsidence or erosion problem, which the District determines occurred in connection with the construction of the Project.

6.3 Routine Maintenance. Applicant shall protect the completed Project and shall be responsible for performing all routine maintenance on the completed Project so as to keep it in good repair and condition, ordinary wear and tear excepted. Applicant's routine maintenance obligations shall include the obligation to repair and/or replace any part or parts of the completed Project damaged or rendered non-operative for any reason as a result of street construction, paving, other utility installation or vehicular traffic, excluding any repair or replacement necessitated by the District's negligent operation or use of the Project.

6.4 Time of Performance. After receipt of written notice from the District specifying what corrections and/or maintenance should be performed, Applicant shall, at his sole cost and expense, promptly perform such corrections and/or maintenance, or cause a licensed and bonded contractor to do the same. In the event Applicant fails or is unable to perform its obligations hereunder, the District, in order to insure the proper operation of its water distribution system and without waiving any of its other remedies, may perform said corrections and maintenance and charge the cost thereof to Applicant, or its bonding company.

6.5 Maintenance and/or Warranty Bond. Applicant hereby agrees that as a condition precedent to the Conditional Acceptance of the Project, it will provide a maintenance and/or warranty bond payable to the District and sufficient to comply with the terms of this Agreement for Conditional and/or Final Acceptance. Said maintenance and/or warranty bond shall, in the District's sole discretion, be acceptable in form and shall be effective as of the date of Conditional Acceptance.

6.6 Emergency Repairs. In the event of any emergency, such as but not limited to, a water main break, the District, in order to insure the proper operation of its water distribution system, may perform the necessary emergency repair and charge the cost thereof to Applicant, or its bonding company.

6.7 Warranty. The Applicant and its contractor shall provide a minimum one (1) year warranty of the water pipelines, appurtenances, and surface restoration work, including asphalt and concrete. The warranty period shall commence at the time of Conditional Acceptance of the Project. Final acceptance will be made when all punch list items have been corrected to the District's satisfaction as set forth in Paragraph 7. This general warranty shall not be considered a waiver of any manufacturer's warranty, which may exceed the one (1) year period, or the Statute of Limitations for construction projects as provided for in the Colorado Revised Statutes or Uniform Commercial Code. Satisfactory compaction test results are not a guarantee that settlement will not occur. The Applicant and its contractor shall be responsible for all work, including any repairs or replacements, that are required during the duration of the warranty period, including all parts, material, and labor. If upon notification of the Contractor, such repairs are not completed within sixty (60) days, the District shall complete the work and seek recovery from the Contractor or its bonding company. The Applicant and its Contractor shall be responsible for all consequential damages as a result of

failure of such work.

7. **Acceptance for Maintenance.** On or after one (1) year from the date of Conditional Acceptance, the District shall inspect the completed Project. Such inspection shall, among other items, confirm that all fire hydrants, valve vaults and valve boxes are at finished grade, that all valve boxes are centered over the valve operation nut and are free and clear of sand, gravel, stones or other foreign material, and that all fire hydrants are operational. Any replacement or repairs necessary to bring the Project into compliance with the approved plans, construction notes and specifications, including repair of street paving, curb and gutter work, if applicable, and any other changes required by District personnel at their sole discretion, shall be promptly performed by the Applicant or by a licensed and bonded contractor, at Applicant's sole cost and expense.

Upon the satisfactory completion of all replacements and repairs, the District shall finally accept the Project for maintenance and release the maintenance and/or warranty bond (generally referred to as "Final Acceptance"). The District's Final Acceptance of the Project for maintenance shall be effective as of the date of the District's written notice of Final Acceptance, and from that date forward, the District shall operate and maintain the Project at the District's expense.

8. **Indemnification.** Applicant shall indemnify, defend and hold harmless the District, its officers, agents and employees from all claims and demands or liability arising out of or encountered in connection with this Agreement or the performance of the work contemplated hereunder or otherwise related to the Project, whether such claims, demands or liability are caused by Applicant, his agents or employees, or by Applicant's contractors or subcontractors, their agents or employees, or by products or materials installed on the Project by Applicant, its contractors, or subcontractors; EXCEPTING ONLY such injury or damage as may be caused directly and exclusively by the District's negligent acts. This indemnification shall extend to claims, demands or liability for injury occurring on or off the Project and for injury occurring during or after completion of construction of the Project.

9. **Right to Stop Work.** In the event of a breach of this Agreement, the District reserves the right to halt all work on the Project until all breaches are cured to the satisfaction of the District.

10. **Easements.** Before the District will Conditionally Accept the Project or, if any Project work will be performed on property that is not owned by the Applicant, before any Project work is commenced on such property, all rights-of-way and easements necessary therefor shall be obtained and conveyed to the District as required in the District's sole discretion. Applicant shall provide the following documents to the District before the District will begin processing or preparation of rights-of-way or easements:

a. Legal description and land survey prepared by registered land surveyor.

b. Land survey showing location of structures, utilities, and other easements on the property.

c. Statement, in writing, of proposed width of easement, whether it is exclusive or non-exclusive, and any other pertinent information.

d. Title commitment showing present ownership and encumbrances on the easement property.

e. In case the title is to be signed by a partnership, corporation, or other business entity, in those cases other than a corporation signing by its president, a recordable authority affidavit will be required for the person signing.

f. The signature of Applicant and holder of any encumbrance on the property to be made subject to the easement and right-of-way.

The Applicant hereby understands that the District will require a minimum of forty-five (45) days from receipt of the above required documents before the rights-of-way and easements prepared by the District's Attorney will be signed and approved by the District for recording.

11. **Reimbursable Expenses.** It is hereby understood and agreed that the District will incur engineering, management and legal expenses in processing this Agreement on behalf of the Applicant. The expenses so incurred by the District for review of the Applicant's plans as well as the preparation of easements and/or performing other matters will be considered reimbursable expenses. Any other expense reasonably incurred by the District to process this Agreement will also be considered a reimbursable expense, including but not limited to administration and maintenance costs. The Applicant shall be billed by the District for its reimbursable expenses on a monthly basis. The Applicant herein agrees to promptly reimburse those expenses. Any reimbursable expenses which are not paid within thirty (30) days shall be considered delinquent. Delinquent reimbursable expenses shall incur a late penalty of one (1%) percent of the amount of the reimbursable expenses per month. Further, the District shall charge $25.00 administration fee for collecting the past due amounts. The District will not authorize Conditional or Final Acceptance of the Project, if any reimbursable expenses are unpaid, whether past due or not. Should any reimbursable expenses become delinquent, all further processing by the District of the Project, including but not limited to the sale of taps, execution of easements, or approval of plans, will promptly be halted until the reimbursable expenses are paid. If the Applicant become delinquent in the payment of reimbursable expenses, the District shall have the option to require Applicant to deposit an escrow with the District from which reimbursable expenses will be paid. The amount to be deposited shall be at the sole discretion of the District. Applicant will then be responsible for replenishing the escrow on a monthly basis, or as the escrow is spent.

12. **Integration Clause.** This Agreement constitutes the entire agreement of the parties, except, if applicable, the right-of-way agreements or easements for the Project, which may impose additional obligations upon Applicant. No other agreements, oral or written, pertaining to the Project to be performed under this Agreement exist between the parties. This Agreement can be modified only by a writing signed by both parties hereto.

13. **Interpretation of Agreement.** This Agreement, the approved plans, construction notes and specifications, are intended to supplement one another. In the case of conflict however, the specifications shall control the plans, and the provisions of this Agreement shall control both. In the event that work is displayed on the plans, but not called for in the specifications, or in the event that work is called for in the specifications, but not displayed on the plans, Applicant shall be required to perform the work as so called for and displayed in either place. Should any court determine that any provision of this Agreement is unenforceable, such interpretation shall not work to invalidate the entire Agreement. All other provisions shall remain in full force and effect.

14. **Governing Law.** This Agreement shall be construed in accordance with and governed by the laws of the State of Colorado. Should any legal action be instituted for interpretation of this Agreement and/or any of the rights of the parties hereunder, such action shall be brought in the District Court for Jefferson County.

15. **Assignment.** Applicant may not assign this Agreement without the express written consent of the District.

IN WITNESS WHEREOF, this Agreement has been executed in duplicate by the parties hereto as of the day and date opposite their signatures.

APPLICANT:_____

By: _____

_____ Title: _____
Date

ACKNOWLEDGEMENT OF INDIVIDUAL APPLICANT

STATE OF COLORADO)
)ss.
County of _____)

The foregoing instrument was acknowledged before me this ____ day of _____, 20__ , by ._____.

WITNESS my hand and official seal.

_____
Notary Public

My Commission Expires:

NOTE: This Agreement must be executed exactly as the Applicant is doing business

ACKNOWLEDGEMENT BY CORPORATION

STATE OF COLORADO)
) ss.
County of _____)

The foregoing instrument was acknowledged before me this ___day of _____, 200 , by _____ as President (Vice President), and _____, Secretary (Assistant Secretary) of _____, a _____ corporation.

WITNESS my hand and official seal.

_____

Notary Public

My Commission expires:

APPROVAL BY EVERGREEN METROPOLITAN DISTRICT

a) Approval of Application

Date: _____ _____
Name

_____
District Manager

b) Conditional Acceptance of Project

Date: _____ _____
District Manager

Date of Conditional Acceptance _____

Cost of Project to Applicant_____

c) Final Acceptance of
Project for Maintenance

Date: _____ _____
District Manager

Date of Effective Final Acceptance _____

APPLICATION AND AGREEMENT FOR EXTENSION OF SEWER MAINS

APPLICATION AND AGREEMENT FOR EXTENSION OF SEWER MAINS

THIS APPLICATION AND AGREEMENT (the "Agreement") is made and entered into in duplicate original between _____ (hereinafter referred to as Applicant), whose address is _____ and whose telephone number is _____, and **EVERGREEN METROPOLITAN DISTRICT,** a quasi-municipal corporation of the State of Colorado (hereinafter referred to as "District"), and whose address is 30920 Stagecoach Blvd. Evergreen, CO 80439, and whose telephone number is 303-674-4112.

Applicant's Engineer is _____ whose address is _____, and whose telephone number is _____.

District Engineer is _____, whose address is _____, and whose telephone number is _____.

WITNESSETH:

WHEREAS, Applicant is the owner of a tract of land legally described as: See Attached Exhibit A.

WHEREAS, in order to provide sewer service to said tract or a portion thereof, it is necessary for Applicant to extend sewer lines and related collections facilities (hereinafter referred to as "Project"), and to connect the same into District's existing sewer collections system; and

WHEREAS, Applicant and District desire to execute this Agreement covering basic understandings between the parties hereto with regard to the Project.

NOW, THEREFORE, in consideration of the mutual promises and covenants contained herein, Applicant and District hereby agree as follows:

1. **Effective Application.** This Agreement shall become a binding contract between the parties hereto upon execution by the Applicant and the District.

2. **Sewer Service.** This Agreement does not guarantee that sewer service will be available to the Project or any part thereof. Sewer service is dependent upon inclusion of the subject property into the District. If this has been done, the District will be able to provide sewer service in accordance with the District Rules and Regulations as amended from time to time (the "Regulations"). However, if this has not been accomplished, then the property must first be included into the District before service can be provided. With this caveat, sewer taps are, as of the date of this Agreement, available and must be purchased at the District office prior to the institution of sewer service to any property. The availability of sewer taps is subject to sewer infrastructure limitations and other restrictions set forth in the Regulations.

3. **Description of Work.** Applicant covenants that the Project shall be constructed in accordance with the Regulations, including but not limited to, easement and right-of-way requirements, if applicable, and in accordance with the plans and construction notes approved by the District Engineer, any additions or

modifications made thereto by said Engineer, and all District specifications. Applicant agrees to furnish or cause to be furnished at his own cost and expenses, all labor, equipment, power, materials, supplies and all other things necessary to perform and complete the Project in a good, expeditious and workmanlike manner.

4. **Independent Investigation.** Applicant represents that he has read thoroughly all plans, notes and specifications and that he has thoroughly examined the Project site and ascertained for itself all soil, geological, ground water and other conditions to be encountered and which might affect the construction, operation and future maintenance of the Project. Applicant agrees that it enters into the work contemplated hereunder relying on its own investigation and information and not on any statements or representations, if any, that have been made by the District, its officers, agents or employees. It is understood and agreed that a review of the plans of the Applicant by or on behalf of the District is only for the purposes of the District and in no way relates to an approval of the material used, an approval of the end product of the Applicant's work, or a release of the Applicant's obligation to comply with the District's rules and specifications.

5. **Conditional Acceptance - Title.** The District will conditionally accept the Project after it determines that the Project has been constructed and connected into the District's sewer collections system in accordance with the approved plans, construction notes and specifications and after the District has received certified compaction test results, as-constructed drawings for the entire Project, a verified total cost of the Project and acceptable documentation of the release of all mechanics liens and other encumbrances against or affecting the Project (generally referred to as "Conditional Acceptance"). Conditional Acceptance shall be effective as of the date the District provides written notice of Conditional Acceptance. No sewer taps nor physical connections to the Project shall be allowed, nor will permits be issued for such connections, until the District has conditionally accepted the Project as herein provided.

5.1 Facility Ownership. As of the date of Conditional Acceptance, all of Applicant's right, title and interest in and to the constructed Project, including all mains, pipelines, valves, and related parts and materials which compromise the completed Project, shall immediately pass to and vest in the District, subject, however, to Applicant's warranty obligation for maintenance and repair as provided herein. This Agreement constitutes and shall be deemed a transfer and conveyance of the Project by the Applicant to the District effective as of the date of Conditional Acceptance. **Prior to commencement of work on the Project, the Applicant will provide a performance bond in the amount of ten (10) percent of the total Project cost, naming the District as the obligee, to insure completion of punch list items which may be necessary for the District to conditionally and/or finally accept the Project. If, for any reason, the Applicant has not completed the punch list items necessary for Conditional and/or Final Acceptance, if applicable, the District will suspend issuance of letters of availability and sewer tap sales until all items have been completed. Further, if the punch list items have not been completed sixty (60) days from the date of written notification by the District, the District may, in coordination with the bonding company, complete the punch list items.**

5.2 Title Warranty. Applicant agrees that the completed Project shall be transferred to the District free and clear of all liens and encumbrances, and Applicant agrees to **WARRANT AND DEFEND** the conveyance of such property to the District, its successors and assigns, against all and every person or persons whomsoever. If, after the date of Conditional Acceptance, the District determines that title to the Project and/or easements and rights-of-way has not been effectively conveyed to the District, Applicant agrees that he will do whatever is necessary, at its expense, to effectuate the transfer and conveyance of the Project to the District.

6. **Maintenance and Repairs.** Applicant shall, as described in this Paragraph 6, be responsible for correcting and repairing all defects in the completed Project (hereinafter referred to as "Corrective Maintenance") and for any necessary maintenance of the completed Project, until the same is finally accepted for maintenance by the District. The Applicant understands that the District will own, operate and use the Project and related facilities subject to the Applicant's responsibility to perform the following

measures during the one-year Corrective Maintenance period.

6.1 Guarantee. Applicant guarantees all equipment, materials, supplies, and work furnished to the Project against defective construction and workmanship for a period of one (1) year from the date of Conditional Acceptance of the Project by the District, or until the Project is finally accepted for maintenance by the District, whichever period is longer.

6.2 Corrective Maintenance. Applicant shall correct, repair or replace any part or parts of the completed Project, which the District determines were not constructed in accordance with the approved plans, construction notes and specifications, or which the District determines to be defective or of poor or non-workman quality. In addition, Applicant shall correct any soil subsidence or erosion problem, which the District determines occurred in connection with the construction of the Project.

6.3 Routine Maintenance. Applicant shall protect the completed Project and shall be responsible for performing all routine maintenance on the completed Project so as to keep it in good repair and condition, ordinary wear and tear excepted. Applicant's routine maintenance obligations shall include the obligation to repair and/or replace any part or parts of the completed Project damaged or rendered non-operative for any reason as a result of street construction, paving, other utility installation or vehicular traffic, excluding any repair or replacement necessitated by the District's negligent operation or use of the Project.

6.4 Time of Performance. After receipt of written notice from the District specifying what corrections and/or maintenance should be performed, Applicant shall, at his sole cost and expense, promptly perform such corrections and/or maintenance, or cause a licensed and bonded contractor to do the same. In the event Applicant fails or is unable to perform its obligations hereunder, the District, in order to insure the proper operation of its sewer collections system and without waiving any of its other remedies, may perform said corrections and maintenance and charge the cost thereof to Applicant, or its bonding company.

6.5 Maintenance and/or Warranty Bond. Applicant hereby agrees that as a condition precedent to the Conditional Acceptance of the Project, it will provide a maintenance and/or warranty bond payable to the District and sufficient to comply with the terms of this Agreement for Conditional and/or Final Acceptance. Said maintenance and/or warranty bond shall, in the District's sole discretion, be acceptable in form and shall be effective as of the date of Conditional Acceptance.

6.6 Emergency Repairs. In the event of any emergency, such as but not limited to, a sewer main break, the District, in order to insure the proper operation of its sewer collections system, may perform the necessary emergency repair and charge the cost thereof to Applicant, or its bonding company.

6.7 Warranty. The Applicant and its contractor shall provide a minimum one (1) year warranty of the sewer pipelines, appurtenances, and surface restoration work, including asphalt and concrete. The warranty period shall commence at the time of Conditional Acceptance of the Project. Final acceptance will be made when all punch list items have been corrected to the District's satisfaction as set forth in Paragraph 7. This general warranty shall not be considered a waiver of any manufacturer's warranty, which may exceed the one (1) year period, or the Statute of Limitations for construction projects as provided for in the Colorado Revised Statutes or Uniform Commercial Code. Satisfactory compaction test results are not a guarantee that settlement will not occur. The Applicant and its contractor shall be responsible for all work, including any repairs or replacements, that are required during the duration of the warranty period, including all parts, material, and labor. If upon notification of the Contractor, such repairs are not completed within sixty (60) days, the District shall complete the work and seek recovery from the Contractor or its bonding company. The Applicant and its Contractor shall be responsible for all consequential damages as a result of failure of such work.

7. **Acceptance for Maintenance.** On or after one (1) year from the date of Conditional Acceptance, the District shall inspect the completed Project. Such inspection shall, among other items, confirm that all manholes are at finished grade. Any replacement or repairs necessary to bring the Project into compliance with the approved plans, construction notes and specifications, including repair of street paving, curb and gutter work, if applicable, and any other changes required by District personnel at their sole discretion, shall be promptly performed by the Applicant or by a licensed and bonded contractor, at Applicant's sole cost and expense.

Upon the satisfactory completion of all replacements and repairs, the District shall finally accept the Project for maintenance and release the maintenance and/or warranty bond (generally referred to as "Final Acceptance"). The District's Final Acceptance of the Project for maintenance shall be effective as of the date of the District's written notice of Final Acceptance, and from that date forward, the District shall operate and maintain the Project at the District's expense.

8. **Indemnification.** Applicant shall indemnify, defend and hold harmless the District, its officers, agents and employees from all claims and demands or liability arising out of or encountered in connection with this Agreement or the performance of the work contemplated hereunder or otherwise related to the Project, whether such claims, demands or liability are caused by Applicant, his agents or employees, or by Applicant's contractors or subcontractors, their agents or employees, or by products or materials installed on the Project by Applicant, its contractors, or subcontractors; EXCEPTING ONLY such injury or damage as may be caused directly and exclusively by the District's negligent acts. This indemnification shall extend to claims, demands or liability for injury occurring on or off the Project and for injury occurring during or after completion of construction of the Project.

9. **Right to Stop Work.** In the event of a breach of this Agreement, the District reserves the right to halt all work on the Project until all breaches are cured to the satisfaction of the District.

10. **Easements.** Before the District will Conditionally Accept the Project or, if any Project work will be performed on property that is not owned by the Applicant, before any Project work is commenced on such property, all rights-of-way and easements necessary therefor shall be obtained and conveyed to the District as required in the District's sole discretion. Applicant shall provide the following documents to the District before the District will begin processing or preparation of rights-of-way or easements:

a. Legal description and land survey prepared by registered land surveyor.

b. Land survey showing location of structures, utilities, and other easements on the property.

c. Statement, in writing, of proposed width of easement, whether it is exclusive or non-exclusive, and any other pertinent information.

d. Title commitment showing present ownership and encumbrances on the easement property.

e. In case the title is to be signed by a partnership, corporation, or other business entity, in those cases other than a corporation signing by its president, a recordable authority affidavit will be required for the person signing.

f. The signature of Applicant and holder of any encumbrance on the property to be made subject to the easement and right-of-way.

The Applicant hereby understands that the District will require a minimum of forty-five (45) days from receipt of the above required documents before the rights-of-way and easements prepared by the District's Attorney will be signed and approved by the District for recording.

11. **Reimbursable Expenses.** It is hereby understood and agreed that the District will incur engineering, management and legal expenses in processing this Agreement on behalf of the Applicant. The expenses so incurred by the District for review of the Applicant's plans as well as the preparation of easements and/or performing other matters will be considered reimbursable expenses. Any other expense reasonably incurred by the District to process this Agreement will also be considered a reimbursable expense, including but not limited to administration and maintenance costs. The Applicant shall be billed by the District for its reimbursable expenses on a monthly basis. The Applicant herein agrees to promptly reimburse those expenses. Any reimbursable expenses which are not paid within thirty (30) days shall be considered delinquent. Delinquent reimbursable expenses shall incur a late penalty of one (1%) percent of the amount of the reimbursable expenses per month. Further, the District shall charge $25.00 administration fee for collecting the past due amounts. The District will not authorize Conditional or Final Acceptance of the Project, if any reimbursable expenses are unpaid, whether past due or not. Should any reimbursable expenses become delinquent, all further processing by the District of the Project, including but not limited to the sale of taps, execution of easements, or approval of plans, will promptly be halted until the reimbursable expenses are paid. If the Applicant become delinquent in the payment of reimbursable expenses, the District shall have the option to require Applicant to deposit an escrow with the District from which reimbursable expenses will be paid. The amount to be deposited shall be at the sole discretion of the District. Applicant will then be responsible for replenishing the escrow on a monthly basis, or as the escrow is spent.

12. **Integration Clause.** This Agreement constitutes the entire agreement of the parties, except, if applicable, the right-of-way agreements or easements for the Project, which may impose additional obligations upon Applicant. No other agreements, oral or written, pertaining to the Project to be performed under this Agreement exist between the parties. This Agreement can be modified only by a writing signed by both parties hereto.

13. **Interpretation of Agreement.** This Agreement, the approved plans, construction notes and specifications, are intended to supplement one another. In the case of conflict however, the specifications shall control the plans, and the provisions of this Agreement shall control both. In the event that work is displayed on the plans, but not called for in the specifications, or in the event that work is called for in the specifications, but not displayed on the plans, Applicant shall be required to perform the work as so called for and displayed in either place. Should any court determine that any provision of this Agreement is unenforceable, such interpretation shall not work to invalidate the entire Agreement. All other provisions shall remain in full force and effect.

14. **Governing Law.** This Agreement shall be construed in accordance with and governed by the laws of the State of Colorado. Should any legal action be instituted for interpretation of this Agreement and/or any of the rights of the parties hereunder, such action shall be brought in the District Court for Jefferson County.

15. **Assignment.** Applicant may not assign this Agreement without the express written consent of the District.

IN WITNESS WHEREOF, this Agreement has been executed in duplicate by the parties hereto as of the day and date opposite their signatures.

APPLICANT:_____

By: _____

_____ Title: _____
Date

ACKNOWLEDGEMENT OF INDIVIDUAL APPLICANT

STATE OF COLORADO)
)ss.
County of _____)

The foregoing instrument was acknowledged before me this ____ day of _____, 20__ , by ._____.

WITNESS my hand and official seal.

_____
Notary Public

My Commission Expires:

NOTE: This Agreement must be executed exactly as the Applicant is doing business

ACKNOWLEDGEMENT BY CORPORATION

STATE OF COLORADO)
) ss.
County of _____)

The foregoing instrument was acknowledged before me this ___day of _____, 200 , by _____ as President (Vice President), and _____, Secretary (Assistant Secretary) of _____, a _____ corporation.

WITNESS my hand and official seal.

_____
Notary Public

My Commission expires:

APPROVAL BY EVERGREEN METROPOLITAN DISTRICT

a) Approval of Application

Date: _____ _____
Name

_____
District Manager

b) Conditional Acceptance of Project

Date: _____ _____
District Manager

Date of Conditional Acceptance _____

Cost of Project to Applicant_____

c) Final Acceptance of
Project for Maintenance

Date: _____ _____
District Manager

Date of Effective Final Acceptance _____

APPENDIX D
DESIGN AND DEVELOPMENT REVIEW DOCUMENTS

THIS PAGE IS INTENTIONALLY BLANK

JVA, Incorporated
1319 Spruce Street
Boulder, CO 80302
303.444.1951
info@jvajva.com

www.jvajva.com

Date

Chris Schauder, CWP
New Services & Environmental Manager
30920 Stagecoach Blvd.
Evergreen, CO 80439

RE: Development Name
Submittal Number – Submittal Type
JVA Job No.: 1059.XXe

Dear Chris:

On behalf of Evergreen Metropolitan District (EMD), JVA has reviewed the submitted documents. The submittal included the following documents:

- Document Name dated DATE
- Document Name dated DATE
- Document Name dated DATE

Our review has generated the following comments:

General Comments:

1.

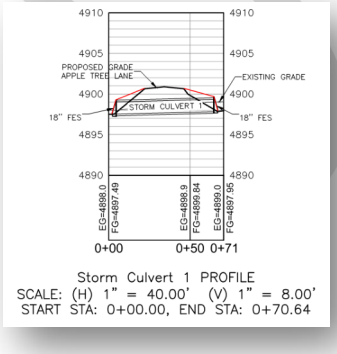
Document Name Comments:

2.

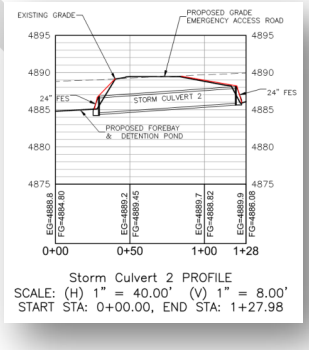
Document Name Comments:

3.

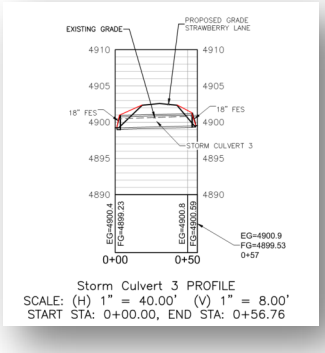
Provide Screenshots if necessary with comments:



Storm Culvert 1 PROFILE
SCALE: (H) 1" = 40.00' (V) 1" = 8.00'
START STA: 0+00.00, END STA: 0+70.64



Storm Culvert 2 PROFILE
SCALE: (H) 1" = 40.00' (V) 1" = 8.00'
START STA: 0+00.00, END STA: 1+27.98



Storm Culvert 3 PROFILE
SCALE: (H) 1" = 40.00' (V) 1" = 8.00'
START STA: 0+00.00, END STA: 0+56.76

Document Name Comments:

4.

The above comments may not reflect all changes required to meet EMD standards. These comments are based on information provided. Additional comments may arise as additional information is provided and/or reviewed. JVA's review of the submittals listed was performed within the following limitations and parameters:

The plan and documents reviewed by EMD does not necessarily include confirmation of design calculations, project approach or every project design element. Therefore, authorization from EMD to proceed with construction of the project does not constitute unconditional acceptance or approval of the submitted plans or documents, particularly if specific aspects are later discovered to not be in compliance with EMD's District codes or regulations in effect at the time such authorization was granted. The responsibility for compliance with EMD's District codes and regulations rests solely with the developer, their design engineer and their engineer's consultants. Neither EMD nor JVA, Inc, accept responsibility for the project design and/or construction of this development nor any other design consideration or standard utilized in the project.

Sincerely,
JVA, INCORPORATED

By: _____
Reviewer Name,
Reviewer Title

APPENDIX E
FIELD INSPECTION CHECKLISTS
(INTERNAL USE ONLY)

THIS PAGE IS INTENTIONALLY BLANK

EVERGREEN METROPOLITAN DISTRICT

WATER SERVICE LINE INSPECTION PROCEDURE

Purpose: To ensure that service lines meet District specifications and are accurately documented.

Water service line inspections and taps are to be scheduled through the Collections and Distribution Department. Prior to the excavation and installation, the Water Resources Department will ensure that all administrative tasks have been completed. Only EMD staff are allowed to perform water taps unless the service diameter is greater than 2". Water service materials will be ordered upon the completion of the payment of tap fees. Water taps may be scheduled at any time during the construction process with a minimum 48-hour scheduling notice. Partial inspections may be requested with a minimum 48-hour notice if any potion of the trench must be backfilled before the tap is made. The excavation and installing contractor is responsible for all permitting that may be required (Road cuts, easements, erosion control, etc.) Contractor/owner and District staff should verify the best location for the service line shut-off. The shut off should be located within the customers property in an area that is protected from vehicles, plows and future construction activities. Any encroachment of adjacent properties must be approved by the owner of the property. District staff do not have authority to permit service lines to be installed through any portion of adjacent properties. District employees inspecting service lines have the authority to instruct the contractor to uncover any part of the service line that has not been inspected prior to being backfilled. All trenching shall conform to federal, state and local governmental standards. All inspectors must be familiar with the Water Tap and Trench Safety Procedures. Partial inspections may not require a trench entry as dimensions can be made from the surface or from the contractors material records.

All contractors digging to or near District property are to be bonded and insured. Contractor are required to be licensed thru the District and renewed yearly. If District personnel arrive for a scheduled tap or inspection and the customer is not ready for any reason, the tap or inspection will be rescheduled and a call-back fee may be charged. Reasons for call-back can include: Excavation not complete, unsafe trench or work conditions. Confirmation should be made with the contractor and the tap application of the size of the service line and verified with the size of the main that is being tapped. It is good practice to contact the contractor a few hours before the tap to verify if they are on schedule.

The contractor is responsible for providing a safe trench for the tapping operations. This includes a benched or slope trench to prevent cave-ins and an access to the trench. This access can be a ladder or a sloped entry on one side of the trench. Technicians are not to enter a trench that they deem unsafe. If a trench is deemed unsafe, inform the contractor with your concerns and provide time to make the trench acceptable for entry. If you must leave the site to perform other work give the contractor a time that you will return for the capping operation. Never be pressured to enter unsafe trench. Never enter a trench without a spotter. This can be a qualified coworker or a contractor or a contractor assistant. It is always beneficial to have an extra technician on hand to provide assistance with tool handling and to take measurements after the tap.

The customer shall provide, at his expense, a completed water service installation consisting of all piping, fittings, valves, meters, valve boxes and related appurtenances extending from the point at which the main is tapped to a point inside the structure where the meter yoke is installed. EMD will provide most of the service line materials billed as inspection and connection fees to the homeowner. "Water Service Line" means that part of any water line for any Licensed Premises connecting to the Public Water System commencing at the Curb Stop. A water service line is not the property of the District. The District shall have no liability for the operation, maintenance or repair of the Water Service Line. The District will provide the tapping saddle, corporation valve, curb valve, curb box and thaw wire at the time of the tap. The curb valve and valve box shall be installed on service lines at a location inside the property line as shown on the attached drawings. If the curb box is to be located on adjacent property, the owner and contractor should provide information that permissions to access and install the service line in the adjacent property was granted by that owner.

District staff should have basic information to schedule and complete the tapping operation. This information includes: service address, Contractor and/or Owner contact information, size of main and size of service line. During the inspection document all other information required to completely fill in the top of the form. The bottom of the form is reserved for a detailed drawing and comments regarding the installation. It is best to make a rough sketch on site and then transfer the information to the form when the entire installation is completed. Occasionally, a partial inspection may occur a day or two before or after the tap has been made. It is important to keep track of when and where the partial inspections take place to accurately record the entire service line. Some final swing-tie measurements may not be available until after the install is complete.

Procedure:

1. Appointment is made or call received by the contractor for a tap or partial inspection.
2. Verify that contractor has provided bonding and liability information for licensed contractor requirements.
3. Document address, type and size of service, contractor, date and time.
4. Identify the size of main and tap. Verify that materials are in stock for the tap.
5. Arrive on site with all necessary tools and PPE. And verify that the trench is secure and safe entry is available (ladder or ramped trench).
6. Notify contractor that you are on sight and begin to gather information that may not be apparent, such as type of pipe, other utilities present and the scope of work completed.
7. Make a sketch of the footprint of the foundation if available and any helpful features, such as location from street, driveways. Record the compass direction.
8. Identify where the pipe enters the building. (Ex. 12 feet West of Southeast corner) and the depth at this location. **All water lines must be a minimum of 6 feet deep.** If the line is not at correct depth to current grade, verify with the contractor that the grade will be raised to provide a minimum 6 foot cover.
9. Identify the size and type of pipe. (Ex. ¾" type K copper, 1" PEX tubing or 4" ductile iron pipe)
10. If the service line parallels the foundation, record the distance between them.
11. Record any changes in depth and direction along the service line.
12. Identify any connections that are installed along the line, such as couplings or reducers and record the distances between them.

13. Verify that the bedding material is not coarser than 3/4" granular material. Identify what material will be used for backfill.
14. Document the placement of the service shut off and curb box (typically a stop & waste valve) by identifying at least 2 swing ties from permanent structures, such as utility poles, pedestals, hydrants or the corner of the building.
15. Record the distance from the tap at the main to the service shut off. Couplings are not allowed between the tap and the service shut off.
16. Identify the type and size of connection made to the main. (Ex. 6" Ductile pipe X ¾" saddle tap) Multiple taps should be a minimum of 18" apart at the main.
17. Provide a lateral measurement from a surface feature (valve or hydrant) to the location of the tap on the main.
18. Verify that the service shut off is in the "off" position and charge the line by opening the corp. valve. Bleed any air from the line by opening the service valve briefly. Observe both connections at the corp. & service valves and verify there is no leakage at connection points before allowing the line to be backfilled. The contractor is responsible for charging and leak testing all connections from the service shut off to the building. Partial inspections should not involve more than 2 or 3 trips to the site unless the service line has complications due to location within right of ways or length of service. Proven and Competent excavators are allowed to backfill without direct inspections if previously granted such permissions and can document and provide evidence of proper installation with pictures and/or sketch including dimension and quantity of materials.
19. Transfer all information and drawings to the service card and scan it for computer files.

The top of the card should record the following:

1. Name, address and account information.
2. Where on the main the service is installed. (149' west of Valve #1222)
3. Size, type and location of the main from the curb box.
4. Size, depth, type and length of service from main to curb box.
5. Location of thaw wire, if any.
6. Installing Contractor.
7. Name of inspector (Foreman) and date installed (tapped).

The bottom of the card should record the following:

1. Approximate shape of building.
2. Address.
3. Compass direction
4. Entry point at building.
5. Location of curb box. (3 swing ties)
6. Location of tap on main.
7. Location of main in road. (Ex. Edge of asphalt - EOA)
8. Length of pipe from main to curb box.
9. Length of pipe from curb box to house.

EVERGREEN METROPOLITAN DISTRICT

SEWER SERVICE LINE INSPECTION PROCEDURE

Purpose: To ensure that service lines meet District specifications and are accurately documented.

Sewer service line inspections and taps are to be scheduled through the Collections and Distribution Department. All administrative tasks prior to the tap will be coordinated with the Water Resources Department. Sewer taps may not be scheduled until all tap fees have been paid. Partial inspections may be requested with a minimum 48-hour notice if any potion of the trench must be backfilled before the tap is made. Sewer taps are to be scheduled a minimum 48-hours in advance. District employees inspecting service lines have the authority to instruct the contractor to uncover any part of the service line that has not been inspected prior to being backfilled. All trenching shall conform to federal, state and local governmental standards. All inspectors must be familiar with the Sewer Tap and Trench Safety Procedures. Partial inspections may not require a trench entry as dimensions can be made from the surface or from the contractors material records.

All contractors digging to or near District property are to be bonded and insured. Contractor are required to be licensed thru the District and renewed yearly. It is the responsibility of the customer or contracting excavator to obtain road cut permits. If District personnel arrive for a scheduled tap or inspection and the customer is not ready for any reason, the tap or inspection will be rescheduled and a call-back fee may be charged. Reasons for call-back can include: Excavation not complete, improper installation, unsafe trench or work conditions.

The District will recognize the most current version of the Uniform Plumbing Code as the minimum standard for plumbing practices within the District and any Contracting District. The UPC contains specifications and details regarding sizing, materials and types of connections. The District reserves the right to impose stricter standards and regulations in any circumstance, if in the interests of the Public Wastewater System.

The customer provides, at their expense, a completed wastewater service installation consisting of all piping, fittings, bends, clean outs and related appurtenances extending from the point at which the main is tapped to a point inside the structure. A wastewater service line is not the property of the District. The District has no liability for the operation, maintenance or repair of the Wastewater Service Line. Each Wastewater Service Line connection to the Main shall be made at a tap location designated by the District. The main will be tapped by the District, by mechanically drilling a smooth, round hole in the Main, inserting a tapping saddle, and joining the pipe to the Main in a manner acceptable to the District. Cleanouts shall be installed in Wastewater Service Lines at approximate 100-foot intervals starting at the structure. The cleanout shall be a capped "Y" and shall be properly marked. Wastewater Service Lines shall be laid on a uniform grade, free of ups and downs, and of good alignment without abrupt bends, unless appropriate fittings are used. Grade shall not be flatter than 1% (1/8 inch of fall per lineal foot of line), unless written approval is specifically obtained from the District. If the District cannot provide wastewater service because of problems in satisfying grade requirements or in avoiding any obstruction, the District shall not be responsible for resolving such problem, nor incur any liability that occurs. A 3-foot minimum bury will be required; provided that if the Wastewater Service Line is buried in a road or driveway,

appropriate pipe shall be used. Factory-made joints shall be solvent glued or fitted with a rubber ring, die cast into the socket of the pipe, and the spigot shall be fitted with a collar of suitable materials. The collar of the spigot shall be of a size such that, when shoved into the ring of the socket, there shall be tight fit between the interfaces. When putting die cast joints together, only the solvents and lubricants recommended by the pipe manufacturer shall be used.

No individual wastewater pumping system shall be connected to, or discharge wastewater into any Wastewater Service Line to the Public Wastewater System without first obtaining a License from the District. Prior to issuance of such License, adequate plans and specifications shall be submitted to the District for review and approval. Such plans and specifications shall conform to the following requirements:

A. The wastewater pumping system shall have a non-clog pump opening with at least 2" diameter solids handling capacity where raw wastewater is pumped or at least 3/4" diameter solids handling capacity where previously settled effluent is pumped.

B. Automatic liquid level controls shall be provided to start and shut-off pumps at a frequency required by the design.

C. The Wastewater Service Line shall be pressure pipe of sufficient strength to accommodate pump discharge pressure and sized to maintain a velocity of two or more feet per second.

D. Automatic air release valves shall be installed at high points in the Wastewater Service Line where necessary to prevent air locking.

E. A holding tank preceding the pump shall be provided to allow pump cycling commensurate with pump design capacity.

F. The Wastewater Service Line shall have a minimum of six feet of earth cover. If this cannot be attained, then the Wastewater Service Line must drain back into the holding tank after pumping in order to prevent freezing of the line.

G. All pressure pump Wastewater Service Lines must terminate either in a manhole or Main using design and materials approved by the District.

The District shall assume no responsibility for the operation or maintenance of any individual wastewater pumping system or Wastewater Service Line connected to the Public Wastewater System. Such individual wastewater pumping system shall be subject to all other provisions of these Regulations.

Wastewater service cards shall include: service address, owner name and account number. During the inspection document all other information required to completely fill out the card. The service card is reserved for a detailed drawing and comments regarding the installation. It is best to make a rough sketch on site and then transfer the information to the card when the entire installation is completed. Occasionally, a partial inspection may occur a day or two before or after the tap has been made. It is important to keep track of when and where the partial inspections take place to accurately

record the entire service line on the card. Some final measurements may not be available until after the install is complete.

Procedure:

1. Appointment is made or call received by the contractor for a tap or partial inspection.
2. Document address, type of service, contractor, date and time.
3. Schedule the tap with C&D staff with a 48-hour notice. Identify the size of main and tap.
4. Arrive on site with all necessary tools and PPE. Do not enter an unsafe trench. Most inspections can be made outside of the trench.
5. Notify contractor that you are on sight and begin to gather information that may not be apparent, such as type of pipe, other utilities present and the scope of work completed.
6. Make a sketch of the footprint of the foundation if available and any helpful features, such as location from street, driveways. Record the compass direction.
7. Identify where the pipe exits the building. (Ex. 12 feet West of Southeast corner) and the depth at this location. Verify that a clean out is in place at the structure. If the line is not at correct depth to current grade, verify with the contractor that the grade will be raised to provide a minimum 3 foot cover.
8. Identify the size and type of pipe. (Ex. 4" Schedule 35 PVC)
9. If the service line parallels the foundation, record the distance between them.
10. Record any changes in depth and direction along the service line.
11. Identify any connections that are installed along the line, such as bends and clean outs and record the distances between them.
12. Verify that the bedding material is not coarser than 3/4" granular material. Identify what material will be used for backfill.
13. Verify that there are no water utilities within 10 foot horizontal distance of the service line.
14. If the water line crosses over a sewer line, verify that there is at least 18 inches between them. If the sewer line crosses over the water line, the material of the sewer line must be encased in steel or concrete for 10 feet on each side of the water line (20 foot total).
15. If a sewer line tap is occurring in a road, it should be encased in concrete. The concrete is to be supplied by the customer or contractor.
16. Document the location of the tap on the main with a distance from the tap to the nearest manhole.
17. Identify the type and size of connection made to the main. (Ex. 4" Epoxy saddle) Multiple taps should be a minimum of 3' apart at the main.
18. Transfer all information and drawings to the service card and scan it for computer files.
19. Add service line and features to the GIS at the next editing session or sooner.
20. Use pictures when possible and add annotation for more concise future reference.

PDF # _____ TAP # 15000-002

WASTEWATER SERVICE RECORD

SDF # 55-0-2875 DISTRICT EMD

ADDRESS 29633 Thimbleberry Lane

LOT 114 BLOCK 3 FILING _____ SUBDIVISION Hiwan Hills

CUSTOMER NAME Monica Calvert

CONTRACTOR Saylor & Sons

INSPECTOR Chris Schaudler DATE 10-19-05

TYPE OF CONNECTION TO MAIN Epoxy Saddle

SIZE OF LINE 4" TYPE OF PIPE SDR 35

TYPE OF JOINT Glue

GRADE Good ALIGNMENT Good AVERAGE DEPTH 3'

MIN. DEPTH 2½'

NOTES: 1 Residential Wastewater Tap ACCT # 33164700

Form 60-0793

DRAWING:

LOCATION OF DRAIN TO BLDG. 2 DRAINS AS SHOWN

DISTANCE OF TRIP TO NEAREST MANHOLE AS SHOWN

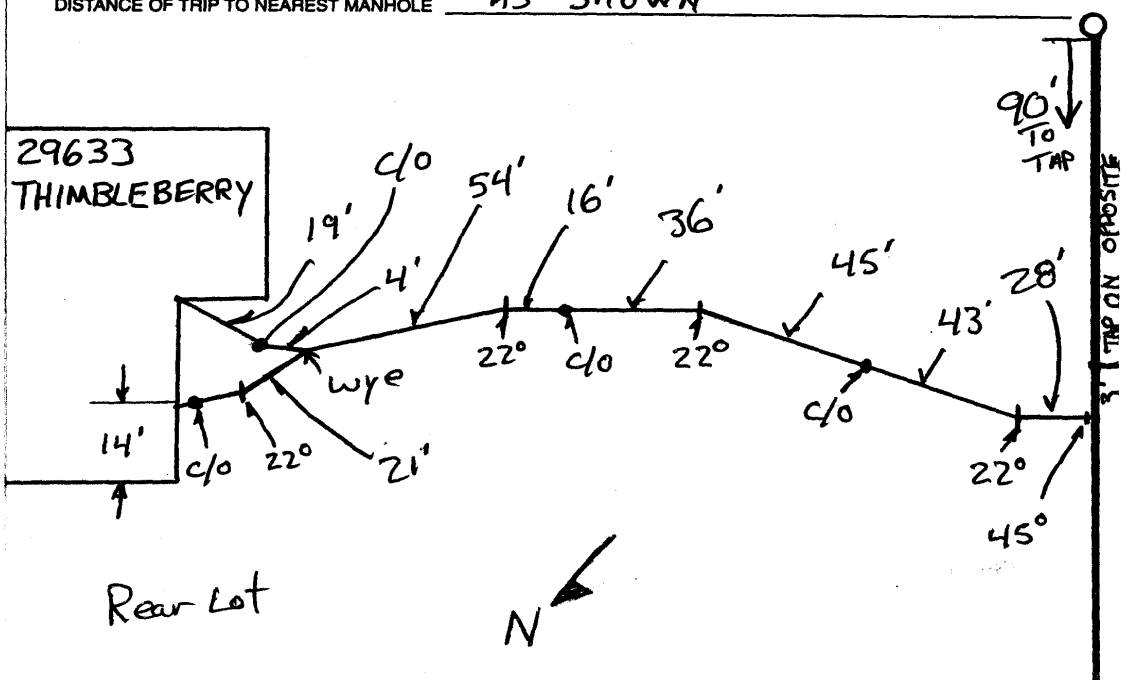


Figure 1

The top of the card should record the following:

1. Name, address and account information.
2. District, Legal description.
3. Installing Contractor.
4. Inspector and date installed.
5. Type of connection to main.
6. Size and type of line.
7. Type of joint.
8. Condition of grade, alignment and average depth.
9. Minimum depth (2-1/2 feet at house)

The bottom of the card should record the following:

1. Approximate shape of building.
2. Address.
3. Compass direction
4. Drain at building.
5. Location of clean out.
6. Location of tap on main.
7. Location of main in road.
8. Identify all fittings (bends and clean outs).
9. Length of pipe between fittings.