



**STANDARD SPECIFICATIONS
FOR
WATER AND WASTEWATER UTILITIES**

EFFECTIVE JANUARY 1, 2024

CITY OF STEAMBOAT SPRINGS UTILITIES
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SECTION 00: PROCEDURE FOR WATER AND WASTEWATER EXTENSIONS AND NEW MAINLINE SYSTEMS

1.0 Purpose

This document establishes the minimum standards for the design, modification, abandonment, and construction of water distribution and wastewater collection facilities with the City of Steamboat Springs utility service area.

Criteria not covered herein will be evaluated on a case-by-case basis with the review and approval by the Utility Division.

1.1 Authority

The Utility Division shall have full authority to review and approve all submittals and construction for compliance with these standards and specifications. An approval or acceptance by the Utility Division does not relieve the owner, engineer, designer, or contractor from responsibility for ensuring that the calculations, plans, specifications, construction, and record drawings are in compliance with these standards and specifications and applicable laws and regulations and accepted engineering practices.

1.2 Revisions, Amendments or Additions

This document will be periodically updated. It is the responsibility of the engineer, contractor, and developer to verify that they are utilizing the current version of this document. The current version of this document can be found on the [Utilities webpage](#).

1.3 General

The Developer/Engineer shall analyze any impacts to the existing off-site infrastructure. If there are any impacts, as determined by the Utility Division, additional analysis, including, but not limited to, hydraulic modeling, may be required at the Owner's expense.

All water and wastewater system improvements shall be designed by or under the direct supervision of a Professional Engineer registered in the State of Colorado utilizing the most current technical standards along with good, sound engineering judgment throughout the design process. The Engineer shall have experience in the design and construction of municipal water distribution and wastewater collection systems.

1.3 Relationship to Other Standards, Codes, & Requirements

All proposed development and construction within the City of Steamboat Springs will be subject to compliance with all applicable City, local, state, and federal standards, codes, and requirements. It is the responsibility of the engineer, contractor, and developer to ensure compliance with all applicable standards, codes, and requirements.

Additional Standards that may be applicable in addition to these standards include:

- [City of Steamboat Springs Engineering Standards and Specifications](#)
- [Steamboat Springs Municipal Code](#)

2.0 Development Review

The review of proposed water and wastewater extensions, improvements, and new mainlines is performed in conjunction with the City of Steamboat Springs (City) development review process. Additional information on the development review process can be found on the City's website on the [Planning and Community Development page](#). Submittal requirements will depend on the type and complexity of proposed project and will be discussed during the pre-submittal meeting. Projects that include water and wastewater elements will require, at a minimum, submittal of a preliminary utility plan. Additional submittals that may be required include a water demand report, hydraulic analysis report.

The preliminary utility submittals shall be reviewed by the Utility Division for general compliance with this document. Upon approval of the development application by the City's Planning Department the

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applicant can move forward with the construction permitting process.

2.1 Construction Permit Review

After the City has approved the development application, an applicant seeking approval to construct must submit the appropriate permit application along with engineered project plans, specifications, and other applicable documents through the [CityView Portal](#).

The Utility Division will review construction permit application documents to determine compliance with the approved development plan and these Standards.

The City requires a minimum of two weeks to adequately review a project plan, and an additional two weeks for each subsequent revised submittal. Any requested deviation from standard specifications shall be submitted as the project's special provisions to be approved by the Utility Division.

City acceptance for construction in no way relieves the Engineer of any responsibility for errors and omissions.

All approvals and permits must be issued, and all fees paid prior to scheduling the pre-construction meeting and prior to the start of any construction activity.

3.0 Approval of Construction Drawings, Specifications, and Preconstruction Meeting

The Owner/Developer will be responsible for hiring a Professional Engineer registered in the State of Colorado for the preparation of construction drawings and specifications utilizing these standards and specifications along with good, sound engineering judgement throughout the design process. Submitted construction documents shall bear the PE's seal prior to approval for construction.

Any failure or unsatisfactory performance of the system, as constructed, is not the Utility Divisions responsibility and shall not be a cause for action against the City. The Utility Division does not perform engineering services for any person or entity in connection with its review of plans. The Utility Division's approval of plans signifies only that plans appear to meet the minimum requirements of these Standards based upon information provided by the PE.

3.1 Minimum Pipe Size

The minimum size for public water and wastewater mains is 8 inches. Larger mains may be required if determined necessary in the preliminary utility plan. All pipe sizing and demand calculations shall be provided to the Utility Engineer for review when requested, to increase the size of public water and sewer infrastructure. The final decision on pipe sizes will be made by the Utility Division. For both public and private cases, engineered water and sewer utility plans are required for any water or sewer mainline extension, any new water or sewer pipe system developed as a mainline, or any water line 4 inches in diameter or greater.

3.2 Specifications

The City of Steamboat Springs Standard Specifications for Water and Wastewater Utilities (Standard Specifications) in effect when project construction plans are approved will define project specifications. Any additional construction specifications required for privately funded developments shall be submitted to the Utility Engineer under the title of Special Provisions, which shall be used to propose modifications to the Standard Specifications, and/or include specifications for other areas of project construction, including City Engineering Specifications.

The Special Provisions shall be prepared by a licensed professional engineer registered within the State of Colorado. The hierarchy below shall prevail, in the following order, in the event there is a conflict between any of the following:

1. Special Provisions
2. Standard Specifications
3. Construction Drawings

3.3 Construction Drawings

Refer to Appendix A for detailed sheet checklists.

The construction drawing set must include benchmark and reference datum, an existing condition/demolition plan, a site plan, a grading plan, a water and wastewater plan, a preliminary plat with all water and sewer line easements, a water main profile sheet, a wastewater main profile sheet, an erosion control plan, a detail sheet, a dry utility plan with wet utilities shown, and a landscape plan with wet utilities and easements shown. A profile must be provided for all existing mains impacted by any proposed grading.

All construction plans shall be based on the North American Datum 1983 (1992). The vertical datum shall be NVGD 1929. If NVGD 1929 is not used, a conversion shall be shown on the plans.

Names and phone numbers for the Owner, Developer, Consulting Engineer, and Site Surveyor shall also be included in the construction drawing set.

For initial review, one set of plans and specifications should be submitted electronically. These will be red lined for correction and returned to the Consulting Engineer to make needed revisions. Construction plans and/or specifications will not be approved with red line corrections.

Final construction plan approval shall not be granted until after potholes have been utilized through Subsurface Utility Engineering (SUE) to determine elevation, horizontal location, and the slope of pipe, as established by a professional land surveyor, at all water and sewer connection points and at all points where proposed utilities cross existing utilities.

The Utility Division requires SUE Quality Level A (QL A). Per CDOT and ASCE C-I 38-02, QL A involves the use of nondestructive digging equipment at discrete, critical points to determine the precise horizontal and vertical position of underground utilities, as well as the type, size, condition, material, and other characteristics. This activity is called "locating." It is the highest quality level presently available. This information, when combined with other surveyed and mapped information, allows the Consulting Engineer to infer plan and profile information, for use in making final design decisions. By knowing exactly where a utility is positioned in three dimensions, the Consulting Engineer can accurately determine the extent of a utility conflict or can often make small adjustments in elevations or horizontal locations and avoid the need to relocate utilities. Additional information such as utility material, condition, size, soil contamination, and paving thickness also assists the Consulting Engineer in their decisions. Less invasive means of field verification through SUE may be used as an alternative to potholes with prior Utility Division approval. The City shall receive only electronic versions of the plans for review.

3.4 Pre-Construction Meeting

Prior to the start of any construction activity, a pre-construction meeting is required between the Construction Inspector, the Consultant Engineer of Record, the Contractor, a Developer representative, Utility Engineer, the Distribution and Collection Supervisor, and other Subcontractors as applicable. The following items will be reviewed and discussed:

- Reviewing staking and alignment
- Reviewing survey requirements for installed fittings and appurtenances
- Reviewing inspection requirements (both by the Construction Inspector and the Utility Division)
- Reviewing test methodology
- Ensuring the contractor has current Standard Specifications
- Ensuring the contractor has current approved construction plans
- Adding the City to the distribution list for testing results
- Defining the de-watering requirements

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- Reviewing the schedule of construction and limitations for weather conditions
- Discussing any other relevant topics dealing with water or sewer

4.0 Construction, Testing, and Quality Control

During the construction phase, the Consulting Engineer shall be the point of contact between the City Utility Engineer and the Owner or any Owner's representatives. Any issues that arise during the construction phase that require City participation shall be directed through the Utility Engineer. Any changes to the Consulting Engineer's design shall be coordinated and approved by the Utility Engineer.

The Consulting Engineer will be responsible for quality control, testing, and field inspections as outlined in Section 4: Engineering Services of the Standard Specifications. Testing and inspections shall include water quality testing, pressure testing, leakage testing, lamping inspections, deflection testing, quality inspections, facility operation inspections, infiltration and inflow inspections, televised inspections, final grade, easements, and landscaping inspections.

A Utility Division representative is required to be present for and observe live taps, dry ties, and all water testing procedures as outlined later in this document. The Consulting Engineer is required to provide progress reports and weekly inspections to the Utility Engineer. The Utility Engineer must review and approve all water main testing results and documentation prior to service tapping. The Utility Engineer shall receive testing results within 24 hours of the test.

Whenever there is insufficient evidence of compliance with any of the provisions of these standard specifications, or evidence that any material or construction does not conform to the requirements herein, the Utility Division may require additional testing to be performed, which will be used as proof of compliance. Test methods will be as specified by these standard specifications or by other recognized test standards. If there are no recognized and accepted test methods for the proposed alternate, the Utility Division will determine test procedures. All tests will be made by an approved agency and all costs shall be the responsibility of the contractor. Reports of such tests shall be submitted and retained by the City. The person responsible for the Quality Control Testing and/or Quality Assurance Testing shall be registered as a professional engineer in the State of Colorado and practicing in this field.

4.1 Scheduling and Coordination

All operation of City valves and hydrants for the purposes of constructing, testing, chlorinating or flushing newly constructed water lines shall be performed by Utility Division personnel unless specific permission has been otherwise granted in writing by the Utility Division.

A written request for field service assistance and/or observation must be sent to the Utility Division a minimum of 48 hours in advance. Requests that have been rescheduled for the following reasons; not ready for inspection, failed, no shows, and not properly scheduled will be charged a subsequent inspection fee.

4.2 Locating Utility Division Facilities

The Utility Division is a Tier 1 utility under Colorado's One call Law (Section 1. Article 1.5 of title 9.CRS). The Consulting Engineer shall utilize the 811 system for locate requests. For private service lines within the right-of-way, the City will attempt to locate and mark all water (including curb stops) and sewer service lines within the right-of-way to the best of its ability by using available information. Basic line locations will be made free of charge, but the City will not accept financial liability to any party for any costs incurred as a result of an inaccurate location. The City, by providing such location services, does not waive or intend to waive the monetary limitations or any other rights, immunities, defenses, and protections provided by the Colorado Governmental Immunity Act, § 24-10-101, et seq., C.R.S., as from time to time amended (the "CGIA").

4.3 Underground Locatable Facilities

All newly installed underground facilities must be electronically locatable per C.R.S Title 9, Article 1.5-103 (10). Tracer wire will be required on all Utility Division Facilities to include water and wastewater mains as well as privately owned service lines.

4.4 Changed Conditions or Deficient Work

Changed conditions or deficient work from the accepted plans and specifications shall be documented by the Consulting Engineer and presented with revised corrective actions to the Utility Division for review and acceptance. Various options may be evident in the resolution of a changed condition or deficient work item. All requests shall be made in writing to the Utility Engineer. Plans by the Contractor to resolve a changed condition or deficient installation issue shall be reviewed, approved, and initialed by the Consulting Engineer, red-lined by the Utility Engineer, or redrafted by the Consulting Engineer prior to submittal to the Utility Division.

All such Contractor requests shall be incorporated by the Consulting Engineer into a Corrective Action Plan. All Corrective Action Plans shall ultimately bring the deficient work into conformance with Utility Division specifications and/or the approved project plans and specifications, whichever is in the best interests of the Utility Division.

The Consulting Engineer shall immediately contact the Utility Engineer if the Consulting Engineer or others witness work being completed by the Contractor or others not conforming to Utility Division specifications.

Work that does not conform to approved plans and specifications, which results in an inferior or unsatisfactory product, will 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, will be immediately removed, and acceptably replaced or otherwise satisfactorily corrected by and at the expense of the Developer or Contractor of record.

This expense includes total and complete restoration of any disturbed surface to original or better than the original condition that existed before the repairs or replacement, regardless of improvements on lands where the repairs or replacement are required.

4.5 City Ownership of Public Improvements

The Developer (private development projects) and/or the City (capital improvement projects) is responsible for the proper installation of all improvements and maintenance of improvements during the warranty period. Before the City assumes ownership and maintenance responsibility for newly constructed public improvements, they shall be formally accepted by the Utility Division through the preliminary and final acceptance process.

5.0 Project Preliminary Acceptance

The Developer shall be required to meet the following process prior to the City's preliminary acceptance of the public improvements and any operations or maintenance.

5.1 Preliminary Acceptance Inspection

Upon work completion, the Consulting Engineer must perform a thorough inspection of all installed public improvements consistent with Utility Division preliminary acceptance inspection checklist. The construction of public improvements will be inspected for conformance with the approved public improvement construction plans, the official development plan, the public improvements agreement, project specifications, these Standards and Specifications, and the municipal code.

A. Written Request

Upon completion of the Consulting Engineer's preliminary acceptance inspection per the Preliminary Inspection checklist found in Appendix A, a punch list shall be created, and all items on the punch list shall be addressed prior to requesting the Utility Engineer's preliminary

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acceptance inspection. The request cannot be made before all grading is final, excluding pavement. The Contractor and Consulting Engineer must be present with the Utility Engineer on all such inspections. All utility easements shall be clearly staked prior to inspection. All inspection requests shall be in writing and sent a minimum of 48 hours in advance. See Appendix B for a sample certificate for inspection.

B. Utility Engineer Inspection

Upon completion of inspection, the Utility Engineer shall provide the Consulting Engineer with a written punch list. A subsequent inspection shall be conducted once the Consulting Engineer determines the punch list items have been addressed. If additional punch list items are found and/or existing items have not been addressed, this process shall be repeated until all punch list items have been addressed. After the second inspection, if not all punch list items have been addressed, each subsequent inspection will incur a fee from the City in accordance with the current fee schedule provided on the City's Utility Division webpage. After the City's punch list has been completed to the Utility Engineer's satisfaction, the City will indicate in writing to the Consulting Engineer that the construction was completed in compliance with the plans and specifications. Inspections shall not be made between November 1 and April 30, when weather could prohibit a thorough inspection.

If, due to excessive dirt or snow on streets, poor weather conditions, inaccessibility, or other reasons the inspection cannot be performed, the Consulting Engineer will be notified of the need to postpone these activities until the cause of the delay can be rectified.

Failure by the City's representatives to detect improper installations or defects during the construction of improvements or during subsequent inspections does not relieve the Developer of the responsibility to correct defects later. There shall be no partial acceptance of public improvements within new developments. The Developer is fully responsible for maintenance and operation of any constructed public facilities until the City formally accepts public improvements.

5.2 Record Drawings

The Utility Division shall accept plans in accordance with the checklist in **Appendix A**. A complete set of as-constructed record drawings of public improvements (water and sewer) shall accompany the request for preliminary acceptance. Upon the City's Utility Engineer acceptance, the Consulting Engineer shall submit a certified set of electronic as-constructed drawings through email or shared drive system. The submittal shall include a PDF set and AutoCAD.dwg files. These drawings shall be in accordance with Appendix A: Subsection 4.

If significant corrections to the improvements are noted during the acceptance inspection, the record drawings may be returned to the Consulting Engineer for revisions. The final submittal of record drawings shall have each sheet signed and sealed by the Professional Engineer registered in the State of Colorado, who is responsible for the preparation of record drawings.

Record documents will be returned to the Consulting Engineer of Record for corrections until an acceptable submittal of record documents is produced.

5.3 Written Notice of Preliminary Acceptance

Upon completion of all deficiencies list items and payment of all outstanding fees, reimbursements, and other items owed to the City, the Utility Engineer will issue a written preliminary acceptance of public improvements and start the warranty period. The Utility Engineer shall issue a letter to the Developer within 10 days of acceptance. The preliminary acceptance letter shall specify the date on which the Developer is eligible to request final acceptance. The City Utility Engineer will not release building permits until the Developer has achieved preliminary acceptance.

5.4 Warranty Period

The Developer is responsible for a two-year warranty of constructed public improvements. The two-year warranty starts with preliminary acceptance.

5.5 Maintenance Responsibility

The Developer shall be responsible for the maintenance of all public improvements during the warranty period. The Utility Engineer will notify the Developer of any maintenance that may be necessary during this time. The cost of any routine maintenance not performed by the Developer that must be performed by the City will be billed to the Developer at cost plus 15 percent. If the Developer does not pay for these costs in 60 days, the City may pull the surety to recover costs.

5.6 Emergency Repairs

In the event of a water main break, sanitary sewer main blockage, or other emergency that may occur during the warranty period, the City may need to undertake immediate repairs to the facilities and/or make the area safe for residents, pedestrians, or motorists. The City will attempt to contact the Developer in the event of such an emergency. If the Developer or the Developer's representative cannot be contacted quickly or if the Developer is unable to take immediate action to relieve the urgent situation, the City may proceed with such action as deemed necessary by the Utility Division, and the Developer will be billed for all costs of these actions at cost plus 15 percent. Until final acceptance is granted, the repaired infrastructure shall be under extended warranty and any maintenance and repair work is the responsibility of the Developer. Any repair work completed by the developer shall be inspected and observed by the Utility Division personnel.

5.7 Post-Preliminary Acceptance Sewer Video

After installation of a new sewer main system, and prior to written request for final acceptance, the Developer is required to contract with a sewer mainline video company to video all new sanitary sewer mains. The video must be produced between April 1 and June 1, the Spring following installation. The video cannot be made during the same Spring of installation. The name of the video contractor must be submitted to the City for approval prior to contracting. The City will maintain an eligible video contractor list. The City reserves the right to refuse video services from contractors not on the eligible list. The selected video contractor must be capable of producing the following:

1. Electronic format
2. Colored video production
3. Video must begin at the highest manhole and terminate at the previously existing sewer main
4. By on-screen print and audio, the video shall identify:
 - The video contractor
 - The project name
 - The date
 - The starting point / manhole number
 - Direction of travel
 - All tap locations including mainline pipe tap locations relative to the spring line
 - Full view of service tap
 - Any deflection and low or high spots in the main
 - Any rolled gaskets or other problems at each pipe joint
 - Any infiltration

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- Any root intrusion
 - Any other deficiencies that can be identified in the pipeline construction
5. Each video shall be accompanied by a log on a form approved by the Utility Engineer. The log shall include all information provided on the video. The video and video log information will be provided to the Utility Engineer prior to final acceptance and will become the property of the Utility Division. The Developer will be responsible for correcting any discrepancies, errors, or omissions shown by the video/log information. If the video/log is not produced within the correct time of year or prior to final acceptance, the Developer's warranty period will be extended and surety for the video/log shall be submitted to the Utility Engineer.

6.0 Final Acceptance

Approximately one year and nine months into the warranty period, the Developer shall schedule an inspection of public improvements within the development. All inspection requests shall be in writing and sent a minimum of 48 hours in advance. The Developer, the Developer's representative, and/or the Contractor will be invited to accompany the Utility Engineer on all inspections. The Utility Engineer shall develop a punch list of repairs and deficiencies and deliver it to the Developer. The Utility Engineer may hold an optional meeting to discuss issues.

If, due to excessive dirt or snow on streets, poor weather conditions, inaccessibility, or other reasons the inspection cannot be performed, the Developer will be notified of the need to postpone these activities until the cause of the delay can be rectified. Deficiencies noted during the warranty inspection will be compiled in a corrections list and emailed to the Developer.

6.1 Correction of Deficiencies

The end of the warranty period will not be acknowledged until all noted deficiencies are corrected. The Utility Engineer shall be notified before any corrective work commences and immediately upon completion of repairs. If additional punch list items are found and/or existing items have not been addressed, this process shall be repeated until all punch list items have been addressed. After the second inspection, if not all punch list items have been addressed, each subsequent inspection will incur a fee from the City in accordance with the current fee schedule provided on the City's Utility Division webpage.

6.2 Written Acknowledgment of End of Warranty

Upon the correction of all deficiencies noted in the warranty correction list, the Utility Engineer will issue a written acknowledgment at the end of the warranty period for public improvements.

END OF SECTION

SECTION 1: SPECIAL PROVISIONS

The special provision section serves to supplement, modify, delete, and/or add to the following sections of the specifications as required for the project. Where any article, paragraph, or subparagraph in the specifications conflicts with one of the following provisions, the following provisions shall prevail. Any part of such article, paragraph, or subparagraph not in conflict with the following provisions shall remain in effect.

1.0 Pipe Material

Choices of pipe material for water distribution shall be determined by the Utility Division and should be specified in the special conditions section of the project specifications. Refer to Section 30 and Section 40 for pipe material requirements.

2.0 Measurement and Payment

The method of measurement and payment indicated within the standard specifications are specific to water and sewer construction projects administered by the City. Methods for measurement and payment shall be negotiated between the Contractor and Owner/Developer when the Utility Division does not administer the construction contract.

3.0 Notice of Service Shut-Off

When a water or wastewater main or service must be shut-off, it shall be the Contractor's sole responsibility to notify all businesses and residents that could possibly be affected. Businesses and residents shall be notified 48 hours prior to the scheduled shut-off time. Any water or wastewater main or service shut offs must be pre-approved by the Utility Division. City facilities, including water valves, shall only be operated by City personnel.

If the Developer/Contractor illegally operates the City's valves, the City may issue a fine for this violation, in accordance with the municipal code.

4.0 Administration, Procedures, and Codes

Refer to City Engineering Standards, Section 01105 for this applicable section.

5.0 Erosion Control

Erosion control is required for all projects. Refer to City Engineering Standards, Section 01565.

6.0 Dust Control

All projects are required to meet dust control requirements. Refer to City Engineering Standards, Section 01560.

7.0 Traffic Control

All projects are required to meet traffic control regulations. Refer to City Engineering Standards, Section 01570.

END OF SECTION

SECTION 2: APPLICABLE STANDARDS

1.0 General

1.1 Description

A. Work included: Throughout contract documents, reference is made to codes and standards that establish qualities and types of workmanship and materials and that establish methods for testing and reporting on pertinent characteristics. The Contractor's materials or workmanship must meet or exceed the specifically named code or standard when required by contract documents. It is also the Contractor's responsibility, when so required by the contract documents or by written request from the Utility Engineer, to deliver to the Utility Engineer all required proof that materials, workmanship, or both meet or exceed the requirements of the specifically named code or standard. Such proof shall be in the form requested in writing by the Utility Engineer, generally copies of a certified report of tests conducted by a testing agency approved by the Utility Engineer.

B. Related work described elsewhere: Specific naming of codes or standards occurs on the drawings and in other sections of these specifications.

1.2 Quality Assurance

- A. A. Familiarity with pertinent codes and standards: In procuring all items used in this work, it is the Contractor's responsibility to verify the detailed requirements of the specifically named codes and standards and to verify that the items procured for use in this work meet or exceed the specified requirements.
- B. B. Rejection of non-complying items: The Utility Engineer reserves the right to reject items incorporated into the work that fail to meet the specified minimum requirements. The Utility Engineer further reserves the right, and without prejudice to other recourse the Utility Engineer may take, to accept non-complying items subject to an adjustment in the contract amount as approved by the Utility Engineer and the Owner.
- C. C. Applicable standards listed in these Specifications include, but are not limited to, standards promulgated by the following agencies and organizations:
 1. AASHTO – American Association of State Highway and Transportation Officials, 341 National Press Building, Washington D.C. 20004 www.aashto.org
 2. ACI – American Concrete Institute, P.O. Box 9094, Farmington Hills, MI 48333 www.aci-int.org
 3. AISC – American Institute of Steel Construction, Inc., One East Wacker Drive, Suite 3100, Chicago, IL 60601 www.aisc.org
 4. ANSI – American National Standards Institute, 25 West 43rd Street, 4th Floor, New York, NY 10036 www.ansi.org
 5. ASTM – American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, PA 19428 www.astm.org
 6. AWS – American Welding Society, Inc., 550 N.W. LeJeune Road, Miami, FL 33126 www.aws.org/
 7. AWWA – American Water Works Association, Inc., 6666 West Quincy Ave., Denver, CO 80235 www.awwa.org/
 8. CDOT – Colorado Department of Transportation, Standard Specifications for Road and Bridge Construction, Latest Edition <http://www.dot.state.co.us/>
 9. CDPHE - Colorado Department of Public Health and Environment, 4300 Cherry Creek Drive South, Denver, CO 80246 www.cdph.state.co.us/
 10. CRSI – Concrete Reinforcing Steel Institute, 933 North Plum Grove Road, Schaumburg, IL 60173 www.crsi.org/

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11. FGMA – Flat Glass Marketing Association, 3310 S.W. Harrison Street, Topeka KS 66611
12. NAAMM – The National Association of Architectural Metal Manufacturers, 8 South Michigan, Suite 1000, Chicago, IL 60603 www.naamm.org
13. NEC – National Electric Code (see NFPA) www.necdirect.org
14. NEMA – 1300 North 17th Street, Suite 1847, Rosslyn, Virginia 22209 www.nema.org
15. NFPA – National Fire Protection Association, 1 Battery March Park, Quincy, MA 02269 www.nfpa.org
16. NIST – National Institute of Standards and Technology, 100 Bureau Drive, Gaithersburg, MD 20899 www.nist.gov
17. SDI – Steel Deck Institute, P.O. Box 25 Fox River Grove, IL 60021 www.sdi.org
18. SSPC – Society for Protective Coatings, 40 24th Street, 6th Floor, Pittsburgh, PA 15222 www.sspc.org
19. TCA – Tile Council of America, Inc. – 100 Clemson Research Blvd., Anderson, SC 29625 www.tileusa.com
20. Underwriters’ Laboratories, Inc., 333 Pfingsten Road, Northbrook, IL 60062 www.ul.com
21. UBC – Uniform Building Code, International Conference of Building Officials, 5360 South Workman Mill Road, Whittier, CA 90601 www.icbo.org
22. UPC – Uniform Plumbing Code, International Conference of Building Officials, 5360 South Workman Mill Road, Whittier, CA 90601 www.icbo.org
23. Fed Specs. And Fed Standards Specifications Sales (3 FRI), Building 197, Washington Navy Yard, General Services Administration, Washington, D.C. 20407 www.gsa.gov
24. MIL-SPECS Military Specifications, Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402 www.access.gpo.gov

2.0 Products

No products are required in this section.

3.0 Execution

The Contractor is responsible for being familiar with all named or implied codes. The latest revision or edition of codes or standards shall be used.

4.0 Measurement and Payment

No separate measurement for payment will be made for the work under this section. Its cost shall be considered incidental to the project.

END OF SECTION

SECTION 3: DEFINITIONS, ABBREVIATIONS, AND APPROVED PRODUCTS LIST

1.0 Definitions

AIR GAUGE. Used to monitor the air test and fill and drain lines. Shall be located above grade, not in the manhole.

AIR TEST. A method whereby a Public Main or a Building Water, Sewer, Water Lateral, or Sewer Lateral is pressurized with air for the purpose of detecting leaks or defects in the pipe being tested.

ANNUAL DUE DATE. The annual date as established by the city when required tests must be completed and proof received by the Utility Division. In those years when the annual due date does not fall on a regular business day, the due date for that year will be the next regular business day.

ANY OTHER TERM. Any other term not herein defined shall be as defined or typically used in the water and wastewater utility industry.

APPROVED. Accepted by the City as meeting the applicable specification or procedures of these Rules and Regulations.

APPROVED AIR GAP. The unobstructed vertical distance of free atmosphere between a discharge point and the prevailing grade or flood level of a receptacle. An Approved Air Gap must satisfy the requirements of ASME standard A112.1.2.

APPROVED BACKFLOW PREVENTION ASSEMBLY. A testable Backflow prevention assembly, installed in accordance with the Water Line Extension and Service Standards, approved to prevent Backflow based on the Degree of Hazard. The Approved Backflow Prevention Assembly must also be approved by the American Society of Sanitary Engineering (ASSE)

APPROVED BACKFLOW PREVENTION METHOD. An inspectable Air Gap or other method approved by the City to prevent Backflow based on the Degree of Hazard.

BACKFLOW. The reverse flow of water, fluids or gases into any Water Service Line, any Water Distribution Main, the Water Supply System caused by backpressure or back siphonage.

BACKFLOW PREVENTION ASSEMBLY. Any mechanical assembly installed at a water service line or at a plumbing fixture to prevent a backflow contamination event, provided that the mechanical assembly is appropriate for the identified contamination at the cross connection and is an in-line field-tested assembly.

BACKFLOW PREVENTION METHOD. Any method and/or non-testable device installed at a water service line or at a plumbing fixture to prevent a backflow contamination event, provided that the method or non-testable device is appropriate for the identified contamination at the cross connection.

BALL VALVE. A ball valve is defined as a shut off valve that controls the flow of water by means of a rotary ball having a bore. By rotating the ball, a quarter turn (90 degrees) around its axis, the medium can flow through or is blocked.

BEDDING AND SHADING. Bedding and shading are levels of fill packed around a utility line. Bedding refers to the fill below the pipe or conduit, shading refers to the fill from spring line to above the pipe or conduit.

BELL AND SPIGOT. A form of joint used on pipes that have an enlarged diameter or bell at one end and a spigot at the other that fits into and is laid in the bell. The joint is then made tight by lead, cement, rubber O-ring, or other jointing compounds or materials.

BLOWOFF VALVE. A valve attached to a water or sanitary sewer line to allow excess pressure to escape the line.

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BUILDING PERMIT. An official document issued by the County having jurisdiction which authorizes the erection, alteration, demolition and/or moving of buildings and structures.

BURIED BOLTS. All stainless steel bolts that are within a structure in the subgrade requiring a certification.

BURY LINE. Elevation at the final grade of the adjacent road shoulder, curb line, or landscaping area, as approved by the City. Bury line also refers to finished grade around fire hydrants.

BUTTERFLY VALVE. A valve consisting of a disk rotating on an axis across the diameter of a pipe to regulate the flow of water.

CASING PIPE. A hollow steel tube that is typically rammed into place through the earth by using a hydraulic or pneumatic jack. After being driven, the displaced soil is removed and the product pipe, or carrier pipe, is inserted inside the steel tube.

CERTIFICATION. Certification by an engineer, as required by any portion of these specifications, shall include the signature and the P.E. stamp of the engineer in responsible charge.

CERTIFIED CROSS-CONNECTION CONTROL TECHNICIAN. A person who possesses a valid backflow prevention assembly tester certification from one of the following approved organizations: American Society of Sanitary Engineering (ASSE) or the American Backflow Prevention Association (ABPA).

CHANGE ORDER. An agreement between a contractor or subcontractor and a consumer that makes modifications to an existing construction contract. These changes can consist of addition, omission, or substitution for the work, schedule, price, or other aspects of the contract.

CHARGE. A "Charge" is the total or portion of any amount of money due from a Customer to the City.

CITY OF STEAMBOAT SPRINGS UTILITY DIVISION. Any person of the Division that has been authorized by the City to inspect the Water and Wastewater Systems, and the property of Customers and Industrial Users to ensure compliance with these Rules and Regulations.

CITY, CITY OF STEAMBOAT SPRINGS. "City" refers to the City of Steamboat Springs, specifically the Utility Division, as applicable.

CLEAN. Except as otherwise specifically provided, "clean" shall be defined as the level of cleanliness generally provided by skilled cleaners using commercial quality building or site maintenance equipment and materials.

CLEANOUT. A pipe or pipe(s) with a cap that provides access to the sewer line so that blockages can be removed.

COLLECTION SYSTEM. "Collection System" means City Sewer Mains including connections and service pipes from the sewer to the property line/easement (whichever is closer), and associated appurtenances, property, easements, and equipment used or to be used in collecting wastewater.

COLORADO PRIMARY DRINKING WATER REGULATIONS. Any regulations promulgated by the State of Colorado or any State agency to assure the safety of Public drinking water supplies, and to enable the State of Colorado to assume responsibility for enforcing the standards established by the Federal Safe Drinking Water Act (Public Law 93-523), as amended.

CONNECTION. A "Connection" is the existence of a continuous pipe or conduit from a Customer's structure or place of water use and the Water or Wastewater System. In the case of a new or expanded use added to an existing Connection, the new connection is deemed to be made when the new or expanded use first occurs. Refer to Article IV, Connection to Water and Wastewater System.

CONSULTING ENGINEER. A Consulting Engineer is any person or firm that has been authorized by the City to perform engineering services for the City.

CONTAINMENT. The control of cross-connections within a property owner's plumbing system by the

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installation of approved backflow prevention assemblies or methods on the property owner's service line after the meter and before any branches.

CONTAINMENT OR CONTAINMENT ASSEMBLY. The installation of an Approved Backflow Prevention Assembly in a service line, at the User's expense, within the User's Potable Water System, immediately following the meter where the Water Service is metered, and in all cases, before the first branch line leading off the service line.

CONTAMINATION, CONTAMINATED. The degradation of the water quality relative to state and federal standards to which the City's water supply is regulated by the Colorado Department of Public Health and Environment and the Environmental Protection Agency, or which otherwise creates a potential Hazard to the public health through the introduction of any physical, chemical, biological, or radiological substance or matter to the Water System.

CONTRACTOR. A contractor is any person, firm, or corporation licensed or permitted to perform Work and to furnish materials for such Work within the City.

CONTROLLED. Having a properly installed, maintained, and tested or inspected backflow prevention assembly or backflow prevention method that prevents backflow through a cross connection.

CORPORATION STOP OR TAPPING VALVE. Corporation Stop or Tapping Valve is the point of connection of a Water Service Line to the City's Water Distribution Main. The Corporation Stop is the demarcation of ownership of the water service between the property Owner and the City.

CROSS-CONNECTION. Any connection that could allow any water, fluid, or gas such that the water quality could present an unacceptable health and/or safety risk to the public, to flow from any pipe, plumbing fixture or a customer's water system into a public water system's distribution system or any other part of the public water system through backflow.

CURB STOP. The Curb Stop is the shutoff valve at a point on the Water Service Line to the Premises being served; typically located at, near, or on the property or easement line.

DEFECTIVE. "Defective" is defined as unsatisfactory, faulty, deficient, or does not meet the requirements of any inspection, test, or approval, or an installation that has been damaged prior to acceptance by the City.

DEFLECTION. The maximum allowable pipe deflection is 5 percent of the pipe diameter or the manufacturer's specifications, whichever is least.

DEGREE OF HAZARD. The classification of a cross connection is based on the potential that a Backflow event would pose an unacceptable health and/or safety risk to the Public. The City shall have sole discretion to classify Cross Connections in to one of the following hazard levels:

High Hazard: A determination by the Executive Director that a Backflow event would result in an unacceptable health and/or safety risk to the Public.

Low Hazard: A determination by the Executive Director that a Backflow event may result in an unacceptable health and/or safety risk to the Public.

DEVELOPMENT PERMIT. Permits for the building, together with all amendments, modifications, or replacements thereof, and all plans, drawings and specifications related thereto, which are approved by the City.

DEVELOPMENT PLAN. An accurate detailed, scaled, graphic representation of a proposed development which shows the specific land uses, Site design, and land dedication requirements for the property. It provides information including, but not limited to, building locations, and building footprints, parking areas and designs, ingress/egress, access and utility Easements. The development plan includes, but is not limited to, a detailed Site plan, a preliminary or final landscape plan, building elevation drawings, a preliminary utility/facilities plan, a preliminary grading plan or a phasing plan, as appropriate. The development plan shall contain the information required in the development plan application provided by the City.

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DEWATERING. The process of removing surface or ground water from a particular location.

DISTRIBUTION SYSTEM. "Distribution System" means City Water Mains including valves, fire hydrants, Connections, meters, service pipes from the Water Main to the curb stop or property line/easement (whichever is closer to the Water Main), and associated appurtenances, property, easements, and equipment used or to be used in distributing water to customers.

DOUBLE CHECK BACKFLOW PREVENTION ASSEMBLY OR DC. An Approved Backflow Prevention Assembly composed of two independently acting, approved check valves, including tightly closing, resilient seated shutoff valves attached at each end of the assembly and fitted with properly located, resilient seated test cocks.

EARTH EXCAVATION. Shall include all soils and loose, broken, and laminated ledge rock or stones and boulders which can be reasonably ripped, broken, and removed with skillfully operated, suitably powered excavating equipment in good operating condition having a bucket capacity of 3/4 cubic yard.

EASEMENT. A right, privilege, or liberty which one has in land owned by another; a right to limited use of another's land for some special and definite purpose within a specified boundary. It is not ownership of the land, but it includes the right to enter upon the land for the purpose(s) for which it was granted.

ELECTRONIC DRAWINGS. "Electronic Drawings" shall be AutoCAD ".dwg" drawing format files, unless specified otherwise.

ENGINEER OF RECORD. The registered licensed Professional Engineer who develops the overall design criteria for the Project elements, components, and systems and performs the analysis and is responsible for the preparation of the Construction engineering documents.

FAT, OIL AND GREASE (FOG). A semi-solid, viscous liquid organic polar compound derived from animal and/or plant sources that contain multiple carbon chain triglyceride molecules. These substances are detectable and measurable using analytical test procedures established in 40 Code of Federal Regulations (CFR) Part 136, as may be amended.

FIRE HYDRANT LATERAL. The extension pipe from the fire hydrant to the valve at the point of connection to the Water System.

FIRE MAIN. A Water Distribution Main dedicated to serving fire protection systems and possibly hydrants which may be looped around a building or complex.

FIRE PROTECTION SYSTEM. Any system used for firefighting purposes and comprised of underground and/or overhead piping designed in accordance with fire protection engineering standards.

FIRE SERVICE LINE. The water line and its appurtenances extending from the base of the system riser up to and including the connection to the Water Main for the exclusive purpose of supplying water to Fire Protection Systems.

FIRE SUPPRESSION SYSTEM. A type of Fire Protection System which generally includes – sprinklers or some type of fire extinguishing apparatus.

FOOD SERVICE ESTABLISHMENT. Any facility engaged in preparing and/or serving food for consumption by the public either on or off Premises, such as but not limited to: restaurants, commercial kitchens, cafeterias, nightclubs, coffee shops, delicatessens, meat cutting preparations, bakeries, bagel shops, grocery stores, caterers, hotels, schools, churches, hospitals, correctional facilities, day cares and nursing care institutions.

GREASE INTERCEPTOR. A tank that serves one or more fixtures and is remotely located. Grease Interceptors include, but are not limited to, tanks that capture Wastewater from dishwashers, floor drains, pot and pan sinks and trenches where grease containing materials may exist.

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GREASE TRAP. A device designed to retain grease from 1 to a maximum of 4 fixtures per the International Plumbing Code.

GROUNDWATER. Subsurface waters in a zone of saturation which are or can be brought to the surface of the ground or to surface waters through wells, springs, seeps, or other discharge areas.

HAZARD. The term is derived from an evaluation of the potential risk to public health and the adverse effect of the Hazard upon the Potable Water System as determined by the State of Colorado.

ISOLATION. The control of cross-connections within the plumbing system of a property owner by isolating individual cross-connections at or near the point of potential contamination or pollution with approved backflow prevention assemblies or methods.

ISOLATION VALVE. A valve installed in the Water System that can be used for operation or maintenance of the Water Distribution System operated in either an open or closed position.

LAMPING. Light flashed between manholes by means of reflecting sunlight with a mirror.

LEAKAGE. Leakage shall be defined as the quantity of water that must be supplied into the newly laid pipe, or any valved section thereof, to maintain pressure within 5 PSI of the specified test pressure after the air in the pipeline has been expelled and the pipe has been filled with water. Leakage shall not be measured by a drop in pressure in a test section over a period of time.

LIFT STATION. A Wastewater pumping station that pumps the Wastewater to a different point when the continuance of the sewer at reasonable slopes would involve excessive depths of bury or that pumps Wastewater from areas too low to drain into available sewers.

LOOPED MAIN. A Water Distribution Main with at least two separate connections to the existing Distribution System that are within the same designated water pressure zone. In order to be designated as a Looped Main, the connections to the Distribution System shall be designed such that if one of the connections is not available due to repairs or maintenance, then the other connection can supply water from the Distribution System to the Water Service Lines and Fire Service Lines served by the Looped Main.

MAY. Whenever "may" is used herein, it shall be construed as a permissible, but not mandatory direction.

MULTI-FAMILY CONNECTION. A single residential connection to the Water distribution system from which two or more separate dwelling units are supplied water. For the purposes of administering CDPHE Rule 11.39, Multi-Family Connections are always considered Non-Single-Family-Residential Connections.

NON-POTABLE WATER. Water that is not safe for human consumption or that does not meet the requirements set forth in the State of Colorado Primary Drinking Water Regulations.

NON-SINGLE-FAMILY-RESIDENTIAL CONNECTION. Any connection to the Water Distribution System, which is in the sole discretion of the City, does not meet the definition of a Single-Family-Residential Connection. For the purposes of administering CDPHE Rule 11.39, Multi-Family Connections are always considered Non-Single-Family Residential Connections.

OWNER/DEVELOPER. Any person, association, corporation, entity, or government agency desiring Utility Service for Premises under their control, often a sub-divider, Developer, an Owner or their authorized representative.

POLLUTION. See "*Contamination*".

POST INDICATOR VALVE. An Isolation Valve installed on a Fire Service Line which visually indicates the open or closed position of the valve.

POTABLE WATER. Water that meets the regulatory standards of the Colorado Department of Public Health and Environment and the Environmental Protection Agency for drinking water.

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PRECONSTRUCTION MEETING. A "Preconstruction Meeting" is a mandatory meeting including the Contractor, Consulting Engineer, a representative from City of Steamboat Springs Utility Division, and a representative from City of Steamboat Springs field crew during which materials, installation methods, and schedule for construction is discussed and agreed upon.

PRETREATMENT. The treatment of wastewater from commercial and industrial facilities to remove hazardous material before being discharged into a municipal sewer system.

PRIVATE SERVICE MAINS. "Private Service Main" is any wastewater collector, or any water distribution main that is connected to the City system but not accepted for City ownership, operation, maintenance, or repair.

RECORD DRAWING (AS-BUILT). Construction drawings revised to show significant changes made during the Construction process, usually based on marked-up prints, drawings, and other data furnished by the Contractor and/or the City.

REDUCED PRESSURE PRINCIPAL BACKFLOW PREVENTION ASSEMBLY OR RP. An Approved Backflow Prevention Assembly with two independently acting approved check valves, together with a hydraulically operated, mechanically independent pressure differential relief valve located between the two check valves and at the same time below the first check valve. The unit shall include properly located resilient seated test cocks and tightly closing, resilient seated shutoff valves at each end of the assembly.

RESIDENT-CONTROLLED LANDSCAPE IRRIGATION. Irrigation of grass, trees and other vegetation located on the property of a single family or other residential occupancy where the occupant is the User and is responsible for the maintenance and/or operation of the irrigation system.

RESIDENTIAL USER. Any person whose use of the utility supply system is exclusively for domestic purposes in a Private home or individual dwelling unit where not more than one dwelling unit is served through one meter.

RESPONSIBLE PARTY. The person billed for water service provided by the City, or the owner of the property served by city water if the owner is different than the person billed. In the event that the property owner and the person billed for city water service are different, the owner shall be solely responsible for all obligations and duties of this section.

RIGHT-OF-WAY (ROW). A strip of land occupied or intended to be occupied by a street, crosswalk, railroad, electric transmission line, oil or gas pipeline, water main, sanitary or storm sewer main, telephone line, shade trees or other similar uses. Rights-of-way are not easements; however, easements can be in rights-of-way.

RIGHT-OF-WAY (ROW) PERMIT. A permit granted by the City to an applicant for permission to construct, to repair and maintain, and to use overhead and underground facilities that it owns, and which are located in the right-of-way.

ROCK EXCAVATION. Shall include all solid rock masses which cannot be excavated as specified under "Earth excavation" and isolated boulders exceeding 1 cubic yard in size.

RULES AND REGULATIONS. "Rules and Regulations" are these Rules and Regulations of the City as adopted and amended from time to time by the City which state the policy and procedures by which the Water System and Wastewater System are operated and administered.

SAND/OIL SEPARATOR. A tank that serves one or more fixtures and is remotely located. Sand/Oil Separators include, but are not limited to, tanks that capture wastewater from vehicle maintenance facilities, car washes or facilities that perform fermentation processes such as breweries.

SEWER SYSTEM. Refer to "*Wastewater System*".

SHALL. Whenever "shall" is used herein, it shall be construed as a mandatory direction.

SINGLE-FAMILY-RESIDENTIAL CONNECTION. A single residential connection to the Water

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distribution system that meets one of the following criteria: A single dwelling which is occupied by a single family and is supplied by a separate service line; or a single dwelling comprised of multiple units where each living unit is supplied by a separate service line.

SPECIFICATIONS. Documents consisting of written technical descriptions of materials, equipment, systems, standards, and workmanship as applied to the work and certain administrative details applicable thereto.

SPRING LINE. "Spring Line" is the point of maximum horizontal dimension when looking at an end cross section of a pipe.

STUB OUT. "Stub Out" is a service line for the benefit of the development of a vacant lot which is connected to the Water or Wastewater System and ends at the property line, with an intent to facilitate the Connection of a Customer's service line to the Water or Wastewater System.

SURVEY. A "Survey" is conducted to assess customer compliance and may consist of a physical inspection or a questionnaire that the customer is required to complete and submit to the City within the specified timeframe.

TAP. A "Tap" is the joining of a Water or Wastewater Service to the Water or Wastewater System, respectively, or a Private Service Main.

TAPPING VALVE OR CORPORATION STOP. Corporation Stop or Tapping Valve is the point of connection of a Water Service Line to the City's Water Distribution Main.

TEST TEE. This tee allows you to test the plumbing system for leaks and provides a cleanout port in case of blockages.

THRUST BLOCKS. A thrust block is a concrete pipe restraint that prevents the mainline from moving by transferring pipe loads (mainly due to pressure thrust) to a wider load-bearing surface. Usually, thrust blocks are provided for buried pipelines at fittings requiring branching or direction change.

TIE IN. Refers to the physical act of connecting a main line extension to the existing system.

TRENCH SUPPORT SYSTEM. Used to minimize the excavation area, to keep the sides of deep excavations stable, and to ensure that movements will not cause damage to neighboring structures or to utilities in the surrounding ground.

TRENCHLESS TECHNOLOGY (TRENCHLESS). A type of subsurface Construction work that requires few trenches or no continuous trenches. It can be defined as a "family" of methods, materials, and equipment capable of being used for the installation of new, replacement, or rehabilitation of existing underground infrastructure with minimal disruption to surface traffic, business, and other activities.

UNCONTROLLED. Not having a properly installed, maintained, and tested or inspected backflow prevention assembly or backflow prevention method, or the backflow prevention assembly or backflow prevention method does not prevent backflow through a cross connection.

UNDERGROUND FACILITIES. All underground pipelines, conduits, ducts, cables, wires, manholes, Vaults, tanks, tunnels, or other such facilities or attachments, and any encasements containing such facilities, including those that convey electricity, gases, steam, liquid petroleum products, telephone or other communications, cable television, water, wastewater, storm water, other liquids or chemicals, or traffic or other control systems.

UNSUITABLE MATERIAL. Shall include all materials that contain roots, debris, organic, frozen, unstable, or unshapable materials, soil with excessive moisture, or stones having a maximum dimension of 12-inches or greater and that are determined by the Utility Engineer as unsuitable for providing a proper foundation or backfill.

VACUUM. A mechanized system of wastewater transport. Unlike gravity flow, vacuum sewers use differential air pressure to move the sewage.

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VACUUM POTHOLING. A potholing technique used to verify the location of a detected utility. Vacuum excavation is carried out by simultaneously shooting compressed air jets and removing excavated material by vacuum action.

VALVE BOX. A way of access to operate underground valves.

VARIANCE. See “*Change Order*”.

VAULT. An underground Structure large enough to accommodate equipment including but not limited to meters, pressure regulating valves (PRVs), meter bypasses, all valves and piping or other underground infrastructure.

WARRANTY PERIOD. Preliminary acceptance begins the warranty period, which shall not end until such time as final acceptance has been granted. The warranty period shall not be less than two years. Until final acceptance is granted the infrastructure shall be under warranty and any maintenance and repair work is the responsibility of the developer.

WASTEWATER MAIN. A Wastewater Main is any collector or interceptor pipe used as a conduit for conveyance of wastewater in the City's Wastewater Collection System that is owned and maintained by the City.

WASTEWATER SERVICE. A Wastewater Service is any pipe or conduit used to provide Wastewater Service from the place where the wastewater is generated to the Wastewater Collection System, including all appurtenant fittings and bedding materials. Maintenance, repair, or replacement of the Wastewater Service is the sole responsibility of the Applicant or Customer.

WASTEWATER SYSTEM. Wastewater System is any network of wastewater collection or interceptor mains, wastewater treatment facilities, appurtenances, accessories, or portion thereof, owned and maintained by the City.

WATER MAIN. A Water Main is any distribution or transmission pipe used as a conduit for water, connected to the City's Water System and owned and maintained by the City.

WATER METER. Water Meter is a measuring device installed on a Water Service. The Water Meter includes the meter and all the appurtenances necessary to connect it to the Water Service.

WATER SERVICE. A Water Service or means any pipe or conduit and related fittings used to convey water to a place of use from a Water Main.

WATER SYSTEM. Water System is any network of water distribution or transmission mains, storage tanks or reservoirs, water treatment facilities, appurtenances, accessories, or portion thereof owned and operated by the City.

WATERTIGHT PLUG. A seal that prevents any wastewater from leaking out and contaminating surrounding groundwater.

WORK. As applicable, “Work” is any construction activity on, above, in or around the Water or Wastewater Systems or Water or Wastewater Service/Connection, or the construction, installation, modification and/or abandonment described in the approved engineering drawings and submittals.

2.0 Abbreviations

AASHTO – American Association of State Highway and Transportation Officials

ACI – American Concrete Institute

AISC – American Institute of Steel Construction

ANSI – American National Standards Institute

APCO – Association of Public-Safety Communications Officials

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ASTM – American Society for Testing and Materials
AWS – American Welding Society
AWWA – American Water Works Association
BMP – Best Management Practice
BMR – Baseline Monitoring Report
BOD – Biochemical Oxygen Demand
CCTS – City Collection And Treatment Systems
CDOT – Colorado Department of Transportation
CDPHE – Colorado Department of Public Health and Environment
CFR – Code of Federal Regulations
CIU – Categorical Industrial User
COD – Chemical Oxygen Demand
CRSI – Concrete Reinforcing Steel Institute
DIP – Ductile Iron Pipe
EJIW – East Jordan Iron Works
EPA – U.S. Environmental Protection Agency
FGMA – Flat Glass Marketing Association
GPD – Gallons per day
IPC – International Plumbing Code
IU – Industrial User
LSS – Life Support Systems
mg/l – Milligrams per Liter
MIL – Unit - one thousandth (0.001) of an inch
MIL-Specs – Military Specifications
NAAMM – The National Association of Architectural Metal Manufacturers
NEC – National Electric Code
NEMA – National Electrical Manufacturers Association
NFPA – National Fire Protection Association
NIST – National Institute of Standards and Technology
NPDES – National Pollutant Discharge Elimination System
NSCIU – Non-Significant Categorical Industrial User
NST – Nonsewered toilet system
PSI – Pounds per Square Inch (pressure)
PSIG – Pounds per Square Inch (gauge)
PVC – Polyvinyl Chloride
RCRA – Resource Conservation and Recovery Act

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SDI – Steel Deck Institute

SIU – Significant Industrial User

SNC – Significant Noncompliance

SSPC – Society for Protective Coatings

TCA – Tile Council of America

THHN – thermoplastic high-heat-resistant, nylon-coated wire

TSS – Total Suspended Solids

U.S.C – United States Code

UBC – Uniform Building Code

UPC – Uniform Plumbing Code

3.0 Approved Products List

Steamboat Springs Water and Sewer Approved Products List		
Material Description	Approved Manufacturer and Model	Performance Specification and Information
MANHOLES AND APPURTENANCES		
Concrete		ASTM C 478, 4000 PSI, Minimum 470 lb/cy Type II Portland Cement, Maximum 0.53 water cement ratio
Base, Riser, and Conical Top Sections		ASTM C 478, Conical top section shall have 24" diameter access opening at its top. Base, Riser, and bottom of Conical top section shall be 48" diameter
Pre-cast Base slabs or floors		ASTM C 478, minimum thickness of 6" for 48" diameter risers and 8" for larger dimensions
Flat Slab Tops		ASTM C 478, 24"diameter access opening, minimum thickness of 6" for 48" diameter risers and 8" for larger dimensions, H-20 live load and dead load
Grade Rings		ASTM C 478 Pre-cast concrete
Steps	M.A. Industries, Inc.	ASTM C 478, Type PS-2PF or PS-2PFS 1/2" diameter, Grade 60 steel rod encapsulated in Copolymer Polypropylene, 1000 lb load minimum
Frames and Lids (Rings and Covers)	Castings Inc.	H-20 heavy duty castings, or gray cast iron per ASTM A 48 - MH-400-24 CI with one Aurora style pick slot frame with solid lid,
Waterproof Lids	Neenah	"Self-sealing" lids

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Adjusting (Extension) Rings	Neenah	Gray cast iron per ASTM A 48, Class 25, Neenah R-1979
MANHOLE JOINT SEALS AND GASKETS		
Between Manhole Sections to Include Pre-cast Base, Riser, Conical Sections, Flat Slab Tops	RUB'R-NEK	Per ASTM C 478 made with male and female ends and sealed with RUB'R-NEK or approved equal flexible gasket-type sealant of partially vulcanized butyl rubber per Federal Specification SS-S-210A. Two gaskets are required per joint. Gasket size shall be as recommended by the manufacturer based upon the annular space to be sealed. If the minimum cross sectional area equivalent of the gasket is less than one-inch diameter, confirm suitability with the Engineer before proceeding.
Between Cast-in-place Base and Riser	RUB'R-NEK	Flat bottom riser placed on a flat-formed base and sealed with two flexible gaskets, same as above.
Pipe To Manhole Seal (Pre-cast Base)	KOR-N-Seal, A-Lok	Flexible rubber boot in a cored hole per ASTM C 923. Connectors shall be KOR-N-Seal, A-Lok or approved equal.
Pipe To Manhole Seal (Cast-in-place Base)		Two elastomeric seals minimum per pipe (O ring water stops) per ASTM F47
Between Grade Rings, and Between Flat Slab Top or Conical Section and Grade Ring	RUB'R-NEK	RUB'R-NEK or approved equal flexible gasket-type sealant of partially vulcanized butyl rubber per Federal Specification SS-S-210A. One gasket with a minimum cross sectional area equivalent to one inch in diameter is required per joint.
Between Cast Iron Frame and Concrete Surface	RUB'R-NEK	RUB'R-NEK or approved equal flexible gasket-type sealant of partially vulcanized butyl rubber per Federal Specification SS-S-210A. One gasket with a minimum cross sectional area equivalent to one inch in diameter is required per joint.
LININGS AND COATINGS		
DIP Cement Lining		ANSI/AWWA C104/A21.4
Manhole Exterior Coating	MASTERSEAL	MASTERSEAL Foundation Coating
GROUT, CEMENT MORTAR, AND CONCRETE		
Manhole Grout		Non-shrink, Non-metallic, either cement or epoxy based
Manhole Mortar		Masonry cement per ASTM C91, Aggregate per AASHTO M 45, Maximum proportion by volume to be one part masonry to three parts aggregate
VALVES AND APPURTENANCES		
Valve Box and Extension	Tyler Pipe or East Jordan Iron works (EJIW)	For valves less than 14" the boxes shall be screw type 668S for series 8550 and for valves 14" or larger the boxes shall be screw type 668S for series 8560.

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Gate Valve (3-12")	Waterous Series 2500 or Mueller 2360 series	AWWA C 515-01, non-rising stem, open left, with 2 inch operating nut, rated for 200 PSI working pressure.
Tapping Valve	Waterous Series 2500 or Mueller T-2360 series	AWWA C 515-01, non-rising stem, open left, with 2 inch operating nut, rated for 200 PSI working pressure.
Combination Air Valve	A.R.I. D-40-V	AWWA C512, shop assembled and shipped as a complete unit ready for field installation. The valve shall be the single body type with 2" inlet/outlet pipe thread.
Butterfly Valve	Mueller Lineal or Waterous 700	AWWA C 504; short body. Manual operator, open left, replaceable seat, with 2-inch operating nut, rated for 150 PSI working pressure.
JOINTS AND BOLTS		
DIP Push-On or Mechanical Joints		ANSI/AWWA C111/A21.11
Water DIP Tee Bolts	Cor-Ten	ASTM 242, Low alloy steel
Water PVC Joints		ASTM D 3139, integral bell with an elastomeric gasket push-on type joint
Water Restrained Joints		For ductile iron or PVC pipe shall be the correct series of either Megalug or Uni-flange joint restraint for the type of pipe being installed.
Sanitary PVC Joints		ASTM D 3212, rubber gasketed bell and spigot type with integral bell.
Flange Bolts		Type 304 stainless steel A 193, grade B8, coated with C5A copper based anit-seize.
Flange Joints		ANSI/AWWA C 115/A21.15
WATER SYSTEM PIPES AND FITTINGS		
Ductile Iron Pipe (DIP)		ANSI/AWWA C151/A21.51 - Class 52 Wall Thickness
PVC Pressure Pipe		AWWA C900 - Class 200 Wall Thickness with DR 14
Ductile Iron and Cast Iron Fitting		ANSI/AWWA C110/A21.10, 250 PSI min pressure rating
Ductile Iron Compact Type Fitting		ANSI/AWWA C153/A21.53, 350 PSI
Swivel Fitting	Tyler Pipe	per Tyler Pipe or equal
Water Service (diameter of 2" or less)		Type K, seamless soft copper tubing
Water Marker Posts	Carsonite International	Blue carsonite utility marker with water decal 112-CW model CUM-375 CRM 307208 (72 inch length)
Water DIP Tapping Saddle	Rockwell Type 323, Ford B202, or Mueller BR2B.	Shall be cast bronze, double strap, "O" ring seal, compatible with the corporation stop. All service taps larger than 1 inch and all service taps in Class 50 or 51 DIP pipe shall be made using a tapping saddle.
Water PVC Tapping Saddle	Ford S90 and S91	Shall be a brass alloy per AWWA C800 and shall be double strap and shall be designed for use with C-900 pipe.

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Couplings	Ford Grip Joint Connections or Mueller 110 compression connections	
HYDRANTS AND APPURTENANCES		
Hydrant	Kennedy Guardian K81-D, Mueller Super Centurian 250 three-way, 2 foot Mountain Specification with centering spider; or Waterous three-way Mountain Standard with centering spider	AWWA C 502; with 6-inch mechanical joint pipe connection, automatic drain feature (drip valve), open left, 1-1/2 inch pentagonal operating nut, two 2-1/2 inch National Standard (NST) thread hose nozzles, and a 4-1/2 inch NST thread steamer nozzle, red in color, with 7-1/2 foot bury or other length as conditions warrant. All hydrants on a given development shall be of the same year and shall be of the year of construction plus or minus one year.
Hydrant Marker	BARCO	7-foot length - the marker should be attached to the back of hydrant on the first flange immediately above the bury line
Hydrant Grade Offset		Made from ductile iron per AWWA C153/ANSI A21.53. A maximum of a 12" offset is allowed. Both ends are to be restrained.
Blow off Hydrant	Kupferle model #77	2½" NST nozzle and 2" FIP inlet from the side
SANITARY SYSTEM PIPES AND FITTINGS		
PVC Main Lines (4-15" diameter)		ASTM D 3034, SDR35
PVC Main Lines (18-27" diameter)		ASTM F 679, T-1 Wall Thickness
Ductile Iron Pipe (DIP)		ANSI A21.51, Class 50 Minimum Wall Thickness
PVC Service (4-8" diameter)		ASTM D 3034, SDR35
Wastewater Marker Posts	Carsonite International	Green carsonite utility marker with sewer decal 107-CS model CUM-375 CRM 3072-07 (72 inch length)
Sanitary Tapping Saddle		4-inch or 6-inch diameter service line connections to existing mains shall be a gasketed wye, with centering ring and stainless steel straps, specifically made for the size and type of main being tapped. A submittal is required. Solvent weld type saddles are not acceptable.
Wastewater Couplings		For connecting two plain ends of equal or different pipe material, couplings shall be Romac style "LSS" sewer clamp couplings or gasketed joint PVC double bell repair couplings. For service lines 4" in diameter, Shear Guard couplings or approved equal may be used. For connecting schedule 40 pipe to ASTM 3034 pipe a gasketed joint PVC bell by spigot type coupling shall be used.
ENCASEMENTS AND THRUST BLOCKS		

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Concrete		Shall be a minimum 3000 PSI compressive strength, 6 sacks per cubic yard, Type II Portland Cement.
Reinforcing Steel		Grade 40, ASTM A 615
Polyethylene Encasement		Per AWWA C105. Required only when called for in Special Provision.
OTHER		
Corporation Stop	Ford FB-1000G, or Mueller B-25008	3/4", 1", 1-1/2", OR 2"
Curb Box		Shall have a 1 inch diameter upper shaft, 7-1/2 foot box, arch base, plug style lid and stationary rod extending to within 1-foot of the surface. Where necessary, an enlarged base shall be supplied for large curb stops.
Curb Stop	Ford B-44G series or Mueller B25209 ball valve	A stop permitting a 90-degree turn only, with pack joint fittings at both ends. Inlet, outlet, and valve size shall all be identical.
Tracer Wire - Open Trench	Copperhead Industries, Pro Line Safety Products	#12 AWG Copper Clad Steel, or Solid Copper, High Strength with minimum 300 lb. break load, with minimum 30 mil HDPE insulation thickness.
Tracer Wire - Directional drilling/boring	Copperhead Industries, Pro Line Safety Products	#12 AWG Copper Clad Steel, Extra High Strength with minimum 1,150 lb. break load, with minimum 30 mil HDPE insulation thickness.
Tracer Wire - Pipe bursting/Slip lining	Copperhead Industries, Pro Line Safety Products	Tracer wire shall be 7 x 7 Stranded Copper Clad Steel, Extreme Strength with 4,700 lb. break load, with minimum 50 mil HDPE insulation thickness.
Tracer Wire Connectors	Burndy Split Bolt Connector, Copperhead Industries Snakebite Connector	Copper to copper, square head with King Innovation Split Bolt Aqua Housing 69105 (for Burndy Model)
Tracer Wire Test Station	VALVCO, Inc.	Required at all fire hydrants or other locations as specified by the Engineer. Model "Glenn Test Station"
Stub Markers		New metal posts extending down to the stub and up to within 1 foot of the designated grade.
Pipe and Fittings (Cleanouts)		Shall be the same as the wastewater line.
Cover (Cleanouts)	Neenah #R-1970 or approved equal.	

END OF SECTION

SECTION 4: ENGINEERING SERVICES

1.0 General

1.1 Description

Work included: This specification outlines the minimum level of construction engineering services to be provided by a project owner for development work requiring water and wastewater facilities served by the Utility Division. Note: the construction engineering work items listed are intended to be the minimum guidelines to which the owner shall comply. The actual level of construction engineering shall be that required to assure conformance with all detailed requirements of the approved plans and specifications.

These minimum service levels will be required for all public infrastructure associated with water and sanitary sewer in the Utility Division. Some projects may require additional services to ensure quality work. The City may require the same level of inspection and oversight for private improvements and infrastructure that influence or are associated with specific projects.

The minimum level of engineering services to be provided for construction projects shall be as follows:

1.2 Qualifications of Project Observation Personnel

The individual(s) completing construction observation for water and wastewater shall be a professional civil engineer registered in the State of Colorado or a properly trained engineering technician under the direct supervision of a professional engineer. The on-site personnel shall be experienced in construction observation of wastewater collection and water distribution pipelines and appurtenances.

1.3 Water and Wastewater Main Installation, Including Water Installation for Any Private Line 4 Inches in Diameter or Greater:

- A. Limits of right-of-way and easements shall be established prior to staking of mains.
- B. Pre-construction survey review: The Consulting Engineer shall visually verify that the limits of right-of-way, appropriate easements, and pipe centerline are staked and per plans and specifications prior to commencement of utility construction.
- C. For other construction surveying requirements, please refer to Engineering Standards, Section 01050, Construction Surveying.
- D. Stake the centerline of main and location of all appurtenances.
 1. Manhole invert elevation shall be staked with offset hub elevations with cuts and stationing.
 2. Wastewater mains shall be staked for grade.
- E. Observation: pipeline installation
 1. Document that all pipeline materials meet approved specifications.
 2. Certify the trench foundation preparation and placement of bedding and shading materials.
 3. Observe all mechanical joint fittings, joint restraint, and thrust blocks prior to backfill.
 4. Observe all hydrants, valves, and other features as installed. Operate all valves for the best operation.

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5. Document as-constructed conditions prior to backfill.
 6. Some pipelines, at the discretion of the Utility Division, shall require full time construction engineering observation as construction and pipeline installation proceeds.
 7. All appurtenances, bends, manholes, etc., shall be field surveyed prior to backfill.
- F. Observation: Backfill
1. Moisture/density testing shall meet the requirements of Subsection 3.6: Field Quality Control as described in Section 24: Trenching, Bedding, and Backfill.
- G. Testing: Pipeline and Trenches
1. Observe, perform testing, and document that all water and sewer materials meet approved plans and specifications.
 2. Observe and document sampling and testing per Sections 30 and 40 specifications, including: bacteriological, hydrostatic, and leakage tests.
 3. Observe, perform testing, and document backfill for utility trenching in right-of-way and easements. The testing of trench backfill compaction per Section 24 requirements.
 4. Testing of subgrade, base and pavement associated with water and sewer projects in accordance with Engineering Standards Section 01045 Engineering Services.
 5. Identify any field conditions observed that may compromise pipelines, right-of-way, or easements.

1.4 Final Submittals for Wastewater, Water, and Road Acceptance

- A. Record Documents: Water and Wastewater
1. Prior to preliminary acceptance, the Consulting Engineer shall provide the Utility Division with red line record documents of all infrastructures included in the project. These are for initial review only.
 2. After initial review, the Utility Division will either approve or return for corrections.
 3. To maintain the integrity of the City's system maps, all ground level appurtenances (e.g., valve boxes, manholes, fire hydrants, PRVs) will be located and surveyed using State Plane Coordinates, North American Datum 1983 (1992) – NAD83. The northern and eastern coordinates will be included on record documents for appurtenances. In addition to northern and eastern coordinates on NAD83, manhole rim elevations, the top of pipe in instances where the Utility Division requires water line profiles, and all other elevation-related items shall be surveyed and shown on record documents in NGVD29. If topographic contours are required in record documents, contours shall be based on NGVD29 vertical datum. A Colorado registered professional land surveyor shall certify the surveyed data. Ground-level appurtenances do not require as-built surveys for projects that do not include water or wastewater mainlines or public infrastructure, unless specifically required by the Utility Division.
 4. Provide the Utility Engineer with a certified electronic 24-inch-by-36-inch plan and profile sheets of record documents after acceptance. Provide electronic drawings of plan sheets in an AutoCAD version 2020 compatible format. The electronic drawings shall be drawn in State Plan Coordinates, North American Datum 1983 (1992) – NAD83. The engineer that certifies the record drawings must be the same engineer in responsible charge of construction observations.

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5. Minimum criteria to be included in record documents: See Appendix A

B. Daily Observation Logs

1. The Consulting Engineer shall keep a log of daily site observations, make entries to note any conditions that will assist the Utility Division after construction is complete, and assure the City that the Consulting Engineer has performed the necessary service to provide certified as-constructed documents.
2. The Consulting Engineer shall submit copies of all logs to the Utility Division.
3. Typical entries shall include:
 - a. As-constructed dimensions
 - b. Alteration of plans, character, or work and quantities
 - c. Use of materials found in the excavation
 - d. Any decisions on interpretation given to the Contractor
 - e. Partial and final acceptance
 - f. Quality control test results indicating conditions, pressures, durations, volumes, rates, etc., indicating acceptance or failure to specifications
 - g. Weather
 - h. Personnel involved
 - i. Consulting Engineer's time on site

C. Statement by the Consulting Engineer

1. The professional engineer responsible for the project must submit a statement that the work was completed in substantial compliance with the approved plans and specifications, based on observations made by them or the engineering technician performing work under their direct supervision.

If there is a substantial change from plans and specifications, the Consulting Engineer shall notify the Utility Engineer of potential changes. This notification shall be made upon discovery of the changed conditions and prior to construction of any substantial modification from the plans. The Utility Engineer shall agree to these changes prior to any substantial change.

2. The professional engineer responsible for the project must complete and submit an original Certificate of Inspection Letter. See Appendix B.

Certification by an engineer, as required by any portion of these specifications, shall include the signature and the P.E. stamp of the engineer in responsible charge. Failure to comply with this section shall be grounds for non-acceptance of the project.

END OF SECTION

SECTION 6: STAKING, QUANTITIES, AND DRAWINGS OF RECORD

1.0 General

1.1 Description

Work included: This specification shall outline the responsibility for survey work necessary to construct the work to specified lines and grades and for the maintenance of records to properly determine quantities and develop as-constructed records.

1.2 Quality Assurance

The survey and staking requirements for a project shall be established and agreed upon by the Contractor, Utility Engineer, and Consulting Engineer prior to or at the pre-construction meeting.

2.0 Products

No products are required in this section.

3.0 Execution

3.1 Construction Staking

- A. In general, the following construction staking shall be provided by the Consulting Engineer.
 1. Wastewater collection systems
 - a. Manhole and cleanout centerline stakes
 - b. Offset stakes at manholes for invert grade control set 25-feet from outside of manhole
 - c. Offset stakes at manholes for approximate manhole rim elevations
 - d. Location for alignment and stakes for service lines
 - e. Easement locations clearly staked at centerline and edges at a maximum of 50-foot intervals. The sewer line is to be constructed/placed at centerline location. Easements shall not be less than 20-foot wide
 2. Water distribution systems
 - a. Centerline stakes for alignment
 - b. Location stakes for valves, hydrants, and other appurtenances
 - c. Location stakes for service lines
 - d. Offset stakes for approximate valve box and hydrant elevations
 - e. Easement locations clearly staked at centerline and edges at a maximum of 50-foot intervals. The water line is to be constructed/placed at centerline location. Easements shall not be less than 20-foot wide.
- B. In general, the following construction staking is to be provided by the Contractor.
 1. Wastewater collection systems and water distribution systems

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- a. Periodic verification of grade between the stakes established by the Consulting Engineer. The Contractor shall promptly notify the Consulting Engineer if stakes are missing.
 - b. Placement of additional grade stakes between those provided by the Consulting Engineer
 - c. Regular checks of cover depth for water main installation
 - d. Establishing final finished grades of manhole rings and covers, valve boxes, and other appurtenances
 - e. Verification that all water and sewer lines are centered within easements during construction
2. Other wastewater and water facilities

3.2 Quantity Surveys

- A. The Contractor shall provide personnel to assist the Consulting Engineer in conducting the surveys necessary to determine quantities of work performed. Unless waived in writing in each case, quantity surveys shall be made under the direction of the Consulting Engineer or the Consulting Engineer's representative. All original field notes, computations, and other records taken for the purpose of quantity surveys shall become the property of the Owner and be kept in the custody of the Consulting Engineer. Quantity surveys shall be used as necessary to determine the payment amount due to the Contractor.

3.3 Notification

- A. The Contractor shall notify the Consulting Engineer 48 hours in advance of needed staking. The Contractor shall notify the Consulting Engineer immediately upon encountering any known staking errors or if the Contractor suspects a staking error. Any work performed by the Contractor to apparent erroneous staking information shall be at the Contractor's risk.

3.4 Drawings of Record

- A. The Consulting Engineer may certify all as-built dimensions and elevations.
- B. The Consulting Engineer may, in conjunction with the Contractor, maintain a complete set of prints of all contract drawings and maintain a neat and accurate record of all contract work. The Consulting Engineer, in conjunction with the Contractor, shall promptly record the as-built quantities and dimensions of all contract work as it is performed on this set of prints. At the completion of project work, the entire set of prints plus any additional drawings necessary shall be submitted to the Consulting Engineer for final inspection and certification. The Contractor shall correct, amplify, and do all other work as may be required by the Consulting Engineer to complete the as-built record in a manner satisfactory to the Consulting Engineer for certification by the Utility Engineer.
- C. The Contractor's record shall include the location of valves, fittings, connections, service lines, cleanouts, and manholes and identify materials and fittings used, relative placement of fittings with dimensions, depth of water mains, and locations of lines or other items which may be important.
- D. To maintain the integrity of the City of Steamboat Springs System Maps, all ground-level appurtenances (e.g., valve boxes, manholes, fire hydrants, PRVs) will be located and surveyed using State Plane Coordinates, North American Datum 1983 (1992) – NAD83. The northern and eastern coordinates will be included on the record documents for appurtenances. All curb stops and water main bends shall be surveyed. In addition to

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northern and eastern coordinates on NAD83, manhole rim elevations, the top of pipe in instances where the Utility Division requires water line profiles, and all other elevation-related items shall be surveyed and shown on the record documents in NVGD29. If topographic contours are required in record documents, contours shall be based on the NVGD29 vertical datum. Either a Colorado-registered professional land surveyor or the engineer not in responsible charge of survey shall certify the surveyed data. Ground-level appurtenances do not require as-built surveys for projects that do not include water or wastewater mainlines or public infrastructure, unless specifically required by the Utility Division.

- E. Provide professional, civil engineer-certified, reproducible 24-inch-by-36-inch electronic plots of plan and profile sheets and 8.5-inch-by-11-inch electronic reductions of plan and profile sheets of record documents after approval. Provide electronic drawings of plan sheets in an AutoCAD Civil 3D version 2020 compatible format. The electronic drawings shall be drawn in State Plane Coordinates, North American Datum 1983 (1992) – NAD83. The Consulting Engineer that certifies the as-built drawings must be the same Consulting Engineer in responsible charge of construction observations. Unless required by the Utility Division, 24-inch-by-36-inch electronic record drawings are not necessary for projects that do not include water or wastewater mainlines or public infrastructure.
- F. The minimum criteria to be included in record documents shall be as stated in Section 4 Engineering Services under Part III: Final Submittals for Wastewater, Water, and Road Acceptance.

4.0 Measurement and Payment

No separate payment will be made for work required under this section.

END OF SECTION

SECTION 8: SUBMITTALS AND SUBSTITUTIONS

1.0 General

1.1 Description

Work included: Preparation and submittal of shop drawings, cut sheets, compliance certifications, documentation of material types and ratings, and any additional documents or samples required to ensure that specified products are furnished and installed according to design intent.

1.2 Quality Assurance

The work is based on the standards of quality established in the contract documents. All products proposed for use, including those specified by required attributes and performance, shall be reviewed by the Consulting Engineer before being incorporated into the work. The Contractor shall bear ultimate responsibility for providing a complete working system and shall guarantee that all installed system components are compatible and will provide for the intended operation of the component and its system. Pre-approved product substitutions will only be acceptable when authorized by the statement or equal approved by the City. All submittals require pre-approval by the Consulting Engineer. All substitutions require pre-approval by the Consulting Engineer and the Utility Engineer. Per Section 4: Engineering Services, subsection 1.1.II.C.1, the Consulting Engineer shall document that all pipeline materials meet approved specifications.

1.3 Administrative Submittals

A. Administrative submittals include, but are not limited to:

1. Preconstruction submittals
2. Schedules (Refer to City of Steamboat Springs Engineering Standards, Section 01310.)
3. Permits
4. Application for payments
5. Schedule of anticipated payments
6. Schedule of values
7. Closeout documents and record documents
8. Operations and maintenance information, manuals, and procedures
9. Warranties

B. These submittals are for information and record and do not require action from the City's representative except when not in conformity with contract documents. If non-conformity is observed, the City's representative will notify the Contractor. Failure of the City's representative to observe or notify does not relieve the Contractor of compliance with contract documents.

2.0 Products

2.1 Submittal Schedule

A. General: At the pre-construction conference or within 10 days of notice of award, whichever comes first, compile and submit electronic copies of a complete and comprehensive schedule of all anticipated submittals during work. Include a list of each type of item for which Contractor's drawings, shop drawings, certificates of compliance,

material samples, guarantees, or other types of submittals are required. Upon approval by the Consulting Engineer, this section will become part of the contract and the Contractor will be required to adhere to the schedule, except when specifically permitted otherwise.

- B. Coordination: Coordinate the schedule with all necessary subcontractors and materials suppliers to ensure they understand the importance of adhering to the approved schedule, and they confirm their ability to adhere. Coordinate as required to ensure grouping of submittals as described in Subsection 3.2.
- C. Revisions: Revise and update the schedule as necessary to reflect conditions and sequences. Promptly submit revised schedules to the Consulting Engineer for review and comment.

2.2 Shop Drawings and Coordination Drawings

- A. Scale and Measurements: Scale shop drawings large enough to show all pertinent aspects of the item and its method of connection to the work.
- B. Electronic submissions required: Submit copies of all shop drawings, which shall not be made on copies of contract documents.

2.3 Manufacturers Literature

Submit electronic copies of manufacturer's literature. When the submittal literature includes options or other data that is not pertinent to the work, clearly indicate which items and options are being supplied.

2.4 Samples

Unless otherwise specified, submit two samples of the precise article proposed, one of which will be retained by the Utility Engineer. The Contractor may request that the Utility Engineer's sample be installed in the project. The Utility Engineer may approve the request if, in the Utility Engineer's sole opinion, it is not critical to retain the sample.

2.5 Colors and Patterns

Unless the precise color and pattern is specifically described in the contract documents, and whenever a choice of color or pattern is available for a specified product, submit accurate color and pattern charts to the Utility Engineer for review and selection.

2.6 Substitutions

Submittals for proposed substitutions shall meet the requirements of this section. All substitutions require pre-approval from the Utility Engineer and the City. The City requires a minimum of 10 working days for review following receipt of the completed substitution package.

2.7 Availability of Specified Items

- A. Verification: The Contractor shall be responsible for verifying that all specified items will be available for orderly and timely progress of work.
- B. Notification: If specified items will not be available, the Contractor shall notify the Consulting Engineer prior to receipt of bids.
- C. Delays: The costs of delays from the non-availability of specified items, when the Contractor could have avoided delays, will be the Contractor's liability and shall not be borne by the Owner.

3.0 Execution

3.1 Identification of Submittals

- A. General: All submittals shall be consecutively numbered and accompanied by a letter of transmittal containing all pertinent information required for identification and checking of submittals.
- B. Internal identification: On each submittal copy, and elsewhere as required for positive identification, clearly indicate the submittal number in which the item was included.
- C. Re-submittals: When material is re-submitted for any reason, provide a new letter of transmittal.
- D. Submittal log: For the duration of the contract, maintain an accurate submittal log that shows the status of all submittals and is available for Utility Engineer review upon request.

3.2 Coordination of Submittals

- A. Prior to submittal for approval, ensure all material is fully coordinated by:
 - 1. Determining and verifying all interface conditions, catalog numbers, and similar data
 - 2. Coordinating with other trades as required
 - 3. Clearly indicating all deviations from contract document requirements
- B. Grouping of submittals: Unless otherwise specified, make all submittals in groups containing all associated items to ensure that information is available for checking each item. Partial submittals may be rejected as not complying with contract document provisions and the Contractor shall be strictly liable for any associated delays.

3.3 Shop Drawings

- A. Submit newly prepared information, drawn to accurate scale. Highlight, circle, or otherwise indicate deviations from contract documents. Do not reproduce contract documents or copy standard information as the basis for shop drawings. Shop drawings include fabrication and installation drawings, setting diagrams, schedules, patterns, templates, and similar drawings. Include the following information:
 - 1. Dimensions
 - 2. Identification of products and materials, including compliance with specified standards
 - 3. Notation of coordination requirements
 - 4. Notation of dimensions established by field measurement
- B. The Contractor shall not perform any work for which contract documents require submittal and review of shop drawings, product data, or similar submittals until they are approved by the Owner.
- C. The Contractor shall submit each shop drawing individually by email to the City.

3.4 Timing of Submittals

- A. General: Make all submittals far enough in advance of scheduled dates for installation to provide all time required for reviews, securing necessary approvals, completing possible revisions and re-submittals, placing orders, and securing delivery.

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- B. Consulting Engineer's review time: In scheduling, allow at least 10 calendar days for review by the Consulting Engineer following receipt of the submittal.
- C. Delays: Delays caused by tardiness in receipt of submittals will not be an acceptable basis for extensions.

3.5 City Utility Engineer's Review

- A. General: Review by the Consulting Engineer or the Utility Engineer only ensures that construction and detailing is satisfactory and does not represent a complete check. Review shall not relieve the Contractor from responsibility for errors.
- B. Authority to proceed: The notations "No Exception Taken," "Make Corrections Noted," and others authorize the Contractor to proceed with fabrication and/or purchase of items as noted, subject to revisions, if required, by Consulting Engineer or Utility Engineer review comments.
- C. Revisions: Make all revisions required by the Consulting Engineer or the Utility Engineer. If the Contractor considers any required revisions to be a change, he shall notify the Consulting Engineer as found under "Changes" in the General Conditions. Show each drawing revision number, date, and subject in a revision block on the drawing. Make only those revisions directed or approved by the Consulting Engineer or the Utility Engineer.
- D. Revisions after approval: When a submittal has been reviewed by the Consulting Engineer, resubmittals for substitution of material or equipment will not be considered unless accompanied by an acceptable explanation of why the substitution is necessary. All substitutions require pre-approval by the Consulting Engineer and the Utility Engineer.

4.0 Measurement and Payment

No separate measurement for payment will be made for the work under this section. Its cost is considered incidental to the project.

END OF SECTION

SECTION 12: MATERIALS, EQUIPMENT AND WORKMANSHIP

1.0 General

1.1 Description

Work under this Section shall establish the general standards for quality of materials, equipment purchase, and installation and general project workmanship.

1.2 Quality Assurance

- A. All Materials: All materials and equipment supplied for a project shall be new, unused, and correctly designed for the intended application. If dated, materials shall be manufactured within the year (plus/minus) of intended installation. They shall be produced by expert workmen and intended for their designed use. Materials or equipment that, in the opinion of the Utility Engineer, are inferior or of lower grade than indicated, specified, or required will not be accepted.

Due to high elevation, ensure all material and equipment supplied meets the manufacturer's performance requirements at the project site's elevation.

Any two or more pieces of material or equipment of the same kind, type, or classification, and used in a similar way, shall be made by the same manufacturer.

Where intended for use with potable water, materials, and methods shall, in general, comply with the appropriate AWWA and NSF standards.

- B. Equipment: All equipment supplied shall comply with contract document requirements. Equipment and appurtenances shall be designed in conformity with ANS, ASME, IEEE, NEMA and all other generally accepted standards. All equipment supplied shall be of rugged construction and suitable for the intended purpose, under design operating conditions, in the location and climate where it is to be used.

Equipment shall be the approximate dimensions indicated on drawings or as specified, fit in spaces shown on drawings with adequate clearance, and be capable of being handled through openings provided in the structure for this purpose. Equipment shall be of such design that piping and electrical connections, ductwork, and auxiliary equipment can be assembled and installed without causing major revisions to the location or arrangement of any facilities.

Where applicable, all equipment shall bear a brass or stainless-steel nameplate giving manufacturer, make, model, serial number, rated capacity, head, speed, horsepower, service factor, and any other pertinent operating data.

Equipment shall be strong enough to withstand all stresses that may occur during fabrication, testing, transportation, installation, and operating conditions. All bearings and moving parts shall be adequately protected against wear by brushings or other approved means and shall be fully lubricated by readily accessible devices. Details shall be designed for appearance and utility. Protruding membranes, joints, corners, gear covers, etc., shall be finished in appearance. All exposed welds shall be ground smooth and corners of structural shapes shall be mitered.

- C. Machinery: Machinery parts shall conform exactly to the dimensions shown on the working drawings. There shall be no more fittings or adjusting in setting up a machine than is necessary in assembling a high-grade apparatus of standard design. The equivalent parts of identical machines shall be made interchangeable. All grease-

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lubricating equipment fittings shall be safeguarded in accordance with the safety codes of the ANS, applicable state and local codes, and with the U.S. Department of Labor, Part 1910 Occupational Safety and Health Standards, promulgated under the Occupational Safety and Health Act of 1980 (PL 91-596).

1.3 Product Handling and Storage

All materials and equipment incorporated in the work shall be handled and stored by the Contractor in a manner satisfactory to the Consulting Engineer and in a way that prevents damage or theft.

All materials and equipment subject to corrosive damage by the atmosphere if stored outdoors (even though covered by canvas) shall be stored in a building to prevent injury. The building may be a temporary structure on the site or elsewhere, but it must be satisfactory to the Consulting Engineer.

All material which, in the opinion of the Consulting Engineer, has become damaged enough to be unfit for the intended or specified use shall be promptly removed from the site of work, and the Contractor shall receive no compensation for the material or its removal.

All pipe and other materials delivered to the job shall be unloaded and placed in a manner that will not hamper the normal operating of existing facilities or interfere with the flow of traffic or construction progress.

2.0 Execution

General requirements for installation of equipment specified for the project are:

1. All equipment shall be installed, equipped, and serviced per the manufacturer's recommendation except as supplemented or modified by these specification requirements or as directed by the Utility Engineer.
2. All equipment shall be leveled, plumbed, aligned, and placed into position to fit connecting piping and assemblies without transmitting stress to the equipment.
3. Where applicable, equipment base frames shall be anchored to concrete pads with cast-in-place anchor bolts. Dimensions for equipment pads shall be determined by the equipment manufacturer and shall be shown on all shop drawings. The base frame shall be grouted solid.
4. All inlet and discharge piping connections to equipment shall include unions for ease of removal and repair. Wastewater from packing shall be piped directly to a drain and not allowed to discharge freely.
5. All equipment shall be greased, lubed, oiled, and in all ways properly prepared for start-up by the Contractor per the manufacturer's written recommendations. Where required by these documents, a qualified service technician shall provide the necessary start-up services.
6. Ceiling lifting hooks shall be installed above most plant equipment. All hooks shall provide a safety factor of five against failure for equipment gross weight.
7. All concrete work shall be of first-grade quality, meeting the requirements specified in these contract documents. All floors shall be free from ponding and irregularities and drain to the outlets provided.
8. The Contractor shall provide all labor, tools, equipment, and coordination necessary to provide compliance with the Contract documents for leakage, performance, quantity, thickness, efficiency, etc., of installed materials and equipment.

3.0 Measurement and Payment

There shall be no separate measurement or payment for work in this section. Its cost shall be considered incidental to the work. END OF SECTION

SECTION 20: CLEANUP

1.0 General

1.1 Description

- A. Work included: Maintain the project site in an orderly manner to the standard of cleanliness described in this section.
- B. Related work: In addition to the general standards described in this section, comply with all specific requirements for cleaning and cleanup described elsewhere in the Specifications.

1.2 Quality Control

- A. Inspection: The Contractor shall conduct regular inspections to verify that cleanliness requirements are met.
- B. Codes and standards: In addition to the standards described in this section, comply with all requirements of other agencies with jurisdiction.

2.0 Products

2.1 Cleaning Materials and Equipment

The Contractor shall provide all personnel, equipment, and materials to maintain specified cleanliness standards.

2.2 Compatibility

Use cleaning materials and equipment that is compatible with the surface, recommended by the manufacturer, and non-damaging.

3.0 Execution

3.1 Storage of Materials and Periodic Cleanup

Store all items used on the project in an orderly manner, allowing maximum access. Stored materials shall not impede drainage or traffic. Storage of materials on private property shall be by pre-agreement between the property owner and Contractor. Do not allow the accumulation of scrap, debris, waste material, and other items not required for construction on the work site. At least twice each month, and as often as necessary, collect and remove all scraps, debris, and waste material from the job site and discard in an appropriate disposal area. The site and adjacent roadway shall be cleaned daily to control any tracked mud and dirt. Store all items awaiting removal to minimize fire hazard or environmental damage.

When the Utility Engineer requires that the adjacent roadways be cleaned, the Contractor shall sweep or clean the roadways within 24 hours. If the Contractor does not clean the roadways within 24 hours, the Utility Engineer may have the City clean roadways and require the Developer/Contractor to pay for the City's costs of cleaning the roadways and sidewalks or making other improvements.

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3.2 Final Cleanup

- A. Definition: Except as otherwise specifically provided, "clean" shall be defined as the level of cleanliness generally provided by skilled cleaners using commercial quality building or site maintenance equipment and materials.
- B. General: Upon completion of the work, remove all tools, surplus materials, equipment, scraps, debris, and waste from the work site and adjacent property.
- C. Site: Unless specifically authorized otherwise by the Utility Engineer, broom clean all paved areas on or adjacent to the site that were contaminated during work. Completely remove all resulting debris. Graveled parking or driveway areas within or adjacent to the work site that have been excavated or other loose materials stockpiled on them shall be scraped or swept clean down to the original surface. Replacement of gravel materials may be required to restore the surface to its original condition. Grassed areas within or adjacent to the work site shall be scraped and raked clean to the original grass or soil level. All stones and other loose debris shall be picked up and removed. All damaged grass or sod areas shall be restored in accordance with the City of Steamboat Springs Technical Standards Section 02933 Revegetation.
- D. Timing: Schedule final cleaning and cleanup to enable the Owner to accept a clean, finished project.

4.0 Measurement and Payment

There shall be no separate measurement or payment for work in this section. Its cost shall be considered incidental to the work.

END OF SECTION

SECTION 24: TRENCHING, BEDDING AND BACKFILL

1.0 General

1.1 Description

Work included: Excavation, dewatering, preparation of the trench bottom; installation of foundation, bedding, and shading material; backfill; and disposal of waste material for the installation of pipelines, manholes, and their related appurtenances.

1.2 Quality Assurance

Reference: Standard Specifications for Road and Bridge Construction, Colorado Department of Transportation, herein called Standard Specifications. The Contractor shall conduct compaction tests as necessary to monitor the installation procedure and assure the quality of the work. Compaction testing shall be in accordance with Subsection 3.6: Field Quality Control, of this Section. Periodic compaction tests may also be performed by the Consulting Engineer. The Contractor shall assist the Consulting Engineer as necessary to complete the testing and provide a safe trench for the Consulting Engineer. All trench work shall be performed in accordance with OSHA regulations.

1.3 Submittals

Samples: Supply samples of all imported material to the Utility Engineer if requested. With the samples, include, at minimum, the plastic limit and liquid limit.

2.0 Products

2.1 Materials

A. Foundation materials

1. Imported

- a. 3/4-inch minus: Class 6 Aggregate Base Course, per Section 703 of the CDOT Standard Specifications (dry conditions only)
- b. 3/4-inch washed: Number 6 or Number 67 Coarse Aggregate for Concrete, per Section 703 of the CDOT Standard Specifications

B. Bedding and shading materials

1. Use of native bedding and shading materials is not allowed.
2. To prevent the flow of groundwater along the pipe, dams of impervious material approved by the Consulting Engineer are to be placed every 50-feet of pipe installed from the trench bottom to a height of 16 inches below finish grade, spanning the width of the trench, and a minimum length of 2-feet in the pipe laying direction. The Consulting Engineer is encouraged to identify specific locations of impervious dams on the construction drawings to promote the flow of intercepted groundwater to drainage ways and eliminate unintended surfacing of groundwater. Impervious dam locations are to be shown on construction drawings and record drawings. The City prefers clay dams over underdrains.
3. Imported bedding
 - a. 3/4-inch minus: Class 6 Aggregate Base Course, per Section 703 of the CDOT Standard Specifications (dry conditions only)

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- b. 3/4-inch washed: Number 6 or Number 67 Coarse Aggregate for Concrete, per Section 703 of the CDOT Standard Specifications
- c. 3/8-inch screened rock or Squeegee Sand, with 100 percent of the material passing a 3/8-inch screen and zero to three percent passing a No. 200 screen.

C. Backfill Materials

- 1. Native material: Shall include all material not classified as unsuitable, and material that meets the compaction and density requirements
- 2. Imported pit run: Class 3 Aggregate Base Course, per Section 703 of the CDOT Standard Specifications with the following modifications: Material to be 6-inch minus, reasonably well-graded pit or back run material. Reject sand shall not be allowed as imported pit run backfill.
- 3. Flow fill: Shall conform to Section 206.02(a) of the CDOT Standard Specifications or approved equal.

3.0 Execution

3.1 Trench Excavation

- A. General: Limit operations to the smallest area possible to minimize damage to adjacent property. If necessary, clear and grub the area to be excavated. In areas where topsoil exists, remove and salvage the topsoil for replacement. Keep topsoil segregated from other excavation materials. The maximum amount of trench open at one time shall be limited to 100-feet or such length as the Consulting Engineer considers reasonable and necessary. No trench shall be left open overnight unless specified otherwise in the Special Provisions.

A guide for desirable trench width at the top of the pipe shall be the nominal diameter of the pipe plus 12 inches on each side of the pipe. All existing utility lines and watercourses encountered shall be maintained and provided for by the Contractor without damage or nuisance to other parties.

Shoring, bracing, sheeting, other trench support methods, and trench boxes shall be used when necessary to protect the work, property, and persons. The need, appropriateness, and adequacy of all such devices shall be the responsibility of the Contractor.

- B. Alignment and Grade: The trench shall be excavated so the pipe can be installed to the alignment and grade indicated on the drawings or as specified. Under certain field conditions, the Consulting Engineer may authorize, after consultation and approval from the Utility Engineer, a water main to be installed with less than or more than the specified minimum cover. It is the Contractor's responsibility to plan far enough in advance of pipe laying operations to allow grade adjustments to be implemented to provide proper clearances when crossing existing utilities. An 18-inch minimum clearance spacing between utility line crossings, including related encasements, is required. In subdivision work, or other work requiring changes to existing grade along the centerline of a proposed pipeline, the changes shall be made to subgrade elevation prior to line installation.
- C. Dewatering: The Contractor shall provide all necessary dewatering equipment and procedures necessary for excluding and removing water from trenches and other parts of the work. The trench shall remain dry so the work may be completed efficiently, and pipes can be laid, joined, bedded, inspected, and backfilled in dewatered conditions. The pipe shall not be used to dewater the trench. No water shall be allowed to flow over or rise

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upon fresh concrete or mortar, and no water shall be allowed to enter the pipe. The water shall be disposed of by the Contractor in accordance with contract documents and applicable laws and regulations and shall not cause damage due to erosion or sediment accumulations on adjacent property. The Contractor is responsible for obtaining all necessary dewatering or discharge permits and complying with their requirements.

3.2 Foundation

- A. General: Verify that the trench bottom is sound, stable, and free from soft, loose, rocky, excessively hard or other unsuitable native material before proceeding. Per Section 4: Engineering Services, subsection II.E.2, the Consulting Engineer shall certify the trench foundation preparation to the Utility Division.
- B. Required Foundation: Install imported foundation material at all locations specifically required by the drawings or Specifications.
- C. Unsuitable Foundation: Where unsuitable foundation is encountered, over-excavate the trench bottom to the depth authorized by the Consulting Engineer and bring the foundation to grade with the appropriate imported foundation material authorized by the Consulting Engineer and compacted in 6-inch to 8-inch lifts to 90 percent of maximum dry density as determined by ASTM D 1557 (modified proctor test).

3.3 Bedding and Shading

- A. General: Holes for pipe bells shall be provided at each joint. Bell holes shall be no larger than necessary for joint assembly and assurance that the pipe barrel will lie flat on the trench bottom. Generally, 2 inches of clearance beneath the joint is desired. Push-on-type joints require minimum depressions for bell holes. In no case shall the bell support the weight of the pipe at the time of shading and backfill. Under no circumstances shall the pipe be permanently joined in the trench until the trench bottom has been fine graded to provide uniform pipe support at the required invert elevation.
- B. Required Embedment: Imported bedding and shading materials are required for all mainline pipes and appurtenances. In dry conditions, a $\frac{3}{4}$ -inch minus road base material or Squeegee shall be used. In trench conditions with excessive ground water, $\frac{3}{4}$ -inch minus washed rock may be used if approved by the Consulting Engineer.
- C. Procedures for Bedding and Shading: The following procedure shall be used for all types of pipes. Special care is required in the bedding and shading zones to assure proper filling and compaction of materials beneath pipe haunches and to avoid displacing or damaging the pipe. Bedding and shading materials shall be placed in a minimum of two lifts. The thickness of the first lift shall not exceed the pipe spring line. Following placement of the first lift, a tee bar shall be used to compact loose material under pipe haunches. Using the end of a shovel handle to compact under pipe haunches is not considered an acceptable alternative to a tee bar. Mechanical compaction may be required at the first lift and succeeding lifts for pipe diameters larger than 12 inches or where dictated by trench width. Depending on the diameter of the pipe, installation of shading materials may require a single lift or multiple lifts. Lift thickness from the spring line or top of bedding to the top of shading shall not exceed 18 inches. Bedding and shading zone materials shall be placed by hand shoveling, or by careful placement with a backhoe. Dumping or shoving excavated materials over the trench sidewall and "chipping" of soil from the top of the trench are not considered acceptable means of pipe shading. Bedding and shading zone materials shall be compacted to at least 92 percent of maximum modified proctor density. The method of compaction used by the Contractor to obtain the required density is subject to the Consulting Engineer's review. If the specified compaction is not being obtained, the Contractor is required to modify compaction procedures to meet specified requirements. This may require the use of other

types of compaction equipment or a reduction in lift sizes being compacted. Any damage to the pipe that may occur from improper compaction procedures or the use of mechanical compaction too close to the pipe shall immediately be repaired by the Contractor. If using compaction equipment that is narrower than the full trench width, the equipment shall be operated first on each side of the pipe between the edge of the pipe and the trench walls, and then centered over the pipe. Horizontal placement of bedding and shading shall extend the full trench width.

3.4 Trench Backfill

A. Unpaved areas

Backfill materials shall be placed in lifts and compacted to at least 95 percent of maximum dry density as determined by ASTM D 698 (standard proctor test), or 92 percent of maximum dry density as determined by ASTM D 1557 (modified proctor test). Salvaged topsoil shall be replaced to its approximate original depth in all open areas and areas to be revegetated.

B. Paved areas (including paved and graveled roadways, parking lots, and trails; sidewalks; curbs and gutters; and all areas under paved structures of any kind)

Backfill materials shall be placed in lifts and compacted to at least 95 percent of maximum dry density as determined by ASTM D 698 (standard proctor test), or 92 percent of maximum dry density as determined by ASTM D 1557 (modified proctor test). In instances where a trench crosses a paved public street, the upper 12 inches that lie below the pavement shall be backfilled with flow fill. In all other instances where a trench is located under a paved area, the upper 12 inches of the backfill zone that lies below road base or subbase material shall be compacted to at least 95 percent of maximum dry density as determined by ASTM D 1557, or 98 percent of maximum dry density as determined by ASTM D 698. Base course materials shall be compacted to at least 95 percent of maximum dry density as determined by ASTM D 1557. Trenches under paved areas shall, in general, be backfilled with imported material. Native backfill may be used in these areas only with prior written authorization from the Utility Engineer, which requires a submittal from the geotechnical engineer that describes and classifies the native material and a statement that the material is satisfactory for backfilling under paved areas.

C. For manholes located in gravel or paved areas

Backfill materials shall be compacted to at least 95 percent of maximum dry density as determined by ASTM D 1557, or 98 percent of maximum dry density as determined by ASTM D 698, in lifts not to exceed the recommended 6-inch to 8-inch.

D. Deviations of material moisture content

1. Excessive moisture content: The Contractor shall attempt to dry wet backfill material to a moisture content suitable for backfilling. If wet native backfill cannot be compacted to the specified requirements after reasonable drying efforts by the Contractor, the Consulting Engineer may waive the compaction requirement, or may authorize the Contractor to use imported backfill material. If the Consulting Engineer wishes to waive the compaction requirement, the Consulting Engineer must first submit written documentation to the Utility Engineer. The documentation shall explain why the compaction requirement is being waived, what processes were attempted to meet the compaction requirement, how the Contractor proposes to meet sufficient compaction, and assurances that the trench will meet all requirements for minimum settling. The Utility Division reserves the right to reject the waiving of compaction requirements. Where only the upper portion of the trench section is backfilled with imported material, the

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Contractor shall install geotextiles as authorized by the Consulting Engineer to separate the imported and native materials.

2. Insufficient moisture content: Where compaction requirements cannot be met because of insufficient moisture content, the Contractor will be required to add moisture to the material as required for proper compaction.
- E. Flooding and jetting of trenches: Flooding or jetting of trenches shall not be permitted.

3.5 Waste

It shall be the Contractor's responsibility to remove all excess materials or unsuitable materials remaining from excavation, trenching, or other work and dispose of them in compliance with all applicable laws and regulations.

3.6 Field Quality Control

- A. General: The Contractor shall be responsible for obtaining the services of a certified geotechnical engineering laboratory to perform the tests described in this section. The certified geotechnical engineering laboratory shall be owned independently of the Contractor and shall be under the direction of a licensed geotechnical engineer. The geotechnical engineering laboratory shall produce a trench backfill diagram for submittal to the Utility Division upon request for preliminary acceptance. The trench backfill diagram shall be neatly drafted and shall clearly display the location, depth, and results of all compaction tests and retests performed on the utility aspects of the project.
- B. Compaction: The degree of bedding or backfill compaction specified shall be as described in Subsection 3.4. The moisture content of bedding or backfill materials shall be within plus/minus two percent of optimum moisture content. Compaction testing shall include moisture-density relations, and density in place. If compaction testing or other visual observations indicate the possibility of inadequate compaction at a lower depth, the Consulting Engineer may require the Contractor to re-excavate to a lower depth to conduct additional testing. When requested by the Consulting Engineer, the Contractor shall proof roll the trench with a loaded front end loader or truck of sufficient size to determine if soft spots exist. If the tests indicate inadequate compaction, the Contractor shall recompact the material. In cases where there is repeated failure to achieve the required state of compaction, the Consulting Engineer may require that the backfill be removed and recompacted in 6-inch to 8-inch lifts or be replaced with imported material at the Contractor's expense. Testing frequency shall be required by the Contractor's geotechnical engineering laboratory to assure the completed work meets specifications, but shall be no less than the following:
 1. An average of one test per type of material placed per 100 linear feet of trench for every other vertical foot of material placed.
 2. Minimum compaction testing frequency around manholes, valve boxes, and other water and sewer appurtenances, as required per site-specific locations, shall be tested on all four sides. Each side shall be tested, alternating between two sides for every other vertical foot of material placed.
 3. In the event of a failing test, the material representative of the test shall be reworked and retested until a passing test is achieved and the geotechnical engineer is satisfied with the moisture and density. All failing tests and passing retests shall be reported in testing reports submitted to the Utility Engineer.
- C. Testing quality of materials: All material proposed to be imported from offsite shall be sampled and tested by the geotechnical engineer. Sampling procedures shall result in samples that are representative of the actual materials delivered to the project site.

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1. Class 6 Aggregate Base Course shall be tested for conformance with section 703.03 of the CDOT Standard Specifications.
 2. Washed rock shall be tested for gradation.
 3. Imported pit run shall be tested for AASHTO soil classification plasticity index, liquid limit, and gradation.
- D. Trench settlement:
1. General: Variations in soil type and moisture conditions and inconsistencies in compacting effort may cause settlement to occur in portions of the backfill. The specified compaction requirements shall be considered a minimum. Testing for in-place density by the Consulting Engineer during construction shall not relieve the Contractor of assuring that the trench backfill does not settle beyond the limits established below. The Contractor shall be responsible for repairing areas of excessive settlement.
 2. Measurement: Measurement of settlement shall generally take place in July or August, one winter season following completion of trench backfill.
 3. Limits: The following limits to trench backfill settlement shall apply.
 - a. Asphaltic Concrete Paved Areas: Settlement greater than ¼-inch but less than 1-1/2 inches, as measured by a 16-foot straight edge, shall be repaired by removing the asphalt to a minimum of 2-feet on either side of the settled area and replacing it with a new, thicker section of asphalt to produce a final level surface. Settlement greater than 1-1/2 inches shall require removing the asphalt and recompacting or replacing the trench backfill and gravels, at the Consulting Engineer's discretion, then applying a new asphalt surface.
 - b. Gravel Surfaces: The Contractor shall add additional compacted gravel to trenches where settlements are less than 1-1/2 inches. In cases where the settlement is greater than 1-1/2 inches, the Contractor shall be required to replace and re-compact backfill material as necessary.
 4. Warranty: The typical trench settlement warranty is two years. When settlement of trenches necessitates repair, the warranty period for the trench repairs shall be extended one year beyond the time of the repairs.

4.0 Measurement and Payment

4.1 Trench Excavation and Backfill

- A. Native materials: No measurements or separate payment will be made for excavation, backfill, or export and disposal of native materials. The cost for this work shall be included in prices bid for the item being installed, except rock excavation, which will be paid for as described below.
- B. Required foundation and embedment: No measurements or separate payment will be made for over-excavation and backfill with imported foundation or bedding and shading materials when the materials are shown or specified as part of the standard installation. The cost for this work shall be included in prices bid for the item being installed, except rock excavation, which will be paid for as described below.
- C. Imported foundation zone materials: Measurement and payment for removal of unsuitable foundation material and replacement with imported material shall be at the unit price per cubic yard measured by the length of material installed times the payment width limit

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shown on the drawings times the actual authorized thickness of material replaced under the item foundation zone by material type.

- D. Imported backfill: Measurement and payment for imported backfill shall be at the unit price per cubic yard measured by the length of material installed times the width authorized times the actual authorized thickness of material replaced under the item imported backfill. The unit price shall include the export and waste of excess or unsuitable material.
- E. Rock excavation: Measurement and payment for rock excavation shall be in addition to any payment received for other types of excavation and shall be at the unit price per cubic yard based on the quantity of material authorized for removal. The maximum payment width shall not exceed the trench payment width shown on the drawings. The maximum payment depth shall not exceed 6 inches below the pipe invert or manhole bottom. The Contractor shall notify the Consulting Engineer prior to excavating rock to allow measurements of rock to be verified. Failure to do so will result in non-payment for all rock excavated prior to the Consulting Engineer's confirming measurements.

END OF SECTION

SECTION 30: WATER DISTRIBUTION PIPING AND APPURTENANCES

1.0 General

1.1 Description

- A. Work included: Water distribution piping, valves, fittings, and other related appurtenances to include flushing, testing, and disinfecting.
- B. Related work specified elsewhere:
 - 1. Trenching, Bedding and Backfill, Section 24
 - 2. Water and Sewer Line Crossings, Section 44

1.2 Quality Assurance

- A. Installation shall be per Colorado Department of Public Health and Environment requirements and design recommendations and shall be suitable for conveying potable water under pressure.
- B. Installation of ductile iron water mains and their appurtenances shall conform to ANSI/AWWA C600.
- C. Installation of PVC water mains and their appurtenances shall conform to ANSI/AWWA C900.

1.3 Submittals and Substitutions

- A. Items listed by manufacturer name and/or model number may not be substituted unless "or equal" is specified in the description.
- B. Submittals are required for all proposed substitutions and all items not specifically listed by manufacturer name and model number. All substitutions must be approved by the Utility Division prior to installation.
- C. Submittals are required for all infrastructure materials and shall be presented to the City at least one month prior to installation.

1.4 Product Delivery, Storage, and Handling

All material shall comply with AWWA standard C600 and C900 and the following:

- D. Material shall be handled by lifting with hoists or skidding to avoid shock or damage. Slings, hooks, or pipe tongs shall be padded and used to help prevent damage to the exterior surface or internal lining of the pipe. Under no circumstances shall any materials be dropped. If materials are dropped, the City may require, at its discretion, that the materials be removed and not used on the project. Valves and hydrants shall be drained and stored in a manner that will protect them from freezing damage. The interior of all pipes, fittings, and other appurtenances shall always remain free from dirt or foreign matter.
- E. Pipe may be stacked per the manufacture recommendations but no higher than 5-feet. When distributing and moving material on the work site, the pipe placement should not interfere with access to private property, parking, or traffic. Materials shall be stockpiled as close to the installation site as feasible. It is recommended that only the pipe expected to be laid during each day be strung out along the work site.

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- F. Defective or damaged material: All such material shall be rejected and removed from the job site immediately. The City may mark the material with "X" to insure that all rejected materials are identified and removed.
- G. PVC pipe with evidence of scratching, abrasions, or fading shall be rejected as damaged.
- H. All material shall be new and never previously used. Dated materials shall be used for construction during the same year of manufacture unless otherwise approved by the City.

1.5 Job Conditions

- A. Pipe laying from November 1 through May 1 shall only occur with site-specific approval from the Utility Division. Approval shall require full-time observation by a professional engineer registered in the State of Colorado or a properly trained engineering technician under direct supervision of a professional engineer. Request for such work between November 1 and May 1 must be made in writing to the Utility Engineer and such work shall proceed only with written approval from the Utility Engineer.
- B. Excavation within a dedicated right-of-way shall not occur between November 1 and May 1. The City may also limit excavation during other times that frost is present. No backfill shall occur with material that contains frost.
- C. Water mains shall not be exposed between November 1 and May 1, except via vacuum potholing, with site-specific approval from the City.
- D. Weather: Weather protection, temporary heating, snow removal, etc., shall be the Contractor's responsibility. The method of weather protection shall be pre-approved by the City.
- E. Temperature:
 - 1. No work shall be allowed on the pipelaying portion of the project at temperatures below 20-degrees Fahrenheit or against the manufacturer's recommendations, whichever is more restrictive.
 - 2. No work shall be allowed on the pipelaying portion of the project on any day when the temperature at 10 a.m. is below 30-degrees Fahrenheit.
 - 3. A temperature below 30-degrees Fahrenheit at 10 a.m. for three consecutive days shall be grounds for shutting down the pipelaying portion of the project. Resumption of work on the pipelaying portion of the project will be allowed after three consecutive days of above 30-degrees Fahrenheit at 10 a.m., provided there is no frozen backfill or bedding material.
 - 4. The Contractor shall coordinate with the Utility Engineer when temperatures approach the conditions for shutting down pipe laying operations. The Contractor may propose and institute suitable protective measures to continue work if given written authorization by the Utility Division.

2.0 Products

2.1 Materials

- A. Ductile iron pipe (DIP): Under limited use in the City due to unfavorable soil conditions in certain areas. Refer to Map 30.1 for permissible DIP locations. PVC is required in all other areas.
 - 1. Pipe: ANSI/AWWA C151/A21.51

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2. Cement lining: ANSI/AWWA C104/A21.4
 3. Push-on or mechanical joints: ANSI/AWWA C111/A21.11
 4. Wall thickness: Class 52 unless specified otherwise for a specific application
 5. Conductivity: By serrated brass wedges (three equally spaced per joint for 2-inch through 12-inch pipe; four equally spaced per joint for larger diameter pipe).
 6. Tee bolts: Low-alloy steel (Cor Ten or equal).
- B. PVC pressure pipe: PVC pressure pipe is required in areas west of 12th Street as shown on Map 30.1 and when specified otherwise by the Utility Division.
1. Pipe: AWWA C900
 2. Wall thickness: Class 200 with a dimension ratio of 14.
 3. Joints: Shall be made using an integral bell with an elastomeric gasket push-on-type joint meeting ASTM D 3139.
- C. Fittings: Shall be mechanical joint and employ a Megalug follower gland unless specifically noted as a flange joint for a particular fitting.
1. Ductile iron and cast iron: ANSI/AWWA C110/A21.10, 250 PSI minimum pressure rating
 2. Ductile iron compact type: ANSI/AWWA C153/A21.53, 350 PSI
 3. Cement lining: ANSI/AWWA C104/A21.4
 4. Mechanical joint: ANSI/AWWA C111/A21.11
 5. Flange joint: ANSI/AWWA C 115/A21.15
 6. Swivel fitting: Per Tyler Pipe or equal
 7. Sleeves: Mechanical joint long solid sleeves
 8. Tee bolts: Cor-Ten per ASTM 242
 9. Flange bolts: Type 304 stainless steel A 193 grade B8. All bolts shall employ a washer between the flange and nut. All bolt threads and washers shall be coated with C5A copper-based anti-seize.
 10. Tapping sleeve: Shall be compatible with tapping valve. Gaskets shall be totally confined and correctly sized for the outside diameter of the pipe being tapped. Tapping sleeves shall be ductile iron, mechanical joint by flange, split tee type or 304 stainless steel full circle or split tee by flange with full body and full-face gaskets. 200 PSI minimum working pressure.
- D. Valves and appurtenances:
1. Gate valves (3 inches through 12 inches): AWWA C 515-01; non-rising stem, open left, with 2-inch operating nut, rated for 200 PSI working pressure. Waterous Series 2500 or Mueller 2360 series. Bolts to be type 304 stainless steel A 193 grade B8 with C5A anti-seize on threads. Tee bolts to be Cor-Ten per ASTM 242.
 2. Tapping valve: Per gate valves this section, Waterous 2500 or Mueller T-2360 series
 3. Butterfly valves: All valves over 12-inch-diameter AWWA C 504; short body. Manual operator, open left, replaceable seat, with 2-inch operating nut, rated for 150 PSI working pressure. Mueller Lineal or Waterous 700. Bolts to be type 304 stainless steel A 193 grade B8 with C5A anti-seize on threads.

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4. Combination air valve: All combination air and vacuum release valves shall be in accordance with AWWA C512, shop assembled, and shipped as complete units ready for field installation. The valve shall be the single-body type: APCO 145C with 2-inch inlet/outlet pipe thread.
5. Valve boxes and extensions: Valve boxes and all valve box components including lids and risers shall be Tyler Pipe or East Jordan Iron works (EJIW). For valves less than 14 inches, the boxes shall be screw-type 668S for series 8550. For valves 14 inches or larger, the boxes shall be screw-type 668S for series 8560. Due to casting differences, all parts may not be interchangeable between Tyler and EJIW. The Contractor shall be responsible for assuring compliance between all parts.
6. Valve operator nut extension: Per fire hydrant detail. All extensions will not be securely mounted to the valve (2-inch operation nut).

E. Fire hydrants and appurtenances:

1. Hydrant: Per AWWA C 502; with 6-inch mechanical joint pipe connection, automatic drain feature (drip valve), open left, 1 ½-inch pentagonal operating nut, two, 2 ½-inch NST thread hose nozzles, and a 4 ½-inch, red, NST thread steamer nozzle, with 7 ½-foot bury or other length as conditions warrant. Hydrant shall be Kennedy Guardian K81-D, Mueller Super Centurian 250 three-way, two-foot Mountain Specification with centering spider; or Waterous three-way Mountain Standard with centering spider. All buried bolts shall be type 304 stainless steel A 193 grade B8 or equal with C5A anti-seize on the threads. All hydrants on a given development shall be of the same year and within one year, plus or minus, of construction.
2. Hydrant marker: Shall be a 7-foot fire hydrant marker by BARCO (11 N. Batavia Avenue, Batavia, IL 60510, 1-800-338-2697). The marker should be attached to the back of the hydrant on the first flange immediately above the bury line.
3. Hydrant grade offsets: Made from ductile iron per AWWA C153/ANSI A21.53. A maximum of one 12-inch offset is allowed. Both ends are to be restrained.
4. Blow off hydrants: Kupferle model #77 with 2½-inch NST nozzle and 2-inch FIP inlet from the side.

F. Fire hydrant locations:

1. Locate fire hydrants within 25-feet of each street intersection, measured from the end of a street paving return. Locate fire hydrants outside street paving returns. Avoid conflicts with storm sewers, intakes, and sidewalks. Whenever possible, locate fire hydrants at the high point of the intersection.
2. Locate fire hydrants between street intersections to provide spacings of no more than 450 feet in single-family residential areas and no more than 300 feet in all other areas. Coverage radii for structures as noted below should be checked when determining hydrant placement. Vary spacings slightly to place fire hydrants on extensions of property lines. When hydrants are required between intersections, they should be located at the high point of the main for air release or at a significant low point for flushing on the downhill side of an in-line valve.
3. When street curvature or grid patterns places a proposed protected structure at an unusual distance from the fire hydrant, the coverage radius should not exceed 300 feet in single-family residential districts and 150 feet in all other districts. The City's Fire Marshall may have additional private fire protection requirements.

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4. On cul-de-sac streets, hydrants should be located at the intersection of the cul-de-sac and cross street and at the end of the cul-de-sac.
 - a. For cul-de-sacs between 300-feet and 500-feet in length, an additional hydrant should be located at the mid-block.
 - b. For cul-de-sacs greater than 500-feet in length, hydrants should be placed at near equal spacings, but not exceeding the spacings described above.
- G. Service lines and appurtenances with diameters of 2 inches or less:
 1. Service line: Shall be Type K, seamless soft copper tubing in accordance with ANSI/AWWA C904-16.
 2. Corporation stop:
 - a. $\frac{3}{4}$ -inch and 1-inch Ford FB-1000G, or Mueller B-25008.
 - b. 1 $\frac{1}{2}$ -inch and 2-inch Ford FB-1100G, or Mueller B-25028.
 3. Curb stop: Shall be Ford B-44G series or Mueller B25209 ball valve with a stop permitting a 90-degree turn only, with pack joint fittings at both ends. Inlet, outlet, and valve size shall all be identical.
 4. Couplings: Shall be Ford grip joint connections or Mueller 110 compression connections.
 5. Curb boxes: Shall have a 1-inch diameter upper shaft, 7 $\frac{1}{2}$ -foot box, arch base, plug-style lid, and stationary rod extending to within 1-foot of the surface. Where necessary, an enlarged base shall be supplied for large curb stops.
 6. Tapping saddles for DIP: Shall be cast bronze, double strap, "O" ring seal, compatible with the corporation stop. Rockwell Type 323, Ford B202, or Mueller BR2B. All service taps larger than 1-inch and all service taps in Class 50 or 51 DIP pipe shall be made using a tapping saddle.
 7. Tapping saddles for PVC C-900 pipe: Shall be a brass alloy per AWWA C800, double strap, and designed for use with C-900 pipe such as the Ford S90 and S91.
- H. Restrained joints: For ductile iron or PVC pipe, shall be the correct series of either Megalug or Uni-flange joint restraint for the type of pipe being installed. Bolts and all thread rod or tie bars shall be Cor-Ten steel per ASTM 242.
- I. Encasements and thrust blocks:
 1. Concrete: Shall be a minimum 3,000 PSI compressive strength, six sacks per cubic yard, Type II Portland cement.
 2. Reinforcing steel: Grade 40, ASTM A 615.
- J. Water marker posts: Blue utility marker with water decal 112-CW model CUM-375 CRM 307208 (72-inch length) by Carsonite International.
- K. Stub markers: New metal posts extending down to the stub and within 1-foot of the designated grade.
- L. Polyethylene encasement: Per AWWA C105. Required only when called for in special provision.

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M. Tracer wire:

1. Open trench: Tracer wire shall be #12 AWG copper-clad steel or solid copper, high-strength with a minimum 3,000-pound break load and a minimum 30-mil HDPE insulation.
2. Directional drilling/boring: Tracer wire shall be #12 AWG copper-clad steel, extra high-strength with minimum 30-mil HDPE insulation.
3. Pipe bursting/slip lining: Tracer wire shall be 7x7 stranded copper-clad steel, extreme strength with 4,700-pound break load and minimum 50-mil HDPE insulation thickness.

Approved manufacturer: Copperhead Industries, Pro Line Safety Products, or approved equal.

THHN wire is not acceptable as tracer wire. Tracer wire and test stations shall be installed with all buried main and service pipelines in the water and wastewater system for private systems. All tracer wire shall have HDPE insulation intended for direct bury, color coded per American Public Works Association (APWA) standard for water lines being marked. Wire insulation for potable water will be colored blue. Wire insulation for the lead from the grounding anode will be colored red.

4. Connectors: All mainline tracer wire must be interconnected in intersections, at mainline tees and mainline crosses. At tees, the three wires shall be joined using a single, three-way lockable connector. At crosses, the four wires shall be joined using a four-way connector. The use of two, three-way connectors with a short jumper wire between them is an acceptable alternative.
 - a. Direct-bury, wire connectors shall include three-way lockable connectors and mainline to lateral lug connectors specifically manufactured for use in underground tracer wire installation. Connectors shall be dielectric silicone filled to seal out moisture and corrosion and shall be installed to prevent any uninsulated wire exposure.
 - b. Non-locking friction fit, twist-on, or taped connectors are prohibited.
 - c. Approved manufacturers: Burndy Split Bold Connector copper to copper, square head with King Innovation Split Bolt Aqua Housing 69105, Copperhead Industries Snakebite Connector, or approved equal.
5. Termination/access: All tracer wire termination points at water service curb stops and sewer service cleanouts must utilize an approved tracer wire access box (above-ground access box or grade-level/in-ground access box as applicable), specifically manufactured for this purpose as specified below for pipeline type.
 - a. All grade level/in-ground access boxes shall be appropriately identified with "sewer" or "water" cast into the cap and be color coded.
 - b. A minimum of 2-feet of service loop wire is required in all tracer wire access boxes after meeting final elevation.
 - c. All tracer wire access boxes must include a manually interruptible conductive/connective link between the terminal(s) for the tracer wire connection and the terminal for the ground anode wire connection.
 - d. Grounding anode wire shall be connected to the identified (or bottom) terminal on all access boxes.

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6. Grounding: Tracer wire must be properly grounded at all dead ends/stubs and at all connection points to existing systems without tracer wire.
 - a. Grounding of tracer wire shall be achieved by use of a drive-in magnesium grounding anode rod with a minimum of 20-feet of #12 red HDPE, insulated, copper-clad steel or solid copper wire connected to anode (minimum 1 pound) specifically manufactured for this purpose and buried at the same elevation as the utility.
 - b. When grounding the tracer wire at dead ends/stubs, the grounding anode shall be installed in a direction 180 degrees opposite of the tracer wire, at the maximum possible distance.
 - c. Where the anode wire will be connected to a tracer wire access box, a minimum of 2-feet of service loop is required after meeting final elevation.
 - d. All service lateral tracer wire shall be a single wire, connected to the mainline tracer wire using a mainline to lateral lug connector, installed without cutting/splicing the mainline tracer wire.
 - e. When an existing tracer wire is encountered on an existing utility that is being extended or tied into, the new tracer wire and existing tracer wire shall be connected using approved splice connectors.
7. Water system: A mainline tracer wire must be installed, with all service lateral tracer wire properly connected to the mainline tracer wire to ensure full tracing/locating capabilities from a single connection point. Lay mainline tracer wire continuously, bypassing around the outside of valves and fittings on the north or east side. Water system valves shall have a tracer wire connected to the mainline tracer wire and brought up outside of the valve box and inserted into the valve box via a hole within the top 6 inches of the valve box with a minimum of 1-foot of spare wire.
 - a. Tracer wire on all water service laterals must daylight at an approved tracer wire access box, color coded blue, and located adjacent to the curb stop. A grounding anode shall be installed at the curb stop location at the depth of service.
 - b. Access box approved manufacturers: Copperhead Industries Snake-Pit or approved equal.
 - c. Hydrants: Tracer wire must terminate at an approved, above-ground tracer wire access box, installed at finished grade directly behind the hydrant. Affixing with tape or plastic ties is not acceptable. Approved manufacturer: Copperhead Cobra Access Point with hydrant flange package.
 - d. Tracer wire shall terminate at the structure being served with a buried grounding anode beneath the service line at the building foundation or other entry point. All conductive and non-conductive service lines shall include tracer wire.
8. Prohibited products and methods: The following products and methods shall not be allowed or acceptable:
 - Uninsulated tracer wire.
 - Stranded copper wire in all applications.
 - Tracer wire insulations other than HDPE.

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- Non-locking, friction fit, twist-on or taped connectors.
 - Brass or copper ground rods.
 - Wire connections utilizing taping or spray-on waterproofing.
 - Looped wire or continuous wire installations that have multiple wire laid side-by-side or in close proximity.
 - Tracer wire wrapped around the corresponding utility.
 - Brass fittings with tracer wire connection lugs.
 - Connecting tracer wire to existing conductive utilities.
9. Testing: All new mainline tracer wire installations shall be located by the Utility Division using typical low frequency (512 Hz) line tracing equipment and witnessed by the Inspector, Contractor, Consulting Engineer, and Facility Owner as applicable, prior to acceptance of ownership. This verification shall be performed upon completion of rough grading and again prior to final project acceptance.
- a. Continuity testing in lieu of actual line tracing is not allowed.
- N. Tracer wire test station: Required at all fire hydrants or other locations as specified by the Utility Engineer. Model: Glenn Test Station by VALVCO, Inc.
- 1. Approved manufacturer: Copperhead Cobra Access Point with hydrant flange package.
- O. Backflow prevention: Refer to Section 32.

3.0 Execution

3.1 Preparation

The location of all piping and other items shown on the drawings or called for in the specifications that are not definitely located by dimensions or elevations are approximate only. The exact locations and dimensions necessary for proper installation must be determined at the project site. The Contractor and Consulting Engineer shall stake the locations of pipe and appurtenances prior to installation.

3.2 Pipe Installation

- A. General: Comply with the manufacturer recommendations and ANSI/AWWA C 600 and C 900.
- 1. Polyethylene encasement shall be installed (when specifically called for in the special provisions) and on all valves, fittings, etc., as stated below when installed with C900 pipe. Installation shall be in accordance with AWWA C-105 and shall cover all DIP water main, valves, fittings, services from the main 3-feet outward, and hydrant barrels to the bury line.
 - 2. Materials shall not be dropped into the trench but lowered by hand or machine.
 - 3. Blocking under the pipe shall not be used.
 - 4. The interior of all pipes and fittings shall always be kept in clean, sanitary conditions. During pipe-laying operations, no debris, tools, clothing, or other material shall be placed in the pipe. Any foreign material found in the pipe shall be removed prior to jointing. When pipe-laying operations are not being conducted, all pipe openings are to be plugged with a water-tight plug.

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5. All lumps, blisters, and excess coal-tar coating on DIP shall be removed from the bell-and-spigot end of each pipe. The outside of the spigot and inside of the bell shall be wire-brushed, wiped clean and dry, and free from soil and grease before the pipe is laid.
 6. After placing a length of pipe in the trench, the spigot end shall be centered in the bell and the pipe forced home and brought to correct line and grade. Pipe and fittings that do not allow a uniform space for joints shall be removed and replaced with pipe and fittings of proper dimensions to insure such uniform space. Precautions shall be taken to prevent dirt from entering the joint space.
 7. The cutting of pipe for inserting valves, fittings, or closure pieces shall be done in a neat and workmanlike manner, leaving a smooth end at right angles to the pipe axis. Pipe cutting shall be done without damaging the remainder of the pipe or cement lining. The flame cutting of pipe by means of an oxyacetylene torch is not allowed. The cut end shall be beveled to allow the pipe to be joined without damage to or displacement of the rubber gasket.
 8. Wherever it is necessary to deflect the pipe from a straight line, either in the vertical or horizontal plane, the allowable amount of deflection shall be that indicated in the following section.
 9. The standard depth of cover from finished grade for water mains shall be 7-feet. All appurtenances shall be compatible with a 7-foot depth of cover if not so specified. In areas where water mains are to be installed in conjunction with road construction or overlot grading, the rough subgrade shall be constructed prior to installing water mains or service lines. Water mains and extensions shall be designed with a minimum cover unless otherwise approved by the Utility Engineer. Greater depths of cover, surface loading conditions, or unusual trench conditions may require a stronger class of pipe according to the AWWA Standard regarding the type of pipe being installed. Where a dip must be placed in a main to pass under another utility, the length of the deeper main should be kept to a minimum, and bends should be considered to affect the desired offset.
- B. Location in the street: All new water mains shall be placed on the east or north side of the street.
- C. Dead-ends should be minimized by looping mains whenever possible. Dead-ends should terminate with an approved flushing device (blowoff, hydrant, or flushing hydrant). They may terminate with an approved fire hydrant when adequate pressure is available at required flows. Unless required by the City, permanent inline shut-off valves should not be placed at the end of dead-end mains. A valve may be placed one or two pipe lengths back from the end of the project. No services should be placed past the valve. These pipes will provide sufficient support for the valve and allow a future extension to be made without impacting current water customers. If a dead-end is over 600 feet, it must be looped.
- D. Blowoffs: A blowoff or approved flushing device is required on all dead-end mains where a hydrant is not installed. The minimum riser assembly size should be no less than two diameter sizes smaller than the diameter of the water main. The flushing device should be sized to provide flows that will give a velocity of at least 2 ½-feet per second in the main being flushed. When the water main is extended, the blowoff should be removed. A new valve should be placed between the existing and extended main.
- E. Deflection or curvature:
1. PVC push-on joints: Refer to manufacturer recommendations.
 2. Ductile iron push-on joints:

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Allowable deflection per joint (unless specified differently by the manufacturer)		
Diameter (inches)	Minimum radius of curvature (feet)	Deflection in inches-per-18-foot length
4	205	16
6	205	16
8	205	16
10	205	16
12	205	16
14	340	9
16	340	9
18	340	9
18	Refer to manufacturer recommendations	

3. PVC mechanical joints: Refer to manufacturer recommendations.

4. Ductile iron mechanical joints:

Allowable deflection per joint (unless specified differently by the manufacturer)		
Diameter (inches)	Minimum radius of curvature (feet)	Deflection in inches-per-18-foot length
4	125	24
6	145	24
8	195	17
10	195	17
12	195	17
14	285	11
16	285	11
18	340	9
18 or greater	Refer to manufacturer recommendations	

F. Warning tape and electric conductivity

1. Ductile iron pipe

- a. Warning tape: Above all ductile iron mains, install a 6-inch-wide detectable aluminum foil plastic backed tape indicating a buried water line and place on top of first backfill lift above shading. The tape must be blue in color and made by Thortec or approved equal. Warning tape is optional, though recommended, over services.
- b. Electric conductivity: Install brass wedges on all push-on joints to provide electrical conductivity. Install three wedges equally spaced per joint for 12-inch and smaller diameter pipe and four equally spaced wedges for pipe larger than 12 inches in diameter.

In addition to brass wedges, tracer wire shall be attached directly on top of all DIP by taping the wire to the center of each section of pipe and the ends and center of each bend using at least one full wrap of 2-inch-wide polyethylene, pressure-sensitive tape. The wire shall be installed so there is 2 inches of flex between the wire and the pipe. Splicing of the tracer wire shall be per the manufacturer recommendation and be waterproof. Tracer wire shall be connected to existing adjacent pipeline systems so that conductivity between the new and existing infrastructure is achieved. Tracer wire shall be installed so that the pipeline is fully traceable from each test station in

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all directions. Tracer wire shall be electrically connected to each fire hydrant test station using the provided terminals. The test station shall be located immediately behind the fire hydrant, opposite the largest nozzle. On private service lines 4 inches in diameter or greater, the test station shall either be located outside of the building, accessible to the City, and immediately adjacent to the outside wall where the line enters the building or at the fire department connection.

2. PVC pipe:

- a. Warning tape: Above all PVC mains, install a 6-inch-wide detectable aluminum foil plastic backed tape indicating a buried water line and place on top of first backfill lift above shading. The tape must be blue in color and made by Thortec or approved equal. Warning tape is optional, though recommended, over services.
- b. Electric conductivity: Tracer wire shall be attached directly on top of all PVC pipe by taping the wire to the center of each section of pipe and the center of each bend using at least one full wrap of 2-inch-wide PVC tape. The wire shall be installed so there is 2 inches of flex between the wire and the pipe. Splicing of the tracer wire shall be per the manufacturer recommendation and be waterproof. Tracer wire shall be connected to existing adjacent pipeline systems so that conductivity between new and existing infrastructure is achieved. All tracer wire connections shall be waterproof. Tracer wire shall be installed so the pipeline is fully traceable from each test station in all directions. Tracer wire shall be electrically connected to each fire hydrant test station using the provided terminals. The test station shall be located immediately behind the fire hydrant, opposite the largest nozzle. On private service lines 4 inches in diameter or greater, the test station shall either be located outside of the building, accessible to the City, and immediately adjacent to the outside wall where the line enters the building or at the fire department connection. THHN wire is not acceptable for use as tracer wire.

- G. Thrust blocks: Standard for precast blocks. All plugs, caps, tees, bends, and hydrants shall be thrust blocked as required to resist vertical and horizontal reactions. Thrust blocks should be used in addition to joint restraint. The thrust blocks shall extend from the fitting, valve, or hydrant to solid, undisturbed earth. Form sides of all thrust blocks. Wrap fittings with polyethylene prior to pouring thrust blocks so that concrete does not encounter the joint bolts. Thrust blocks shall be installed so all joints are accessible. Cure concrete for a minimum of 24 hours at no less than 40 degrees Fahrenheit prior to backfilling. Do not apply internal water pressure to any section of pipe containing concrete thrust blocks until the concrete has cured for at least 48 hours. Where undisturbed trench walls are not available for thrust blocking, the Contractor shall make other provisions for added thrust restraint subject to the Utility Engineer's review and approval. All thrust blocks are to be inspected by the Utility Engineer prior to backfill.

- H. Restrained joints: Joint restraint devices shall be required for the following installations:

1. Fire hydrants
2. Reducers
3. Vertical and horizontal offsets

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4. Bends
5. Caps and plugs
6. Branch of all tees

Horizontal and vertical offsets and reducers shall be restrained one full pipe length on each side of the fitting. For all other fittings, the required length of pipe to be restrained from the precedent item is as specified in the following table:

Fitting/pipe size	4-inch	6-inch	8-inch	10-inch	12-inch
90° bend	30'	45'	60'	73'	86'
45° bend	20'	20'	20'	21'	25'
22 ½° bend	20'	20'	20'	20'	20'
11 ¼° bend	20'	20'	20'	20'	20'

I. Reinforced concrete encasements:

1. The City requires reinforced concrete encasements for pipes located at water crossings and railroad crossings. Encasements shall be constructed as shown on the standard details. Wrap the pipe and fittings with polyethylene prior to pouring concrete so that the concrete does not encounter the pipe or fittings.
2. Prior to placing the concrete, temporary supports consisting of concrete blocks or bricks shall be used to support the pipe in place. No more than two supports shall be used for each pipe length, one adjacent to the shoulder of the bell and the other near the spigot end.
3. No reinforced concrete encasements shall be poured until the Utility Engineer has inspected the pipe to be encased, the reinforcement, the supports, and the polyethylene wrap. The encasement shall cure a minimum of 24 hours at no less than 40 degrees Fahrenheit prior to backfilling.

J. Water marker posts:

1. Shall be installed at all curb stops on unconnected services. Markers shall also be installed on valve boxes and stubs for future water extensions when located in open areas not subject to vehicular traffic. The posts shall be buried 2 ½ feet and extend above grade 3 ½ feet.

K. Stub markers: Shall be installed at all water main stubs for future service. The markers shall extend from 1-foot below the finished grade down to the stub.

3.3 Location and Installation of Fire Hydrants

- A. Unless approved otherwise, fire hydrants shall be located on the fill side of the right-of-way. Fire hydrants shall be located a minimum of 15-feet from all existing and proposed structures, utility pedestals, fences, trees, bushes, boulders, etc.
- B. Hydrant locations shall be staked by the Surveyor at locations to be approved by the City and shall be in the location indicated on the approved plans. Hydrants shall stand plumb with pumper outlets facing in the direction in which a fire department vehicle will logically be located and will typically be placed a minimum of 8-feet from the edge of public street pavements. Hydrants shall be set to the established grade as staked by the Surveyor with

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- nozzles 42 inches above final grade. The hydrant bury line shall be placed at the final grade of the adjacent road shoulder, curb line, or landscaping area, as approved by the City.
- C. Each hydrant connection shall have a gate valve and valve box located on the hydrant lateral. The hydrant lateral shall be connected to the main with a swivel tee and the lateral pipe shall be 6 inches in diameter. The valve on the hydrant lateral shall be placed at the tee or as designated on the drawings.
 - D. If the water main and fire hydrant lateral is shallower or deeper than standard depth after finished grading and fill, then the appropriate fire hydrant for that depth shall be purchased and installed. Any grade adjustments requiring modifications to the fire hydrant shall only be performed in a manner pre-approved by the Utility Division. When pre-approved by the Utility Division, using cast offsets on hydrant laterals or changing the length of the operating shaft to help meet grade requirements is allowed. Only a single, 6-inch or 12-inch offset is allowed on each lateral. Both ends of the offset are to be restrained.
 - E. Hydrant drainage shall be provided by a drainage pit 2-feet in diameter and 3-feet-deep, excavated below the hydrant and filled with $\frac{3}{4}$ -inch washed rock under and around the elbow of the hydrant and to a level of 6 inches above the waste opening. A minimum of 1 cubic yard shall be provided.
 - F. A bench is required at each hydrant where necessary for access. The bench shall be as shown on the drawings and as agreed upon with the Utility Engineer based on field conditions. The bench shall have a minimum of 8 inches of road base placed on it. Compaction of the bench shall be per trench backfill and pavement removal and replacement requirements.
 - G. After installation, hydrants are to be cleaned with a coarse-surface cleaning item, primed with a DEM-KOTE or Rust-O-Leum primer, and repainted with DEM-KOTE or Rust-O-Leum federal safety red enamel finish.

3.4 Gate Valve and Box Installation

- A. Valves shall have the interior cleaned of all foreign matter and shall be inspected in opened and closed positions before installation to ensure that all parts are in working condition. A valve box shall be set so that it is centered and plumb over the valve operating nut.
- B. Grade: The Contractor is responsible for adjusting the final height of all new valve boxes and curb boxes to the specified levels or as directed by the Consulting Engineer. The valve boxes shall typically be set to the following grades:
 - 1. Paved Streets: $\frac{1}{4}$ - to $\frac{1}{2}$ - inch below grade
 - 2. Gravel roads, shoulders, and driveways: 1 to 2 inches below grade
 - 3. Areas not in road easements or affected by snow plowing operations: Set flush to grade or as agreed upon by Utility Engineer.
- C. Valve operator nut riser: Shall be provided on all valves to bring the operating nut to within 6 inches of finished grade. Set screws are not allowed on extensions.

3.5 Location Identification

All bends, tees, crosses, or other fittings shall be surveyed for the record drawings. These locations shall be tied to three visual points for future location determination.

3.6 Service Lines

All taps to existing mains shall be performed by the Utility Division. The City does not provide 3-inch taps. No service lines from a building to a curb stop or water main shall be installed until the mainline has gained preliminary acceptance from the Utility Division and a building permit has been obtained. Curb stops shall be located on the property line, within 5 feet of the property line, or on the edge of the right-of-way.

- A. Size: No service line shall be less than ¾-inch in diameter. All service lines shall conform to the current International Plumbing Code (IPC) to adequately supply the property being served.
- B. Installation of service: Water service line construction in streets or rights-of-way shall be performed in compliance with all pertinent City, County, or State ordinances or requirements, whether stated herein or not. Curb stops shall be installed so that the “open” position is perpendicular to the direction of the mainline and in line with the service line.
- C. Taps: No taps for services shall be made prior to the main being pressure tested and the Utility Engineer’s approval of all testing documentation. Make all taps to a live, pressurized main. The minimum separation between a service line tap and valves, fittings, or another service tap shall be 5 feet, unless otherwise authorized by the Utility Engineer. The distance from the bell or plain end of the pipe to the tap must be greater than three times the diameter of the pipe. Water service line taps shall be a minimum of 5 feet from a fitting of any kind. Two taps shall not be within 5 feet of each other. The water service line must be a minimum of 5 feet from a building line when running parallel to the building.
- D. Depth of Service Lines: All services shall be installed to a minimum depth of 7 feet, as measured from the top of the pipe to finished grade.
- E. Inspection: The Utility Engineer shall inspect all water services prior to backfilling and use. A minimum of 48-hours advance notice is required for inspection scheduling. In instances where a water service stub-out is being installed on a new main that has not been accepted by the City as part of new mainline infrastructure construction, the Consulting Engineer shall inspect the stub-out from the tap to the curb stop, and the Utility Engineer shall inspect the service from the curb stop to the building.
- F. Location: All service line locations are subject to review and approval by the City. Service lines shall be installed in a continuous straight line, perpendicular to the main whenever possible.

Separate trenches: All domestic water services shall be laid so that no point is nearer than 10 horizontal feet from a wastewater service line, wastewater main, building drain, any waste discharge line, or non-potable water line.

For duplex water service lines, the lines may be in the same trench but must be a minimum of 5 feet apart.

- G. Water Service Line Abandonment: For abandonment of 2-inch and smaller water service lines or stub outs, the corporation stop must be shut off at the water main and the line disconnected. For abandonment of 3-inch or larger water service lines or stub outs, a mainline shutdown must be coordinated, the curb stop valve and lateral will be removed, and a MJ flange or plug installed on the main line tee. Alternatively, a solid sleeve on the mainline is an acceptable abandonment method. All water service line abandonments must be inspected and approved by the Utility Engineer prior to backfill.

3.7 Tapping Sleeve and Valve (Live Tie)

Prior to performing a live tie, the tapping tee and valve shall pass a hydrostatic pressure test at 200 PSI for a minimum of 10 minutes. This test must be witnessed by the Utility Engineer.

The Utility Division will make the wet tap for all live ties up to 2 inches at no charge to the Contractor on Utility Division-initiated projects using materials furnished by the Contractor. The same applies to privately initiated projects, but a fee will be issued. All live ties performed by a hot tap company will require 48-hour notice for a standby operator from the Utility Division. All other live ties shall be made by a Contractor experienced and specializing in making live ties. The Contractor shall review his live tie procedures with the Utility Engineer prior to commencing the work. All utility taps require supervision by Utility Division Staff without exception.

Tapping sleeves shall be supported independently of the pipe. All tapping procedures shall be in accordance with the manufacturer recommendation. All shavings should be thoroughly flushed from the connection by means of a blow-off valve on the tapping equipment.

3.8 Disinfecting and Flushing

Permanent connections to the existing system shall not be made until authorized by the Utility Division. Looped pipelines shall be connected only at one end prior to completion and approval of the disinfection tests. Utility Division staff **must be on site to observe the installation of all permanent connections, including all cleaning and disinfection, for the full duration of the work.** The Owner or Owner's representatives may request a variance from the Utility Division allowing permanent connection to the existing system prior to all disinfection, flushing, and testing. Requests must be made in writing on a case-by-case basis.

The Utility Engineer may require the Contractor to clean and disinfect pipeline materials that have noticeable contamination prior to installation.

Disinfect the work in accordance with the procedures and requirements of the current revision of AWWA C651. Three methods of disinfecting new water mains are available, including the tablet method, continuous feed method, and slug method. If calcium hypochlorite tablets are used, they must be attached to the top of the inside of the pipe with an NSF 61-approved adhesive. Do not use excessive chlorine. Chlorine in excess of 50 mg/L after 24 hours may be grounds for rejection of the water system. Filling of the water main shall be accomplished at a water velocity less than 1-foot per second. After 24 hours, the Contractor shall test the chlorine residual. If a minimum residual of 10 mg/L is not met, the disinfecting procedure shall be repeated.

After water line disinfecting has been approved, flush the heavily chlorinated water from the mains until the chlorine residual is no higher than that generally prevailing in the system. Procedures to include dichlorination, if necessary, must be followed to prevent heavily chlorinated water from entering streams or irrigation ditches. The Utility Division shall conduct final tests to determine that chlorine and bacteriological levels are safe before the new water system is approved for domestic use. The final bacteria test must be made no sooner than 16 hours after the line was last flushed. A low chlorine test shall be taken immediately prior to the bacteria test to determine that chlorine residuals have not increased since flushing and to ensure that chemical disinfection is complete. The Contractor shall be responsible for any re-chlorination and flushing necessary to obtain safe bacteriological levels.

Several days are required to obtain the results of bacteriological tests. Coordinate the construction schedule around the requirements of bacteriological testing. The Utility Division may require passing bacteriological tests on two consecutive days.

Flushing shall ensure that sand, rocks, or other foreign materials are not left in the pipeline. The contractor shall supply the water necessary for flushing if enough water is not available from the existing water system. In such a case, the Contractor shall present his flushing program to the Utility Engineer before proceeding.

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Special care shall be taken when disinfecting and flushing sections of new mains to avoid contaminating the existing system or delivering highly chlorinated water to the system.

3.9 Backflow Prevention

A. Requirements

1. All water service connections to the City water system must be installed and maintained according to City of Steamboat Springs Water Standards and Specifications Regarding Water and Sanitary Sewer Infrastructure relating to backflow prevention and cross-connection control.
2. The installation or maintenance of any unprotected cross connection that may endanger the City's water supply is prohibited. Any such cross-connection now existing or hereafter installed is hereby declared unlawful and shall be immediately protected by a City-approved backflow assembly/method or else eliminated.
3. No provision of this section exempts a responsible party from the cross-connection control requirements for water distribution systems as otherwise required by law.

B. Inspections, testing, and repair

1. The responsible party shall have operational tests conducted on any required backflow prevention assembly or inspect any required backflow prevention method prior to receiving a certificate of occupancy and at least annually thereafter. The responsible party shall ensure that proof of such test or inspection is provided to City no later than the annual due date. These tests shall be made at the expense of the responsible party and must be performed by a certified cross-connection control technician.
2. Where the City deems necessary, the City may require operational tests at more frequent intervals. The cost for any test shall be at the responsible party's expense. A certified cross-connection control technician shall perform all tests.
3. Any required backflow prevention assembly or method shall be repaired or replaced at the expense of the responsible party whenever the assembly or method is found to be malfunctioning, defective, or is not approved by the City for the degree of hazard.
4. Records of all tests, repairs, or replacements shall be kept by the certified cross-connection control technician and the responsible party, and a copy of all such records shall be sent to City Water and Wastewater within five working days of work performance.
5. The City retains the right, at any time, to test or inspect the installation and operation of any containment or isolation assembly, device, or method, used for compliance with this section.

- C. Right of entry: Upon presentation of credentials, a representative of the City has the right to request entry, at any reasonable time, to a property served by a connection to the water system for the purpose of inspecting the property for cross connections. If such entry is refused, the representative may procure the right to enter and inspect by application to and proper orders from the City's municipal court. It shall be unlawful for any owner or occupant to refuse the representative access to a property when the representative is acting in compliance with a warrant for inspection and order issued by the City's municipal court. Refusing entry to the City representative shall be sufficient cause for the City to discontinue water service to the property.

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D. Compliance: Refer to Municipal Code

1. Service of water to any premises may also be discontinued by the Director if uncontrolled cross-connections exist on the premises, if any defect is found in an installed backflow prevention assembly, or if a backflow prevention assembly has been removed or bypassed or does not adequately protect the public health.
 - a. Service will be discontinued within 30 days of notification of a failed test or notification of an inadequate backflow prevention method and shall not be restored until such conditions or defects are corrected to the satisfaction of the Utility Engineer.

3.10 Field Quality Control

A. General

1. Conduct pressure and leakage tests in accordance with ANSI/AWWA C600.
2. Schedule with the Utility Engineer at least 48 hours in advance of conducting tests so they may attend the test.
3. Test completed sections of pipeline as soon as is practical after installation. No more than 1,000 feet of pipeline or 10 percent of the total pipeline, whichever is greater, shall be installed without testing completed portions.
4. All valves shall operate smoothly on opening and closing. All boxes shall be centered, plumb, and to the specified grades.
5. Joints that cannot be pressure tested, such as tie-in points, shall be visually inspected for leaks by the Utility Engineer while the joints are charged under static pressure. The Contractor must fully expose these joints for inspection.
6. Pressure testing against existing valves is strongly discouraged. The Utility Division does not guarantee the condition of any existing valves.

B. Pressure Test

1. General: After concrete thrust blocks have cured for a minimum of 48 hours, all newly laid pipe or any valved section shall be subjected to a hydrostatic pressure of 200 PSI for mains 12 inches in diameter or less and 150 PSI for mains greater than 12 inches in diameter. Pressure tests will only be allowed after the main has passed all disinfection and bacteriological tests.
2. Test pressure restrictions
 - a. Do not exceed pipe or thrust-restraint design pressures.
 - b. The test shall last at least two hours.
 - c. Pressure shall not vary by more than 5 PSI for the duration of the test.
 - d. Do not exceed twice the rated pressure (200 PSI for 12-inch diameter or less and 150 PSI for greater than 12-inch diameter) of the valves or hydrants when the pressure boundary of the test section includes closed solid wedge gate valves or hydrants. Note: Valves shall not be operated in either direction at differential pressure exceeding the rated pressure.
 - e. Do not exceed the rated pressure of the valves when the pressure boundary of the test section includes closed resilient-seated gate valves (200 PSI) or butterfly valves (150 PSI).

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3. Pressurization: Each valved section of pipe shall be filled with water slowly to the specified test pressure; based on the elevation of the lowest point of the line or section under test and corrected to the elevation of the test gauge, shall be applied by means of a pump connected to the pipe in a manner satisfactory to the Utility Engineer. The test pump must be clean and used with potable water only. Valves shall not be operated in either the opening or closing direction at differential pressures above the rated pressure. It is good practice to allow the system to stabilize at the test pressure before conducting the leakage test.
4. Air removal: Before applying the specified test pressure, air shall be expelled completely from the pipe, valves, and hydrant. If permanent air vents are not located at all high points, the Contractor shall install corporation cocks at such points so that the air can be expelled as the line is filled with water. After all the air has been expelled, the corporation cocks shall be closed, and the test pressure applied. At the conclusion of the pressure test, the corporation cocks shall be removed and plugged or left in place, at the discretion of the Utility Engineer.
5. Examination: Any pipe, fittings, valves, hydrants, and joints shall be examined carefully during the test. Any damaged or defective pipe, fittings, valves, or hydrants that are discovered following the pressure test shall be repaired or replaced with sound material, and the test shall be repeated until it is satisfactory to the Utility Engineer.

C. Leakage test: Shall be conducted concurrently with the pressure test.

1. Leakage defined: Leakage shall be defined as the quantity of water that must be supplied into the newly laid pipe, or any valved section thereof, to maintain pressure within 5 PSI of the specified test pressure after the air in the pipeline has been expelled and the pipe has been filled with water. Leakage shall not be measured by a drop in pressure in a test section over a period.
2. Allowable leakage for ductile iron and PVC mains: No pipe installation will be accepted if the leakage is greater than that determined by the following formula:

$$L = (SD) * \text{SQRT}(P) / 133200$$

- L is the allowable leakage, in gallons per hour
- S is the length of pipe tested, in feet
- D is the nominal diameter of the pipe, in inches
- P is the average test pressure during leakage test, in pounds per square inch gage

This formulae are based on allowable leakage of 11.65 GPD, per mile, per inch nominal diameter at a pressure of 150 PSI.

When hydrants are in the test section, the test shall be made against the closed hydrant.

- D. Service line testing: No service lines shall be tapped to the main prior to passing all tests. Once a portion of main has been passed, service line taps may be made, and service lines stubbed out to the property line. Following completion of service line installation, but prior to backfill, all services are to be inspected from the main to the curb stop. This is to be done by pressurizing the service to system static pressure. The test pressure shall be maintained for at least 15 minutes while the Utility Engineer inspects the line and fittings for leaks or other defects. The City shall perform service line inspection from the curb stop to the building.

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- E. Conductivity: The Utility Engineer may require the Contractor to verify the electrical conductivity of new mains. The method of verification shall be at the Utility Engineer's discretion.
- F. Corrosive soil: Water mains should be adequately protected from corrosive soil environments. Comply with AWWA C105. Complete soil testing or check with the Utility Engineer to determine if corrosive soils are present within the project area. If so, include polyethylene encasement for DIP, valves, and fittings or use of other nonmetallic pipe materials. If nonmetallic materials are used, provide polyethylene encasement for fittings and valves. In severe instances, cathodic protection may be required.

4.0 Measurement and Payment

4.1 Water Mains

- A. Water mains: Will be measured and paid for at the unit price per linear foot under the item "water main" per pipe size and class. The total length of the water main will be measured horizontally along the centerline of the pipe and will include the length of all fittings and valves. Where the pipe enters a building or a casing pipe, the limit of measurement shall be the outside face of the building or casing pipe. The price includes installations up to and including 9 feet in depth measured from the top of the pipe to finished grade.
- B. Overdepth water main: The additional cost for overdepth installation (greater than 9 feet in depth measured from the top of the pipe to the finished grade) of the water main to include related appurtenances such as valve or hydrant extensions will be measured and paid for at the unit price per linear foot (measured horizontally as in the water mains section above) under the item "overdepth water main" per overdepth range, regardless of pipe size.
- C. Valves and valve appurtenances: Shall be measured and paid for at the unit price per each under the appropriate valve item based on type and size and shall include the valve, valve box, and appurtenances.
- D. Tapping sleeve and valve: Shall be measured and paid for at the unit price per each under the tapping sleeve and valve item based on size and shall include the tapping sleeve, valve, valve box, and appurtenances.
- E. Fittings: Shall be measured and paid for per the unit price per each under the appropriate fittings item based on size and type. Fittings not specifically listed will be paid for by change order.
- F. Dry ties: The additional cost of completing a dry tie (system shut-down allowed) above and beyond the cost for other unit price items shall be measured and paid for at the lump sum price per the appropriate dry tie item.
- G. Fire hydrant and appurtenances: Shall be measured and paid for at the unit price per each under the hydrant item and will include all appurtenances, lateral extensions, and the hydrant bench complete with all excavation, fill, compaction, and gravel required.
- H. Air release valve and vault: Shall be measured and paid for at the lump sum price under the "air release valve" item and shall include all materials and work detailed on the drawings.
- I. Reinforced concrete encasement: Shall be measured and paid for at the unit price per linear foot measured along the centerline of pipe per the reinforced concrete encasement item per pipe size.
- J. Service lines: Shall be measured and paid for at the unit price per linear foot under the "service line" item based upon size regardless of depth. The length shall be measured

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horizontally along the centerline of the pipe through all fittings from the centerline of the water main to the end of the new service. No additional payment will be made for curb stop boxes or couplings necessary to connect to existing services; their cost shall be included in other items.

- K. Service line taps: To the water main shall be measured and paid for at the unit price per the "corporation stop" item or "corporation stop with tapping saddle" item based on size.

4.2 General

Unit prices for the above items shall include the cost of maintaining existing water supply, trench excavation, backfill, trench support system, bedding and shading, gravel, or other imported material where specifically required, markers, thrust blocks, restrained joints, dewatering, testing and inspection, flushing and disinfection, and the cost of all materials, equipment, tools, and labor incidental to or necessary for completion of work.

4.3 Testing

No extra payment will be made for testing, including but not limited to all necessary work and equipment, temporary plugs, temporary blow-offs, taps, restraints, and testing equipment. The cost for this work is considered incidental and should be included in other bid items.

4.4 Limitations

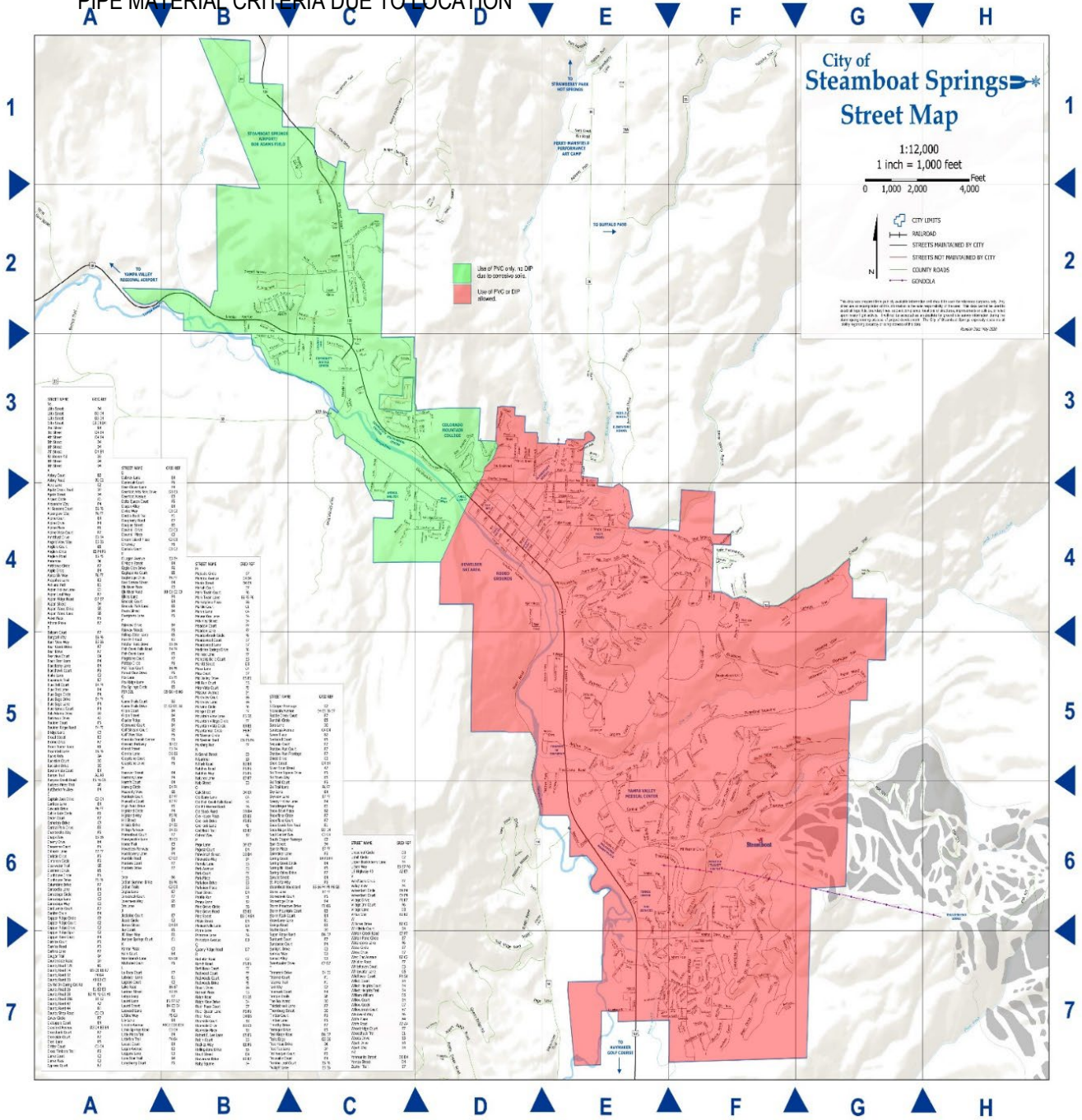
Payment to exceed 85 percent of the contract price for water line installation shall not be made until testing, disinfection, and flushing is satisfactorily completed.

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MAP 30.1

PIPE MATERIAL CRITERIA DUE TO LOCATION



END OF SECTION

SECTION 32: BACKFLOW PREVENTION ASSEMBLIES

1.0 General

1.1 Compliance. Refer To Municipal Code

- L. Service of water to any premises may be discontinued by the Utility Engineer if uncontrolled cross-connections exist on the premises, if any defect is found in an installed backflow prevention assembly, or if a backflow prevention assembly has been removed, bypassed, or does not adequately protect public health.
- M. Service will be discontinued within seven days of notification of a failed test or notification of an inadequate backflow prevention method and shall not be restored until such conditions or defects are corrected to the satisfaction of the Utility Engineer.

1.2 Backflow Prevention Requirements

Fire service lines without chemical feed systems require at least double-checking backflow assembly. All other fire lines, commercial, multi-family, and master-metered, single-family residential water service lines require a reduced pressure backflow assembly as required by Steamboat Springs Utility Engineering. Backflow prevention shall be designed and installed per Colorado Primary Drinking Water Regulation 11.39. Building plans must be submitted, approved, and permitted through the County Bid Department and will be reviewed by the City of Steamboat Springs Utility Division.

Plans must show, at a minimum:

- Water service type, size, and location.
- Backflow prevention assembly manufacturer, size, type, and location.
- Adequate drainage as needed if installed inside.
- Thermal expansion tank as required by code.
- Fire sprinkling system(s) service line, size, and type of backflow prevention assembly, if applicable.
- Irrigation system(s) service line, size, and type of backflow prevention assembly. If it becomes necessary to install a booster pump on the water service line to any consumer's premises due to low pressure or special operating conditions, such service lines shall be protected by the installation of an approved air-gap separation or an approved reduced pressure principal assembly.

1.3 Requirements

- A. All water service connections to the City water system must be installed and maintained in accordance with City of Steamboat Springs Water Standards and Specifications relating to backflow prevention and cross-connection control.
- B. The installation or maintenance of any unprotected cross connection which may endanger the water supply of the City is prohibited. Any such cross-connection now existing or hereafter installed is hereby declared unlawful and shall be immediately protected by a City-approved backflow assembly method or eliminated.
- C. No provision of this section exempts the responsible party from the cross-connection control requirements for water distribution systems as otherwise required by law.

1.4 Ownership

All costs for design, installation, maintenance, repair, and testing are to be borne by the Owner or the party billed for water service. The testing shall be conducted by a certified cross-connection control

technician.

1.5 Existing Installations

Backflow preventers currently installed, which are not approved, shall be replaced with an approved backflow prevention assembly when they fail an operational test or if the assembly is determined to be non-testable or no longer approved for the degree of hazard. No grandfather clauses exist. All laws and regulations apply regardless of the facility's age.

1.6 Approved Backflow Prevention Assemblies

Any backflow prevention assembly required herein shall be of a model and size approved by Steamboat Springs Utility Division. The term "approved backflow prevention assembly" shall mean an assembly manufactured in full conformance with the standards established by the latest version of the Colorado Cross-Connection Control Manual, the EPA Cross Connection Control Manual, the 10th Edition of the USC Foundation Cross Connection Control and Hydraulic Research Manual, and/or by the Steamboat Springs Utility Division. A single check valve is not considered an approved backflow prevention assembly.

1.7 Residential Services

Backflow prevention in single-family detached and single-family attached buildings as defined by CDPHE regulation for water service must be accomplished with an assembly approved by the American Society of Sanitary and Mechanical Engineers and designated by Steamboat Springs Utility Division.

2.0 Irrigation Systems

2.1 Airgaps and Reduced Pressure Zone Assemblies

Irrigation and lawn sprinkling systems connected to an irrigation or commercial meter, as classified by Steamboat Springs Utility Division, shall be separated from the public potable water system by an approved air-gap separation or an approved reduced pressure zone assembly.

2.2 Pressure Vacuum Breakers

All residential irrigation and lawn sprinkling systems must, at minimum, provide a pressure vacuum breaker. In residential irrigation and lawn sprinkling systems not incorporating the use of an injection system or booster pump(s), a pressure vacuum breaker assembly may be used. Irrigation and lawn sprinkling systems having quick-coupling valves or other similar type heads permitting pressure to be retained in the system shall have a pressure vacuum breaker assembly installed on the system. Irrigation and lawn sprinkling systems using the subsurface drip method shall also have a pressure vacuum breaker assembly installed on the system.

3.0 Fire Suppression Systems

3.1 Requirements

All fire lines supporting a fire sprinkler system shall require an approved reduced pressure backflow prevention assembly or an approved double check backflow prevention assembly as required by the Steamboat Springs Utility Division. Installation of a backflow prevention assembly can reduce the required operating pressure of the overall fire sprinkler system flow requirements. An evaluation of this potential effect must be evaluated by a qualified sprinkler contractor and submitted to a City of Steamboat Springs Life Safety representative within the Building Division for review and approval prior to installation. Backflow assemblies used on fire lines shall be listed by the National Fire

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Protection Association and/or UL-approved. All glycol (ethylene or propylene) or antifreeze systems shall have an approved reduced pressure zone assembly for containment upstream of the point of use. Dry fire systems shall have an approved double check valve installed upstream of the air pressure valve. Single-family residences with a combined domestic water and fire sprinkler system shall have a double check valve when no chemicals are used.

4.0 Installation

4.1 Location And Design

Approved backflow prevention assemblies shall be installed in an accessible location to facilitate maintenance, testing, and repair. Building plans must show the location of the backflow prevention assembly. Critical facilities may require redundant systems. Backflow prevention assemblies shall be installed downstream of the water meter before any other tee or branch. In no case shall it be permissible to have any connections or tees between the meter and service line backflow prevention assembly. Backflow prevention valves shall not be used as the inlet or outlet valve of the water meter. Test cocks shall not be used as supply connections. Approved backflow prevention assemblies shall be installed without any bypass, unless the bypass line is also protected by an approved backflow prevention assembly providing an equivalent degree of protection. All backflow assemblies shall be installed in the horizontal position.

Vertical installations shall be acceptable when approved by University of Southern California Foundation for Cross Connection Control and Hydraulic Research and/or ASSE Specifications. Variances may be granted by review. Proper drainage should be provided for the relief valve and may be piped away from the location provided it is readily visible from above grade and provided the relief valve is separated from the drain line by a minimum of double the diameter of the supply line. Freezing is a major problem in this area. Precautions shall be taken to protect above ground outdoor installations. All assemblies must be on the approved list from one of the following organizations:

- American Society of Sanitary Engineering (ASSE), 901 Canterbury, Suite A, Westlake, OH 44145
- USC Foundation for Cross-Connection Control and Hydraulic Research, University of Southern California, KAP-200 University Park MC-2531, Los Angeles, CA 90089-2531

4.2 Basement Installations

Basement installations are allowed providing the following conditions are met:

- Installation of a drain large enough to allow the maximum flow of discharged under twice the normal static water pressure for the assembly, and the installation of a high-water alarm system. Electrical systems and/or components shall not be installed in the same general area.
- The relief valve opening shall never have a water level under the assembly reach within a vertical distance of 12 inches of the relief valve discharge port, which shall be directed down.
- The relief valve discharge port on a reduced pressure principal assembly shall not be connected to any sump or sanitary sewer.
- Only factory-supplied funnels shall be used to remove the periodic discharge from the assembly. The piping system must have an approved airgap at the termination of the run.

4.3 Pressure Vacuum Breakers

Pressure vacuum breakers shall be used only where the assembly is never subjected to back pressure and shall be installed a minimum of 12 inches above the highest piping or outlet downstream of the assembly in a manner to preclude back pressure.

4.4 Atmospheric Vacuum Breakers

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Atmospheric vacuum breakers shall be used only where the assembly is installed as an isolation assembly and is never subject to more than 12 hours of continuous back pressure. Atmospheric vacuum breakers shall be installed with the air inlet in a level position and a minimum of 6 inches above the highest piping or outlet it is protecting.

4.5 Double Check Valve Assemblies

Double check valve assemblies may not be installed in below-grade vaults but shall be placed in above-ground vaults designed to prevent the assembly from freezing. Double check valve assemblies may only be installed on dry fire systems and shall not be utilized for chemical feed fire suppression systems unless the chemical feed itself is protected by a reduced pressure backflow device. Adequate clearance shall be provided for testing, drainage, flushing, and repairs.

4.6 Reduced Pressure Backflow Preventers

Reduced pressure backflow preventers shall be installed above ground. The unit should be placed at least 12 inches above finish grade to allow clearance for repair work. A concrete slab at finish grade is recommended. Reduced pressure zone assemblies shall not be installed in any below-grade pit or vault.

4.7 Waterline Flushing

Before installing an approved backflow prevention assembly, pipelines must be thoroughly flushed to remove foreign material.

5.0 Inspections, Testing, And Repair

5.1 Testing Requirements

Backflow prevention assemblies must be tested at the time of installation, repair, or replacement, and on an annual basis. All testing equipment used in the testing of backflow prevention assemblies shall be checked for accuracy at least yearly and proof of compliance shall be submitted to Steamboat Springs Utility Division annually, or upon request. Steamboat Springs Utility Division retains the right to check the installation and operation of any containment assembly at any time to ensure proper operation. Backflow prevention assemblies shall be returned to service by the technician at the completion of the test.

The responsible party shall have operational tests conducted on any required backflow prevention assembly or inspect any required backflow prevention method prior to receiving a certificate of occupancy and at least annually thereafter. The responsible party shall ensure that proof of such test or inspection is provided to the City no later than the annual due date.

Where the City deems necessary, it may require operational tests at more frequent intervals. The cost for any test shall be at the responsible party's expense.

Any required backflow prevention assembly or method shall be repaired or replaced at the expense of the responsible party whenever the assembly or method is malfunctioning, defective, or is not approved by the City for the degree of hazard.

5.2 Reporting, Record-Keeping Duties, And Requirements

The certified cross-connection control technician shall submit test results to the Utility Division prior to the annual test due date, and within five working days of following the completion of the test or maintenance of the assembly. The certified cross-connection control technician shall also attach a tag to the backflow prevention assembly following each test or maintenance activity to document and date the activities performed. Records of all tests or maintenance activities, including materials and parts changed, shall be kept by the certified cross-connection control technician, the property owner, and

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Utility Division for a period of not less than three years.

Records of all tests, repairs, or replacements shall be kept by the certified cross-connection control technician and the responsible party, and a copy of all such records shall be sent to the Utility Division within five working days.

5.3 Right of Entry

The City retains the right, at any time, to test or inspect the installation and operation of any containment or isolation assembly, device, or method used for compliance with this section.

Upon presentation of credentials, a City representative may request entry, at any reasonable time, to a property served by a connection to the water system for the purpose of inspecting the property for cross connections. If such entry is refused, the representative may procure the right to enter and inspect by application to and proper orders from the City's Municipal Court. It shall be unlawful for any owner or occupant to refuse to allow the representative access to a property when the representative is acting in compliance with a warrant for inspection and order issued by the City's Municipal Court. Refusing entry to the City representative shall be sufficient cause for the City to discontinue water service to the property.

END OF SECTION

SECTION 40: WASTEWATER COLLECTION PIPING AND APPURTENANCES

1.0 General

1.1 Description

- A. Work included: Wastewater collection mainlines, laterals, services, and other related appurtenances to include flushing and testing.
- B. Related work specified elsewhere:
 - 1. Trenching, Bedding, and Backfill: Section 24
 - 2. Water and Sewer Line Crossings: Section 44
 - 3. Sewer Design Form: Appendix C

1.2 Quality Assurance

Installation shall be per Colorado Department of Public Health and Environment requirements and design recommendations.

1.3 Submittals and Substitutions

- A. Items listed by manufacturer name and/or model number may not be substituted unless "or equal" is specified in the description.
- B. Submittals are required for all proposed substitutions and all items not specifically listed by manufacturer name and model number. All proposed substitutions must be approved by the Utility Division prior to installation.
- C. Submittals are required for all infrastructure materials prior to installation. Submittals shall be presented to the City at least one month prior to installation for the necessary review time.

1.4 Product Delivery, Storage, And Handling

- A. All material: Material shall be handled by lifting with hoists or skidding to avoid shock or damage. Slings, hooks, or pipe tongs shall be padded and used to prevent damage to the exterior surface or internal lining of the pipe. Under no circumstances shall any materials be dropped. If materials are dropped, the City may require, at its discretion, that the materials be removed and not used on the project. Extra care shall be taken when the temperature approaches or is below freezing.
- B. Pipe may be stacked per the manufacturer recommendations no higher than 5 feet. When distributing and moving material on the work site, the pipe placements should not interfere with access to private property, parking, or traffic. Materials shall be stockpiled as close to the installation site as feasible. It is recommended that only the pipe expected to be laid during each day be strung out along the work site.
- C. Defective or damaged material: All such material shall be rejected and removed from the job site immediately. The City may mark the material with an "X" to ensure that all rejected materials are identified and removed.
- D. PVC pipe with evidence of scratching, abrasions, or fading shall be rejected as damaged.
- E. All material shall be new and never previously used. Dated materials shall be used for construction during the same year it was manufacture unless otherwise approved by the City.

1.5 Job Conditions

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- A. Pipe laying from November 1 through May 1, when the average frost depth is 36 inches deep, shall only occur with site-specific approval from the Utility Engineer. Approval shall require full-time observation by a professional engineer registered in the State of Colorado or a properly trained engineering technician under direct supervision of a professional engineer. Request for such work between November 1 and May 1 must be made in writing to the Utility Division and such work shall proceed only with written approval from the Utility Division.
- B. Excavation within a dedicated right-of-way shall not occur between November 1 and April 30.
- C. Wastewater mains shall not be exposed between November 1 and May 1, except via vacuum potholing with site-specific approval from the City.
- D. Weather: Weather protection, temporary heating, snow removal, etc., shall be the Contractor's responsibility. The method of weather protection shall be pre-approved by the City.
- E. Temperature:
 - 1. No work shall be allowed on the pipelaying portion of the project at temperatures below 20-degrees Fahrenheit or against manufacturer recommendations, whichever is more restrictive.
 - 2. No work shall be allowed on the pipelaying portion of the project on any day when the temperature at 10 a.m. is below 30-degrees Fahrenheit.
 - 3. A temperature below 30-degrees Fahrenheit at 10 a.m. for three consecutive days shall be grounds for shutting down the pipelaying portion of the project. Resumption of work on the pipelaying portion of the project will be allowed after three consecutive days of above 30-degrees Fahrenheit at 10 a.m., provided there is no frozen backfill or bedding material.
 - 4. The Contractor shall coordinate with the Utility Engineer when temperatures approach the conditions for shutting down pipe laying operations. The Contractor may propose and institute suitable protective measures to continue work if given written authorization by the Utility Division.

2.0 Products

2.1 Materials

- A. Polyvinyl chloride (PVC) pipe and fittings:
 - 1. Service lines with a 4-inch-to-8-inch inside diameter: ASTM D 3034, SDR35
 - 2. Mainlines:
 - 4-inch-to-15-inch inside diameter: ASTM D 3034, SDR35
 - 18-inch-to-27-inch inside diameter: ASTM F 679, wall thickness T-1
 - 3. Joints: ASTM D 3212, rubber gasketed bell-and-spigot-type with integral bell
- B. DIP is limited in City use due to unfavorable soil conditions in certain areas:
 - 1. Pipe: ANSI A21.51
 - 2. Cement lining: ANSI A21.4
 - 3. Push-on or mechanical joints: ANSI A21.11
 - 4. Wall thickness: Class 50 minimum

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5. DIP use limited to river crossings
- C. Saddles: 4-inch or 6-inch in diameter service line connections to existing mains shall be a gasketed wye, with centering ring and stainless-steel straps, specifically made for the size and type of main being tapped. A submittal is required. Solvent weld-type saddles are not acceptable.
- D. Cleanouts:
 1. Pipe and fittings: Shall be the same as the wastewater line
 2. Cover: Neenah #R-1970 or approved equal
- E. Encasements:
 1. Concrete: Shall be a minimum 3,000 PSI compressive strength, six sacks per cubic yard, Type II Portland cement
 2. Reinforcing steel: Grade 40, ASTM A 615
- F. Couplings: For connecting two plain ends of equal or different pipe material, couplings shall be Romac-style LSS sewer clamp couplings or gasketed joint PVC double-bell repair couplings. For service lines 4 inches in diameter, Shear Guard couplings or approved equal may be used. For connecting schedule 40 pipe to ASTM 3034 pipe, a gasketed joint PVC bell by spigot-type coupling shall be used.
- G. Wastewater marker posts: Green Carsonite utility marker with sewer decal 107-CS model CUM-375 CRM 3072-07 (72-inch length) by Carsonite International
- H. Stub markers: New metal posts extending down to the stub and up to within 1-foot of the designated grade

3.0 Execution

3.1 Pipe Installation

- A. General: Pipe placement shall conform to the manufacturer's recommendations. Materials shall not be dropped into the trench but shall be lowered by either hand or machine. Pipe laying shall proceed upgrade with the spigot ends of bell-and-spigot pipe pointing in the direction of flow. The entire surface of all pipes shall be clean when laid. Interior surfaces of pipe sockets shall be cleaned prior to piping connection. No debris, tools, clothing, or other material shall be placed in the pipe. When pipe-laying operations are not being conducted or are temporarily suspended, all pipe openings shall be plugged with an appropriate size wastewater plug. Pipes without a good fit shall be removed from the job site. Field-cut sections of pipe shall only be used for making connections to manholes, other structures, or existing pipelines when make-up piping is needed to make the closure. Each pipe shall be laid true to line and grade to form a close concentric joint with the adjoining pipe and to prevent sudden offsets to the flow line. Pipe grade shall be uniform between manholes. No pipes shall be placed in the trench or no final joints shall be made until unstable trench bottoms have been stabilized and fine grading of the trench bottom to accommodate the pipe invert has been completed. Immediate partial backfill may be required to prevent accidental deflection of the pipe. State health regulations require that wastewater mains and service lines be installed at a 10-foot minimum clear horizontal distance from potable water mains and services. If this separation cannot be maintained, consult with the Consulting Engineer for any special precautions that may be required. When authorized to connect new pipe to an existing plain-end pipe, use an approved coupling tightened to a watertight fit.

- B. Plain or reinforced concrete encasements: Shall be constructed as shown on the drawings or described elsewhere in the Specifications. Wrap pipe and fittings with polyethylene prior to pouring concrete so that concrete does not encounter the pipe or fittings. Prior to placing concrete, temporary supports consisting of concrete blocks or bricks shall be used to support the pipe in place. Supports shall be used for each pipe length, according to the manufacturer's recommendations. No encasements shall be poured until the Utility Engineer has inspected the pipe to be encased, the reinforcement, the supports, and the polyethylene wrap. The encasement shall cure a minimum of 24 hours at no less than 40 degrees Fahrenheit prior to backfilling.

3.2 Tracer Wire

3.2.1 Materials

A. General

Tracer wire shall be installed with all buried main and service pipelines in the water and wastewater system, including private systems over 4 inches in diameter. The applicant shall submit plans through the development review process that include a complete tracer wire system for all water and wastewater projects.

All tracer wire shall have HDPE insulation intended for direct bury, color coded per the APWA standard for the specific utility being marked. Wire insulation for wastewater will be colored **green**. Wire insulation for the lead from the grounding anode will be colored **red**.

1. Open trench: Tracer wire shall be #12 AWG copper-clad steel, or solid copper, high strength with minimum 300-pound break load, with minimum 30 mil HDPE insulation thickness.
2. Directional drilling/boring: Tracer wire shall be #12 AWG copper-clad steel, extra high strength with minimum 1,150-pound break load, with minimum 30 mil HDPE insulation thickness.
3. Pipe bursting/slip lining: Tracer wire shall be 7x7 stranded copper-clad steel, extreme strength with 4,700-pound break load, with minimum 50 mil HDPE insulation thickness.
4. Approved manufacturer: Copperhead Industries, Pro Line Safety Products, or approved equal.

B. Installation

Tracer wire shall be installed on the top half of the pipe and secured at the center and ends of the pipe and be properly grounded as specified.

Tracer wire shall be installed to allow the proper locating of a wire without the loss or deterioration of low frequency (512 Hz) signals for distances exceeding 1,000 linear feet, proper access for the connection of line tracing equipment, and without distortion of the signal that can be caused by multiple wires being installed within close proximity. Except where approved connectors are used, tracer wire systems shall be installed as an unbroken continuous wire with no looping or coiling of wire.

If any damage occurs during installation of tracer wire, it must be immediately repaired by removing and replacing the damaged section with new wire and approved connectors. Spray coating and taping are prohibited.

At dead-ends for all wastewater mainlines and service line cleanouts closest to the property being served, tracer wire shall go to ground using an approved connection to a drive-in magnesium grounding anode rod, buried at the same depth as the service. (See Grounding)

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If no mainline tracer wire exists at a connection point, then mainline tracer wire shall not be connected to existing conductive pipes. Instead, treat as a mainline dead end, grounding using an approved waterproof connection to a grounding anode buried at the same depth as the main.

All service lateral tracer wire shall be a single wire, connected to the mainline tracer wire using a mainline to lateral lug connector, installed without cutting or splicing the mainline tracer wire.

When an existing tracer wire is encountered on a utility being extended or tied into, the new tracer wire and existing tracer wire shall be connected using approved splice connectors.

3.2.2 Sanitary Sewer System

A mainline tracer wire must be installed with all service lateral tracer wire properly connected to the mainline tracer wire to ensure full tracing/locating capabilities from a single connection point.

Lay mainline tracer wire continuously, by-passing the outside of manholes/structures on the north or east side. Manholes/structures shall have a locating wire connected to the mainline tracer wire and brought up the outside of the structure and installed through a notch cut at the top of the precast cone section, beneath the lid, protected with Ram-Nek material. Wire shall be left with a minimum of 2 feet of service loop.

A grounding anode shall be installed at all dead-end mainline manholes. The mainline tracer wire and the grounding anode lead wire shall be installed up the manhole barrel section. Access to the wire will be provided by cutting a small notch in the top of the manhole cone section and protecting the wire with Ram-Nek material. A minimum of 2 feet of service loop will be provided in each manhole.

Tracer wire on all sewer service laterals must terminate at an approved tracer wire access box that is color coded green and located directly adjacent to the sewer service cleanout closest to the structure. A grounding anode shall be installed beneath the cleanout at the depth of service.

Access Box Approved Manufacturer: Copperhead Industries Snake-Pit or approved equal.

Tracer wire shall terminate at the structure being served with a buried grounding anode beneath the service line at the building foundation or other entry point.

All conductive and non-conductive service lines shall include tracer wire.

3.2.3 Prohibited Products and Methods

The following products and methods are not allowed or acceptable:

- Uninsulated tracer wire
- Stranded copper wire in all applications
- Tracer wire insulations other than HDPE
- Non-locking, friction fit, twist-on, or taped connectors
- Brass or copper ground rods
- Wire connections utilizing taping or spray-on waterproofing
- Looped wire or continuous wire installations that have multiple wires laid side-by-side or in close proximity
- Tracer wire wrapped around the corresponding utility
- Brass fittings with tracer wire connection lugs
- Connecting tracer wire to existing conductive utilities

3.2.4 Grounding

Tracer wire must be properly grounded at all dead ends/stubs and at all connection points to existing systems without tracer wire.

Grounding of tracer wire shall be achieved using a drive-in magnesium grounding anode rod with a minimum of 20 feet of #12 red HDPE insulated copper clad steel or solid copper wire connected to anode (minimum 1 pound) specifically manufactured for this purpose and buried at the same elevation as the utility.

When grounding the tracer wire at dead ends/stubs, the grounding anode shall be installed in a direction 180 degrees opposite of the tracer wire, at the maximum possible distance.

Where the anode wire will be connected to a tracer wire access box, a minimum of 2 feet of service loop is required after meeting final elevation.

3.2.5 Testing

Prior to acceptance of ownership and upon completion of rough grading, and again prior to final acceptance of the project, all new mainline tracer wire installation shall be located by the applicant using low-frequency (512Hz) line tracing equipment, witnessed by the Inspector, Contractor, Consulting Engineer, and Facility Owner as applicable.

Continuity testing in lieu of actual line tracing shall not be accepted.

3.3 Private Sewer Systems

All sewer lines are public except individual service connections, taps, or on-site sewer systems serving only private development as approved by the Utility Engineer. All private sewer systems that connect to the City's collection system shall be reviewed and approved by the Utility Division before installation and connection.

3.4 Service Line Installation And Connections

Service connections to new mains shall be made with full-bodied wyes meeting the same specifications as the wastewater main. Service connections to existing mains shall be made with saddles. All taps to existing mains shall be performed by the Utility Division utilizing a saddle provided by the Contractor. Provide all bends required for proper vertical or horizontal alignment. The minimum slope for a 4-inch sewer service line shall be 2 percent. All service lines shall be electronically locatable.

Depth of service lines: All services shall be installed to a minimum depth of 4 feet as measured from the top of the pipe to finished grade. All service lines shall be installed perpendicular to the main and shall cross the easement and/or right-of-way via the shortest and most direct route practicable, or as approved by the Utility Division. Service connections to mains shall be bedded in imported bedding material as necessary to support all fittings.

Inspection: Do not backfill a service until the City has visually observed the service and authorized it. The service shall be checked for grade, water tightness, cleanout installation, bedding, and adequate cover. At the time of inspection, the service must be bedded up to the spring line of the pipe, and a test tee must be installed at the tap for leak testing. Plugging the end of the pipe at the tap is not acceptable for leak testing. All services to undeveloped property or to vacant lots shall be watertight and have the end capped and extended to the inner edge of the lot's utility easement.

Wastewater marker posts: Shall be installed at the end of all unconnected services and at all cleanouts not located in paved or graveled areas. The Carsonite posts shall be buried 2-1/2 feet and extend above grade 3-1/2 feet.

Metal stub markers: Shall be installed at the end of all unconnected services. The markers shall extend from 1-foot below the finished grade down to the stub. No service lines from a building to a

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mainline or wastewater service stub shall be installed until the mainline has gained preliminary acceptance from the Utility Division and a building permit has been obtained.

3.5 Field Quality Control

- A. General: Test the pipeline promptly after installation through completion of backfill. No more than 800 feet shall be installed without testing the completed portions.
- B. Lamping: Alignment, grade, and pipe condition shall be checked by the Utility Engineer during the inspection for preliminary acceptance. Light will be flashed between manholes by means of reflecting sunlight with a mirror. Proper alignment shall consist of a “full moon” clearly visible at the opposite end of the line from the observer’s location.
 - 1. No more than 24 hours prior to the lamping test, the Contractor shall put water in the upper section of the line and let it flow out through the new lines and manholes. During the lamping tests, the Utility Engineer shall check for standing water indicating sags or settled sections of pipe or manholes. The maximum amount of standing water allowed in any pipe or manhole shall be 3 percent of the pipe’s diameter or ½-inch, whichever is smaller.
 - 2. The Contractor shall correct any deficiencies noted such as poor alignment, displaced pipe, debris in the pipe, or any other defects. Tests will be repeated after completion of repair and backfill.
- C. Leakage: Tests for water tightness shall be made by the Contractor in the presence of the Utility Engineer.
 - 1. Air test: The Contractor must test wastewater mains by means of an air test. The Contractor’s testing procedure and equipment shall be approved by the Utility Engineer prior to proceeding. All lines shall be pressurized in the Utility Engineer’s presence and all pressurized lines shall have the pressure released in the Utility Engineer’s presence. Gauges used to monitor the air test and fill and drain lines shall be located above grade, not in the manhole. The length of time for a 0.5 psig pressure drop from 3.5 psig to 3.0 psig shall not be less than the following table:

Length of Time (minutes:seconds)								
PIPE DIA (IN)	100'	150'	200'	250'	300'	350'	400'	450'
4	1:53	1:53	1:53	1:53	1:53	1:53	1:53	1:53
6	2:50	2:50	2:50	2:50	2:50	2:50	2:51	3:12
8	3:47	3:47	3:47	3:47	3:48	4:26	5:04	5:42
10	4:43	4:43	4:43	4:57	5:56	6:55	7:54	8:54
12	5:40	5:40	5:42	7:08	8:33	9:58	11:24	12:50
15	7:05	7:05	8:54	11:08	13:21	15:35	17:48	20:02
18	8:30	9:37	12:49	16:01	19:14	22:26	25:38	28:51
21	9:55	13:05	17:27	21:49	26:11	30:32	34:54	39:16
24	11:24	17:57	22:48	28:30	34:11	39:53	45:35	51:17
27	14:25	21:38	28:51	36:04	43:16	50:30	57:42	66:54

The Contractor shall locate and repair the defective joints or pipe in every section of line that fails the air test.

The Contractor shall retest the line until the line passes the test.

- D. Deflection: The maximum allowable pipe deflection is 5 percent of the pipe diameter or the manufacturer’s specifications, whichever is less. Deflection testing may be required if the Utility Engineer suspects excessive pipe deflection or if the Contractor’s pipe bedding

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procedures, in particular tamping and compaction of the bedding, are questionable in the opinion of the Utility Engineer. The deflection test will be performed by the Contractor in the presence of the Utility Engineer. The test shall be conducted by pulling a 5 percent deflection mandrill through the pipe. If the mandrill does not pass a point between manholes A and B when being pulled from A to B, the mandrill will be pulled from B to A. The Contractor shall provide all personnel and equipment, including deflection mandrels and a water truck if necessary. If areas of greater than 5 percent deflection are encountered, the Utility Engineer may require excavation of the line in the area of excessive deflection to determine the cause. All areas of excessive deflection shall be corrected at the Contractor's expense.

- E. Minimum grade of mainline: The minimum grade for all sanitary sewer pipe shall be placed in accordance with the following table:

Pipe Diameter	Minimum Slope
4 inches	2%
6 inches	1%
8 inches	0.334%
10 inches	0.248%
12 inches	0.194%
14 inches	0.158%
15 inches	0.144%
16 inches	0.132%
18 inches	0.113%
21 inches	0.092%
24 inches	0.077%
27 inches	0.066%
30 inches	0.057%
36 inches	0.045%

- F. Cleaning the line: When all pipes have been installed, the line and manholes shall be cleaned and free of sand, dirt, and debris. If the line must be flushed, it shall be done with a high-pressure jet or sewer balling method. Care shall be taken to ensure that no non-sewage water enters the existing sanitary system. Should the Contractor allow water to enter the existing system, damages to the system, costs of treating the water, and fines in accordance with the City code shall be at the Contractor's expense.
- G. Underdrain pipe: Shall only be used when approved by the Utility Engineer. Shall be installed as required per a Geotechnical Engineer's recommendation.
1. P.V.C. Pipe: Shall be perforated or non-perforated and conform to ASTM Standard D 3034 SDR 35. The pipe shall be installed and in full compliance with ASTM Standard D 2311. The system shall not be watertight unless designated by the Consulting Engineer on the approved plans.
 2. Bedding: Bedding for underdrain pipe shall be installed per the recommendation of the Geotechnical Engineer.
 3. Alignment: The grade of the underdrain pipe shall be parallel to and 1-foot below the flow line of the mainline pipe as measured from the mainline invert to top of underdrain pipe. The underdrain shall end in a storm sewer or drainage course. At no time shall an underdrain be unable to drain. The underdrain connection

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shall be properly grouted into a storm sewer pipe. When emptying into a water course, the outlet shall be protected with an approved outlet structure.

If the site has a high water table, the Geotechnical Engineer shall approve any underdrain system design.

- H. Dewatering: During construction, suitable dewatering equipment and labor shall be provided at the cost of the Contractor. Activities shall be conducted to not disturb or interrupt stormwater along their existing drainage courses, and in such a manner as to not disturb or affect any existing surface or subsurface drainage patterns of adjacent properties. The control of surface water and groundwater during construction is the Contractor's sole responsibility.

4.0 Measurement and Payment

4.1 Wastewater Mains

- I. Wastewater mains: Will be measured and paid for at the unit price per linear foot under the item Wastewater Main per pipe size, type, and depth. The main depth will be measured vertically from the invert of the main to the existing ground level directly above the pipe. The total length of the main will be measured horizontally between centerline of manholes. Where the pipe enters a building or a casing pipe, the limit of measurement shall be the outside face of the building or casing pipe. Pipe installed from existing stubs shall be measured from the beginning of that pipe to the centerline of the next manhole.
- J. Reinforced concrete encasement: Shall be measured and paid for at the unit price per linear foot per the Reinforced Concrete Encasement item per pipe size.
- K. Service lines: Will be paid for at the unit price per linear foot under the item Wastewater Service Lines per the size and type of pipe regardless of depth. The length shall be measured horizontally along the centerline of the pipe through all fittings, including tap fittings, from the centerline of the wastewater main to the end of the new service.
- L. Cleanouts: Shall be measured and paid for at the unit price under the Cleanout item per cleanout size.

4.2 General

The unit prices for the above items shall include the cost of maintaining existing wastewater flows, trench excavation, backfill, trench support system, bedding and shading, gravel, or other imported material where specifically required, markers, dewatering, flushing, testing and inspection, and the cost of all materials, equipment, tools, and labor incidental or necessary for completion of work.

4.3 Limitations

Payments to exceed 85 percent of the contract price for wastewater main installation shall not be made until testing is satisfactorily completed.

END OF SECTION

SECTION 42: MANHOLES

1.0 General

1.1 Description

Work included: Manholes for wastewater, water system specialty valves or meters, and other installations when specifically called out.

1.2 Quality Assurance

Work shall meet Colorado Department of Public Health and Environment requirements for installations of wastewater and potable water systems. The Contractor shall guarantee all water and wastewater manholes to be leak-free for two years from the date of preliminary acceptance of the entire project.

1.3 Submittals and Substitutions

Submittals are required for the work in this section unless waived by the City. If the Contractor proposes not to provide submittals on portions of this work, the Contractor must submit a clarification request, formally requesting a waiver.

1.4 Product Delivery, Storage, and Handling

Precast concrete units shall be carefully handled and stored. Any damage such as cracks, chips, or fractures shall be cause for rejection of the product.

2.0 Products

2.1 Materials

A. A. Manholes:

1. Concrete: Per ASTM C 478. 4,000 psi with a minimum of 470 pounds of Type II Portland Cement per cubic yard of concrete, and a water cement ratio not to exceed 0.53.
2. Base, riser, and conical top sections: Per ASTM C 478. The conical top section shall have a 24-inch diameter access opening at its top. The base, riser, and bottom of the conical top section shall be 48-inch inside diameter for pipes 12 inches or under and 60-inch inside diameter for pipes 15 inches and larger. The City may require a larger diameter manhole for 24-inch and larger pipe. Pre-cast base slabs or floors shall have a minimum thickness of 6 inches for 48-inch diameter risers and 8 inches for larger diameter risers.
3. Flat slab tops: Per ASTM C 478. Access opening shall have a 24-inch diameter. Minimum slab thickness is 6 inches for risers up to 48 inches in diameter, and 8 inches for larger riser diameters. The design shall be for H-20 live load and dead load based upon the amount and type of fill to be placed on the slab and the weight of the riser supported by the slab.
4. Grade rings: Precast concrete. Per ASTM C 478.
5. Joint and joint sealant:

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- a. Between manhole sections to include precast base, riser, conical sections, and flat slab tops: Per ASTM C 478. Made with male and female ends and sealed with RUB'R-NEK or approved equal flexible gasket-type sealant of partially vulcanized butyl rubber per Federal Specification SS-S-210A. Two gaskets are required per joint. Gasket size shall be as recommended by the manufacturer based on the annular space to be sealed. If the minimum cross sectional area equivalent of the gasket is less than 1-inch in diameter, confirm suitability with the Utility Engineer before proceeding.
 - b. Between cast-in-place base and riser: Flat-bottom riser placed on a flat-formed base and sealed with two flexible gaskets per (a) above.
 - c. Pipe to manhole seal:
 - i. Precast base: Flexible rubber boot in a cored hole per ASTM C 923. Connectors shall be KOR-N-Seal, A-Lok or approved equal.
 - ii. Cast-in-place base: Two elastomeric seals minimum per pipe (O ring water stops) per ASTM F477.
 - d. Between grade rings, and between flat slab top or conical section and grade rings:
 - i. RUB'R-NEK or approved equal flexible gasket-type sealant of partially vulcanized butyl rubber per Federal Specification SS-S-210A. One gasket with a minimum cross-sectional area equivalent to 1-inch in diameter is required per joint.
 - e. Between cast iron frame and concrete surfaces:
 - i. RUB'R-NEK or approved equal flexible gasket-type sealant of partially vulcanized butyl rubber per Federal Specification SS-S-210A. One gasket with a minimum cross-sectional area equivalent to 1-inch in diameter is required per joint.
6. Steps: Per ASTM C 478 modified as follows. Type PS-2PF or PS-2PFS ½-inch diameter Grade 60 steel reinforcing rod completely encapsulated in copolymer polypropylene as manufactured by M.A. Industries, Inc. or approved equal. The manhole steps shall be corrosion resistant. The step shall be installed so that the distance from the wall of the riser or cone, measured from the point of embed to the outside face of the rung, is 6 inches. The step spacing shall conform to the standard manhole cross-section detail. Steps must be capable of carrying a load of 1,000 pounds when projected 6 inches from the wall without causing permanent deformation. Steps shall be cast in place during manufacturing of the manhole barrel sections. Drilling barrel sections on site for installation of steps shall not be accepted.
7. Frames and lids (rings and covers): Heavy-duty castings, designed for H-20 traffic loading, or gray cast iron per ASTM A 48 of uniform quality, free from cracks, holes, swells, and cold shuts, and having a smooth, workmanlike finish. Castings Inc. MH400-24 CI with one Aurora style pick slot frame with solid lid. All metal bearing surfaces between the ring and cover will be machined or fabricated to insure good seating. See manhole lid detail. Waterproof lids shall be Neenah self-sealing lids lettered "SEWER" or "WATER."
8. Adjusting rings (extension rings): Gray cast iron, ASTM A 48, Class 25, Neenah R1979 or equal to match lid opening.

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9. Exterior coating: MASTERSEAL Foundation Coating or approved equal shall be applied the full manhole height prior to backfill. Chips or scrapes shall be repaired prior to applying MASTERSEAL.
10. Grout: Non-shrink, non-metallic, either cement- or epoxy-based as recommended by the application manufacturer.
11. Mortar: Masonry cement per ASTM C91. Aggregate per AASHTO M 45. Proportion by volume shall be one part masonry cement to three parts aggregate (maximum).
12. Concrete: All concrete work shall conform to the requirements of the City of Steamboat Springs Roadway Design Standards and Specifications, latest edition.

3.0 Execution

3.1 General

Manholes shall be installed level and plumb.

3.2 Installation

- A. Connecting to existing manholes:
 1. Design and connection to existing manholes may only be done with pre-approval by the Utility Division. Sewer pipe connections to existing manholes where there are no existing pipes stubbed out shall be made so that the finished work conforms to the requirements specified for new manholes. The Contractor shall drill and break out as small an opening in the existing manhole as necessary to insert the new water stop gasket and sewer pipe. The existing concrete foundation bench shall be chipped to the cross-section of the new pipe to form a smooth, continuous invert like what would form in a new concrete base. Non-shrink, non-metallic grout 3M 5600 or an approved equal shall be used to smoothly finish the new invert and seal the new line so the junction is watertight.
- B. Bases:
 1. Pre-cast bases: Install unless specific connection requirements dictate a cast-in-place structure authorized by the Utility Division.
 2. Cast-in-place manholes: Not allowed.
- C. Invert channels: Required in all wastewater manholes unless called out otherwise on the Drawings, Special Provisions, or Special Conditions. Where invert channels are required, they shall be smooth and semi-circular in shape, conforming to the inside of the incoming and outgoing lines. Changes in the direction of flow shall be made with a smooth curve with as large of a radius as the manhole size will permit. Changes in size and elevation shall be made with smooth, uniform transitions. The change in elevation between the invert-in and invert-out must be between 0.2 and 0.5 feet. Deflecting pipes to meet inlet and outlet openings in manholes will not be permitted. All inverts shall be constructed to allow the Utility Division sewer video equipment to be inserted both up and down stream. Such equipment is approximately 6 inches in diameter and 30 inches in length.
- D. Stubouts for future connections: Shall consist of a section of the specified wastewater pipe with bell end. The end of the stub shall extend 6 inches to 2 feet beyond the outside edge of the manhole base and shall be plugged with a manufactured, watertight plug compatible with the stubout pipe used. The stubout shall be bedded in and fully supported with imported bedding material.

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- E. Flat slab tops: Substitute a riser section and flat slab top for the cone section in all manholes where the vertical distance between the top of the cone section and invert is 5 feet or less.
- F. Grade rings: A maximum of 6 vertical inches of grade rings shall be allowed to bring the frame and lid to final elevation. A maximum of two grade rings may be used to make up the total 6 inches.
- G. Wastewater marker posts: Shall be installed at all manholes not located in paved or graveled areas.
- H. Frames and lids (rings and covers):
 - 1. In paved areas: Frames and lids shall be installed to match the slope of paved areas by shimming the grade rings with mortar. Where no grade rings are installed, shimming with mortar between the top section and frame is permitted. A 2-inch adjusting ring is required between the frame and lid in all paved areas. LadTech HDPE slope adjustment rings may be used in place of mortar. Set the lid $\frac{1}{4}$ to $\frac{1}{2}$ -inch below the pavement surface.
 - 2. In gravel areas: Frames and lids shall be installed plumb and level. Set the lid 2 to 4 inches below the gravel surface.
 - 3. In gravel areas to be paved: Frames and lids shall be installed to match the slope of the future pavement. Set the lid 1 to 2 inches below the gravel surface.
 - 4. In open fields or places other than paved or graveled areas: Final grade shall be as shown on drawings or stated in Special Provisions or Special Conditions. If the final grade is not indicated, submit a clarification request to the Consulting Engineer for establishment of the final grade.
 - 5. General: The Contractor shall make all adjustments to manholes necessary to achieve the above requirements in phased construction where traffic or plowing will be allowed on the partially completed work.
- I. Sealing: Manholes for water and wastewater systems shall be watertight. All necessary precautions shall be taken to assure that water will not infiltrate into the manhole. All visible leaks shall be permanently sealed. The joints between sections to include the base, riser, conical top section, and flat slab top shall be sealed with two flexible joint sealants such as RUB'R NEK. Seal shall not be pinched or folded. In pre-cast bases, pipe to manhole connections shall be sealed with a flexible rubber boot per manufacturer instructions. In cast-in-place bases, pipe to manhole connections shall be sealed with two elastomeric seals minimum per pipe (O-ring water stops) per ASTM F477. Connections to existing manholes shall be done by core boring. The pipe to manhole connection shall be sealed with two O-ring water stops as in cast-in-place bases and the annular space shall be grouted watertight per the manufacturer's instructions. Joints between grade rings, cast iron frames and concrete surfaces shall be sealed with flexible joint sealant. Install one coat of exterior coating on the outside of all buried concrete surfaces in accordance with the manufacturer's instructions. The application rate shall be 2 pounds per square yard of surface area coated. Install waterproof lids in all locations noted on the drawings or called out in the Special Provisions.
- J. Pavement transitions: When located in pavement it is preferred that the manhole cover be installed completely within the pavement area. If the manhole is located such that it is partially within the pavement, the pavement shall be widened to extend around the manhole cover a minimum of 1-foot with a 20-foot transition to normal pavement width on either side. In each case the Contractor shall coordinate with the Consulting Engineer prior to installing manhole covers partially within a paved area and prior to constructing the pavement transition to clarify exactly how to proceed.

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- K. Drop manholes: Shall be outside drops constructed as shown on the drawings. An in-line wye fitting shall be provided to initiate the drop. Additional bends may be necessary along the drop to provide proper drop alignment. All fittings shall be securely anchored to prevent movement during placement of flowable fill around the drop. Drop manhole locations shall be identified on the drawings or may be required by the Consulting Engineer to facilitate field changes in grade or alignment.
- L. Drivable access: Drivable access to sewer mains shall be a flat bench not exceeding side slopes of 5% and longitudinal slopes of 10%, allowing one to drive a pickup with trailer or a dual wheel truck (e.g., jet truck) along the bench and to back directly up to each manhole. The access shall provide an access point and exit point at each end of the sewer main or a turnaround at the end of the sewer main that will accommodate the above-mentioned vehicles. The bench shall be a flat surface a minimum of 10-feet-wide without drainage swales or ditches or landscaping including but not limited to rocks, trees, and shrubbery. If swales or ditches exist, they shall be culverted to allow vehicles to cross. The access shall be in a legally documented access or utility easement.
- M. Distance between manholes: The maximum distance between manholes shall be as follows:

Sanitary Pipe Size	Maximum Distance
8" to 15"	400'
18" to 30"	400'
Larger than 30"	400'

- N. Manhole leakage test: At the discretion of the Utility Engineer, vacuum testing manholes may be required. All pipes entering the manhole shall be plugged and braced and a vacuum of 10 inches of mercury shall be drawn. The vacuum pump shall be turned off and the time monitored as the vacuum drops 1-inch. The vacuum must not drop more than 1-inch for the duration of the time indicated in the following table:

Specified Test Duration for Diameter of Manhole			
(Duration indicated in min:sec)	1:00	1:15	1:30
Manhole diameter	48"	60"	72"

Manholes that fail the vacuum test shall have defects located and repaired, and then the test shall be repeated. Repair and retesting shall be continued until the test meets the requirements. In lieu of vacuum testing of manholes, the Utility Engineer may require water testing of manholes. Manholes shall be tested separately from the pipe. The sewer pipe in the manhole will be plugged. If the ground water table is below the invert, the manhole shall be filled to a depth of 5 feet above the invert. If the ground water level is above the invert of the manhole, then the manhole will be filled to level at least 3 feet above the ground water level or to the top of the upper most precast manhole section, whichever is less, but not less than 5 feet above the invert. After soaking for one hour, the manhole shall be filled to the original level. It shall then be tested for two hours. The allowable drop of water shall be ¼-inch. No manhole will be accepted when there is any visible infiltration when empty.

- O. Cleaning the manhole: When all manholes have been installed, they shall be cleaned and free of sand, dirt, and debris. If the manhole must be flushed, it shall be done using a high-pressure jet or sewer balling method. Care shall be taken to ensure that no non-sewage water enters the existing sanitary system. Should the Contractor allow water to enter the existing system, damages to the system, costs of treating the water, and fines in accordance with the City code shall be at the Contractor's expense.

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- P. Follow-up inspection/extended warranty: The Owner's Engineer will inspect all manholes for water and wastewater systems for leakage during spring runoff in the year following installation. All leaks or other defects noted during the inspection will be corrected under the Contractor's warranty. The Contractor shall provide personnel necessary to assist in these inspections if requested by the Owner. If an abnormally dry winter causes low spring run-off and a low groundwater table, the Owner's Engineer may elect to re-inspect the manholes for leakage the following spring. The Owner will notify the Contractor of the decision to re-inspect manholes for leakage prior to the end of the normal two-year warranty period. The Contractor shall automatically extend his warranty for leak-free manholes for one additional year at no additional expense to the Owner upon receipt of the Owner's notice.

4.0 Cleanouts

4.1 Cleanout Installation

- A. Cleanout structures shall be located and constructed as shown in the drawings, or as directed by the Consulting Engineer. The cleanout shall have a true and smooth interior to allow easy access for inspection lights, plugs, and cleaning equipment. Cleanouts shall be installed at intervals not to exceed 100 feet in straight runs and for each aggregate horizontal change in direction exceeding 45 degrees. Sizing locations and installation shall be in accordance with the IPC. Final grade of the cleanout cover shall be as specified for manhole lids.
1. Submission of drawings details and specifications are required for all cleanouts.
 2. A cleanout must be the same size as the pipe served.
 3. Cleanouts to be terminated above the lawn and/or landscaping must be finished off with the appropriate FIP adapter and plug and must be 3 inches above finished grade to make the cleanout clearly visible and accessible.
 4. Cleanouts to be terminated in lawn and/or landscape areas can be placed in a lawn box marked or tagged with the letters C.O. and ended under the box with the appropriate FIP adapter and plug.
 5. In lawn or landscape, cleanout termination made at finished or final rough grade, (e.g., before landscape) must have the lawn boxes in place and/or be terminated at a recommended 6 inches above finished or final rough grade to allow for landscaping.
 6. Cleanouts must be located outside storm drain swales or flowlines.
 7. Cleanouts shall not, under any circumstance, be allowed in place of a manhole.

5.0 Measurement and Payment

5.1 Manholes

- A. Manholes: Will be measured and paid for at the unit price, under the item Manholes, and per diameter, up to 8 feet deep. The depth of a manhole is measured from the highest point of the cover to the lowest pipe invert.
- B. Extra depth at manholes: Shall be measured and paid for at the unit price per vertical foot, in excess of an 8-foot depth, under the item Extra Depth at Manholes per manhole diameter.

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- C. Drop manholes: Will be measured and paid for at the lump sum price under the Drop Manhole item per specific manhole.

5.2 General

Prices for above items shall include the cost of excavation (excluding rock excavation), native backfill, support system, imported foundation and bedding shown or specified as a part of the standard installation, stub outs, dewatering, flushing, testing and inspection, and the cost of all materials, equipment, tools, and labor incidental or necessary for completion of work. No measurement or separate payment will be made for alterations to existing manholes required to make pipe connections. The cost shall be considered incidental to the work.

END OF SECTION

SECTION 44: WATER AND SEWER LINE CROSSINGS

1.0 General

1.1 Description

- A. Work included: This specification shall define the precautions required when potable lines and non-potable lines (including both sanitary sewer and storm sewer) intersect.
- B. Related work described elsewhere:
 - 1. Trenching, Bedding, and Backfill, Section 24
 - 2. Water Distribution Piping and Appurtenances, Section 30
 - 3. Wastewater Collection Piping and Appurtenances, Section 40

1.2 Quality Assurance

Potable and non-potable line crossings shall be done in accordance with the current Colorado Department of Public Health and Environment guidelines and these specifications. In the event of a conflict, the more stringent requirements, as determined by the City, shall govern.

2.0 Products

2.1 Materials

Materials shall be as specified for waterline and/or wastewater line construction. See Section 30 or 40 as appropriate.

3.0 Execution

3.1 Crossing Conditions

Seven different crossing conditions have been identified for separate consideration. Each of the conditions is visually represented within the standard details (SS-006 and SS-007) included in this specification. The conditions shall pertain to all water mains and services; sanitary sewer mains and services; and storm sewer mains, services, and culverts. Consulting Engineers are encouraged to analyze pipe types at crossing locations and specify crossing conditions on the construction plans. Site-specific crossing conditions may be evaluated on a case-by-case basis during the construction plan approval process.

3.2 Crossing Requirements

- A. Condition 1: When a new water line crosses above or below a new sewer line, the crossing shall be no less than 18 inches of separation. If, for any reason, this separation cannot be maintained, the following shall be done through the variance process.
 - 1. The full length of pipe from each line shall be centered on the other line.
 - 2. Caution: The Contractor must plan the installation of the first utility installed so the second utility installed will cross at the center of a full length of pipe of the first utility.
 - 3. Backfill between the two pipes shall be fully compacted imported ¾-inch minus gravel.

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4. The minimum vertical separation between the bottom of the higher pipe and the top of the lower pipe shall be 18 inches.
- B. Conditions 2 and 3: Separation between a new water line and an existing sewer line shall be 18 inches. If this cannot be achieved because of changing conditions, a variance must be filed and approved, and the following items must be completed.
1. A full length of water pipe shall be centered over the sewer line.
 2. Avoid exposing the existing sewer line if possible. If the sewer line is exposed, the section of sewer line shall be flow fill or lean concrete capped for the full width plus 1-foot into each side of the bank of the water line trench. Encasement shall extend from the spring line of the sewer line to a point 6 inches above the top of the sewer line. The cap shall be placed on fully compacted material on each side of the sewer line. If the sewer line is damaged, the damaged section of line shall be replaced in accordance with City specifications and shall be encased in concrete 6 inches around the pipe across the full width of the trench plus extending 1-foot into each bank on both sides of the trench and/or 1-foot beyond the repair couplings or sleeves, whichever is the greater length. The encasement shall be placed on fully compacted material.
 3. Backfill between the two pipes shall be fully compacted, imported $\frac{3}{4}$ -inch minus gravel or flow fill.
 4. Minimum vertical separation between the bottom of the water line and the top of the sewer line or the top of the cap or encasement shall be 18 inches.
- C. Condition 4: When a new sewer line crosses less than 18 inches below an existing water line, the following shall be done:
1. A full length of sewer pipe shall be centered on the water line.
 2. The new sewer line shall be concrete encased with flow fill for 6 inches around the pipe and extending to 1-foot beyond each pipe end joint. All encasements shall be placed on fully compacted material. Such encasements shall be allowed to fully cure using industry-best standards and practices prior to backfill.
 3. Backfill between the two pipes shall be fully compacted, imported $\frac{3}{4}$ -inch minus gravel or flow fill.
 4. The minimum vertical separation between the bottom of the water line and the top of the sewer line encasement shall be 18 inches. If less than 18 inches, a variance must be obtained from the City.
- D. Condition 5: When a new sewer line crosses above an existing water line, the following shall be done:
1. A full length of sewer pipe shall be centered on the water line and the joints of the sewer line that lie within 10 feet of the water line shall be flow-fill or lean concrete-encased for 1-foot on each side of the joint.
 2. Avoid exposing the water line if possible. If joints are exposed or the water line is damaged, the section of line shall be flow-fill or lean-concrete capped for the full width of the sewer line trench. Encasement shall extend 6 inches on each side from the spring line of the water line to a point 6 inches above the top of the water line.
 3. Backfill between the two pipes shall be fully compacted, imported $\frac{3}{4}$ -inch minus gravel or flow fill.
 4. Minimum vertical separation between the bottom of the sewer line and the top of the water line or the top of the cap or encasement shall be 18 inches.

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- E. Condition 6: When a new waterline crosses above or below an existing storm sewer line, a minimum separation of 18 inches shall be maintained.
- F. Condition 7: When a new sewer line crosses below an existing storm sewer line, a minimum separation of 18 inches shall be maintained.

3.3 Locations of Lines and Services

The Utility Division will attempt to provide, at the Contractor's request, as accurate information regarding utility locations as is available. The Contractor will ultimately be responsible for line locations and protection.

3.4 Damage and Repair of Existing Lines and Services

In accordance with Colorado Senate Bill 18-167, when excavating around existing water and sewer mains or services, the Contractor shall notify the system Owner and request field locations by calling 811 no less than 72 hours in advance of the work. When excavating for crossings of existing lines, the Contractor shall use extreme caution to avoid damaging them. If the Contractor accidentally damages existing lines, the following repair procedures in addition to the standard crossing requirements specified in Section 3.2 must be followed.

- A. Damage to existing sanitary sewer mains or services: Existing sanitary sewer mains or services shall be repaired by replacement of the damaged section of pipe with new couplings and pipe of identical material or a new section of PVC sanitary sewer pipe. Both the type of pipe and the type of repair couplings shall be approved by the Utility Engineer and the operator of the sanitary sewer system prior to their use. All repairs are to be inspected and approved by the Utility Division prior to backfill.
- B. Damage to existing water mains or services: Existing water mains or services shall be repaired by installing a new section of pipe in the damaged area or by use of repair couplings. The new pipe for repair shall be of similar material to the existing pipe. Repair couplings shall be suitable for the type of pipe with which they are to be used. Both the type of pipe and the type of repair couplings shall be approved by the Utility Engineer and the operator of the water system prior to their use. All repairs are to be inspected and approved by the Utility Division prior to backfill.

3.5 Field Verification Prior to Construction Plan Approval

Field verification shall be required for crossing conditions 3, 4, 5, and 6 for the purpose of determining the exact elevation of the existing utility. This requirement will be noted on the construction plans at the point of intersection of the lines.

4.0 Measurement and Payment

4.1 Water and Sewer Main Crossings

Separate payment will be made for the additional cost associated with each crossing per the Water and Sewer Main Crossing pay item by condition per each crossing. If reinforced concrete encasement is required, it shall be paid for by the Reinforced Concrete Encasement bid item. If no bid item appears in the bid schedule, payment will be made by change order.

4.2 Service Line Crossings

In general, no separate payment will be made for crossing water service lines located by the system Owner. If a water service line is not located by the system Owner or is incorrectly located, and the Contractor subsequently damages the service line, payment for repair shall be made by change order. No separate payment will be made for crossing sewer service lines.

4.3 Repair of Damaged Mains

Repair of damaged mains shall be the Contractor's responsibility. No separate payment will be made for repair of lines damaged by the Contractor. The method of repair shall be pre-approved by the Utility Division. If, in the Contractor's opinion, damage to a line is a result of conditions beyond his control, the Contractor shall, within five days of the event, present a written request to the Utility Engineer for reimbursement of costs incurred.

END OF SECTION

SECTION 46: WASTEWATER PRETREATMENT

1.0 General Provisions

1.1 Administration

Except as otherwise provided herein, the Utility Engineer shall administer, implement, and enforce the provisions of this section. Any powers granted to, or duties imposed upon, the Water Wastewater Engineer may be delegated by the Water Wastewater Engineer to a duly authorized City utility employee.

1.2 Legal Authority for Regulations

These regulations were approved by the City of Steamboat Springs (Council) pursuant to the Amended and Restated Establishing Contract, § 29-1-204.2(3)(e), (j), (k) and (l), C.R.S., and other applicable Colorado and Federal law and regulations.

1.3 Reasonableness Standard Applies

The Council delegates the powers and authority granted to the Utility Engineer in this section with the following standard to be used by the Utility Engineer in the exercise thereof: In all situations and instances in which this section grants authority to the Utility Engineer to undertake an activity, promulgate a policy, decide upon a course of action, impose a fine or penalty, order compliance, refer a matter to an agency or person, act or determine not to act, or exercise any discretionary power, the Utility Engineer shall do so reasonably based upon the information, conditions, and circumstances known and prevailing at such time.

2.0 General Sewer Use Requirements

2.1 Prohibited Discharge Standards

General Prohibitions: No user shall introduce or cause to be introduced into the City Collection and Treatment Systems (CCTS) any pollutant or wastewater which causes pass-through or interference. The discharge of any waters containing any substance or any toxic or poisonous solids, liquids, or gases in sufficient quantity, either singly or by interaction with other wastes, as determined by the City, to contaminate the sludge (biosolids) of any municipal system, or to injure or interfere with any wastewater conveyance or create any hazard in or have an adverse effect on the water receiving any discharge from the wastewater treatment facility and works, is prohibited.

Specific prohibitions: No user shall introduce or cause to be introduced into the CCTS the following pollutants, substances, or wastewater:

- Pollutants which create a fire or explosive hazard in the CCTS, including, but not limited to, waste streams with a closed-cup flashpoint of less than 140 degrees F (60 degrees C) using the test methods specified in 40 CFR 261.21
- Wastewater having a pH less than 5.5 or more than 9.0, or otherwise causing corrosive structural damage to the CCTS or equipment
- Solid or viscous substances in amounts which will cause obstruction of the flow in the CCTS resulting in interference
- Pollutants which, either singly or by interaction with other pollutants, will cause interference with the CCTS
- Wastewater with a temperature greater than 104 degrees F (40 degrees C)

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- Petroleum oil, non-biodegradable cutting oil, or products of mineral oil origin, in amounts that will cause interference or pass-through
- Pollutants which result in the presence of toxic gases, vapors, or fumes within the CCTS in a quantity that may cause acute worker health and safety problems
- Noxious or malodorous liquids, gases, solids, or other wastewater which, either singly or by interaction with other wastes, are sufficient to create a public nuisance or a hazard to life, or to prevent entry into the sewers for maintenance or repair
- Wastewater that imparts color which cannot be removed by the treatment process, such as, but not limited to, dye wastes and vegetable tanning solutions, which consequently imparts color to the treatment plant's effluent, thereby violating the City's NPDES permit
- Wastewater containing any radioactive wastes or isotopes except in compliance with applicable state or federal regulations
- Stormwater, surface water, ground water, artesian well water, roof runoff, subsurface drainage, swimming pool drainage, condensate, de-ionized water, and non-contact cooling water, unless specifically authorized by the Utility Engineer
- Sludges, screenings, or other residues from the pretreatment of industrial wastes
- Medical wastes, except as specifically authorized by the Utility Engineer in an individual wastewater discharge permit or a general permit
- Wastewater causing, alone or in conjunction with other sources, the treatment plant's effluent to fail toxicity test
- Detergents, surface-active agents, or other substances which might cause excessive foaming in the CCTS
- Fats, oils, or greases of animal or vegetable origin in concentrations greater than 500 mg/l
- Wastewater causing two readings on an explosion hazard meter at the point of discharge into the CCTS, or at any point in the CCTS, of more than 5 percent or any single reading over 10 percent of the lower explosive limit of the meter.
- The discharge of any substance, which if otherwise disposed of would be considered hazardous waste
- Pollutants, substances, or wastewater prohibited by this section shall not be processed or stored in such a manner that they could be discharged to the CCTS.

The discharge of any waste from septic tanks, chemical toilets, vault toilets, and the biosolids or other wastes from any other wastewater treatment facility to the municipal wastewater conveyance or treatment system is prohibited.

2.2 Surcharge

The City has determined that the average total suspended solids (TSS) and 5-day biochemical oxygen demand (BOD) daily loadings for the average residential user are 200 ppm BOD and 250 ppm TSS. The City may assess a surcharge rate for all nonresidential users discharging wastes with BOD and TSS strengths greater than the average residential user. The surcharge will be sufficient to cover the costs of treating such user's above-normal strength wastes.

2.3 Damage to Facilities

In the event that either wastewater conveyance or treatment structures or processes are damaged, or the flow through these structures or processes are hampered or damaged by a user's wastewater discharge, the City may make or require to be made, at the user's expense, such repairs as are necessary to restore conveyance or treatment structures or processes to normal system operations.

2.4 National Categorical Pretreatment Standards

Users must comply with the Categorical Pretreatment Standards found at 40 CFR Chapter I, Subchapter N, Parts 405–471(inclusive) or Colorado Pretreatment Standards, whichever is stricter.

2.5 City’s Right of Revision

The City reserves the right to establish, by resolution or in individual wastewater discharge permits or in general permits, more stringent standards or requirements on discharges to the CCTS consistent with the purpose of this section.

2.6 Dilution

No user shall ever increase the use of process water, or in any way attempt to dilute a discharge, as a partial or complete substitute for adequate treatment to achieve compliance with a discharge limitation unless expressly authorized by an applicable pretreatment standard or requirement. The Utility Engineer may impose mass limitations on users who use dilution to meet applicable pretreatment standards or requirements or in other cases when the imposition of mass limitations is appropriate.

2.7 Maximum Contribution

POLLUTANT	SYMBOL	DAILY MAXIMUM mg/L
ARSENIC	AS	0.25
CADMIUM	CD	0.17
CHROMIUM	CR	0.68
COPPER	CU	0.86
LEAD	PB	5.82
MERCURY	HG	0.0007
MOLYBDENUM	MO	0.62
NICKEL	NI	3.64
SELENIUM	SE	0.076
SILVER	AG	0.26
ZINC	AN	8.07

3.0 Pretreatment of Wastewater

3.1 Pretreatment Facilities

Users shall provide wastewater treatment as necessary to comply with this section. Any facilities necessary for compliance shall be provided, operated, and maintained at the User’s expense. Detailed plans describing such facilities and operating procedures shall be submitted to the Utility Engineer for review and shall be acceptable to the Utility Engineer before such facilities are constructed. The review of such plans and operating procedures shall in no way relieve the user from the responsibility of modifying such facilities as necessary to produce a discharge acceptable to the City under the provisions of this section.

3.2 Additional Pretreatment Measures

- A. Whenever deemed necessary, the Utility Engineer may require users to restrict their discharge during peak flow periods, designate that certain wastewater be discharged only into specific sewers, relocate and/or consolidate points of discharge, separate sewage waste streams from industrial waste streams, and such other conditions as may be necessary to protect or maintain the CCTS and determine the user’s compliance with the requirements of this section.
- B. The Utility Engineer may require any person discharging into the CCTS to install and maintain, on their property and at their expense, a suitable storage and flow-control

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facility to ensure equalization of flow. An individual wastewater discharge permit or a general permit may be issued solely for flow equalization.

- C. Grease, oil, and sand interceptors shall be provided by the user when, in the opinion of the Utility Engineer, they are necessary for the proper handling of wastewater containing excessive amounts of grease, oil, or sand, except that such interceptors shall not be required for residential users. All interception units shall be of a type and capacity approved by the Utility Engineer and shall be so located to be easily accessible for cleaning and inspection. Such interceptors shall be installed, inspected, cleaned, and repaired by users at their expense. Grease, oil, and sand interceptors shall be cleaned every 6 months. The Utility Engineer may modify the cleaning schedule to assure proper pretreatment of the waste stream. Refer to 9.2 for Grease interceptors, 9.3 for Oil and Sand Separators, and 9.4 for Breweries. The City has the right to access all interceptors for inspection.
- D. Users with the potential to discharge flammable substances may be required to install and maintain an approved combustible gas detection meter.

3.3 Accidental Discharge/Slug Discharge Control Plans

The Utility Engineer shall evaluate whether each SIU needs an accidental discharge/slug discharge control plan or other action to control slug discharges. The Utility Engineer may require any user to develop, submit for approval, and implement such a plan or take such other action that may be necessary to control slug discharges. The City will require a plan for any distillery. Alternatively, the Utility Engineer may develop such a plan for any user. An accidental discharge/slug discharge control plan shall address, at a minimum, the following:

- Description of discharge practices, including non-routine batch discharges
- Description of stored chemicals
- Procedures for immediately notifying the Utility Engineer of any accidental or slug discharge, as required by Section 6.6 of this section
- Procedures to prevent adverse impact from any accidental or slug discharge. Such procedures include, but are not limited to, inspection and maintenance of storage areas, handling and transfer of materials, loading and unloading operations, control of plant site runoff, worker training, building of containment structures or equipment, measures for containing toxic organic pollutants, including solvents, and/or measures and equipment for emergency response.

3.4 Hauled Wastewater

See Subsection 2.2 above.

4.0 Individual Wastewater Discharge Permits and General Permits

4.1 Wastewater Analysis

When requested by the Utility Engineer, a user must submit information on the nature and characteristics of its wastewater within 30 days of the request. The Utility Engineer is authorized to prepare a form for this purpose and may periodically require users to update this information.

4.2 Individual Wastewater Discharge Permit and General Permit Requirement

- No significant industrial user shall discharge wastewater into the CCTS without first obtaining an individual wastewater discharge permit, or a general permit, from the Utility Engineer, except that a significant industrial user that has filed a timely application pursuant to Section 4.3 of this section may continue to discharge for the period specified therein.

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- The Utility Engineer may require other users to obtain individual wastewater discharge or general permits as necessary to carry out the purposes of this section.
- Any violation of the terms and conditions of an individual wastewater discharge permit, or a general permit, shall be deemed a violation of this section and subjects the wastewater discharge permittee to the sanctions set out in Sections 10 through 12. Obtaining an individual wastewater discharge permit, or a general permit, does not relieve a permittee of its obligation to comply with all Federal and State Pretreatment Standards or Requirements or with any other requirements of federal, state, and local law.

4.3 Individual Wastewater Discharge and General Permitting: Existing Connections

Any user required to obtain an individual wastewater discharge permit, or a general permit who was discharging wastewater into the CCTS prior to the effective date of this section and who wishes to continue such discharges in the future, shall, within 60 days after said date, apply to the Utility Engineer for an individual wastewater discharge permit, or a general permit, in accordance with Section 4.5 of this section, and shall not cause or allow discharges to the CCTS to continue after 120 days of the effective date of this section except in accordance with an individual wastewater discharge permit, or a general permit, issued by the Utility Engineer.

4.4 Individual Wastewater Discharge and General, Permitting: New Connections

Any user required to obtain an individual wastewater discharge permit, or a general permit, who proposes to begin or recommence discharging into the CCTS, must obtain such permit prior to the beginning or recommencing of such discharge. An application for this individual wastewater discharge permit, or general permit, in accordance with Section 4.5 of this section, must be filed at least 60 days prior to the date upon which any discharge will begin or recommence.

4.5 Individual Wastewater Discharge and General Permit Decisions

The Utility Engineer will evaluate the data furnished by the User and may require additional information. Within 60 days of receipt of a complete permit application, the Utility Engineer will determine whether to issue an individual wastewater discharge permit or a general permit. The Utility Engineer may deny any application for an individual wastewater discharge permit or a general permit.

5.0 Individual Wastewater Discharge and General Permit Issuance

5.1 Individual Wastewater Discharge and General Permit Duration

An individual wastewater discharge permit or a general permit shall be issued for a period not to exceed five years.

5.2 Permit Modification

The Utility Engineer may modify an individual wastewater discharge permit or general permit for good cause, including, but not limited to, the following reasons:

- To incorporate any new or revised federal, state, or local pretreatment standards or requirements
- To address significant alterations or additions to the user's operation, processes, or wastewater volume or character since the time of the individual wastewater discharge permit issuance
- A change in the CCTS that requires either a temporary or permanent reduction or elimination of the authorized discharge
- Information indicating that the permitted discharge poses a threat to the City's CCTS, City personnel, or the receiving waters, or impacts the quality of sludge or solids.
- Violation of any terms or conditions of the individual wastewater discharge permit

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- Misrepresentations or failure to fully disclose all relevant facts in the wastewater discharge permit application or in any required reporting
- Revision of or a grant of variance from categorical Pretreatment Standards pursuant to 40 CFR 403.13
- To correct typographical or other errors in the individual wastewater discharge permit

5.3 Individual Wastewater Discharge Permit and General Permit

Transfer discharge permits are not transferable. New owners or operators must apply for a permit within 30 days of ownership change.

5.4 Individual Wastewater Discharge Permit and General Permit Re-issuance

A user with an expiring individual wastewater discharge permit or general permit shall apply for individual wastewater discharge permit or general permit reissuance by submitting a complete permit application, in accordance with Section 4.5 of this section, a minimum of 60 days prior to the expiration of the user's existing individual wastewater discharge permit or general permit.

5.5 Regulation of Waste Received From Other Jurisdictions

If another municipality contributes wastewater to the CCTS, the Utility Engineer shall draft and recommend to the City Council that the City enter into an inter-municipal agreement with other contributing municipalities granting the City full pretreatment authority within the contributing municipality.

6.0 Reporting Requirements

6.1 Baseline Monitoring Reports

Industrial users may be required, at the Utility Engineer's discretion, to submit a baseline monitoring report.

6.2 Compliance Schedule Progress Reports

Compliance progress reports may be required by the Utility Engineer.

6.3 Periodic Compliance Reports

All SIUs are required to submit periodic compliance reports, even if they have been designated a non-significant categorical industrial user at a frequency determined by the Utility Engineer.

6.4 Reports of Changed Conditions

Each user must notify the Utility Engineer of any significant changes to the user's operations or system which might alter the nature, quality, or volume of its wastewater at least 30 days before the change.

- The Utility Engineer may require the user to submit such information as may be deemed necessary to evaluate the changed condition, including the submission of a wastewater discharge permit application under Section 4.5 of this section.
- The Utility Engineer may issue an individual wastewater discharge permit or a general permit under Section 5.7 of this section or modify an existing wastewater discharge permit or a general permit under Section 5.4 of this section in response to changed conditions or anticipated changed conditions.

6.5 Reports of Potential Problems

- In the case of any discharge, including, but not limited to, accidental discharges, discharges of a non-routine, episodic nature, a non-customary batch discharge, a slug discharge or slug load, that

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might cause potential problems for the CCTS, the user shall immediately telephone and notify the Utility Engineer of the incident. This notification shall include the location of the discharge, type of waste, concentration and volume, if known, and corrective actions taken by the user.

- Significant industrial users are required to notify the Utility Engineer immediately of any changes at its facility affecting the potential for a slug discharge.

6.6 Reports from Un-Permitted Users

All users, whether required to obtain an individual wastewater discharge permit or general permit or not, shall provide appropriate reports to the Utility Engineer as required.

6.7 Analytical Requirements

All pollutant analyses, including sampling techniques, to be submitted as part of a wastewater discharge permit application or report shall be performed in accordance with the techniques prescribed in 40 CFR Part 136 and amendments thereto, unless otherwise specified in an applicable categorical Pretreatment Standard.

6.8 Sample Collection

Samples collected to satisfy reporting requirements must be based on data obtained through appropriate sampling and analysis performed during the period covered by the report, based on data that is representative of conditions occurring during the reporting period.

6.9 Date of Receipt of Reports

Written reports will be deemed to have been submitted on the date postmarked. For reports that are not mailed, postage prepaid, into a mail facility serviced by the United States Postal Service, the date of receipt of the report shall govern.

6.10 Recordkeeping

Users subject to the reporting requirements of this section shall retain, and make available for inspection and copying, all records of information obtained pursuant to any monitoring activities required by this section, any additional records of information obtained pursuant to monitoring activities undertaken by the User independent of such requirements, and documentation associated with best management practices (BMP).

6.11 Certification Statements

The following certification statement must be signed by an authorized representative as defined in Section 1.4 C:

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Annual Certification for Non-Significant Categorical Industrial Users—A facility determined to be a Non-Significant Categorical Industrial User by [the Utility Engineer] pursuant to 1.4 GG (3) and 4.7 C [Note: See 40 CFR 403.3(v)(2)] must annually submit the following certification statement signed in accordance with the signatory requirements in 1.4 C [Note: See 40 CFR 403.120(l)]. This certification must accompany an alternative report required by the Utility Engineer:

“Based on my inquiry of the person or persons directly responsible for managing

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compliance with the categorical Pretreatment Standards under 40 CFR _____, I certify that, to the best of my knowledge and belief that during the period from _____, _____ to _____, _____ [months, days, year]: o The facility described as _____ [facility name] met the definition of a Non-Significant Categorical Industrial User as described in 1.4 GG (3); [Note: See 40 CFR 403.3(v)(2)] o The facility complied with all applicable Pretreatment Standards and requirements during this reporting period; and (c) the facility never discharged more than 100 gallons of total categorical wastewater on any given day during this reporting period. This compliance certification is based on the following information.”

7.0 Compliance Monitoring

7.1 Right of Entry: Inspection and Sampling

The Utility Engineer shall have the right to enter the premises of any User to determine whether the user is complying with all requirements of this section and any individual wastewater discharge permit or general permit, or order issued hereunder. Users shall allow the Utility Engineer ready access to all parts of the premises for the purposes of inspection, sampling, records examination, and copying, and the performance of any additional duties.

7.2 Search Warrants

If the Utility Engineer is refused access to a building, structure, or property, or any part thereof, and is able to demonstrate probable cause to believe that there may be a violation of this section, or that there is a need to inspect and/or sample as part of a routine inspection and sampling program of the City designed to verify compliance with this section or any permit or order issued hereunder, or to protect the overall public health, safety and welfare of the community, the Utility Engineer may seek issuance of a search warrant from the appropriate court.

8.0 Effective Date

This section shall be in full force and effect immediately following its passage, as provided by law.

9.0 Industrial Pretreatment Devices

This section pertains to interceptor devices only. All pretreatment devices must be approved in writing through the City's Industrial Pretreatment Program. The requirements established in the municipal code shall apply to facilities subject to the Fats, Oils and Grease (FOG) Sector Control Program established by the City. These facilities shall install and maintain a grease interceptor as directed by the City.

9.1 General

The purpose of industrial pretreatment devices is to prevent grease from entering the City's water system and to ensure water quality.

- A. Hydromechanical vs. gravity (Preference: Hydromechanical): The requirements contained in this document are applicable to all commercial food service establishments, including those that are undergoing:
 1. New construction
 2. Interior remodeling to accommodate expansion or operational modifications
 3. Changes of ownership/occupancy

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4. Facilities that may be having trouble achieving compliance with maintenance and/or wastewater discharge limitations

Existing facilities with a gravity grease interceptor currently in operation must operate and maintain a grease interceptor at the standards of the City. Inspection by the City will identify if a facility's grease interceptor is correctly sized and operating efficiently. Under circumstances that the City deems the gravity grease interceptor poses a risk to wastewater back-ups, the City may require upgrades to a hydromechanical grease interceptor (HGI).

All new grease interceptors shall be HGIs unless a written exception is provided by the City.

9.2 Grease Interceptors

- A. For non-domestic facilities:

All non-domestic facilities that prepare, serve or otherwise make any type of food or beverages available for consumption are required to install and maintain a grease interceptor. An individual grease interceptor shall be provided for each building, lot, or unit that requires an interceptor. Domestic waste is prohibited from entering the grease interceptor; thus, no toilets, urinals, and similar fixtures shall be connected to a building's grease interceptor. All domestic waste must be directed into the building's sewer and waste system. In addition, food and food waste shall not directly enter the grease interceptor.

- B. Sizing of hydromechanical:

HGIs shall conform to the following requirements. The HGI Design Form must be completed and stamped by a licensed professional engineer, or otherwise approved by the Water and Sewer Division.

HGIs must be certified to ASME A112.14.3, CSA B481, or PDI G101. They may be installed indoors or outdoors and shall have the minimum flow rate in gallons per minute (gpm) based on the kitchen fixtures connected and the minimum grease storage capacity based on a minimum service frequency of 90 days. The minimum flow rate and the minimum grease storage capacity can be determined through a two-step process.

They must be installed in an easily accessible location with access to the City's Engineer during the hours of 7 a.m. to 5 p.m. and maintain a 3-foot clearance zone to provide adequate space for inspection, cleaning, and removal of intercepted grease. Access to pre-treatment facilities shall always remain unobstructed. The removal of large objects such as boxes, crates, and cans, or the need for a ladder to inspect a wastewater pre-treatment facility, shall constitute a violation. Refer to specific manufacturer requirements for details on compaction requirements and bedding type and depth.

1. Step 1: Size by flow rate

Calculate the minimum required flow rate for the following three types of common kitchen fixtures: drainage fixtures, faucet fixtures, and cleaning fixtures. (See Appendix C for HGI Design Form.)

Drainage fixtures are filled and completely drained at the end of their use and include the three-compartment sink and cooking equipment like tilt skillets, braising pans, rotisserie ovens, and wok ranges. Flow is calculated using the Manning Formula, which accounts for sink pipe drain size, pipe material, and pipe slope to determine the maximum flow rate from fixture. Most drainage fixtures connect to a single drainpipe. If the fixture connected to a separate drainpipe, list as multiple fixtures.

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$$\text{Flow Rate (gpm)} = 669 \times A \times R^{2/3} \times S^{1/3} \div n$$

Where,

$$A = 0.7254 \times [\text{Pipe Diameter (in.)} \div 12]^2$$

$$R = 0.251 \times \text{Pipe Diameter (in.)}$$

$$S = \text{Pipe Slope}$$

$$n = \text{roughness coefficient}$$

Note: Manning's roughness coefficient, n, depends on the pipe material and age of the drainage pipe. Additionally, an estimate can be made for the minimum slope based on pipe size if slope is unknown.

Roughness, <i>n</i>	PVC	Copper
Minimum (new)	0.008	0.010
Normal (used)	0.009	0.011
Maximum (old)	0.010	0.012

Drainage Pipe Diameter	Minimum Slope
2 ½ inches or smaller	0.0208
3 to 6 inches	0.0104
8 inches or larger	0.0052

It is assumed that 87.5 percent of the horizontal drainage pipe is wettable due to flow caused by gravity alone. (Contact the City if sewage ejector pumps are used.)

Faucet fixtures are not filled, but instead drain at their faucet's flow rate and includes sinks for food preparation, pre-rinse, equipment cleaning, and waste food disposal units. If floor drains are present, their combined flow equals the fixture(s) supplying the spray. Sinks with two faucets count as two fixtures. Ignore hand-wash-only fixtures for sizing. The IPC requires most faucets discharge a maximum 2.2 gpm at 60 psi and service/mop sinks should discharge a minimum 3 gpm at 8 psi.

Cleaning fixtures have specific peak discharge rates that exceed faucet flow but are less than the maximum rate the drainpipe permits and includes dishwashers, clothes washers used for cleaning of food services-associated linens, and automatic hood cleaning systems. A facility must provide a list with the manufacturer and model of all fixtures that specifies the flow rate.

The total minimum flow rate is calculated by summing the calculated flow rate from drainage fixtures, the flow rate from faucets discharge, and the flow rate of cleaning fixtures provided by the manufacturer.

$$\text{Thus, HGI Flow Rate} = \text{DFQ} + \text{FFQ} + \text{CFQ} = \text{Minimum flow rate.}$$

Note: DFQ (Drainage Fixture Flow), FFQ (Faucet Fixture Flow) and CFQ (Cleaning Fixture Flow)

2. Step 2: Sizing by grease production

Once the minimum flow rate has been established in Step 1, calculate the minimum grease storage capacity for the HGI required for the desired pump-out frequency as follows:

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Required Grease Capacity

$$= \text{Grease Factor} \times \text{Meals or Customers per day} \\ \times \text{Days between pumpout}$$

where the grease factor is determined using the following table.

Type	Menu	Grease Factor - >	Without fryer without flatware	Without fryer with flatware	With fryer without flatware	With fryer with flatware
			A	B	C	D
1	Bakery		0.035	0.0455	0.035	0.0455
2	Bar and Grille		0.005	0.0065	0.025	0.0325
3	Barbeque		0.035	0.0455	0.035	0.0455
4	Breakfast Bar - Hotel		0.005	0.0065	0.025	0.0325
5	Buffet		0.035	0.0455	0.058	0.0754
6	Burger and fries, fast food		0.035	0.0455	0.035	0.0455
7	Cafeteria		0.025	0.0325	0.035	0.0455
8	Caterer		0.005	0.0065	0.025	0.0325
9	Chinese		0.035	0.0455	0.058	0.0754
10	Coffee Shop		0.025	0.0325	0.035	0.0455
11	Convenience Store		0.005	0.0065	0.025	0.0325
12	Deep Fried Chicken/Seafood		0.035	0.0455	0.058	0.0754
13	Deli		0.005	0.0065	0.025	0.0325
14	Family Restaurant		0.035	0.0455	0.035	0.0455
15	Frozen Yogurt		0.005	0.0065	0.025	0.0325
16	Greek		0.025	0.0325	0.035	0.0455
17	Grocery Bakery		0.025	0.0325	0.035	0.0455
18	Grocery Deli		0.025	0.0325	0.035	0.0455
19	Grocery Meat Department		0.025	0.0325	0.025	0.0325
20	Ice Cream		0.025	0.0325	0.035	0.0455
21	Indian		0.025	0.0325	0.035	0.0455
22	Italian		0.035	0.0455	0.035	0.0455
23	Mexican, Fast Food		0.035	0.0455	0.035	0.0455
24	Mexican, Full Fare		0.035	0.0455	0.058	0.0754
25	Pizza		0.025	0.0325	0.035	0.0455
26	Religious Institution		0.005	0.0065	0.025	0.0325
27	Sandwich Shop		0.005	0.0065	0.025	0.0325
28	Snack Bar		0.005	0.0065	0.025	0.0325
29	Steak and Seafood		0.035	0.0455	0.058	0.0754

Grease interceptors certified to meet the minimum requirement of ASME A112.14.3, CSA B481, and/or PDI G101, shall have the flow rates and minimum grease storage capacities as listed.

HGI Flow Rate	Minimum Grease Storage Capacity* (lbs.)
20	40
25	50
35	70
50	100
75	150
100	200
*Minimum grease capacity as required by ASME A112.14.3, CSA B481 and/or PDI G101	

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C. Sizing of gravity grease interceptors

Gravity grease interceptors are to be sized based on the expected flow rate of three categories of kitchen fixtures (similar to HGI) in gallons-per-minute with criteria of hydraulic residence time of 30 minutes and a 25 percent FOG and solids storage factor. The design flow rate is one-third the maximum flow rate because of the bulk hydraulic compensation of short-term peak flow events.

$$Volume = [Maximum\ Flow\ Rate(gpm)] \\ \times 30\ min \times 1.25\ Storage\ Factor \div 3$$

where maximum flow rate is calculated by summing the calculated flow rate from drainage fixtures, the flow rate from faucets discharge, and the flow rate of cleaning fixtures provided by the manufacturer.

Thus, HGI Flow Rate = DFQ + FFQ + CFQ = Minimum flow rate. (For calculation details of DFQ, FFQ, and CFQ see section, 5.6.2.1. Sizing of Hydromechanical.)

9.3 Sand and Oil Interceptors

A. For automotive facilities

Non-domestic dischargers where work or service is performed includes automotive service, machine shops, parking garages, automotive care centers, auto body shops, car washes or any other facility that generate sand, petroleum oil, grease, or other petroleum products, grit, gravel, or other aggregate that may discharge into the wastewater collection system. Access to the wastewater collection system is often via floor drains located inside shop areas that are not limited to non-polluting wastewater sources.

At repair garages, car-washing facilities with engine or undercarriage cleaning ability, all oil-bearing, grease-bearing, and flammable waste shall be discharged to an HGI before emptying in the building drainage system or other point of disposal.

1. Sizing

Where automobiles are serviced, greased, repaired, or washed, or where gasoline is dispensed, an interceptor shall be installed having a minimum capacity of 45 gallons for the first 100 square feet of area to be drained, plus 7.5 gallons for each additional 100 square feet of area to be drained.

9.4 Best Management Practices

BMPs benefit facilities by preventing grease discharges and keeping interceptor maintenance costs low.

A. All food preparation facilities are required to follow kitchen BMP, including but not limited to the following:

1. Regularly train all employees on fats, oil, and grease control and management.
2. Prevent grease from entering all fixture units.
3. Scrape excess food waste and grease off plates prior to washing.
4. Dispose of food waste in the garbage.
5. Install drain screens on all drainage fixture units.
6. Collect and recycle cooking grease.

It is the responsibility of the waste generator to ensure compliance with the City's discharge limitation. Hazardous waste, such as acids, strong cleaners, pesticides, herbicides, paint, solvent, or gasoline should be disposed of properly.

9.5 Operation and Maintenance

Periodic operation and maintenance inspection are performed by the City to ensure compliance. It shall be the responsibility of those engaged in the operation of the business activity to maintain the associated wastewater pre-treatment facilities in efficient functioning order.

Grease interceptors shall be pumped and cleaned of the accumulated matter as often as necessary to ensure maximum efficiency and to prevent non-compliance with applicable discharge. Must occur at a minimum of once per 90 days for food service establishments and once annually for automotive facilities.

An HGI is deemed to require service when settled solids and FOG exceed manufacturers' recommended depth. A gravity grease interceptor is deemed to require service when settled solids and FOG exceed 25 percent maximum depth.

The City may require a business to maintain a specific grease interceptor pumping and cleaning interval based on observed problems or non-compliance related to grease production, accumulation, and wastewater discharges.

Grease interceptor pumping, cleaning, and hauling service companies must be hired to perform work for non-domestic grease producers in the City. If a facility produces more than 55 gallons of waste to dispose of, an accredited and licensed grease transporter must be hired to remove the waste grease and dispose of it according to Colorado state law. The transport and disposal of waste grease is regulated under Colorado's solid waste regulation (6 CCR 1007-2, Section 18). The Division's website, www.colorado.gov/cdphe/wastegrease, has a list registered waste grease transporters who can accept the waste.

Maintenance and pumping records must be kept on-site for a minimum of three years. The City reserves the right to require a business to submit maintenance and pumping records to the City within a week of the event.

Partial cleaning of grease interceptors is not allowed.

Enzymes, solvents, and emulsifiers are not permitted as these will only change the form of grease allowing it to be carried out of the grease interceptor with the wastewater and deposited in the collection system. Biological treatment systems must be pre-approved by the City. These systems will not alleviate the necessity for inspection and proper maintenance.

9.6 Inspection and Construction

- A. All permitting, construction, and inspection activities must be completed in accordance with the City Plumbing Code. Additionally, the following specifications must be incorporated into grease interceptor construction and inspection.
 1. In facilities where dishwashing machines are installed and water discharge temperature may exceed 150-degrees Fahrenheit, a tempering valve must be installed prior to the grease interceptor.
 2. All grease-bearing waste streams, such as two-compartment sinks, three-compartment sinks, pot/pan sinks, dishwashers, mop sinks, and floor drains should be routed through an appropriate grease interceptor.
 3. All HGIs shall be certified to ASME A112.14.3, CSA B481 or PDI G101. If the interceptor does not follow one of these standards, then an effluent sampling well must be implemented. Sampling wells will have an access cover and a drop from inlet to outlet pipe.

END OF SECTION

SECTION 47: SANITARY SEWER LIFT STATIONS AND FORCE MAINS

1.0 General

1.1 Lift Station Capacity

- A. All lift stations with capacities of 2,000 gallons per day (gpd) or greater are subject to Colorado Department of Health and Environment (CDPHE) Regulation 22.
- B. Lift stations with capacities less than 2,000 gpd and not owned by the City are still required to have inspections before they can be connected to the sewer system.
- C. See Appendix C for lift station and force main design forms.

2.0 Cost Responsibilities

2.1 Design and Construction

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 project.

2.2 Reimbursement

Where additional service area outside of the proposed development is anticipated, the City requires the lift station and associated improvements to provide additional capacity than what is necessary for initial development.

2.3 Operations and Maintenance

- D. Public facilities: Public lift stations are defined as any lift station serving more than one user and accepted by the City Water and Wastewater Division. Operations and maintenance activities shall be the responsibility of the City for all public lift stations only upon completion and acceptance of the proposed improvements. The Developer shall provide operations and maintenance manuals and procedures for all equipment and processes associated with the lift station. The Developer shall coordinate with the City during the planning and design phases on equipment operations and maintenance requirements.
- E. Private facilities: 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.

3.0 Planning and Permitting

3.1 General

- A. Gravity-based solutions are preferred to lift stations as they provide the most reliable and lowest cost service for the City's customers. The use of a lift station and force main shall be evaluated on a case-by-case basis. If there is an appropriate gravity solution, the Developer shall design and construct the proposed improvements, meeting the City of Steamboat Springs Criteria. Any lift station or force main shall first be approved by the City following proper justification by the Developer. Where a lift station is determined to be required, it shall be designed to allow for an eventual connection into a gravity system.

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- B. The lift station and force main design shall adhere to state and regional approval processes and the Developer shall keep informed and notify the City of major milestones during the design and approval processes. The Developer shall adhere to the submittal requirements previously stated in Section 00 of these criteria.

3.2 Procedures

- A. The Developer shall employ the services of an engineer licensed in Colorado that has successfully designed and permitted at least two lift stations of similar size as proposed, within the State of Colorado. The Developer and the Consulting Engineer shall adhere to the following procedures through the planning and design phases:
1. Coordinate a conceptual project meeting with the City to provide justification for the project and initial design considerations including site location, force main alignments, land acquisition requirements, preliminary design criteria, project schedule, and permitting requirements.
 2. Upon preliminary conceptual acceptance for consideration of the need for a lift station, provide written project justification for the project and design considerations including site location, force main alignments, land acquisition requirements, preliminary design criteria, project schedule, and permitting requirements.
 3. Attend follow-up meeting following completion of the review of conceptual documents.
 4. The Developer shall keep the City informed of the project's progress from design through construction approval. This includes notifying the City of the major project milestones, associated CDPHE review and approval process, and allowing for City review of major reports and documents. Major milestones include but are not limited to:
 - Site submittal to Utility Division
 - Signed and approved site application submitted to CDPHE
 - Basis of design report (BDR) submittal to CDPHE
 - Design approval from CDPHE
 - Funding requests
 - Public meetings/outreach
 5. Upon the City's review and acceptance of the conceptual design, the applicant may proceed with the lift station site application process in accordance with CDPHE Regulation 22.
 - The site application shall be submitted for review and acceptance by the City.
 - Following the City's acceptance of the site application, the applicant shall submit the site application and required counterparts in accordance with Regulation 22 to CDPHE for review and approval.
 6. The lift station BDR shall be reviewed by the City prior to submitting the BDR to CDPHE for review and approval. The BDR shall include a 60 percent design package and shall only be submitted to CDPHE upon City acceptance.
 7. Prepare and deliver final design plans and technical specifications for the City's review and approval.

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8. The applicant shall coordinate with the City through the construction bidding process as necessary.
9. The applicant shall coordinate construction inspections with City Inspectors.
10. The applicant shall submit all construction submittals for review, including shop drawings and data and operation and maintenance manuals to the City.
11. The applicant shall coordinate with the City for start-up testing and required training.
12. The applicant shall submit final record drawings to the City in AutoCAD and pdf format.

3.3 Colorado Department of Public Health and Environment (CDPHE)

- A. The design and construction of all lift stations and force mains shall adhere to CDPHE's most recent version of Regulation 22—Site Location and Design Approval for Domestic Wastewater Treatment Works. (The City reserves the right to review all procedures and reports required under Regulation 22 and request revision if necessary. Where CDPHE's Regulation 22 and the City's Criteria differ, the more restrictive of the conditions shall apply.)

Water Quality Planning Association (WQPA)

The planning and site application process of the proposed lift station and force main shall be in accordance with WQPA wastewater utility plan guidance. The applicant will be required to provide updates to the City's Wastewater Utility Plan (WUP) for the proposed lift station and force main as part of the site application process.

- B. The process for obtaining lift station approval from the Water Quality Control Division begins with CHPHE Regulation 22, latest revision. Refer to the WQPA website and Regulation 22 for guidelines and requirements on the lift station site location and design approval process.

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- A. The Developer shall coordinate with the following City's departments to ensure all procedures and policies are followed.
 1. Utility Division
 2. Engineering Development Review
 3. Planning and Community Development
 4. Building Inspections
 5. Other departments as required

3.5. Lift Station Design Criteria

- A. Applicable codes, environmental compliance, and health and safety
 1. Applicable codes: For work done in the City, work shall be performed in accordance to the codes established by the City's building department.
 2. Environmental compliance: Environmental assessments and/or environmental reviews may be required as a preliminary investigation to determine if a particular parcel of real property is subject to recognized environmental constraints such as, and not limited to, the following: floodplain areas, wetlands, endangered species, and hazardous conditions. Should environmental constraints as identified above exist, it is the Developer's responsibility to incorporate mitigation measures to

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comply with environmental requirements in accordance with applicable and current rules and regulations.

3. Health and safety: Public lift stations are required to conform to all City and OSHA health and safety requirements. City operation staff safety shall also be considered during the design and construction of the lift station including, but not limited to:
 - Readily accessible equipment placement for maintenance activities
 - Classified areas in accordance with the National Fire Protection Association (NFPA) 820 Regulations
 - Lifting assistance for heavy equipment
 - Nonslip floor finishes
 - Handrails
 - First-aid and safety equipment
 - Fall protection
 - Limitation of confined spaces: It is desired by the City to limit confined space entries where possible.

B. Determination of wastewater flows

1. Existing wastewater flows shall be calculated. Should the project area not fit the previously stated design flow estimation methods, applicable and industry-standard calculation methods shall be utilized. Methods include real-time flow monitoring or calculations based on land use. Methods and calculations shall be included in relevant planning documents and subject to the City's review.
2. Proposed and future wastewater flow projections shall be estimated for the build-out conditions of the service area. Estimation methods shall be based on projected land use. The planning period and projected land use within the service area shall be coordinated with the City during the planning phases.
3. Organic and other applicable wastewater constituent loadings shall be considered and evaluated based on existing and projected land use. It is the Developer's responsibility to calculate based on most current available information, flows and constituent loadings for accessing available sewer, and wastewater treatment capacities.

C. Impacts on downstream lift stations or sewer capacities:

1. Ultimate peak hour design flows shall be used to determine the impact to downstream collection system infrastructure including treatment facilities, lift stations, and sewers. Existing infrastructure needs to be able to accommodate peak flows and loadings from new lift stations and force mains. The capacity of existing infrastructure to accommodate flows from new lift stations shall be justified to the City as part of the planning and design documents.

D. Lift station capacity

1. Lift station capacity shall be designed to accommodate existing and future projected peak flows for the entire service area.
2. Hydraulic calculations and system/pump curves require consideration and shall be submitted for review during the planning phases to the City and as part of the CDPHE's approval process.

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3. Receiving sewers shall be evaluated to ensure adequate capacity to accommodate the ultimate lift station flow.

E. Emergency storage

1. The lift station shall be designed for at least 60 minutes of emergency storage at peak-hour flow conditions or as required by CDPHE. Emergency storage can utilize volume within the wet well above the high-level alarm and upstream collection system piping provided that it is demonstrated that back-up will not occur into any existing or potential future service connections or taps. No future taps shall be constructed within the section of influent sewer or sewers to the lift station designated to provide emergency storage. If a piping connection is required to accommodate emergency storage provisions, the invert of the pipe connecting the wet well to emergency storage shall be above the high-level alarm. Additional emergency storage may be required at the discretion of the City based on site location, emergency response time, and potential environmental concerns.
2. Emergency storage can be accomplished using an additional precast concrete manhole or storage vault-like structure. The emergency storage structures shall provide adequate access and floor slope for cleaning and shall be designed with precast concrete, cast-in-place concrete, or fiberglass reinforced plastic. If constructed of concrete, adequate protection (e.g., protective coatings) shall be provided to mitigate corrosion caused by hydrogen sulfide. If used, the emergency storage vault shall be designed to provide flow to and from the wet well to the vault and with adequate access for pumping via vacuum truck or other appropriate method.
3. If emergency storage can be accomplished through gravity flow from the lift station to another existing collection system, the City may consider that as an option to meet emergency storage requirements. It shall be demonstrated that the gravity overflow, existing collection system, and downstream facilities be adequately sized to accept increased flow. Additionally, should the collection system be operated by another entity, a legal agreement, stating the entity can and shall receive emergency flows, shall be coordinated and presented to the City during the design review process.

F. Energy Efficiency

1. Lift stations shall be designed for energy efficiency including, but not limited to, the design of force mains, pump selection, overall head losses, lighting, ventilation and odor control. Pumps shall be designed and specified to operate within the manufacturer's recommended operating range.

3.6 Force Main Design Criteria

A. Hydraulic Design Guidelines

1. Force mains shall be designed to minimize their length in order to minimize the costs for operation, maintenance, and replacement. The engineer should thoroughly evaluate the site in order to determine the most efficient alignment for the force main.
2. Force main pipe materials shall be in accordance with these specifications. The force main, joint restraint, thrust blocking, and station piping shall be analyzed and designed to withstand water hammer pressures and associated cyclic reversal of stresses that are expected with the cycling of wastewater lift station pumps. Water hammer shall be evaluated for the normal operation of the lift station, as well as for a power outage while the pumps are running. The modulus

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of elasticity of the pipe material shall be considered when evaluating water hammer effects and cyclical loadings. At a minimum, the following shall be addressed in the analysis to be submitted for approval by the Utility Division::

- a. Transient pressures due to water hammer and the effect of these pressures on the entire system
 - b. Cyclical loading of the force main
 - c. Evaluation of the pipeline profile to determine the possibility of column separation
 - d. Reverse rotation characteristics of the pumps
 - e. Shut-off characteristics of all proposed control valves, including check valve
 - f. Substantiation for the use of surge control valves and other surge protection devices, when necessary, listing recommended size and computed discharge pressures
3. All elements of the piping system must be designed to withstand the maximum water hammer, in addition to the static head and cyclical loading. A safety factor of 1.5 shall be used when determining the adequacy of all piping system components with regard to withstanding system pressures.

B. Materials and sizing

1. Force main material shall be AWWA C900-16 with a minimum wall thickness of at least DR-25. DR-18 or DR-14 shall be required if pressure or surface loading at any location in the system exceeds the DR-25 pressure rating.
2. Force mains shall have, at minimum, a 4-inch diameter. Force mains shall be sized appropriately for a minimum fluid velocity of 2 feet-per-second and maximum velocity of 7.5 feet-per-second. Sizing shall also conform to CDPHE design requirements, whichever is most limiting. Parallel force mains are strongly preferred by the City for maintenance procedures, emergency conditions, and capacity optimization between existing and build-out flows. If parallel force mains are not considered feasible for a specific installation, it shall be demonstrated that the force main diameter is optimal for existing and build-out flow velocities.
3. If force main diameter is such that the wastewater velocity is less than 2 feet per second at initial operating conditions, the design shall include VFDs on the pumps to allow the motors for the pump or pumps to increase frequency to increase the wastewater velocity in the force main to be a minimum of 3 feet-per-second for a minimum flushing time of five minutes. Reference the Electrical and Controls section of this criteria.

C. Access/cleaning stations

1. Force main clean-out access shall be provided every 500 feet in situations where the force main is 950 feet or longer. Clean-outs shall provide adequate access to allow for pipeline condition observations via video camera.

D. Protection, bedding, and compaction

1. Pipe bedding and backfill of force mains shall conform to the specifications in Section 24 of these standards.

E. Force main alignments and separation

1. The minimum buried depth of the force main shall be 60 inches from the top of the pipe.

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2. Wastewater force mains shall adhere to CDPHE and City standards for separation between potable water lines and other utilities. Wastewater force mains shall travel below existing potable water lines meeting the minimum requirements as outlined in Section 4.18. Should minimum separation requirements not be possible, refer to encasement requirements in Section 44 of the criteria.
 3. Should the wastewater force main alignment be such that it cannot accommodate these separation requirements vertically or horizontally, provisions shall be provided to safeguard the existing utilities in accordance with the City design criteria and construction standards.
- F. Special permitting requirements
1. In situations where the force main alignment crosses areas that include wetlands, floodplains, irrigation ditches, railroads, and waterways, the Developer shall be responsible for all permitting during the design phase to ensure that local and state requirements are followed. The Developer shall document all required permits with the City prior to proceeding with construction. In all cases, the Developer shall evaluate alternative force main alignments to minimize impact to sensitive areas described herein.
 2. Easements required for the force main alignment shall adhere to Section 40 of these criteria. All easements required for the force main shall be approved by the City and granted to the City prior to the City's approval of construction documents.

3.7 Land Acquisition and Easements

- A. All land area requests for the lift station sites shall be submitted and approved by the City prior to starting the land acquisition process. Lift stations shall be located on property deeded to the City. The minimum size for the lift station site shall allow for adequate equipment access, maintenance activities, and ancillary equipment (e.g., generator, odor control, emergency storage). In no case shall the lift station site be less than 2,500 square feet in size. The applicant shall provide preliminary lift station site drawings showing major lift station components, security, buildings, and access for the City to review and determine required site size.
- B. Force main alignments exiting the lift station site up to the point of gravity connection shall be contained within an exclusive sewer easement and shall be dedicated to the City per Section 2.06 of this criteria.

4.0 Lift Station Site

4.1 Location and Topography

The lift station and site location shall be designed and constructed to limit disturbance to the surrounding properties both aesthetically and during construction activities. Lift stations shall be located a minimum of 100 feet from any residential property line. The site shall allow adequate access to the site from existing public right-of-way. The lift station site shall be designed to provide adequate drainage away from the lift station and building and conform to City standards for drainage and storm water management plans. The Developer shall perform a geotechnical evaluation of the site to determine soil conditions and hydrology as well as recommendations for lift station construction. Lift station sites shall be located outside of the FEMA 100-year floodplain with the finished floor elevation of the lift station a minimum of 2 feet above the floodplain. All lift station site locations are subject to review and approval by the City and CDPHE Regulation 22.

4.2 Lift Station Building/Enclosure

The lift station shall be enclosed in a weatherproof structure. The lift station enclosure and lift station pumping components at a minimum shall be accessible without permitting for confined space access. As a minimum, the lift station enclosure shall be ventilated and heated and conform to the City's planning and building department requirements and applicable structural and building codes. The size of the building or enclosure shall allow for adequate clearance to maintain pumping equipment, piping, valves, electrical gear, and controls. The minimum spacing between pumps shall be 30 inches and spacing around pumps and electrical panel clearance shall be 36 inches. Building or enclosure entryways, hatches, and overhead doors shall allow for convenient access and equipment removal for maintenance and replacement. All lift station enclosures or buildings must be approved by the City and applicable architectural committees that are associated with the subdivision or local association.

Where high groundwater conditions are anticipated, buoyancy of the lift station structures shall be evaluated and protected against.

4.3 Aesthetics

The lift station shall be subject to the City's development review process and applicable development standards. The lift station architecture and aesthetics shall be designed to match the surrounding structures. Landscaping shall be considered on the perimeter outside of the fence and planned to match the surrounding environment. Appropriate screening and other methods shall be utilized to minimize noise and visual impacts.

4.4 Access

All wastewater lift stations shall be sited to allow access by all-weather surface roads capable of accommodating maintenance trucks from public right-of-way to the lift station site. The access shall at a minimum support HS-20 loading with a minimum width of 15 feet. The access points and site shall be designed to allow WB-50 trucks to maneuver within the site and exit the site without backing into public right-of-way. The site layout shall allow for access to the wet well and vacuum/jetter truck to clean out accumulated material in the wet well. All paved surfaces shall be designed for the expected vehicle and equipment loads.

4.5 Security Fencing

- A. The lift station site shall contain perimeter security fencing at a minimum height of 6 feet. The fencing is subject to the City of Steamboat Springs Municipal Code and shall be reviewed and approved by the City.
- B. The lift station site access gate shall have a minimum size, full-width opening of 18 feet and of lockable type.

4.6 Lighting

- A. Lighting shall be provided at the lift station site to allow for necessary activities during the night and times of low visibility. The lighting system shall be designed to provide illumination best suited for the station layout with may include suspended, wall, or ceiling mounted fixtures and shall be suitable for routine maintenance activities and inspections. Site lighting equipped with photocells shall not be allowed.

4.7 Potable Water

The site shall have access to potable water. Potable water connection, service size, backflow device and meter shall be coordinated with the City. At a minimum, there shall be a frost-proof yard hydrant located in the vicinity of the wet well.

5.0 Lift Station Components

5.1 Pumping System

- A. Each lift station shall have a minimum of two pumps. The pumps shall be designed to accommodate existing flows and future flows from fully developed contributing area. Firm capacity of the pump system shall be designed (or phased) to pump ultimate peak flow at maximum computed total dynamic head. Pump operation shall be automatic but fitted with the capability to run the system in manual control.
- B. Lift stations shall be designed as a duplex system as a minimum. A duplex system for ultimate flow of the service area shall be designed so that each pump is sized for peak hourly flow. The applicant shall provide a spare pump of the same capacity. Lift stations serving service areas that are phased over several years shall be designed initially as duplex systems, at a minimum, with room to add additional pumps for meeting the ultimate flow demands of the service area. Lift stations that are designed with more than two pumps shall be capable of pumping peak hourly flows with the largest pump out of service. The applicant shall provide a spare pump matching the size of the largest pump in service.
- C. In all cases, pumping systems shall be designed to accommodate existing and build-out flows with adequate redundancy as defined by CDPHE Regulation 22 and in these criteria. If future build-out conditions require more than two pumps that are not needed for near-term flow conditions, the lift station shall be designed to add additional pumps, piping, valves, electrical, and control without the need for a major system shutdown and/or bypass pumping.
- D. The pumping system shall be designed to allow for adequate access between other pumps, piping, and ancillary equipment for maintenance activities including, but not limited to, routine maintenance, inspection, and pump removal.
- E. Required pumping system type: Above-ground mounted self-priming suction. The pumping system is self-priming suction pumps placed on grade with minimal piping to suction from the wet well. The only accepted manufacturer for the pumping system is Gorman Rupp. Pumping systems shall be site-specific designs or prepackaged systems meeting site requirements. All designs are contingent on review and approval by the City.
- F. Alternate pumping system: If the Developer, with approval from the City, determines above-ground, mounted self-priming suction pumps are insufficient for the application, the Developer can seek a variance to utilize either wet well/dry well or submersible pump configurations. The Developer must adequately prove that the alternative pump configuration is the optimal choice for the application and include evaluations between both dry-pit and submersible configurations.
 1. Submersible pumps: Where above-ground, mounted, self-priming suction pumps are insufficient, the City will only consider submersible pumps where the ultimate build-out peak hour flow rate is less than 100 gallons per minute. Where submersible pumps are approved by the City, the pumps must be removable without entering the wet well by providing rail and crane system. Control panels and associated equipment shall be located within an enclosure of adequate size. The Developer shall provide two spare pumps to the City.
 2. Wet well/dry well: Where above-ground, skid-mounted, self-priming suction pumps are insufficient and flow rate is greater than 100 gallons per minute during peak hour flow at full build out, the lift station shall be configured to provide separate wet wells and dry wells. Common walls between wet wells and dry wells shall be water and gas tight. Suitable and safe means of access shall be provided to the dry well for operations staff, maintenance, and removal of all equipment

from the dry well. Access shall include separate equipment and access hatches. Access to the dry well shall be provided through stairs. Ladder access is not allowed. Where dry wells are considered, the lift station shall be designed to ensure that surface runoff cannot enter the lift station. Where groundwater is above the dry well, adequate measures shall be taken to prevent infiltration of groundwater into the dry well and wet well.

G. Pumping system components

1. Each pump shall have a dedicated check valve, plug valve, and air-relief valve on the discharge side of the pump. Pressure gauges shall be provided on both the suction and discharge (prior to the check valve) side of the pump. Pressure gauges shall be provided with a pulsation snubber constructed of 316 stainless steel and an isolation valve. It is preferred that these pump system components are supplied by the pump manufacturer if supplied as a skid-type system to ensure compatibility, performance, and single point of supply.

H. Hydraulics

1. Pumps shall be designed to accommodate existing and future flows. Pump design calculations shall be included in the design reports and subject to City review. Hydraulic calculations shall include pipe friction losses using appropriate friction coefficients and minor friction losses. Net positive suction head available (NPSHA) and net positive suction head required (NPSHR) shall be considered to ensure pump cavitation will not occur. Control descriptions for the pumps shall consider water levels required to maintain adequate NPSHA and NPSHR.

5.2 Station Piping

A. Material and sizing

1. Station piping shall be ductile iron and sized to accommodate the necessary flow ranges. Flanged header pipe shall be ductile iron complying with ANSI/AWWA A21.51/C115 and Class 53 thickness. Flanges shall be ductile iron class 125, or as required by pumping application and pressures, and comply with ANSI B16.1. Generally, the liquid velocity in the station piping shall be no less than 3 feet per second and no greater than 10 feet per second.

B. Expansion joints/victaulic coupling

1. Station piping shall include expansion joints, flanged coupling adaptors, and/or grooved couplings to allow for dismantling of station piping for maintenance and parts replacement.

5.3 Valves

A. Plug valves

1. Isolation valves shall be eccentric, non-lubricated plug valves. Each pump discharge shall have a dedicated isolation valve so that each pump can be isolated from the common discharge header. Plug valves shall be of cast iron body, ASTM A126 Class B. Valve plugs shall be cast iron ASTM A126 Class B covered with a Buna-N Rubber compound. The seats are to be a corrosion-resistant alloy either 316 stainless steel or nickel. The valve body shall be semi-steel with flanged end connections drilled to 125 pounds, or higher as required by application pressures standard. The valve shall be operated with a single lever actuator providing lift, turn, and reseal action. The lever shall be equipped with a locking device to hold the plug in the desired position. Valves shall be able to

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pass a spherical solid not less than 3 inches in diameter. Accepted manufacturers include DeZurik, Valvmatic, and Milliken.

- B. Check valves (4-inch or more in diameter)
 - 1. Check valves shall be swing check valves capable of passing a 3-inch spherical solid. Check valves shall meet the latest AWWA C508 standard and be of the resilient hinge check valve type. All internal hardware shall be stainless steel. The valve shall be equipped with flanged ends and be fitted with an external lever and spring. Valves shall be equipped with removable cover plate to permit entry or for complete removal of internal components without removing the valve from the line. The valve shall be rated at 175 PSI water working pressure, 350 PSI hydrostatic test pressure. For high pumping head applications (150 feet or greater), the Developer shall submit a type of check valve that will minimize hydraulic surges and slam to the system. Each pump discharge shall have a dedicated check valve. Accepted manufacturers include Valmatic, DeZurik, Victaulic, and Golden Anderson.
- C. Combination air and vacuum valves
 - 1. Sewage-rated combination air and vacuum valves shall be placed at the discharge of pumps as close to the check valve as possible and at any local high points in the station piping. Accepted manufacturers include Valvmatic and Golden Anderson.

5.4 Bypass Pumping Assembly

- A. Lift station out of service
 - 1. A bypass pumping configuration shall be designed to bypass the lift station should it ever need to be taken offline. The bypass pumping configuration shall include provisions to bypass the entire lift station as well as lift station components including the wet well and pumping equipment and station piping. Bypass connections shall also be included on the common discharge header to the lift station pumps (station piping) as well as the force main (site piping) along with isolation valves. All bypass connections shall be, at a minimum, 6-inch camlock.
- B. Approach manhole
 - 1. An approach manhole shall be constructed upstream of the wet well within the lift station site boundaries. The approach manhole shall serve as a common connection for the gravity sewer or sewers feeding the pump station and shall connect to the wet well by a single gravity pipe.
- C. Corrosion protection and coatings
 - 1. Lift station wet wells shall have corrosion protection on the interior surfaces to prevent damage to the wet well caused by concentrated levels of H₂S and other corrosive properties of raw wastewater. Economic and life cycle analysis shall be performed on various corrosion protection methods including polymer concrete, waterproofing/microbicide admixtures, and epoxy coatings. Determination of the most suitable corrosion protection method is subject to City approval based on the economic and life cycle analysis. All wet well penetrations shall be link sealed and grouted to inhibit any leakage from the wet well or groundwater infiltration.
- D. Coatings and paintings
 - 1. All exposed carbon steel surfaces, piping, and equipment shall have field-applied protective painting or coating except where material (i.e. PVC, stainless steel, hot

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dipped galvanized, or aluminum) or factory coating warrants exception. All paint and coatings systems shall be approved by the City and shall adhere to City standards for color coding.

5.5 Electrical and Controls

A. Electrical equipment

1. All electrical equipment shall be in accordance with the latest standards of NEC and, where applicable, meet all requirements for hazardous locations in accordance with NFPA 820. The Developer shall coordinate with the City Building Department on applicable codes.
2. The Developer shall coordinate with the City for the electrical utility providing electrical service. The station shall be provided with a separate utility transformer and meter/main with ground fault protection. Primary power to the station shall be 480-volt, 60 Hz, three-phase service per utility provider standards. The Developer is required to pay permitting, design, and costs for primary power to the lift station site. Secondary power service shall be designed by a certified electrical engineer licensed in the State of Colorado. As a minimum, the station shall include service disconnect panel, automatic transfer switch (ATS), motor control center (MCC) or electrical distribution panel. The service disconnect panel shall be mounted on the exterior face of the lift station building common wall to the indoor electrical switch gear.
3. The ATS shall be provided to switch from normal utility power to standby emergency power upon power outage and switch back to normal power once the power outage is restored. The ATS shall have indicating lights for normal power, emergency power, and a digital panel indicating volts and amps. The ATS shall be mounted inside the lift station building integral to the MCC. The ATS manufacturer shall be compatible and approved by the accepted lift station pump manufacturer, Gorman Rupp. The City's standard for standby emergency power is natural gas-powered engine generators manufactured and provided with the lift station pumps manufacturer, Gorman Rupp. If the lift station pumps are provided by a manufacturer other than Gorman Rupp, the Developer shall provide the ATS and standby emergency power generator specifications and manufacturer for City review and approval.
4. Electrical switchgear (480-volt) shall be mounted in a NEMA 1 MCC with removable buckets within a NEMA 3R wrapper. A step-down transformer shall be included to provide power service to a separate light or power panel rated for 120/240-volt service. The light or power panel is required to provide service for interior and exterior lighting, receptacles, ventilation, and controls. Switchgear shall be manufactured by Cutler-Hammer, Allen Bradley, Square "D," or approved equal by the City.
5. Transient voltage suppression rated at 80 KA minimum shall be provided at the main electrical service panel and shall be installed in accordance with the latest requirements of NEC Article 285.

B. VFDs and soft start and stop

1. All motor sizes greater than 20 HP shall be equipped with a reduced voltage solid state start and stop or also known as soft start and stop. The use of variable frequency drives (VFD) for the lift station pumps shall be evaluated on a case-by-case basis. The Developer will be required to demonstrate the advantages for installing VFDs for the ranges of pumped flows. The soft start/stop device and/or

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VFD shall be mounted adjacent to the MCC. Accepted manufacturers for the soft start/stop and VFD equipment are Allen-Bradley, Cutler-Hammer, and Toshiba.

C. Level controls

1. The primary level control system used for the lift station to turn pumps on and off and sequence lead and lag operations shall consist of the radar-level measurement type. The primary level control system shall have a minimum of five differential level set points, including low liquid level, start/stop lead pump, start/stop lag pump, start/stop standby pump (if required), and high water level. The level control shall be equipped with a transmitter device and user interface screen for user set points and display of liquid level in the wet well. Contacts shall be provided for selected alarm outputs for integrating into the SCADA and telemetry system. Accepted manufacturers for level control shall be Endress Hauser or a manufacturer approved by the City.
2. The lift station shall be equipped with a secondary level control system for back-up. The secondary level control shall consist of electro-mechanical float switches for low water cut-off, pump on/off, and high-water alarm. Accepted manufacturers for float switches shall be Siemens Water Technologies Model 9G-EF or approved equal.

D. Lift station control systems

1. Controls shall provide automatic reset of alarm conditions for normal power fail, high water level, standby pump run, and a common alarm contact. However, alarm conditions shall activate an alarm light that is mounted at the roof line of the lift station building or enclosure. The alarm light shall require a manual reset. Each pump shall be provided with alarm lights and pump shutdown for pump motor high temperature, pump moisture detection, and pump overload fail conditions. Any pump alarm conditions shall require manual reset. All lift station alarm outputs shall be transmitted via telemetry system to on-call City operation staff and master SCADA control center.
2. Elapsed time meters shall be supplied for each pump and shall consist of the six-digit non-reset type. The elapsed time meters shall be connected to each pump motor starter to indicate total running time for each pump in "hours" and "tenths of hours." An integral pilot light shall be wired in parallel to indicate that the motor is energized and running.
3. The lift station PLC shall be an Allen Bradley CompactLogix 5069-L320ER. Alternate PLC manufacturers must demonstrate compatibility with the City's control logics platform. The PLC shall be equipped with a CPU with 1MB of user memory, two Ethernet/IP communication ports and one USB port for firmware download and programming. The PLC control panel shall be sized to adequately contain all PLC and communication equipment and rated for NEMA 3R enclosure. The face of the control panel shall include a minimum-sized, 10-inch color operator interface terminal (OIT) for data entry and display. The OIT shall be Red Lion Graphite. Each PLC shall have a minimum of a two-hour uninterrupted power supply (UPS). Each control panel shall contain adequate surge protective devices.

- E. Flow meters: Flow meters shall be of the electro-magnetic type and installed on the common discharge header downstream of the last pump discharge connection. The flow meter shall be fitted with grounding rings as required and 125-pound/150-pound flanged connections. The flow meter shall include a wall mounted transmitter along with 4-20mA DC output. The flow meter shall be integrated and programmed with the supplied PLC for

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local and remote display for flow and totalizer. The flow meter shall be manufactured by Rosemont Model 8750W or accepted substitution.

- F. Back-up power supply: Back-up power shall be supplied at the lift station to power the pumps and ancillary equipment in the event of a power outage. The back-up power system shall be natural gas-powered. The Gorman Rupp standby engine system is preferred, and the Developer shall determine if that system is suitable for the application. Other back-up power systems will be considered if the application is not suitable for the Gorman Rupp system. If not provided by Gorman Rupp, an alternate back-up power system will be evaluated and approved by the City on a case-by-case basis. The City's preference for alternate back-up power systems is Cummins for both the generator and ATS.
- G. Telemetry and SCADA: The remote telemetry unit (RTU) shall communicate by way of Modbus serial or Ethernet, or Allen Bradley Ethernet or serial. If there is no ability to communicate with the control panel, analog and digital inputs may be utilized.

Required inputs:

- 1. Wetwell Level
 - 2. Flow
 - 3. Flow totalization
 - 4. Pump motor status
 - 5. Soft-start status "faulted"
 - 6. Power fail
 - 7. Pump amperage
 - 8. VFD status
 - 9. VFD speed
 - 10. Station common alarm
 - 11. Generator running
 - 12. Generator switch in normal or emergency
 - 13. Generator common alarm
 - 14. pump runtime
 - 15. Pump starts
 - 16. Control panel temperature
 - 17. Selector switches status
- H. H2S monitoring systems in wet well or discharge manhole: The City may require that the Developer design and install H2S monitoring in the manhole the force main discharge into. Factors that may require H2S monitoring in the manhole include pump flow, force main length, and location of the discharge manhole.

5.6 Mechanical

- A. Ventilation
 - 1. Adequate ventilation shall be designed in buildings and vaults as required and adhere to all applicable state, NFPA, and OSHA requirements. The ventilating system shall consist of natural gas make-up air units sized to provide minimum of six air changes per hour and shall automatically begin operation upon user

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selected indoor temperature settings for both summer and winter modes. Supplemental cooling and heating will be required if building temperatures exceed 85-degrees Fahrenheit or fall below 55-degrees Fahrenheit. Ventilation shall be accomplished by the introduction of fresh air in the station and be filtered to remove debris and minimize particles. Ventilation fans shall automatically come on upon entry of the lift station enclosure or building or activated by the light switch adjacent to the entry door.

2. In addition to the make-up air ventilation system, supplemental heat shall be required using natural gas unit heaters to maintain a minimum temperature of 55-degrees Fahrenheit. Unit heaters shall be automatically controlled thermostatically. Heating systems shall be designed based on an outside ambient temperature of negative 20-degrees Fahrenheit.
- B. Air conditioning: Air conditioning shall be provided if the ventilation system cannot ensure an inside air temperature of below 85 degrees Fahrenheit within a reasonable time period of ventilating. Cooling systems shall be designed based on an outside ambient temperature of 105-degrees Fahrenheit.
- C. Plumbing (Drains): Lift station enclosures or buildings shall contain no floor drains that connect to the wet well. The enclosure at the level at which the pumps are located shall include a trench drain which slopes to a sump pit equipped with a duplex submersible sump pump system controlled with weighted float level switches. The sump pump system shall discharge to the top of the wet well with an air gap. The pump system shall be sized based on expected drain flows such as air release valves, seal water, and maintenance. Each sump pump discharge shall contain a check valve and isolation valve along with a pump removal system. The sump pump system shall be connected to the back-up or emergency power system. The lift station site shall be equipped with a perimeter drain if recommended from the geotechnical study.

5.7 Odor Control and H₂S Generation

- A. The lift station shall be evaluated for the odor mitigation system and final determination of implementing odor control measures will be reviewed and determined by the City. Supporting data, calculations, or assumptions for hydrogen sulfide generation based on estimated wastewater characteristics and industry standards shall be included in the evaluation. In the absence of supporting data and/or calculations, the Developer shall utilize the latest edition of "Metcalf and Eddy Wastewater Engineering Treatment and Resource Recovery" for medium strength sulfide concentrations in wastewater. Other factors to consider in the evaluation include but are not limited to:
- Proximity to and use of neighboring properties
 - Composition of wastewater (BOD₅, COD, TSS, Sulfides, TKN, Ammonia-N)
 - Wind direction and downwind properties
 - Operation and maintenance requirements of odor control system
- B. If odor control is determined necessary, the type of system shall be selected based on the site-specific needs of the lift station. All ancillary equipment and necessary provisions shall be incorporated into the design of the lift station to provide a functional system. Odor control systems may include but are not limited to the following mitigation technologies:
- Carbon absorption systems
 - Biological scrubber or filter
 - Chemical scrubber
 - Calcium nitrate addition

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- C. If odor control is not required, provisions for the future addition of odor control facilities (e.g., installation of ventilation ducts and penetration into the wet well for future connections) shall be provided.

5.8 Force Main Components

- A. Connection to existing gravity sewer: Force mains shall connect to a gravity wastewater system at a manhole or a structure designed to receive pumped wastewater. The manhole or structure shall be retrofitted with appropriate corrosion protection as described in Section F.5.A of these criteria. In addition to the connecting manhole, the next two downstream manholes shall be protected in accordance with Section F.5.A of these criteria. The force main discharge shall be designed to minimize turbulence and scour within the connecting structure. The City will determine on a case-by-case basis whether odor control is required at the receiving structure.
- B. Valves: It is desired by the City to design the force main to limit required valves along the force main alignment. High points and low points shall be minimized along the pipe alignment.
- C. Air and vacuum relief valves: Air relief valves shall be provided on ultimate and local high points throughout the force main alignments. All air relief valves shall in an access manhole or vault appropriately sized for the application and maintenance staff access.
- D. Non-return valves: If required, isolation valves shall be swing check type. All non-return valves shall be in an access manhole or vault appropriately sized for the application. Accepted manufacturers include DeZurik, Valvmatic, and Milliken.
- E. Isolation valves: If required, isolation valves shall be plug-valve type. All direct buried plug valves shall normally remain open (with the exception of bypass connection and isolation valves) and be installed with a valve box and lid. Accepted manufacturers include DeZurik, Valvmatic, and Milliken.
- F. Corrosion protection: A cathodic protection system shall be designed for any buried carbon steel or ductile iron piping and structures in the system.
- G. Identification: Minimum identification requirements for force mains shall consist of tracer wire and warning tape as required for potable water mains, and green marked polywrap for ductile iron pipe. The warning tape shall be labeled, "Wastewater Force Main".

5.9 Testing and Start-Up

- A. Lift stations: The Developer shall develop a plan to test and demonstrate successful and flawless performance of all equipment and components of the lift station in manual and automatic mode. The start-up and testing plan shall be submitted to the City for review prior to commencing start-up. A factory representative for the pumps and controls shall be on site for start-up operations.
- B. Force mains: Shall undergo hydrostatic pressure testing for at least two hours at two times the working pressure. Test results shall be documented and demonstrate holding pressure within the criteria and specifications described in the City's Design Criteria and Construction Specifications. (See Section 30 Water Distribution System Testing for requirements.)

5.10 Operation and Maintenance Procedures and Warranties

- A. Operations and maintenance
 - 1. The Developer shall supply the Utility Division with an electronic set on a share drive. The Developer and/or manufacturer shall provide one half-day training on the operations of the lift station for City staff.

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2. Operation and maintenance instructions shall be specific to the equipment installed. All non-relevant reference material shall be removed or clearly crossed out using a heavy red line.
3. All emergency power generation equipment shall have operation and maintenance instructions.

B. Warranties

1. A two-year warranty shall be provided for the lift station system including performance, materials, and installation. The acceptance process is outlined in Section 00.
2. The date of substantial completion shall be specifically determined, in writing, for the lift station system.
3. Any warranties associated with the lift station shall be transferred to the City after construction is complete.

END OF SECTION

SECTION 48: SPECIFICATIONS FOR SEWER PIPE AND LINING INSERTION - TRENCHLESS

1.0 Intent

The intent of trenchless sewer pipe insertion is to rehabilitate the existing sewer line in a manner which will correct the following deficiencies:

- A. Cracked/broken/collapsed pipe caused by poor construction, unstable soil, earth movement, infiltration, root damage, destructive loading, cleaning tool damage, etc.
- B. Corrosion of pipe caused by acid attack above flow level
- C. Erosion of pipe caused by abrasion below the flow level
- D. Degradation/deformation of pipe caused by loss of masonry
- E. Infiltration of groundwater and soil through leaking pipe joints and structural defects.
- F. Exfiltration of sewage through leaking pipe joints and structural defects
- G. Inflow of surface water and infiltration of groundwater through abandoned or illegal connections
- H. Root re-growth after removal
- I. Pipe capacity problems: smooth, tight-fitting sewer pipe can usually improve the sewage flow characteristics of the existing line.

These specifications refer to the installation of a structural pipe as opposed to coatings or membranes for corrosion or infiltration and exfiltration prevention.

2.0 Design Loads

The Design Engineer shall determine the design loads for the pipe to be installed and the required thickness regarding the materials specified. External loads (earth loads/live loads/hydrostatic pressure), construction loads (external grout pressure/jacking force), support developed by annulus grouting, long-term flexural strength/modulus, together with appropriate safety factors, are engineering considerations. Each design shall be specific to manufacturer requirements.

3.0 Corrosion Resistance

Available materials shall have sufficient corrosion resistance to handle sanitary sewage. Epoxy, polyester, polyethylene, PVC, and vinylester offer high corrosion resistance for various applications. If service connections are to be cut through the line, the Engineer must determine if fiberglass reinforced material will degrade due to wicking at exposed fibers.

4.0 Pipe Materials

The Engineer must select the pipe material and/or process regarding specific job requirements. Many materials and composite materials are available. The listed methods must have a required number of successful installation projects in North America to be included in these specifications.

5.0 Dimensional Change

For certain processes, dimensional changes can occur during forming, installation, or after installation.

6.0 Installation Procedure

6.1 Cleaning

The Contractor shall clean the sewer line through high-pressure water flow prior to the CTTV inspection and subsequent line installation.

6.2 TV Inspection

The pipeline shall be inspected to determine the location of any conditions which may prevent proper line installation.

6.3 Obstruction Removal

It shall be the responsibility of the Contractor to clear the line of obstructions such as solids, dropped joints, intruding service connections, or collapsed pipe that would prevent line installation. If inspection reveals an obstruction that cannot be removed by conventional sewer cleaning methods, the Contractor shall make a point repair excavation to remove or repair the obstruction. Each excavation for obstruction removal shall be approved in writing by the Utility Engineer prior to the commencement of the work and shall be a separate pay item.

6.4 Flow Control

If necessary for effective CTTV inspection and line installation, the Contractor shall bypass the effluent around the section or sections designated for pipe insertion. The bypass shall be made by plugging an existing upstream manhole, if necessary, and pumping the effluent into a downstream manhole or adjacent system. The pump and bypass lines shall be of adequate capacity and size to handle the flow.

6.5 Pipe Installation

Procedures for liner installation are specific to the method being used and may vary with material, thickness, pipe size, pipe shape, etc. When proprietary techniques are used, the licensor's specification for proper installation should be used.

6.6 Excavation (Sliplining):

When excavations for sliplining are made between manholes, the Contractor will establish the excavation points based on location of the lines, pulling distances, and traffic conditions. The locations of the excavation points should minimize traffic disruption. The number of excavations can be reduced by planning to insert the liner in both directions from a single insertion pit.

Segmented pipe is installed from inside a manhole or from an insertion pit normally located at a change in line direction or at some other accessible location determined by the Contractor based on pulling/pushing distances, traffic conditions, or interfering utilities. Pipe can be pushed or pulled distances more than 3,000 feet depending on pipe diameter, pipe stiffness, and condition of the existing line. Insertion pits should be of a length to accommodate the method of insertion used. The width of the pit is determined by the diameter of existing pipes and allowance for sufficient working room on either side. Sheathing and bracing requirements will depend on pit depth and ground conditions and should be constructed in accordance with applicable safety regulations. The top of the existing sewer line shall be exposed to the spring line and crown of the pipe shall be carefully removed as necessary for liner pipe insertion. Care should be taken not to disturb the bottom portion of the existing pipe as this will remain in place to conduct sewage flow, cradle the liner pipe during insertion, and provide a stable base for the liner pipe. Refer to pipe manufacturer's literature for additional guidelines.

- A. Materials: Cured in Place Pipe (CIPP) with Polyester, Vinylester, Epoxy Materials
Fiberglass Pipe (Slip Line) with Polyester, Vinylester, Epoxy Materials
Polyethylene Pipe
Alloys of Thermoplastic Materials (Pipe) PVC Pipe
- B. Pipe size: The nominal pipe size is not necessarily the size of the pipe in the field. It is essential that the actual inside diameter of the host sewer pipe be measured wherever it is exposed before trenchless pipe insertion is undertaken. Example:

STANDARD SPECIFICATIONS FOR WATER AND WASTEWATER UTILITIES
 City of Steamboat Springs

VITRIFIED CLAY PIPE		
Nominal Pipe Size (inches)	Minimum* ID (inches)	Maximum** ID (inches)
6	5.68	6.32
8	7.50	8.37
10	9.50	10.37
12	11.37	12.43
15	14.18	15.56
18	16.83	18.69
21	19.62	21.75
24	22.50	24.75
27	25.50	27.88
30	28.37	30.88
33	31.12	33.94
36	33.75	37.12
*Extra strength clay pipe	ASTM C200-65	
**Standard strength clay pipe	ASTM C13-65	

Pipe size determines the applicability of several pipe installation methods and materials. Pipe size is a major consideration in the selection of candidates.

- C. Pipe insertion methods: Candidate methods must be selected which will, in fact, correct the existing deficiencies and prevent their recurrence. The listed specifications give several methods:

6.7 Infiltration Prevention

If there is an annulus between the existing pipe and the liner, infiltration must be prevented from entering the sewer at manholes and service connections by one or more of the following means:

- A. Annulus grouting
- B. Sealing liner at manholes
- C. Attaching building sewers to the liner
- D. Chemical grouting at service connection

6.8 Annulus Grouting

Methods or products which have an annular space between the two pipes require annulus grouting to develop the required strength and to prevent groundwater from entering the sewer. Precautions should be taken to prevent collapsing the line with grouting pressure. Various grouts can be placed using low pressure and the newly installed pipeline can be hydrostatically pressurized during grouting. Grout must be prevented from flowing into service connections.

6.9 Sealing at Manholes

Pulled-in-place pipes which are not sealed by the annulus grouting must be sealed where the line enters and exits each manhole. The annular space shall be sealed for a distance of at least one pipe diameter inside the host pipe. Foam sealant should not protrude into the manhole and should be finished over with a quick-set, non-shrink cement grout. Finishing inside the manhole shall be accomplished using a quickset cement type grout to raise the manhole trough to the invert of the liner pipe. NOTE: Only the upstream seal should be made prior to connecting services.

6.10 Reinstating Service Connections

After installation, the Contractor shall reinstate the service connections as designated by the Owner. Certain processes allow this to be done remotely from within the sewer liner using appropriate robotic equipment. Where holes are cut through the line, they shall be neat and smooth to prevent blockage at the service connections. Cut-in service connections shall be opened to a minimum of 90 percent of the flow capacity of the building sewer. Invert of service lines shall be opened and free of any lips to provide proper flow.

7.0 Acceptance

The finished pipe shall be continuous over the entire length of the installation. The liner shall be free as commercially practicable from visual defects, damage, deflection, holes, delamination, uncured resin, and the like. There shall be no visible infiltration through the liner or from behind the liner at manholes and service connections. Cut ins and attachments at service connections shall be neat and smooth.

8.0 Cleanup

After installation is completed and accepted, the Contractor shall clean up the project area and return the site ground cover to grade. All excess material and debris not incorporated into the permanent installation shall be disposed of by the Contractor. Sidewalks, driveways, and street surfaces disturbed by the installation shall be addressed in the pay item or by the Developer.

9.0 Warranty

During the warranty period, any defects which affect the integrity or strength of the pipe shall be repaired at the Contractor's expense in a manner mutually agreed by the Owner and the Contractor.

END OF SECTION

City Of Steamboat Springs



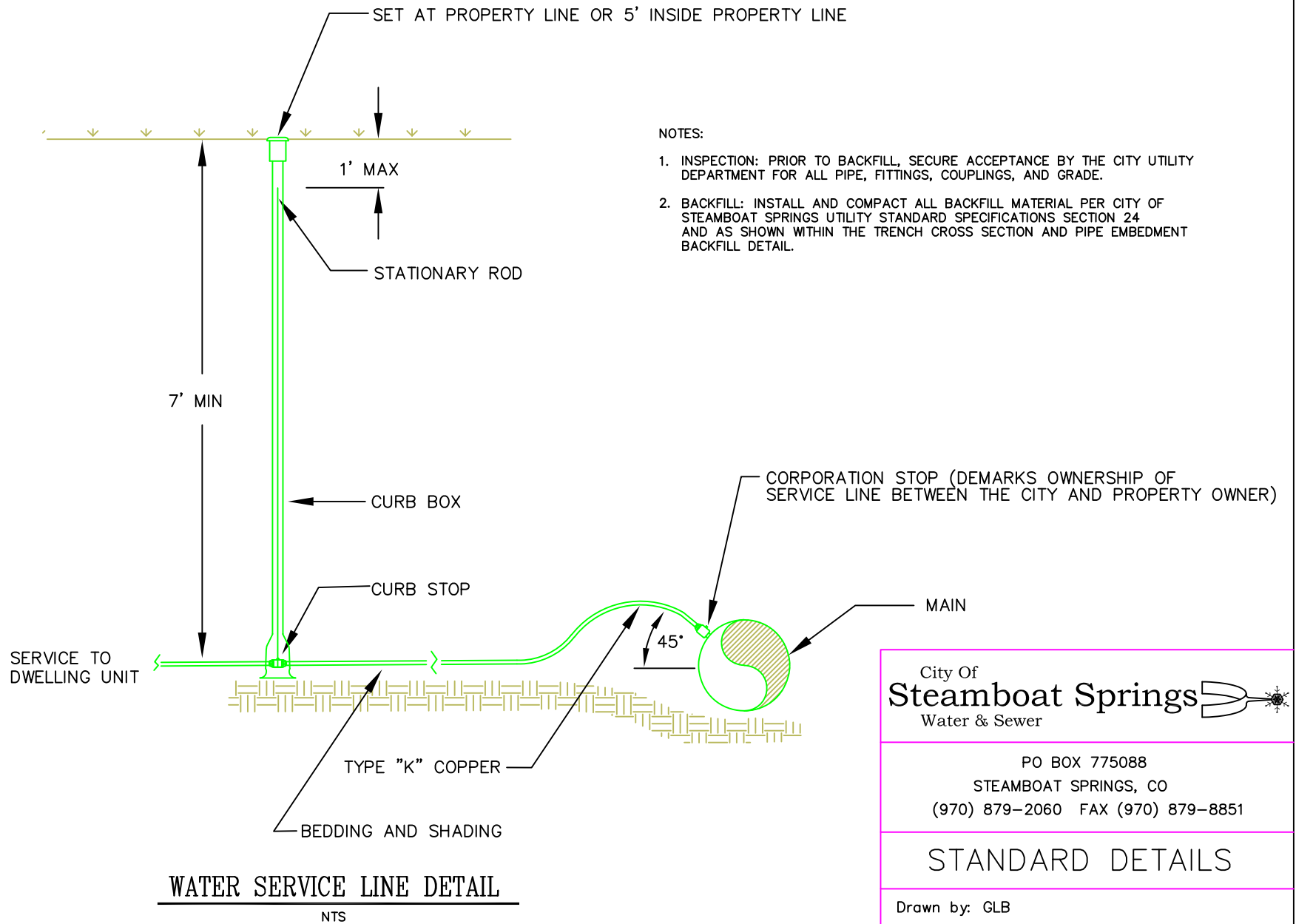
Water & Sewer

PO BOX 775088
STEAMBOAT SPRINGS, CO
(970) 879-2060 FAX (970) 879-8851

STANDARD DETAILS APRIL 2023

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NOTES:

1. INSPECTION: PRIOR TO BACKFILL, SECURE ACCEPTANCE BY THE CITY UTILITY DEPARTMENT FOR ALL PIPE, FITTINGS, COUPLINGS, AND GRADE.
2. BACKFILL: INSTALL AND COMPACT ALL BACKFILL MATERIAL PER CITY OF STEAMBOAT SPRINGS UTILITY STANDARD SPECIFICATIONS SECTION 24 AND AS SHOWN WITHIN THE TRENCH CROSS SECTION AND PIPE EMBEDMENT BACKFILL DETAIL.

City of
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 Water & Sewer

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STANDARD DETAILS

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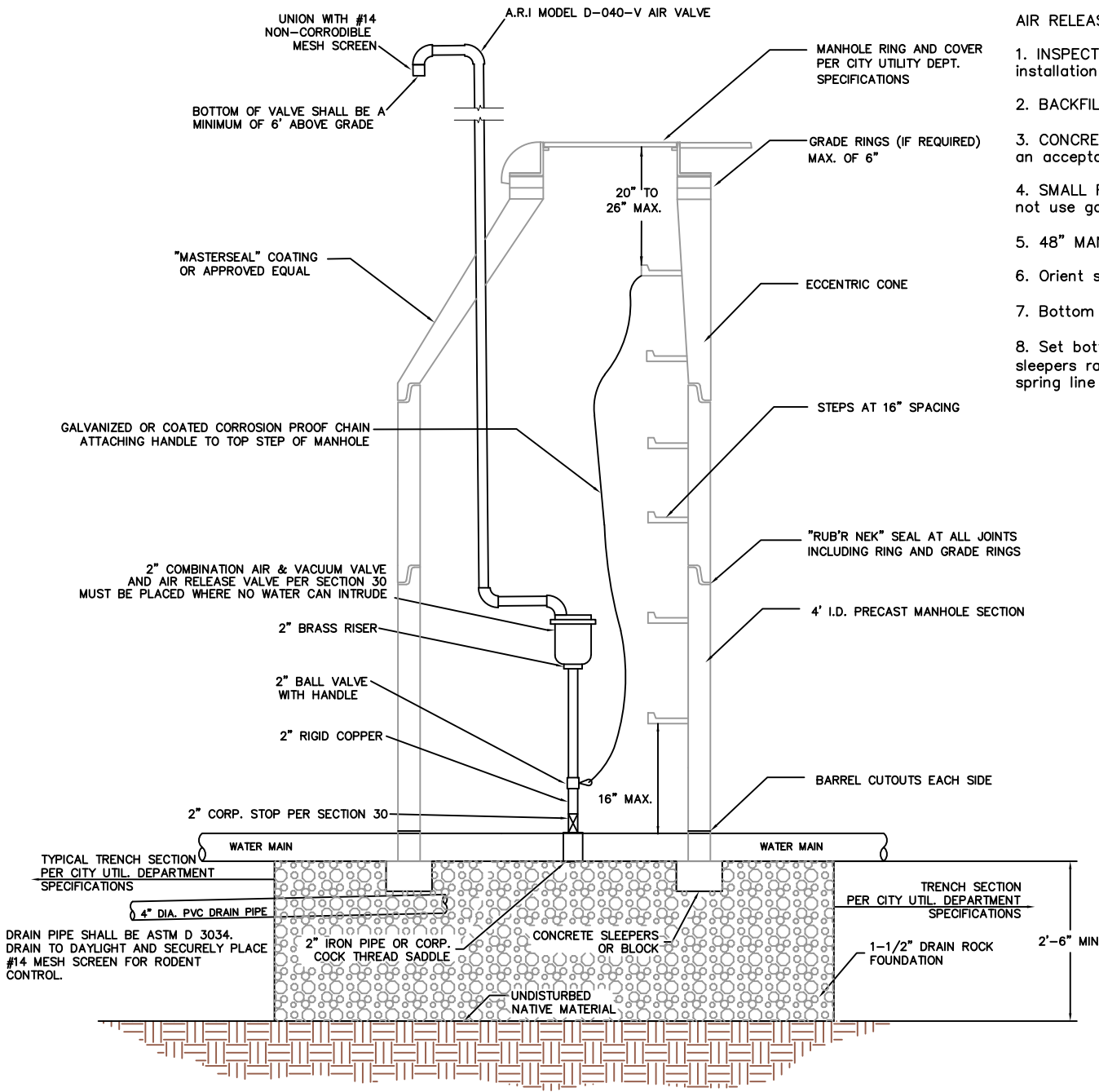
Scale: N.T.S.

Date: April 2023

Revision description: Update

W-001

WATER DISTRIBUTION



AIR RELEASE ASSEMBLY

1. INSPECTION: Prior to backfilling around the assembly, secure inspection of installation by ENGINEER.
2. BACKFILL: Install and compact all backfill material per Section 24.
3. CONCRETE: 4000 PSI strength concrete. Apply a sealing/curing compound or use an acceptable alternate curing compound.
4. SMALL FITTINGS: Provide brass fittings and nipples if not specified otherwise. Do not use galvanized materials.
5. 48" MANHOLE HOLE: Specifications per section 40.
6. Orient steps, ring and cover to best fit site requirements.
7. Bottom barrel section to have cutouts w/ 2" min. clearance around pipe.
8. Set bottom barrel section on 12"x12"x6" reinf. precast concrete sleepers radially. (12" concrete blocks radially acceptable alternate). Shade to spring line inside M.H.

AIR RELEASE ASSEMBLY DETAIL

NTS

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STANDARD DETAILS

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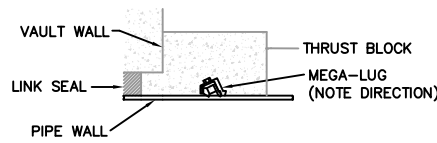
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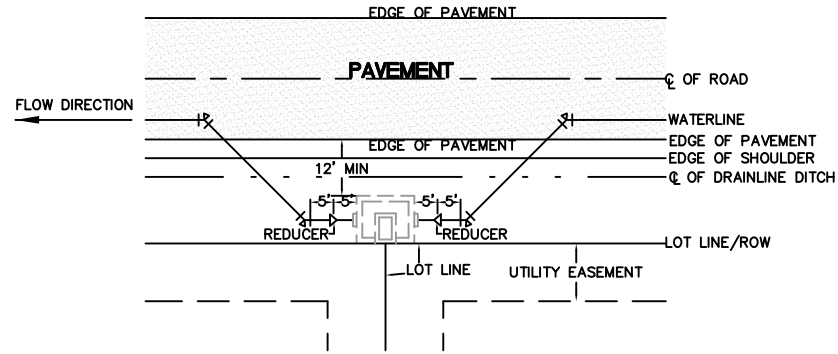
W-002

WATER DISTRIBUTION

MARKER - 1 1/2" Ø X 10' LONG
 GALV PIPE & CAP
 ATTACH TO CONCRETE
 5" BURY
 PAINT BLUE - REF

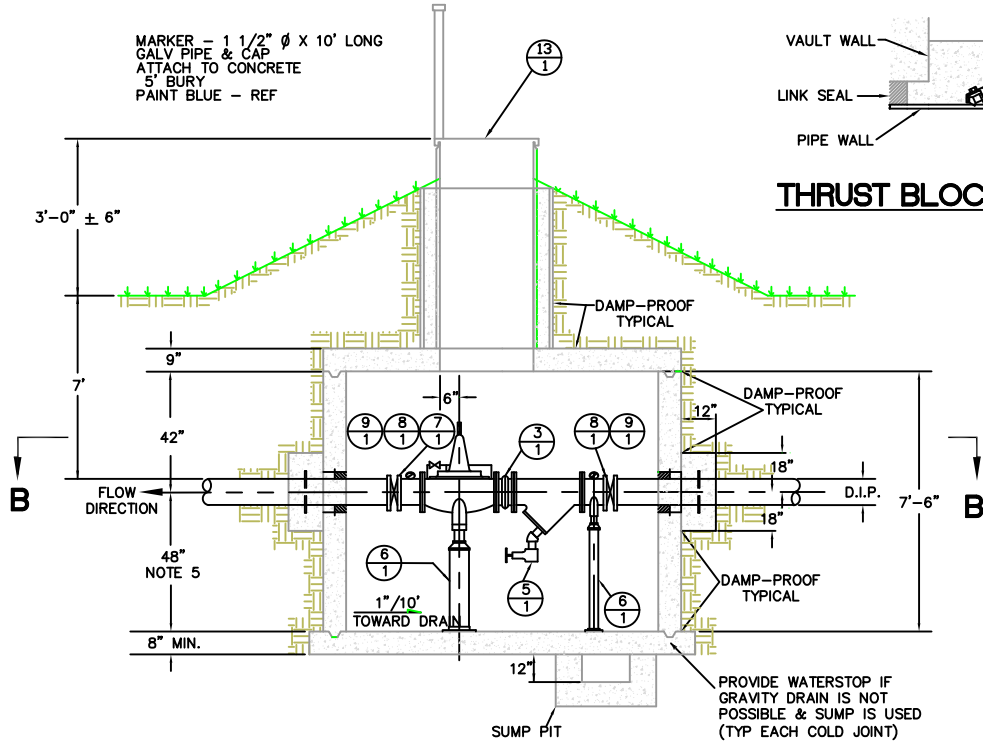


THRUST BLOCK DETAIL



TYPICAL LOCATION

NOT TO SCALE



SECTION A-A
 NOT TO SCALE

PROVIDE WATERSTOP IF GRAVITY DRAIN IS NOT POSSIBLE & SUMP IS USED (TYP EACH COLD JOINT)

SCHEDULE OF ITEMS

ITEM	DESCRIPTION	QTY	NOTES
1	PRESSURE REDUCING VALVE (OR PRESSURE SUSTAINING VALVE) CLAYTON 90G-01A (92G-01A) (EPOXY COATED)	1	
2	STRAINER, BAILEY #100-A	1	
3	EXPANSION JOINT - RUBBER	1	
4	BUTTERFLY VALVE, WAFER, CRANK OPERATED AWW -C-504	2	
5	BALL VALVE - 2"	3	
6	PIPE SUPPORT, SADDLE, ADJUSTABLE, ITT GRINNELL, #264	2	
7	HOSE BIB - 3/4" MPT	4	
8	PRESSURE GAUGE & COCK	2	
9	SPOOL, "Ø F.E.X F.E.	2	
10	SERIES 1100 MEGA-LUG	2	
11	LADDER, BILCO 'LU-1'	1	
12	TAPPING SADDLE, SMITH-BLAIR 313, 2"	2	
13	HATCH, BILCO 'NB'	1	
14	VALVE POSITION INDICATOR, CLAYTON #X101	1	
15	PETCOCK	1	
16	WALL BRACKET, PIPE SUPPORT, ITT GRINNELL #194	2	LOW FLOW BY PASS ONLY
17	UNION, BRASS, SCREWED END F.P.T	2	LOW FLOW BY PASS ONLY
18	P.R.V. WATTS #223	1	LOW FLOW BY PASS ONLY
19	STRAINER, WATTS #777	1	LOW FLOW BY PASS ONLY
20	GAUGE COCK (ADDITIONAL)	2	
	ITEM DESCRIPTION	QTY	

NOTES:

PRV VAULTS NOT TO BE PLACED WITHIN A VEHICULAR TRAVELED WAY UNLESS APPROVED OTHERWISE BY THE CITY OF STEAMBOAT SPRINGS UTILITY DEPARTMENT.

PRV VAULTS APPROVED WITHIN TRAVELED WAYS MUST MEET OR EXCEED AN H-20 VEHICULAR LOADING STRUCTURAL DESIGNATION.

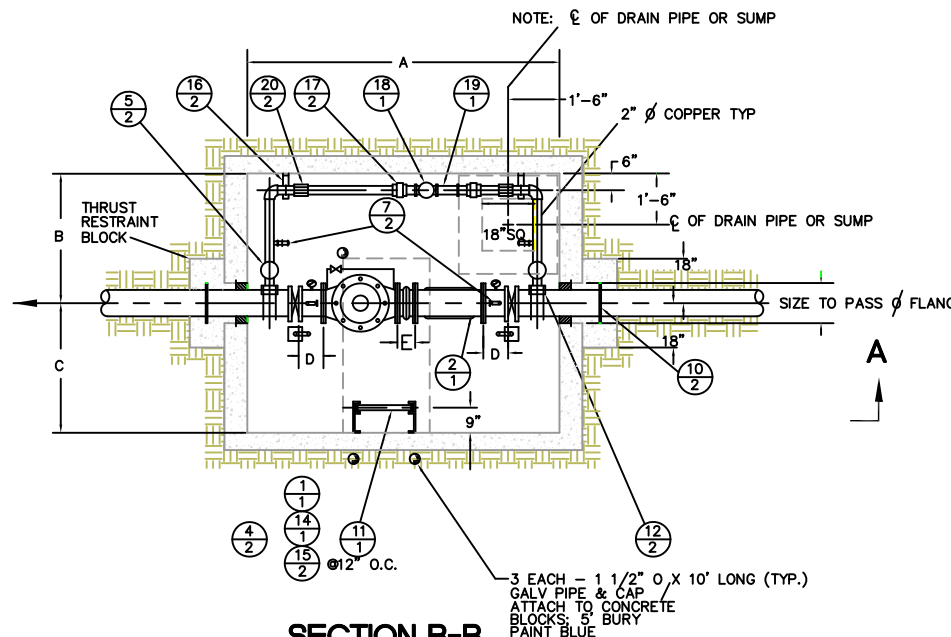
THE PRV VAULT SHOWN IS CONCEPTUAL ONLY. PRV VAULTS SHALL BE DESIGNED ON A CASE BY CASE BASIS BY THE PROJECT DESIGN ENGINEER.

THIS VAULT IS CONSIDERED A CONFINED SPACE. ALL CONFINED SPACE RULES AND REGULATIONS SHALL BE FOLLOWED.

FOR ANY WALL PENETRATIONS USE LINK-SEAL CONNECTIONS.

PRV SIZE	A	B	C	D	E
6"	8'	3'-9"	3'-3"	8"	6"
8"	9'	3'-9"	3'-3"	9"	6"
10"	10'	3'-9"	3'-3"	9"	8"
12"	11'	4'-3"	3'-9"	10"	8"

DIMENSION TABLE



SECTION B-B
 NOT TO SCALE

3 EACH - 1 1/2" Ø X 10' LONG (TYP.)
 GALV PIPE & CAP
 ATTACH TO CONCRETE
 BLOCKS, 5" BURY
 PAINT BLUE

City of
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STANDARD DETAILS

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Scale: N.T.S.

Date: April 2023

Revision description:

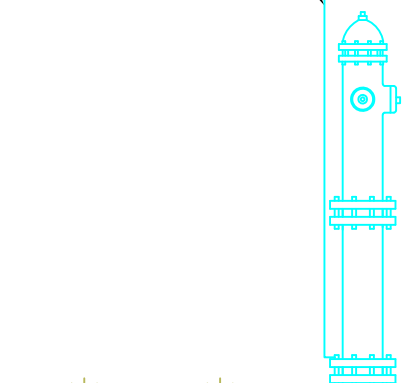
W-004

WATER DISTRIBUTION

NTS

PRESSURE REDUCING VALVE DETAIL

BARCO FIRE
HYDRANT MARKER



BURY LINE

2" x 2" OUTSIDE DIMENSION
SQUARE CUBE

FINISHED GRADE

NOTE:

1. VALVE OPERATOR NUT RISER DIMENSIONS ARE TYPICAL ON ALL GATE VALVES. SHOWN ON FIRE HYDRANT DETAIL FOR ILLUSTRATIVE PURPOSES.
2. THE CONTRACTOR SHALL CHECK THAT THE NUT CAN BE OPERATED AND IS CENTERED IN THE VALVE BOX.

6"
3"

3/16" STEEL CENTERING PLATE
5-1/4" OUTSIDE DIAMETER

VARIES ACCORDING TO VALVE SIZE
AND DEPTH OF BURY

VALVE OPERATOR NUT RISER
7/8" OUTSIDE DIAMETER COLD
ROLLED STEEL. DO NOT SECURE
TO VALVE OPERATOR NUT

VALVE BOX RISER EXTENSION IF NECESSARY

VALVE BOX

NO SET SCREWS ALLOWED

GATE VALVE, MJ x MJ
SWIVEL TEE, MJ

PRECAST THRUST BLOCK

PRECAST
THRUST BLOCK

2-1/4" x 2-1/4" INSIDE DIMENSION
SQUARE CUBE

6" PIPE

UNDISTURBED
NATIVE MATERIAL

DRAINAGE PIT

City Of
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STANDARD DETAILS

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Scale: N.T.S.

Date: April 2023

Revision description: Update

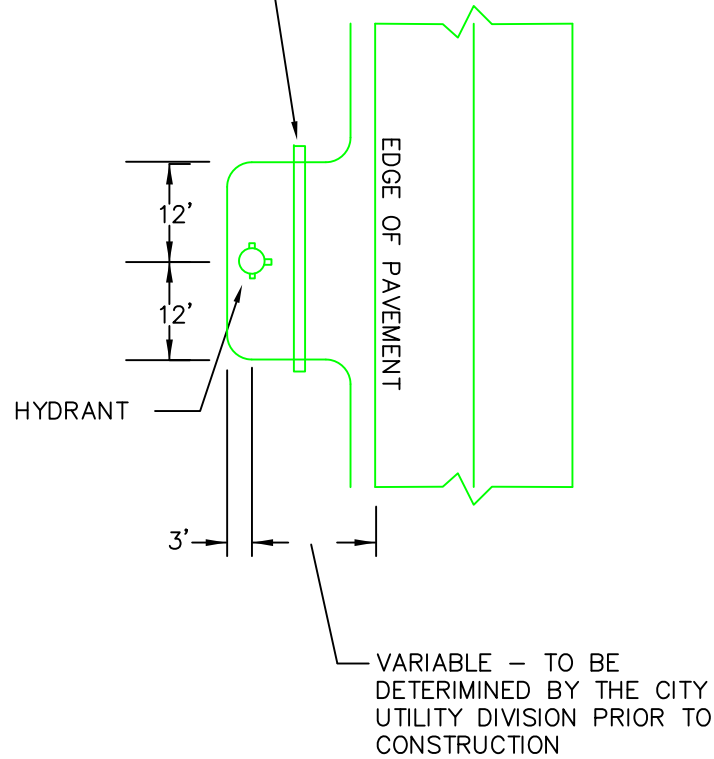
W-004

WATER DISTRIBUTION

FIRE HYDRANT DETAIL

NTS

PROVIDE CULVERT AND FLARED-END SECTIONS
 (18" MIN. DIAMETER OR AS DIRECTED BY CITY PUBLIC WORKS)
 IF BENCH CONSTRUCTED OVER DRAINAGE DITCH



NOTES:
 NO OBSTRUCTIONS SUCH AS
 TREES, PEDESTALS, FENCES OR
 OTHER OBJECTS MAY BE
 PLACED WITHIN A 15-FOOT
 RADIUS OF A HYDRANT.

FIRE HYDRANT BENCH DETAIL

NTS

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STANDARD DETAILS

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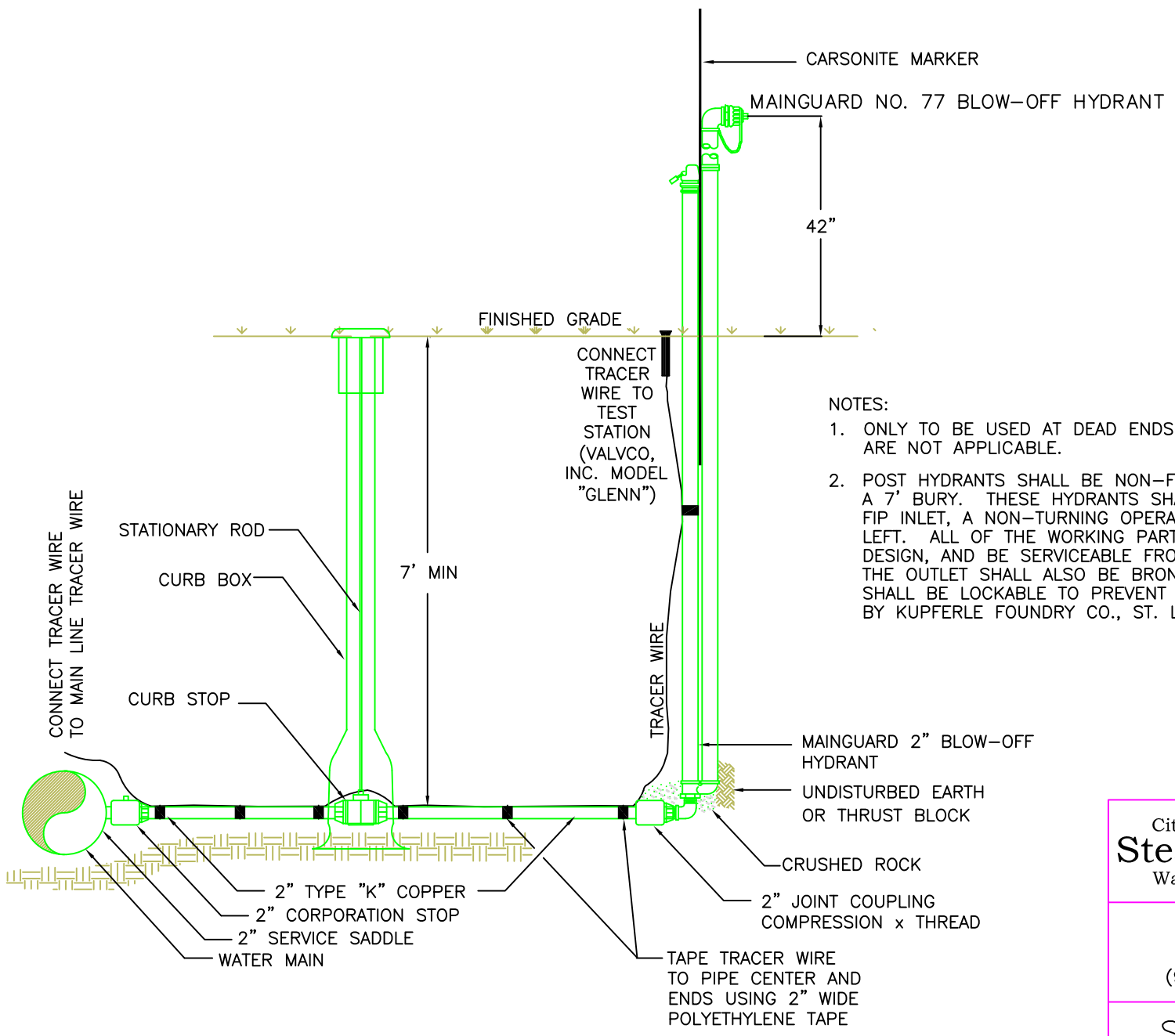
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Date: April 2023

Revision description:

W-005

WATER DISTRIBUTION

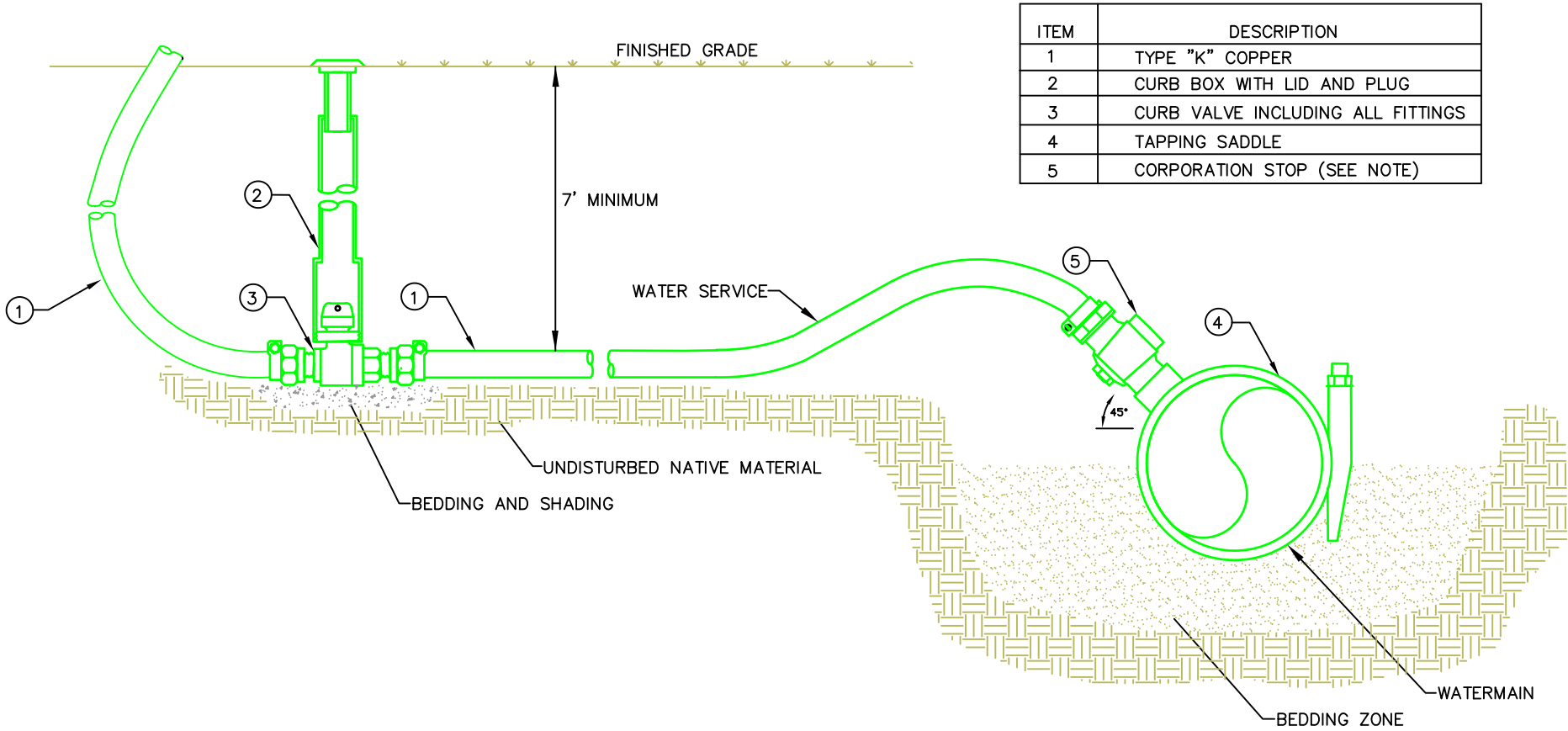


NOTES:

1. ONLY TO BE USED AT DEAD ENDS MOSTLY WHERE FIRE HYDRANTS ARE NOT APPLICABLE.
2. POST HYDRANTS SHALL BE NON-FREEZING, SELF DRAINING TYPE WITH A 7' BURY. THESE HYDRANTS SHALL BE FURNISHED WITH A 2" FIP INLET, A NON-TURNING OPERATING ROD, AND SHALL OPEN TO THE LEFT. ALL OF THE WORKING PARTS SHALL BE OF BRONZE-TO-BRONZE DESIGN, AND BE SERVICEABLE FROM ABOVE GRADE WITH NO DIGGING. THE OUTLET SHALL ALSO BE BRONZE AND BE 2-1/2" NST. HYDRANTS SHALL BE LOCKABLE TO PREVENT UNAUTHORIZED USE AS MANUFACTURED BY KUPFERLE FOUNDRY CO., ST. LOUIS, MO, OR APPROVED EQUAL.

2" BLOW-OFF HYDRANT DETAIL
NTS

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STANDARD DETAILS	
Drawn by: GLB	
Scale: N.T.S.	Date: April 2023
Revision description:	
W-007	WATER DISTRIBUTION



ITEM	DESCRIPTION
1	TYPE "K" COPPER
2	CURB BOX WITH LID AND PLUG
3	CURB VALVE INCLUDING ALL FITTINGS
4	TAPPING SADDLE
5	CORPORATION STOP (SEE NOTE)

NOTE: CORPORATION STOP DEMARKS OWNERSHIP OF SERVICE LINE BETWEEN THE CITY AND PROPERTY OWNER.

CURB STOP DETAIL
NTS

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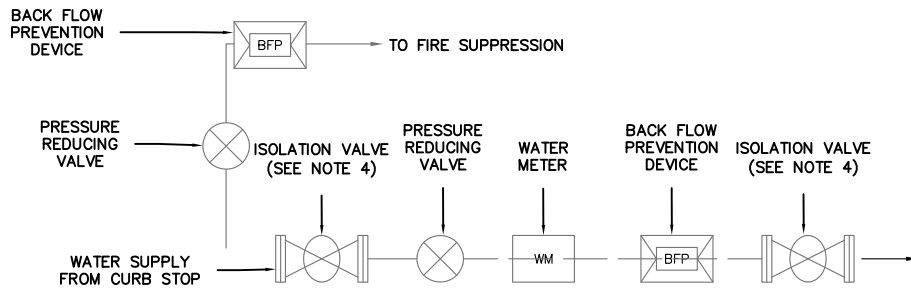
STANDARD DETAILS

Drawn by: JSF

Scale: N.T.S. Date: April 2023

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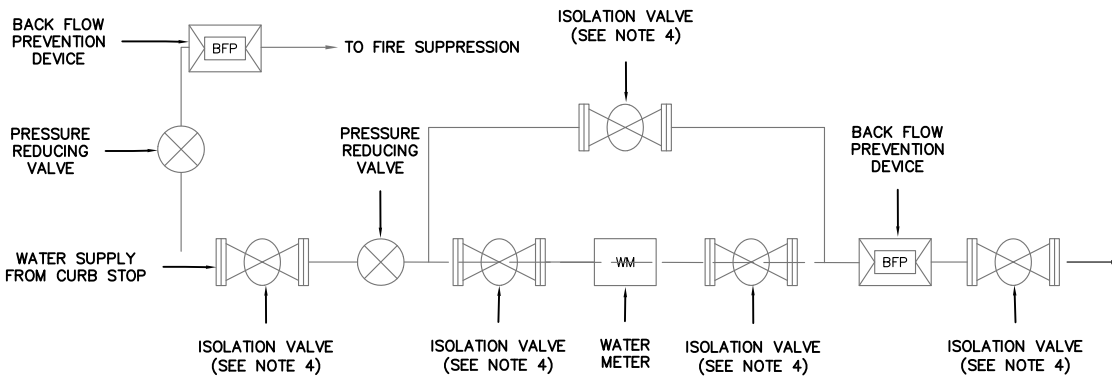
W-007	WATER DISTRIBUTION
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APPROVED METER ASSEMBLY DIAGRAM – SMALLER THAN 2”
(TYP. RESIDENTIAL CONSTRUCTION)

NOTES:

1. ALL WATER SERVICE INSTALLATIONS MUST CONFORM TO THE CURRENT RULES AND REGULATIONS. THE DIAGRAMS ARE THE CURRENT APPROVED METERING SYSTEM ASSEMBLIES. NOTIFICATION TO THE CITY IS REQUIRED TO OPERATE THE BYPASS.
2. ALL WATER SERVICES SHALL BE CONSTRUCTED OF APPROVED MATERIALS.
3. ALL WATER SERVICE ENTRIES GREATER THAN 2” SHALL BE RESTRAINED TO RESIST APPLICABLE THRUST FORCES. THRUST RESTRAINT SHALL BE DESIGNED BY A PROFESSIONAL ENGINEER.
4. ISOLATION VALVES MUST BE INSTALLED PRIOR TO THE PRV AND AFTER THE BACK FLOW DEVICE AND/OR METER TO FACILITATE FUTURE REPAIRS.
5. ISOLATION VALVE TYPE: FOR SERVICE LINES SMALLER THAN 3”, BALL OR GATE VALVES ARE PERMITTED. FOR SERVICE LINES 3” AND LARGER, ONLY GATE VALVES WILL BE PERMITTED. NO BUTTERFLY VALVES ARE PERMITTED.
6. PRESSURE-REDUCING VALVES (PRV) SHALL BE INSTALLED ON BOTH THE DOMESTIC AND FIRE SUPPRESSION LINES UPSTREAM OF THE WATER METER TO ENSURE THAT THE METER AND THE BUILDING PLUMBING SYSTEM, INCLUDING ANY FIRE SPRINKLER SYSTEM, ARE PROTECTED FROM FLUCTUATING WATER MAIN PRESSURES. THE PRESSURE SETTING OF THE PRV SHALL NOT EXCEED 100 PSI FOR DOMESTIC SYSTEMS AND 200 PSI FOR FIRE SPRINKLER SYSTEM, WITHOUT WRITTEN PERMISSION FROM THE CITY. PRV'S ARE REQUIRED ON ALL FIRE SUPPRESSION SYSTEMS.
7. ALL SERVICES ARE REQUIRED TO HAVE A WATER METER PROVIDED BY THE CITY. THE METER ASSEMBLY SHALL BE NO HIGHER THAN 4 FEET ABOVE THE FLOOR AND NO LOWER THAN 18 INCHES ABOVE THE FLOOR LEVEL. NEW METER INSTALLATION REQUIRES NO CONFINED SPACE LOCATIONS. IF THE METER IS CURRENTLY LOCATED IN THE CRAWL SPACE, THE METER SHALL BE LOCATED WITHIN 3 FEET OF THE ACCESS ENTRY POINT.
8. APPROVED BACK FLOW PREVENTION ASSEMBLIES THAT PROVIDE CONTAINMENT SHALL BE INSTALLED AND TESTED ON ALL NEW SERVICE CONNECTIONS AND SHALL BE LOCATED DOWNSTREAM FROM THE METER PRIOR TO ANY OTHER CONNECTION AND IN A HORIZONTAL POSITION. SINGLE CHECK VALVES ARE NOT CONSIDERED BACK FLOW PREVENTION ASSEMBLIES AND SHALL NOT BE PERMITTED WITHIN THE SERVICE AREA OF THE CITY.



APPROVED METER BYPASS ASSEMBLY DIAGRAM – 2” AND LARGER
(TYP. MULTI-FAMILY, MIXED USE, OR COMMERCIAL CONSTRUCTION)

METER ASSEMBLIES

NTS

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STANDARD DETAILS

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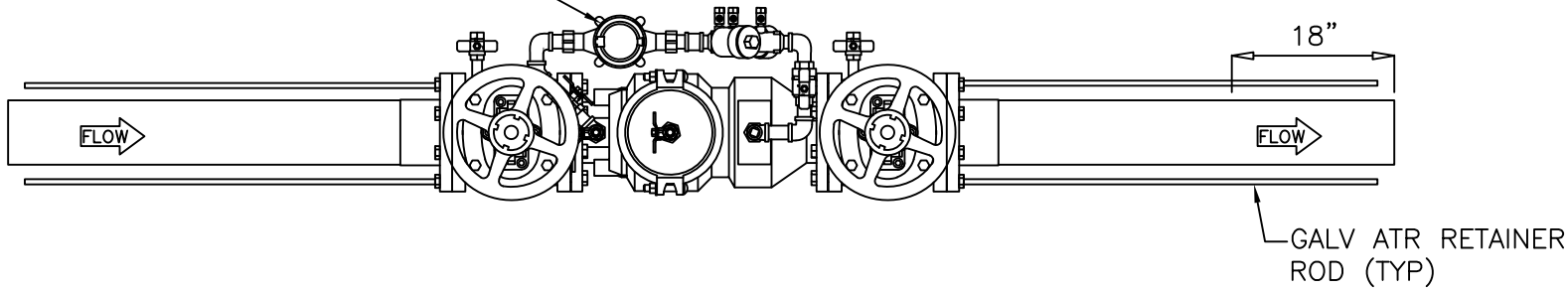
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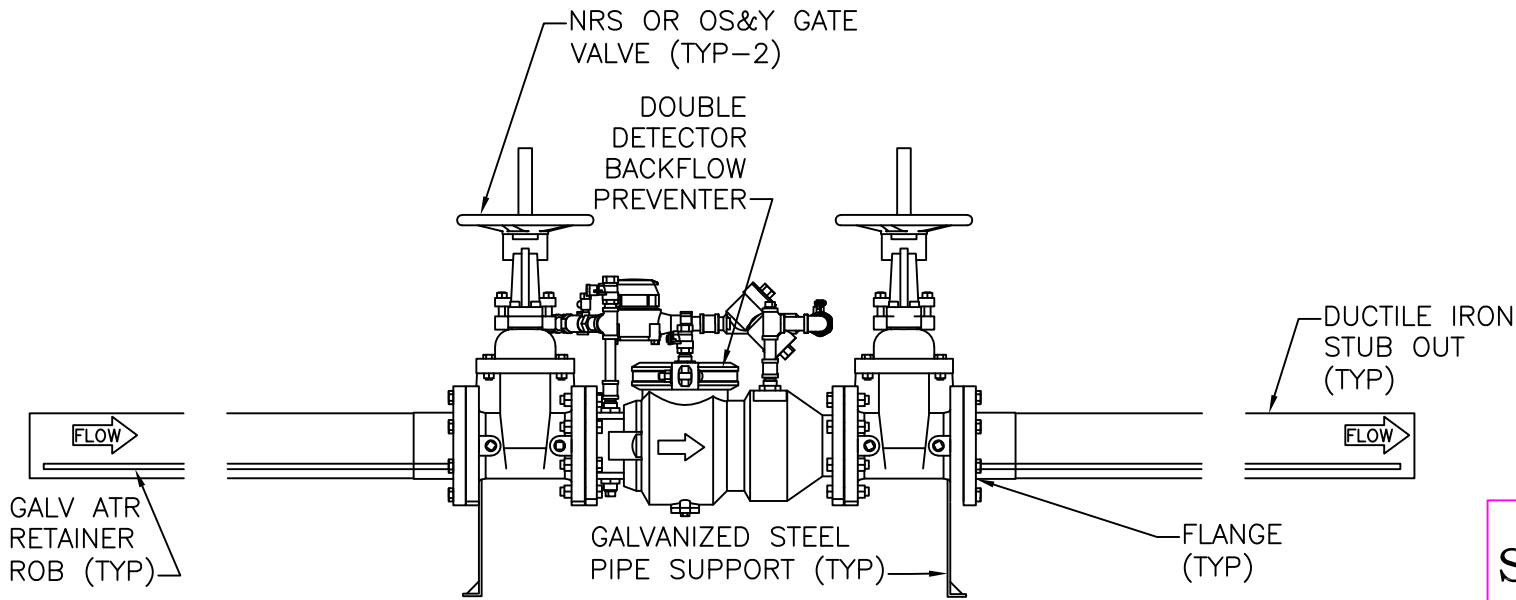
W-008

WATER DISTRIBUTION

3/4" DETECTOR METER W/
2 SHUT-OFF VALVES AND
BACKFLOW PREVENTER



PLAN VIEW



ELEVATION

BACKFLOW PREVENTION DEVICE

NTS

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STANDARD DETAILS

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Scale: N.T.S.

Date: April 2023

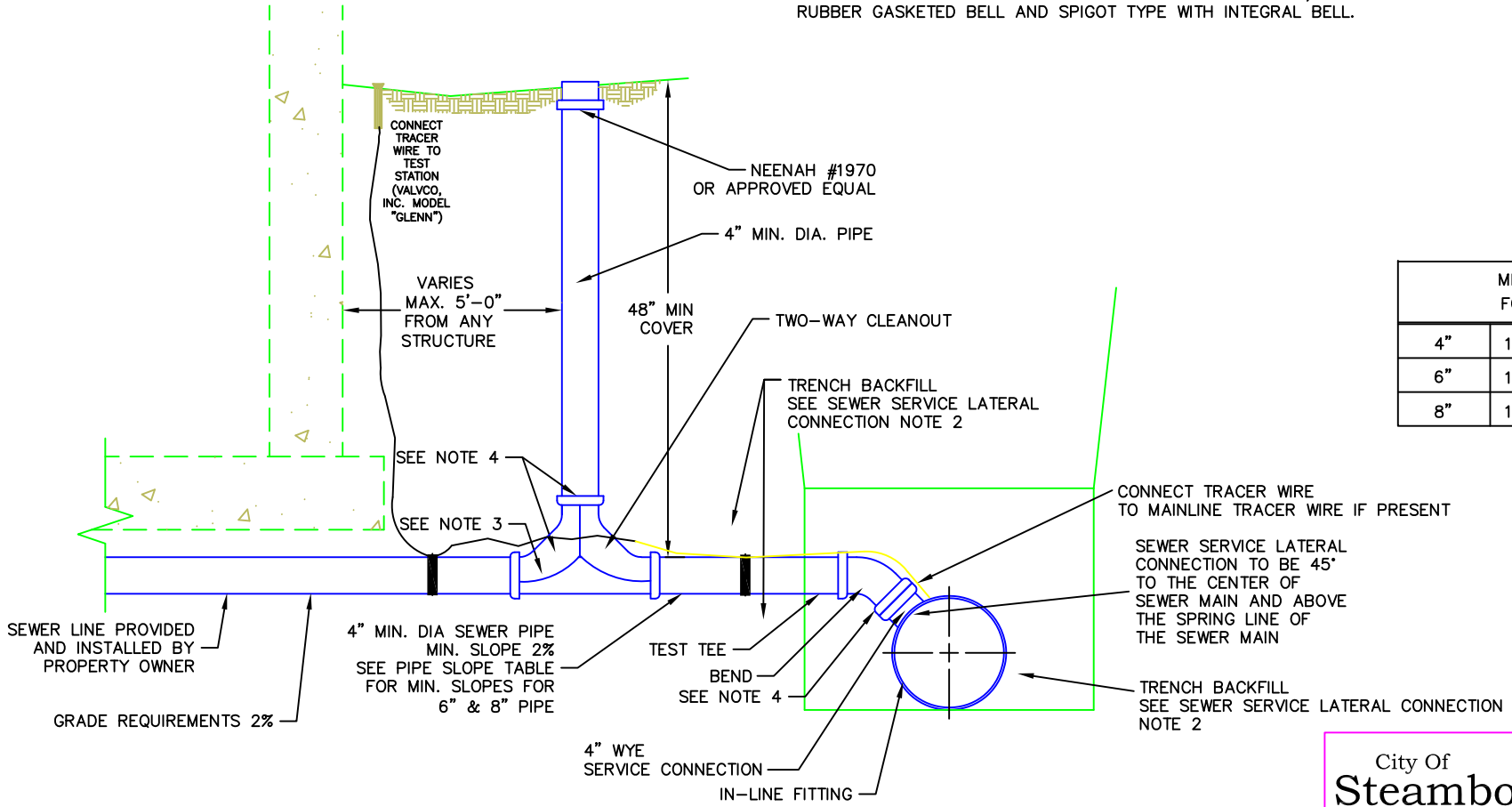
Revision description:

W-010

WATER DISTRIBUTION

SEWER SERVICE LATERAL CONNECTION NOTES:

1. INSPECTION: PRIOR TO BACKFILL, SECURE A PASSING INSPECTION BY THE CITY UTILITY DEPARTMENT FOR ALL PIPE, FITTINGS, COUPLINGS, AND GRADE.
2. BACKFILL: INSTALL AND COMPACT ALL BACKFILL MATERIAL PER CITY OF STEAMBOAT SPRINGS STANDARD SPECIFICATIONS SECTION 24 AND AS SHOWN WITHIN THE TRENCH CROSS SECTION DETAIL.
3. RUBBER GASKETED BELL AND SPIGOT TYPE COUPLER FOR TRANSITION FROM SCHEDULE 40 PVC TO SDR35.
4. ALL PVC FITTINGS SHALL MEET ASTM D3034 SPECIFICATIONS, AND SHALL ALSO MEET ASTM D3212 SPECIFICATIONS FOR RUBBER GASKETED BELL AND SPIGOT TYPE WITH INTEGRAL BELL.



MINIMUM PIPE SLOPES FOR SEWER SERVICES		
4"	1/4" PER FOOT	2%
6"	1/8" PER FOOT	1%
8"	1/16" PER FOOT	0.5%

SECTION

SEWER SERVICE LATERAL CONNECTION DETAIL

NTS

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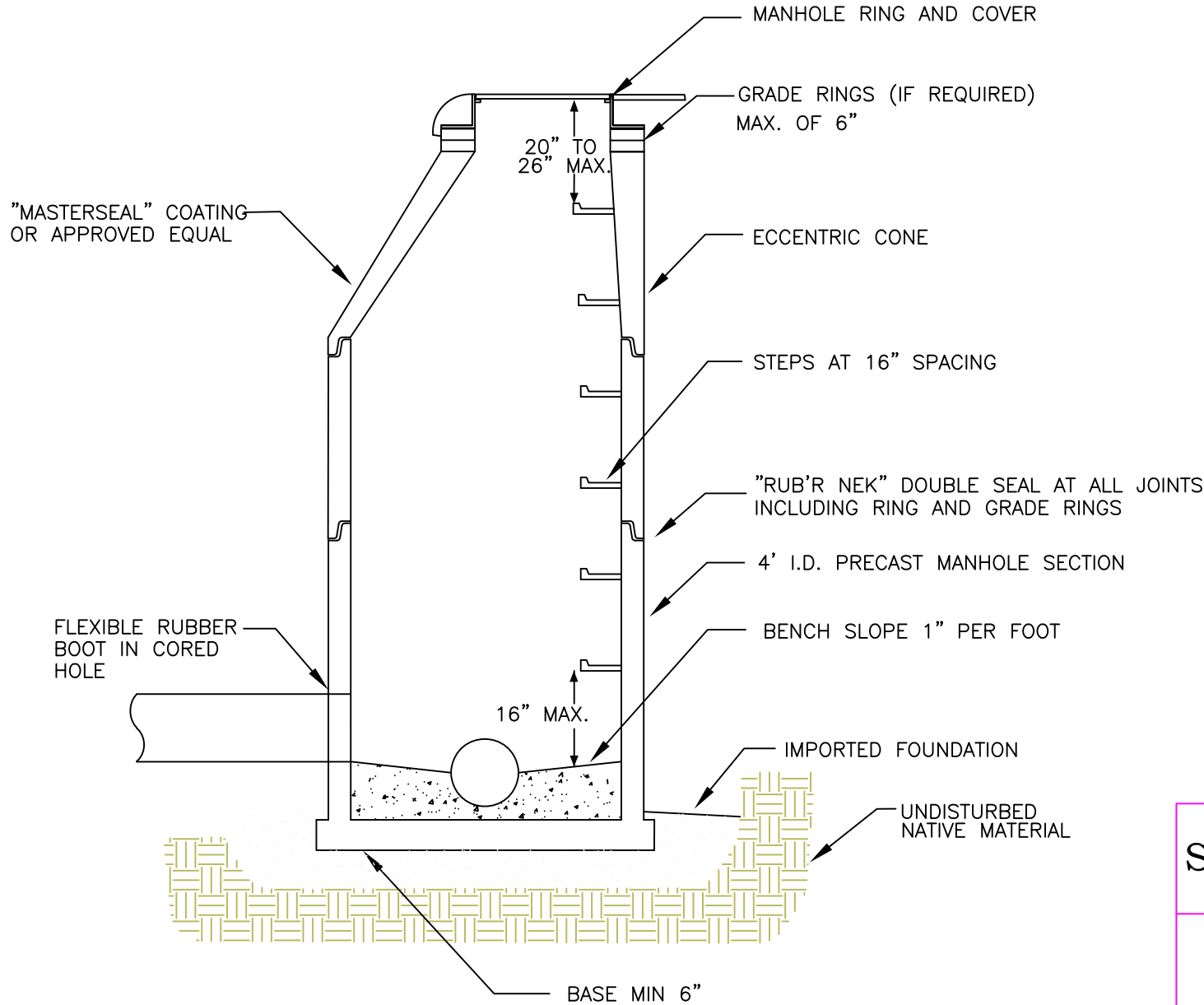
STANDARD DETAILS

Drawn by: ALG

Scale: N.T.S. Date: April 2023

Revision description:

SS-001	SANITARY SEWER
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MANHOLE SIZING

MANHOLE DIAMETER	PIPE DIAMETER
48"	15" MAX
60"	24" MAX
72"	24"+

MUST MAINTAIN A 1' CLEARANCE BETWEEN PIPES.

STANDARD MANHOLE CROSS SECTION

NTS

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STANDARD DETAILS

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Date: April 2023

Revision description: Update

SS-002

SANITARY SEWER

NOTES:
HEAVY DUTY FOR H-20 LOAD REQUIREMENTS

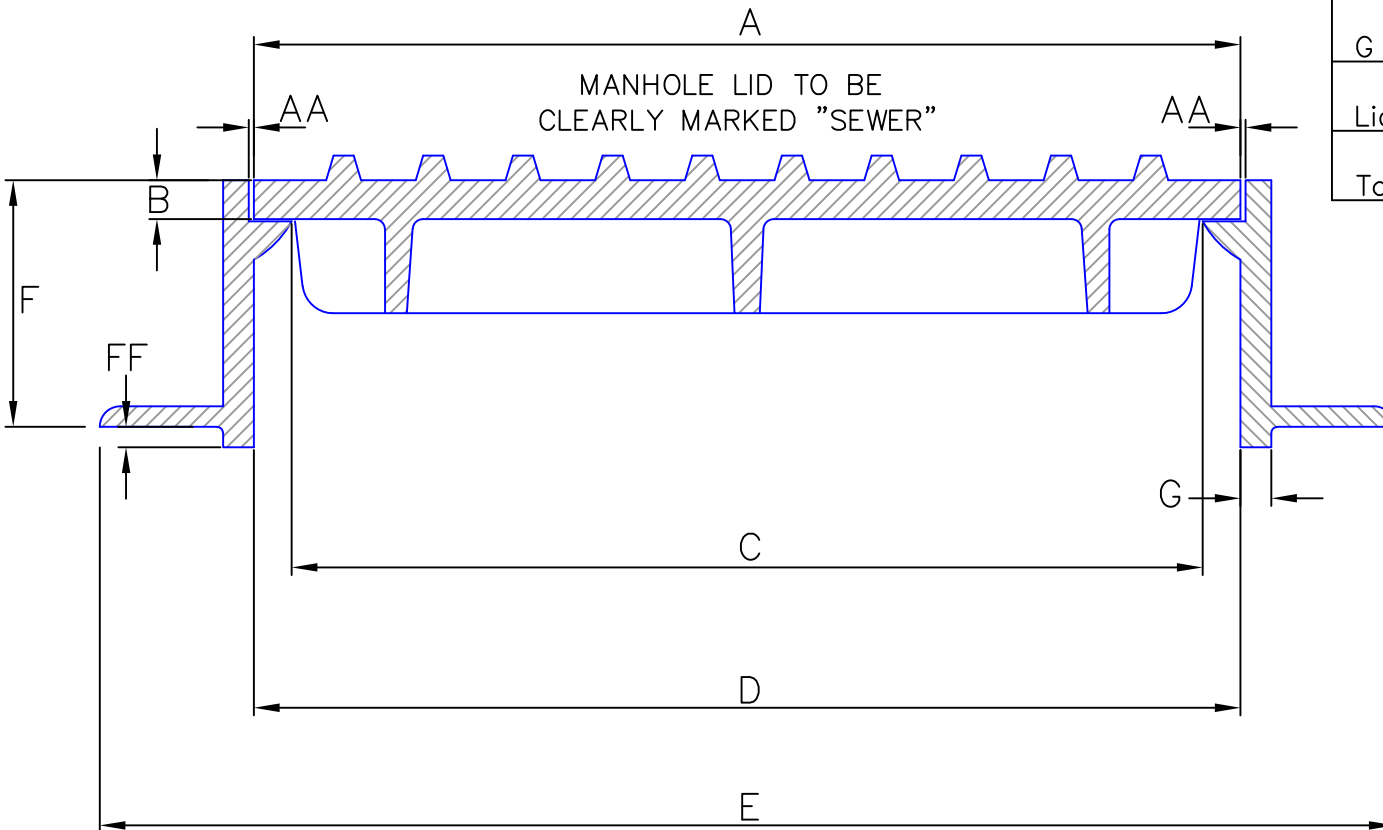
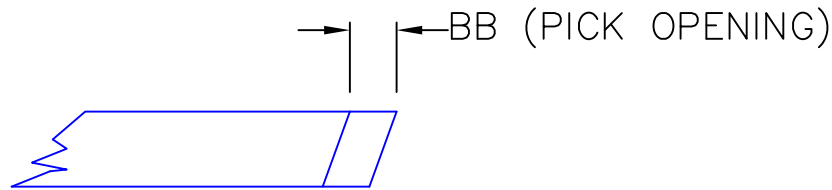
MIN. TENSILE STRENGTH SHALL BE 35,000 PSI

ALL HORIZONTAL BEARING SURFACES SHALL BE A MACHINED SURFACE

COVER TO BE SUPPLIED WITH MANUFACTURER'S STANDARD TRACTION SURFACE

MAY BE SUPPLIED WITHOUT MUDRING (DIM FF)

DIMENSIONS A, AA, B, AND BB SHALL NOT VARY



MANHOLE DIMENSIONS

DIMENSION	CITY	SUPPLIER
A	24"	
AA	1/8"	
B	1"	
BB	3/8"	
C	22 - 1/8"	
D	24 - 1/4"	
E	34"	
F (Typ.)	7" to 8"	
FF	0" to 1/2"	
G	3/4"	
Lid Weight	± 145	
Total Weight	± 345	

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STANDARD DETAILS

Drawn by: GLB

Scale: N.T.S.

Date: April 2023

Revision description: Update

SS-003

SANITARY SEWER

APPROXIMATE WEIGHT

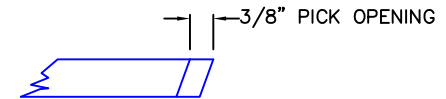
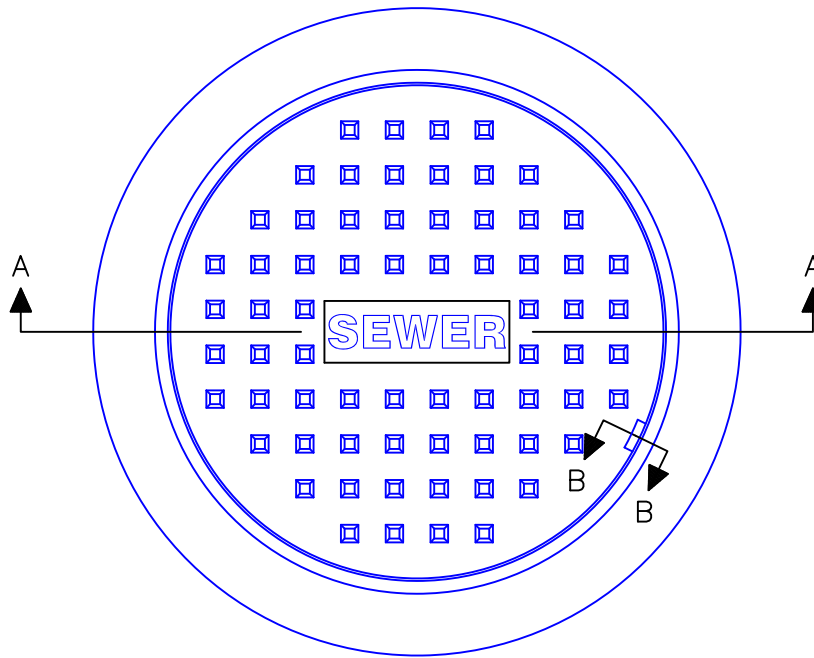
COVER D 122 lb

RING 118 lb

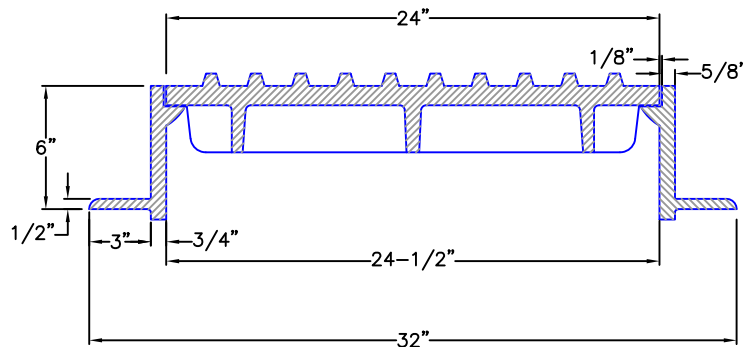
NOTES:

CASTINGS, INC. MH-250-24 C.I.
OR APPROVED EQUAL

NAMEPLATES - CAST AS PER REQUIRED
MACHINING - LID & RING SEAT
FINISH - BLACK BITUMINOUS PAINT



SECTION B-B



SECTION A-A

STANDARD MANHOLE RING & COVER

NTS

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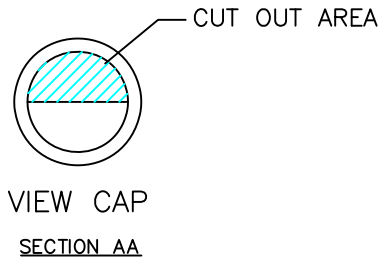
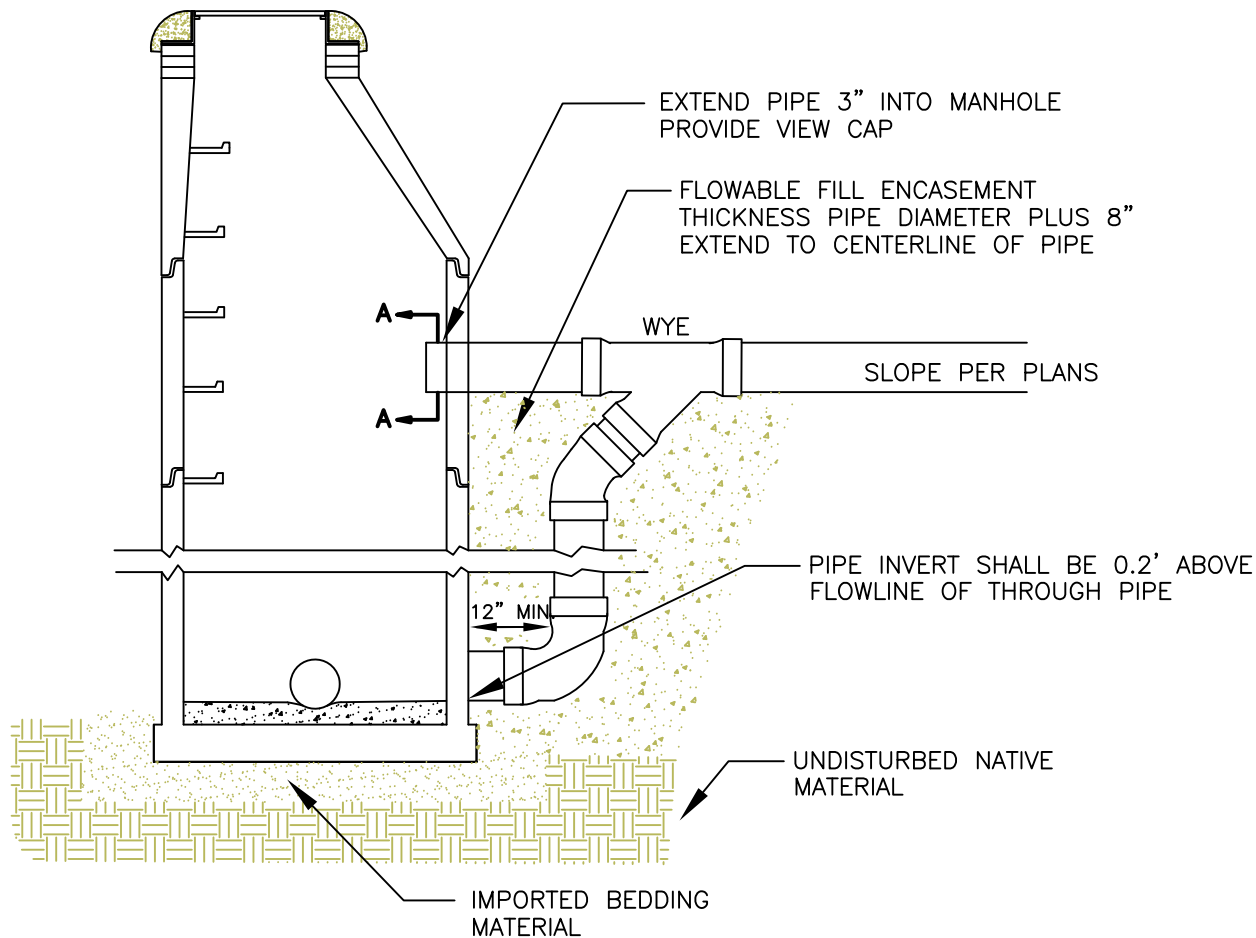
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Date: 2/24/00

Revision description:

Sheet number 3 of 3

SEE STANDARD MANHOLE
DETAIL FOR ADDITIONAL
DETAILS

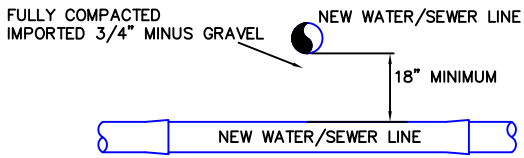


DROP MANHOLE CROSS SECTION
NTS

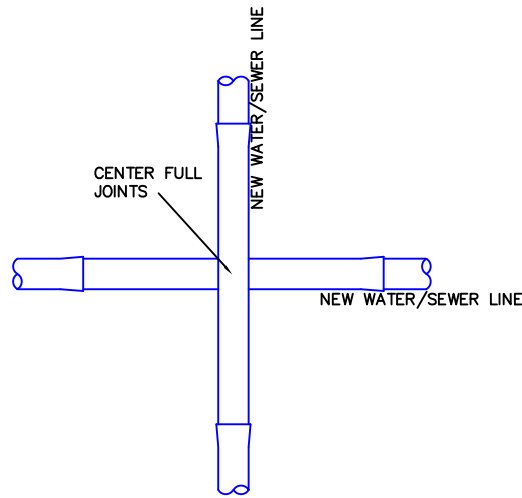
City Of Steamboat Springs Water & Sewer	
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<h2>STANDARD DETAILS</h2>	
Drawn by: GLB	
Scale: N.T.S.	Date: April 2023
Revision description: Update	
SS-004	SANITARY SEWER

NOTE:

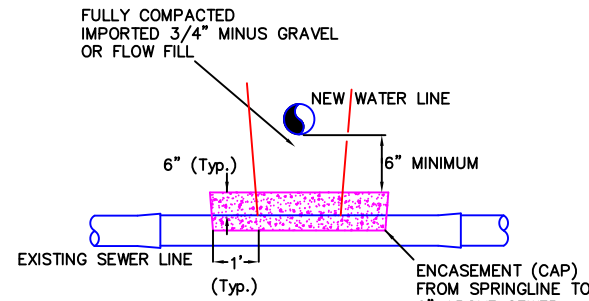
1. CROSSING CONDITIONS APPLY TO ALL MAIN AND SERVICE LINES
2. THE CITY SHALL APPROVE CROSSINGS LESS THAN 18 INCHES ON A CASE BY CASE BASIS.



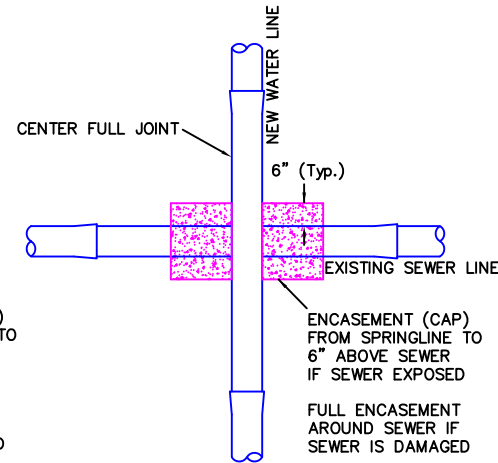
ELEVATION VIEW



PLAN VIEW



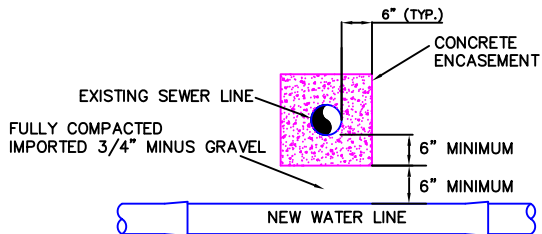
ELEVATION VIEW



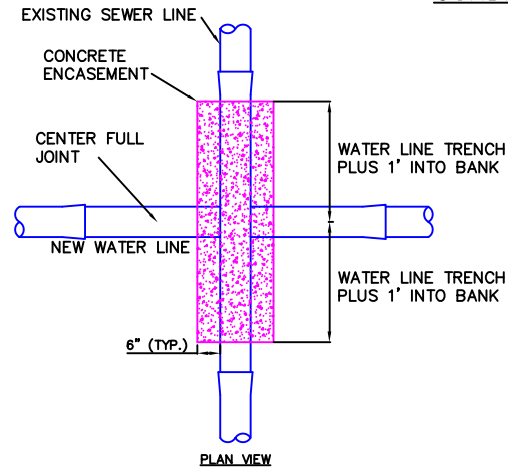
PLAN VIEW

CONDITION #1: NEW WATER LINE ABOVE NEW SEWER LINE
OR NEW SEWER LINE ABOVE NEW WATER LINE

CONDITION #2: NEW WATER LINE ABOVE EXISTING SEWER LINE



ELEVATION VIEW



PLAN VIEW

CONDITION #3: NEW WATER LINE BELOW EXISTING SEWER LINE

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STANDARD DETAILS

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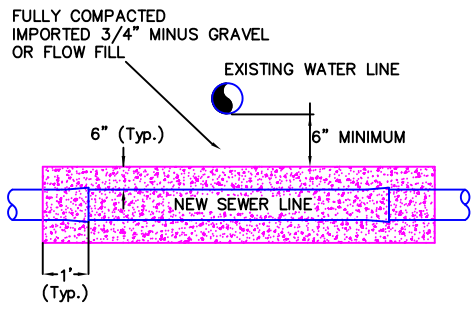
Revision description: Update

SS-006

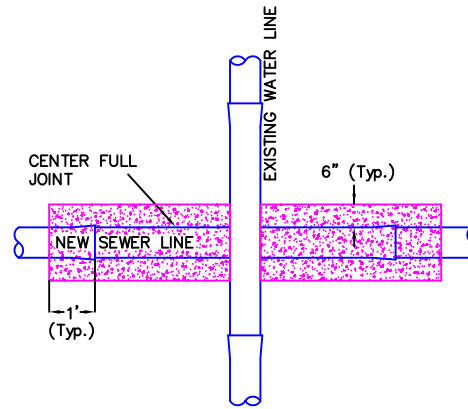
SANITARY SEWER

WATER AND SEWER CROSSING CONDITIONS (SHEET 1 OF 2)

NTS

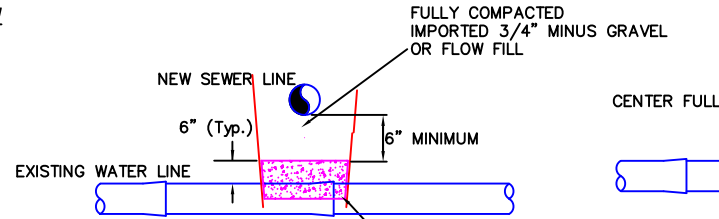


ELEVATION VIEW

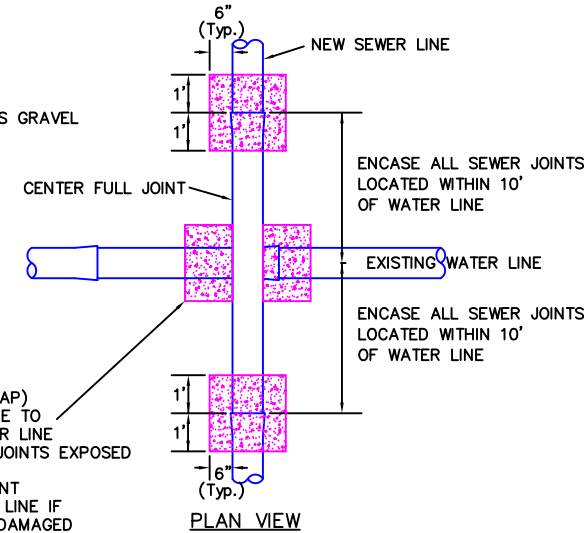


PLAN VIEW

CONDITION #4: NEW SEWER LINE BELOW EXISTING WATER LINE

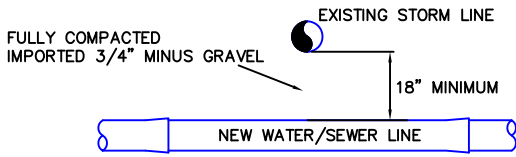


ELEVATION VIEW

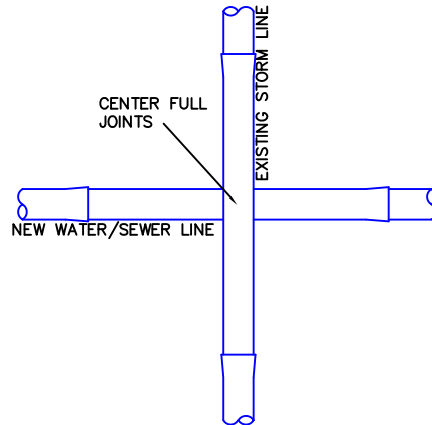


PLAN VIEW

CONDITION #5: NEW SEWER LINE ABOVE EXISTING WATER LINE



ELEVATION VIEW



PLAN VIEW

CONDITION #6 & #7: NEW SEWER/WATER LINE ABOVE/BELOW EXISTING STORM LINE

NOTE:
CROSSING CONDITIONS APPLY TO ALL MAIN AND SERVICE LINES

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Date: April 2023

Revision description: Update

SS-007

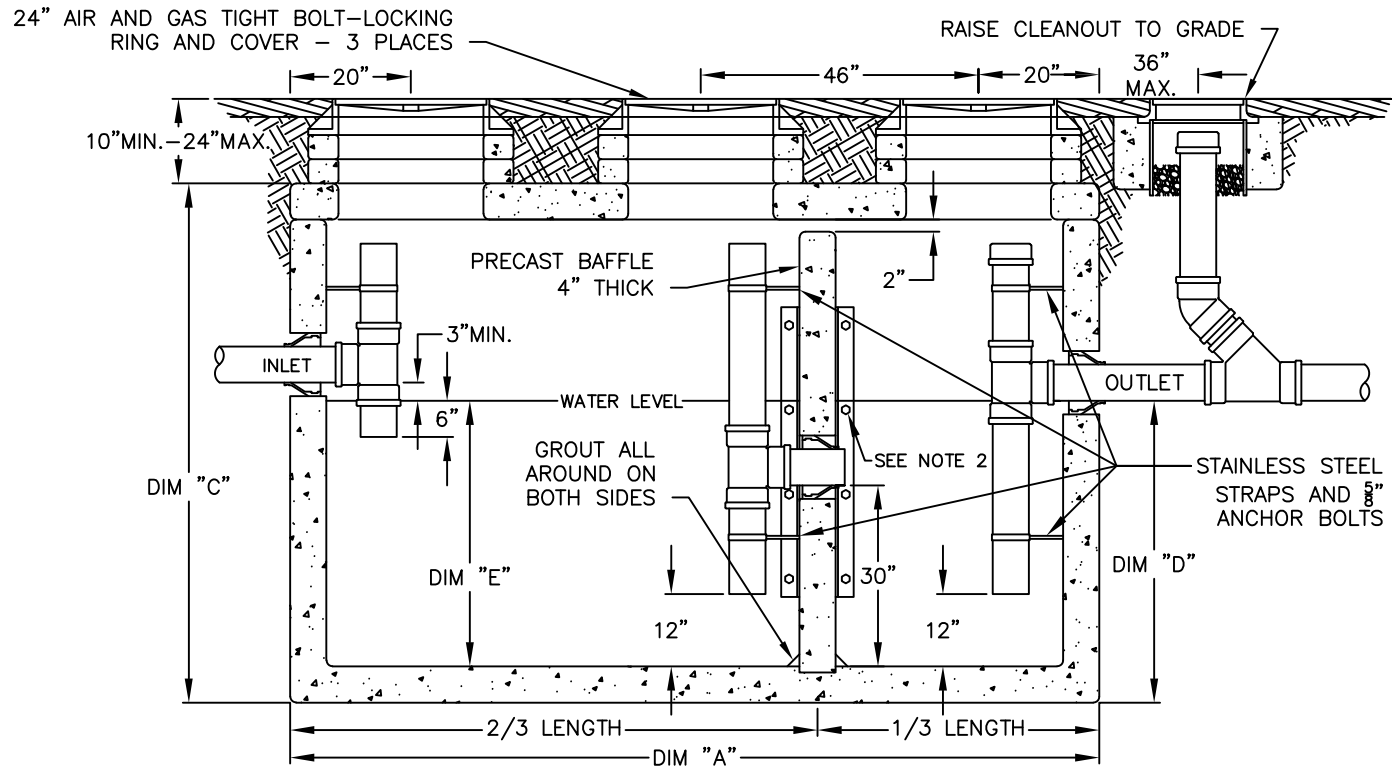
SANITARY SEWER

WATER AND SEWER CROSSING CONDITIONS (SHEET 2 OF 2)

NTS

GREASE INTERCEPTOR

NTS



GALLON CAPACITY	600	750	1000	1500	2000	2500	3000	4000	5000	6000
OLDCASTLE MODEL No.	577-GA	577-GA	4484-GA	5106-GA	612-GA	612-GA	712-GA	712-GA	818-GA	818-GA
LENGTH DIM "A"	7'-0"	7'-0"	9'-0"	11'-2"	12'-8"	12'-8"	15'-7"	15'-7"	19'-11"	19'-11"
WIDTH DIM "B"	4'-8"	4'-8"	5'-0"	5'-8"	6'-8"	6'-8"	9'-7"	9'-7"	9'-11"	9'-11"
HEIGHT DIM "C"	7'-0"	7'-0"	7'-2"	7'-2"	8'-0"	8'-0"	8'-6 1/2"	8'-6 1/2"	8'-11"	10'-5"
HEIGHT DIM "D"	3'-6"	4'-3"	4'-2"	4'-4"	4'-7"	5'-6"	5'-0"	6'-3"	6'-2"	7'-2"
WATER DEPTH DIM "E"	3'-2"	3'-11"	3'-10"	4'-0"	3'-10"	4'-9"	3'-9"	5'-0"	4'-9"	5'-9"

NOTES:

- USE OLDCASTLE PRECAST, PRECAST CONCRETE VAULT OR EQUAL. SEE CHART ABOVE FOR DIMENSIONS REQUIRED FOR EACH GALLON CAPACITY. PRECAST VAULT SHALL HAVE KNOCKOUTS AT ALL PIPE OPENINGS. IF KNOCKOUTS ARE NOT PRESENT, THEN PIPE OPENINGS SHALL BE CORE-DRILLED. PIPE OPENINGS SHALL BE 2" LARGER THAN THE PIPE DIAMETER.
- IF VAULT IS NOT SLOTTED TO ACCEPT PRECAST CONCRETE BAFFLE THEN BAFFLE SHALL BE HELD IN PLACE BY TWO 3"x3"x3/8" ANGLE 4FT. LONG ON EACH SIDE. ALL 4 PIECES OF ANGLE SHALL BE HELD IN PLACE WITH 4 - 1/2" BOLTS WITH WASHERS SPACED 14" ON CENTER. ANGLE AND FASTENERS SHALL BE STAINLESS STEEL OR GALVANIZED AND ASPHALT COATED.
- LOCATE VAULT WITHIN 20' OF DRIVE FOR ACCESS BY MAINTENANCE VEHICLES.
- P.V.C. INSPECTION AND SAMPLING TEE SHALL BE THE SAME SIZE AS THE OUTLET PIPE FOR 6" OUTLET OR GREATER. USE 6" P.V.C. TEE WHERE OUTLET PIPE SIZE IS LESS THAN 6". INSTALL GASKETED CAP ON TOP OF THE SAMPLING TEE.
- POSITION RISERS BELOW ACCESS OPENINGS TO ALLOW CLEAR ACCESS TO RISER AND VAULT CHAMBER.
- ALL RINGS AND COVERS SHALL BE AIR AND GAS TIGHT BOLT-LOCKING TYPE, RATED FOR H2O LOAD MINIMUM.
- FOR 1000 GALLON INTERCEPTOR, SUBSTITUTE 12" RING AND COVER FOR "CENTER MANHOLE". LOCATE 12" RING AND COVER DIRECTLY ABOVE TEE AND RISER.
- FOR 600 AND 700 GALLON INTERCEPTOR, SUBSTITUTE 30" RING AND COVER FOR THE TWO 24" MANHOLES LOCATED AT THE OUTLET END OF THE VAULT. CENTER OF 30" RING AND COVER SHALL BE LOCATED 2 FT. FROM THE OUTLET FACE OF VAULT.
- FILL WITH CLEAN WATER PRIOR TO START-UP OF THE SYSTEM.
- GRAY WATER ONLY. BLACK WATER SHALL BE CARRIED BY SEPARATE SIDE SEWER.
- PIPE CONNECTION TO VAULT: KOR-N-SEAL OR EQUAL FOR CORE-DRILLED OPENINGS, OR SAND COLLAR FOR KNOCKOUT OPENING. SEAL ALL PIPE CONNECTIONS WITH NONSHRINK GROUT.
- INTERIOR GREASE INTERCEPTORS SHALL HAVE VENTING PER 2012 UNIFORM PLUMBING CODE REQUIREMENTS.
- PRIOR TO STARTUP, GREASE INTERCEPTOR SHALL PASS 1% PER DAY LEAK TEST WHERE ONLY A MAXIMUM OF 1% OF DEAD STORAGE REDUCTION IS ALLOWED WITHIN A 24 HOUR PERIOD.

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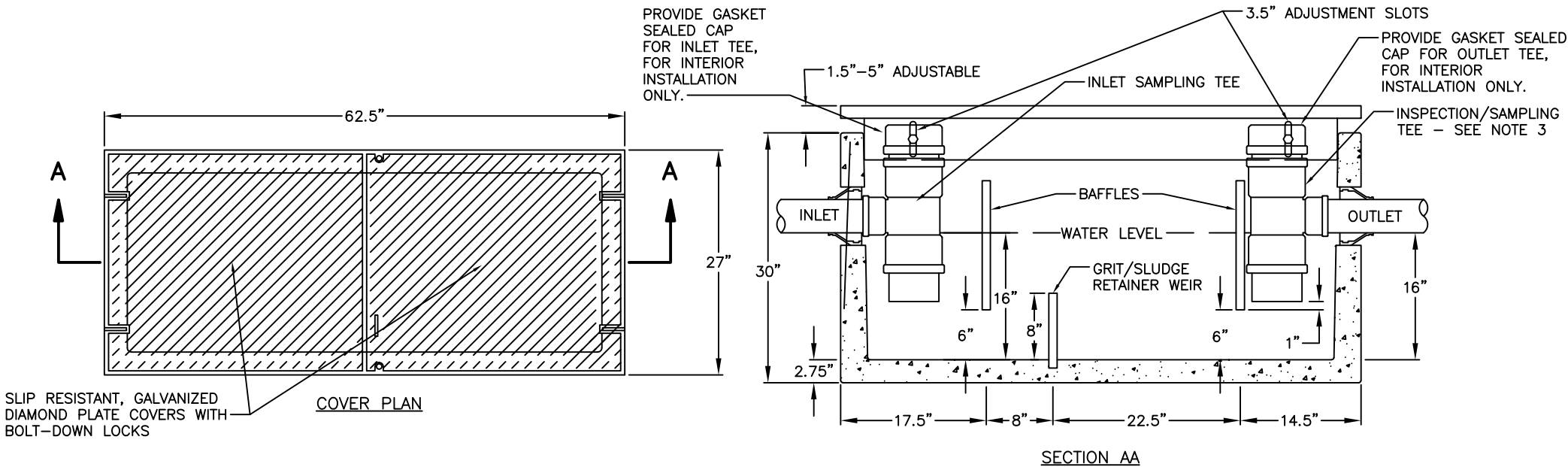
STANDARD DETAILS

Drawn by: JSF

Scale: N.T.S. Date: April 2023

Revision description:

SS-008 SANITARY SEWER



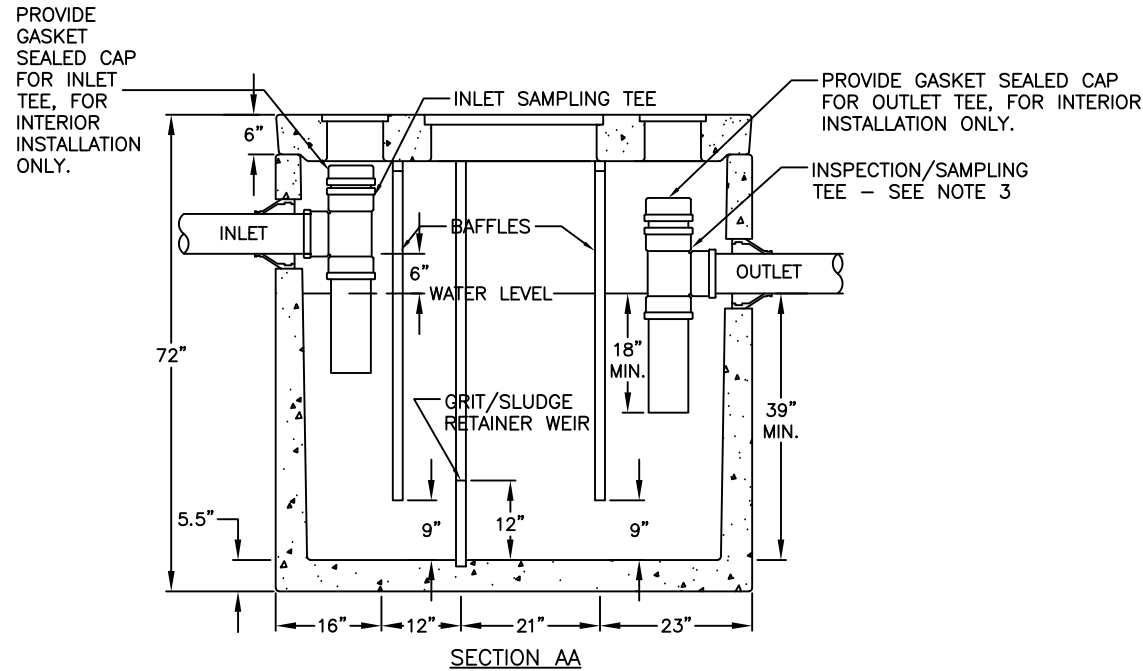
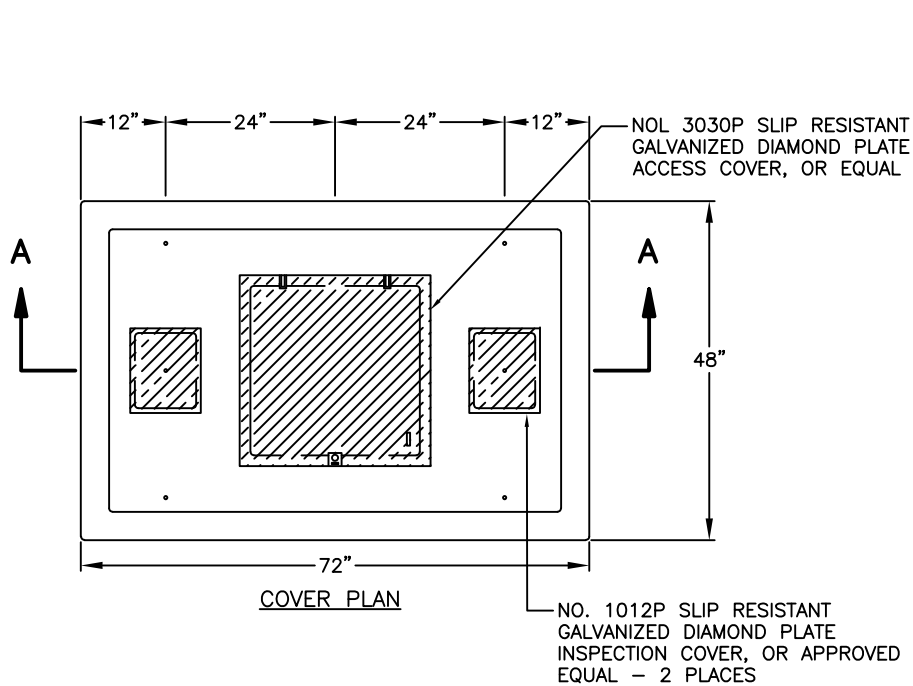
100 GALLON OIL/WATER SEPARATOR

NTS

NOTES:

1. USE OLDCASTLE PRECAST MODEL #25-SA OR APPROVED EQUAL. PRECAST VAULT SHALL HAVE KNOCKOUTS AT ALL PIPE OPENINGS. IF KNOCKOUTS ARE NOT PRESENT, THEN PIPE OPENINGS SHALL BE CORE-DRILLED. PIPE OPENINGS SHALL BE 2" LARGER THAN THE PIPE DIAMETER.
2. LOCATE VAULT WITHIN 20' OF DRIVE FOR ACCESS BY MAINTENANCE VEHICLES.
3. P.V.C. INSPECTION AND SAMPLING TEE SHALL BE THE SAME SIZE AS THE OUTLET PIPE FOR 6" OUTLET OR GREATER. USE 6" BY OUTLET-SIZE TEE WHERE OUTLET PIPE SIZE IS LESS THAN 6". INSTALL GASKETED CAP ON TOP OF THE SAMPLING TEE, FOR INTERIOR INSTALLATION ONLY.
4. FILL WITH CLEAN WATER PRIOR TO START-UP OF THE SYSTEM.
5. GRAY AND BLACK WATER SHALL BE CARRIED BY SEPARATE SIDE SEWER.
6. PIPE CONNECTION TO VAULT: KOR-N-SEAL OR EQUAL FOR CORE-DRILLED OPENINGS, OR SAND COLLAR FOR KNOCKOUT OPENING. SEAL ALL PIPE CONNECTIONS WITH NONSHRINK GROUT.
7. INTERIOR OIL/WATER SEPARATORS SHALL HAVE VENTING PER THE INTERNATIONAL PLUMBING CODE REQUIREMENTS.
8. PRIOR TO STARTUP, OIL/WATER SEPARATOR SHALL PASS 1% PER DAY LEAK TEST WHERE ONLY A MAXIMUM OF 1% OF DEAD STORAGE REDUCTION IS ALLOWED WITHIN A 24 HOUR PERIOD PER THE INTERNATIONAL PLUMBING CODE.

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STANDARD DETAILS	
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Scale: N.T.S.	Date: April 2023
Revision description:	
SS-009	SANITARY SEWER



450-900 GALLON OIL/WATER SEPARATOR

NTS

VAULT CHART		
CAPACITY GALLONS	450	750-900
MODEL #	660-SA	577-SA
LENGTH	6'-0"	7'-0"
WIDTH	4'-0"	4'-8"
HEIGHT	6'-0"	7'-0"
MANUFACTURER	OLDCASTLE	OLDCASTLE

NOTES:

1. USE OLDCASTLE PRECAST MODEL (SEE CHART) OR APPROVED EQUAL. PRECAST VAULT SHALL HAVE KNOCKOUTS AT ALL PIPE OPENINGS. IF KNOCKOUTS ARE NOT PRESENT, THEN PIPE OPENINGS SHALL BE CORE-DRILLED. PIPE OPENINGS SHALL BE 2" LARGER THAN THE PIPE DIAMETER.
2. LOCATE VAULT WITHIN 20' OF DRIVE FOR ACCESS BY MAINTENANCE VEHICLES.
3. P.V.C. INSPECTION AND SAMPLING TEE SHALL BE THE SAME SIZE AS THE OUTLET PIPE FOR 6" OUTLET OR GREATER. USE 6" BY OUTLET-SIZE TEE WHERE OUTLET PIPE SIZE IS LESS THAN 6". INSTALL GASKETED CAP ON TOP OF THE SAMPLING TEE, FOR INTERIOR INSTALLATION ONLY.
4. FILL WITH CLEAN WATER PRIOR TO START-UP OF THE SYSTEM.
5. GRAY AND BLACK WATER SHALL BE CARRIED BY SEPARATE SIDE SEWER.
6. PIPE CONNECTION TO VAULT: KOR-N-SEAL OR EQUAL FOR CORE-DRILLED OPENINGS, OR SAND COLLAR FOR KNOCKOUT OPENING. SEAL ALL PIPE CONNECTIONS WITH NONSHRINK GROUT.
7. INTERIOR OIL/WATER SEPARATORS SHALL HAVE VENTING PER THE INTERNATIONAL PLUMBING CODE REQUIREMENTS.
8. PRIOR TO STARTUP, OIL/WATER SEPARATOR SHALL PASS 1% PER DAY LEAK TEST WHERE ONLY A MAXIMUM OF 1% OF DEAD STORAGE REDUCTION IS ALLOWED WITHIN A 24 HOUR PERIOD PER THE INTERNATIONAL PLUMBING CODE.

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STANDARD DETAILS

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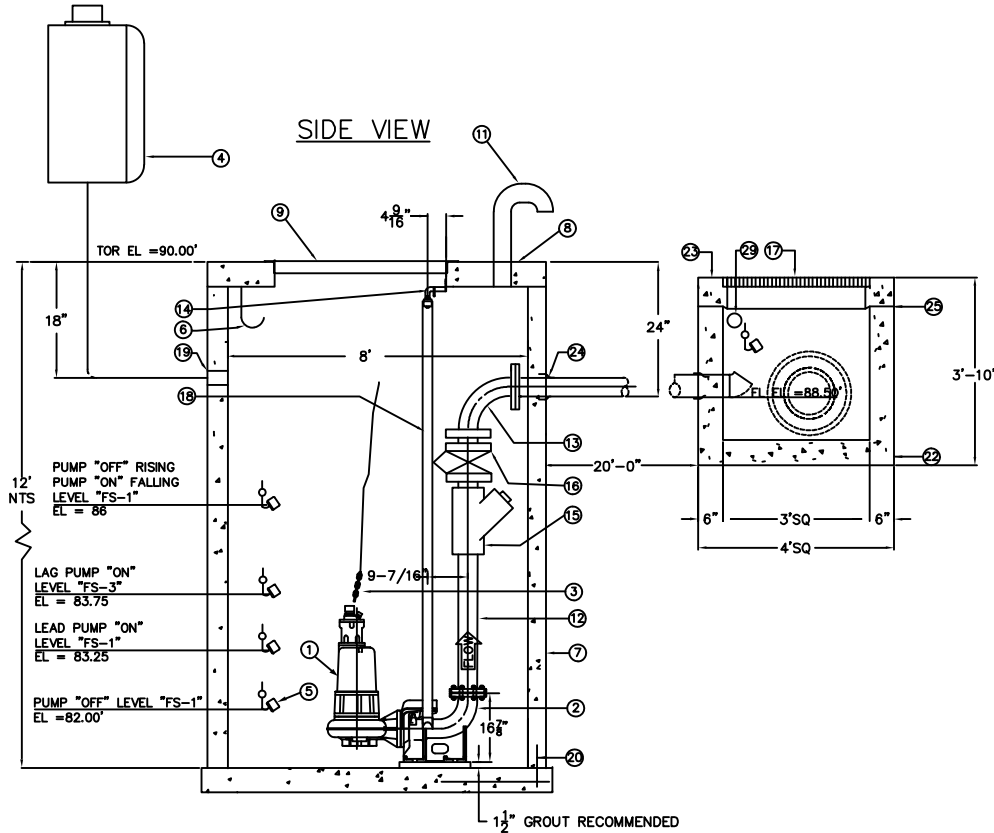
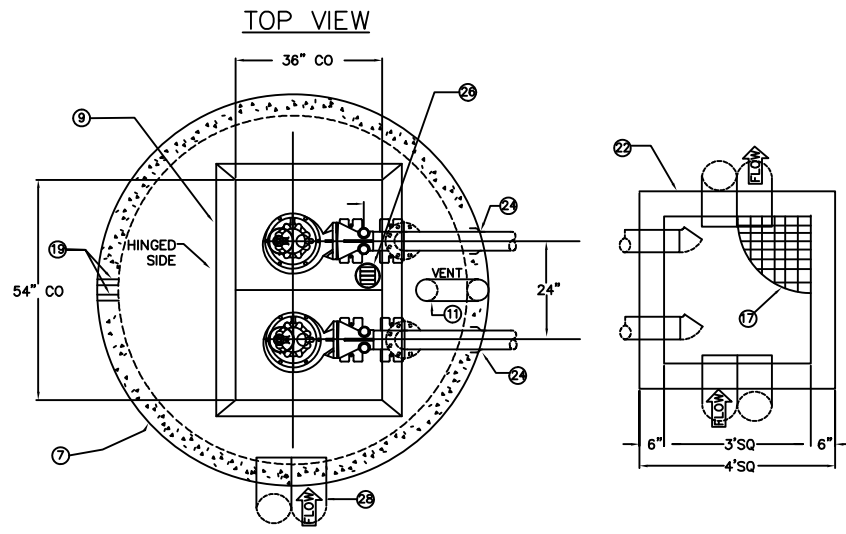
Scale: N.T.S.

Date: April 2023

Revision description: Update

SS-010

SANITARY SEWER



STANDARD LIFT STATION

NTS

KEYED NOTES		
MARK	QTY	DESCRIPTION
1	2	LIBERTY PUMP M/N LE41M-2
2	2	2" BASE ELBOWS
3	2	STAINLESS STEEL LIFTING CHAIN
4	1	DUPLEX CONTROL PANEL NEMA 4X (MOUNTED & WIRED BY CONTRACTOR)
5	4	FLOAT SWITCH
6	1	SS FLOAT HANGER
7	1	48" DIA x 12' DEEP CONCRETE WET WELL
8	1	6" THK FLAT CONCRETE TOP
9	1	30"x36" SINGLE LEAF ALUMINIUM HATCHWAY (300 PSF)
11	1	4" GALVANIZED VENT
12	2	2" SCH 80 PVC PIPE
13	2	2" SCH 80 PVC 90° ELBOW
14	2	SS UPPER GUIDE BRACKETS
15		BALL CHECK VALVE
16		TRUE UNION BALL VALVE
17	2	36" SQ GALV STEEL BAR GRATE
18	4	SS GUIDE RAILS
19	2	3" CONDUIT
20		REBAR AS REQ'D
22	1	36" x 36" x 3'-6" DEEP PRECAST CONCRETE DISCHARGE STRUCTURE
23	1	6" THK DISCHARGE STRUCTURE LID
24	2	RESILIENT RUBBER BOOT
25	-	ALL JOINTS MADE WATER-TIGHT w/ PLASTIC FLEXIBLE GASKET (RAM-NEX)
26	1	NAMEPLATE INDICATING: DATE MANUFACTURED
27	1	REMOTE MOUNT DITCH FLOAT (MOUNTED & WIRED BY OTHERS)
28	1	STORM INLET PIPING SEAL w/ NON-SHRINK GROUT (BY OTHERS)
29		12" ELECTRICAL COUPLING

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STANDARD DETAILS

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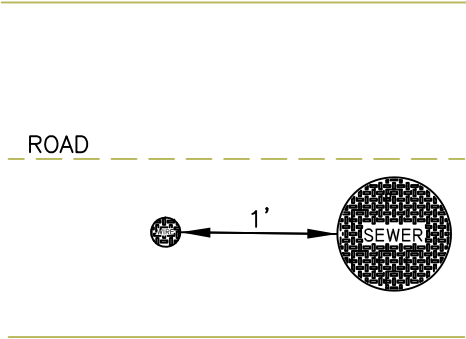
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Date: April 2023

Revision description:

SS-012

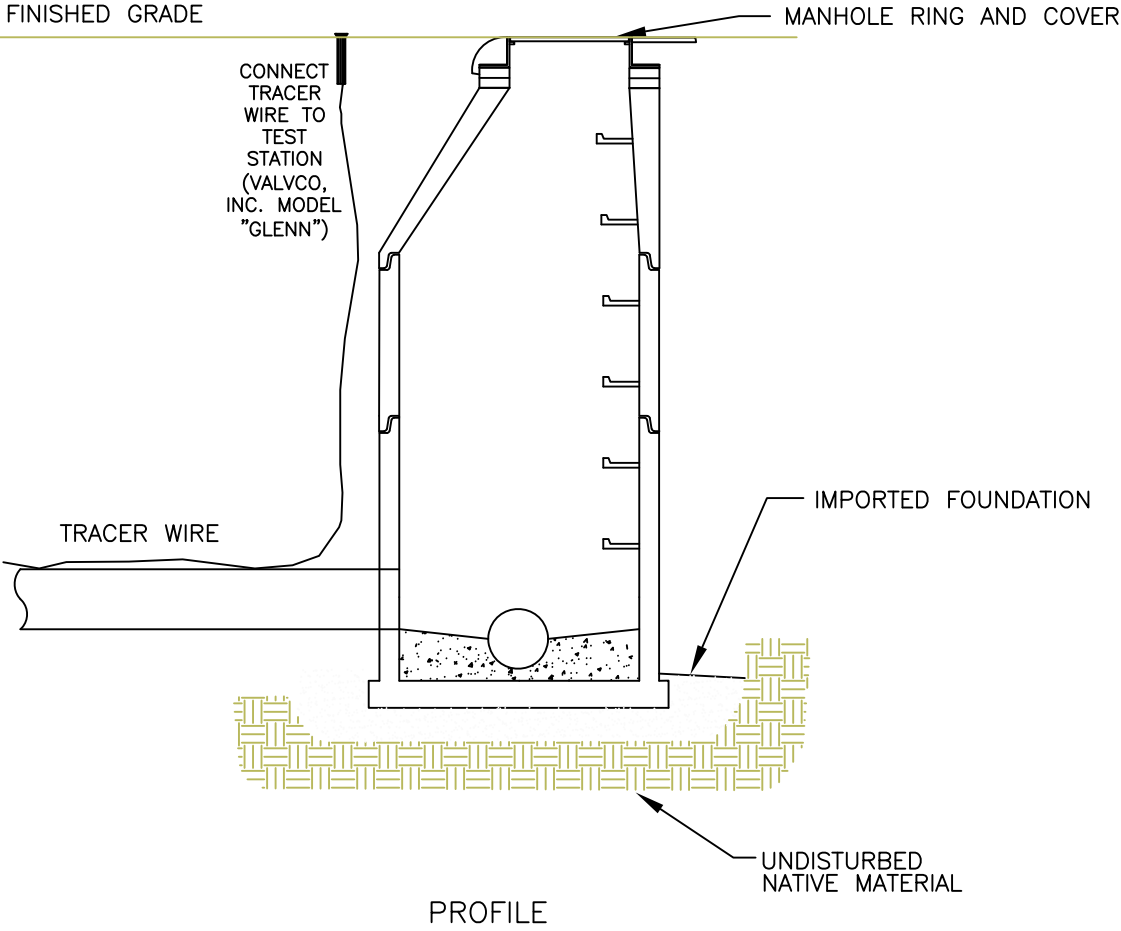
SANITARY SEWER



PLAN

SEWER TRACER WIRE TEST STATION

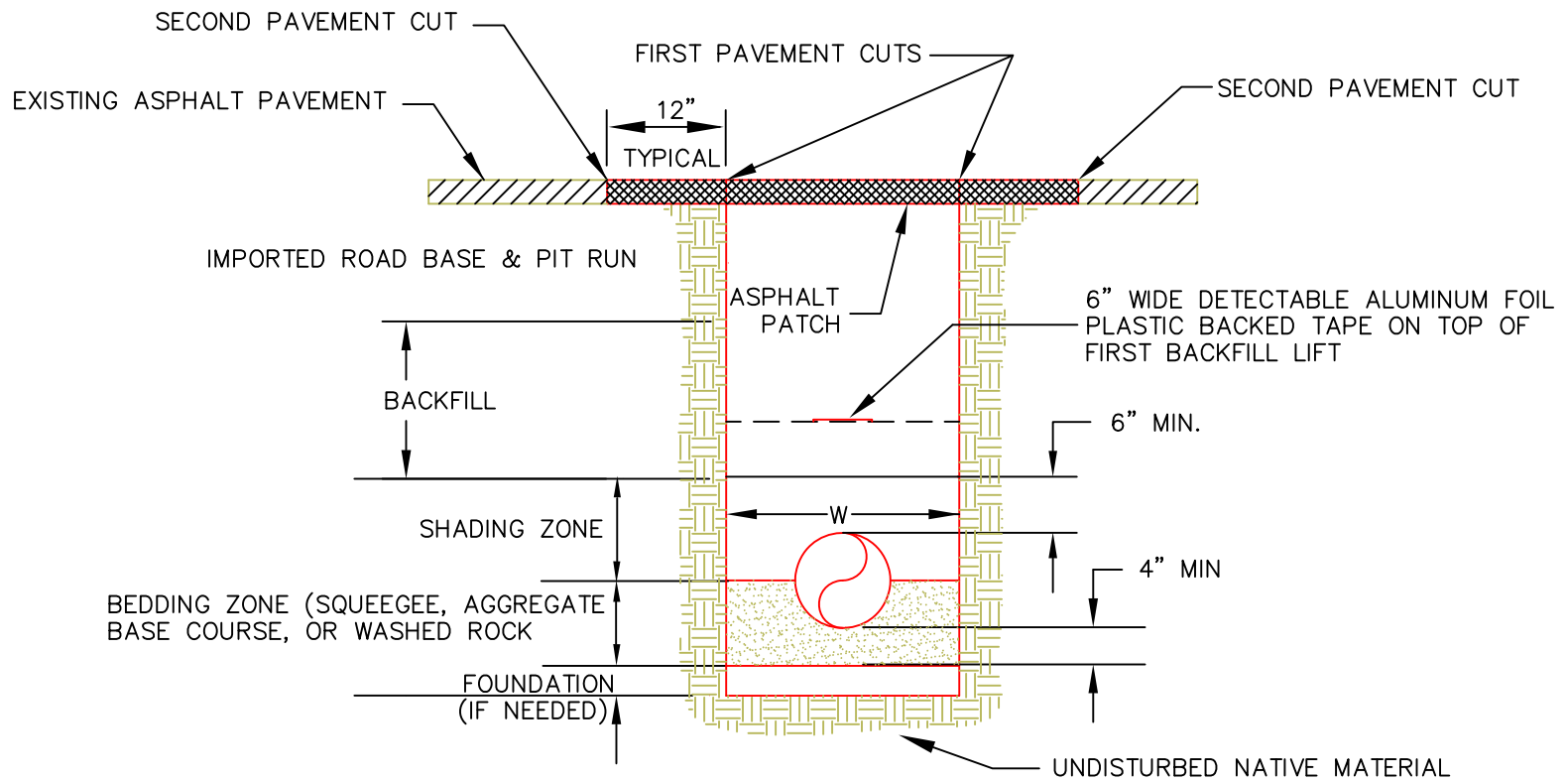
NTS



PROFILE

- NOTES:
1. TRACER WIRE TEST STATION MUST BE H-20 TRAFFIC RATED IF LOCATED IN THE ROADWAY.
 2. SEE SHEET D-002 FOR TRACER WIRE REQUIREMENTS ON SERVICE LINES.

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Revision description: Update	
SS-013	SANITARY SEWER



TRENCH CROSS SECTION

NTS

NOTES:

A GUIDE FOR DESIRABLE TRENCH WIDTH (W) AT THE TOP OF THE PIPE SHALL BE THE NOMINAL DIAMETER OF THE PIPE PLUS 12-INCHES ON EACH SIDE OF THE PIPE.

A SECOND PAVEMENT CUT SHALL BE REQUIRED PRIOR TO PLACING THE ASPHALT PATCH. REMOVE ALL IRREGULAR ASPHALT EDGES A MINIMUM OF 12-INCHES BEYOND ANY DAMAGED SURFACE TO A CLEAN VERTICAL EDGE. APPLY A BITUMINOUS TACK COAT PRIOR TO PLACING THE ASPHALT PATCH.

THE ASPHALT PATCH SHALL BE PLACED IN TWO 2-INCH LIFTS AND ROLLER COMPACTED TO MATCH THE ADJACENT ASPHALT EDGES.

SUB-BASE MATERIALS SHALL CONSIST OF 4-INCHES OF ROAD BASE ON 8-INCHES OF PIT-RUN. COMPACTION REQUIREMENTS SHALL EXCEED 95% MAXIMUM DRY DENSITY AS DETERMINED BY THE AASHTO T-180 TEST PROCEDURES.

THE CONTRACTOR MUST COMPLY WITH THE TRENCHING AND EXCAVATION REQUIREMENTS OF 29 CFR 1926.651 AND 1926.652 OR COMPARABLE OSHA-APPROVED STATE PLAN REQUIREMENTS.

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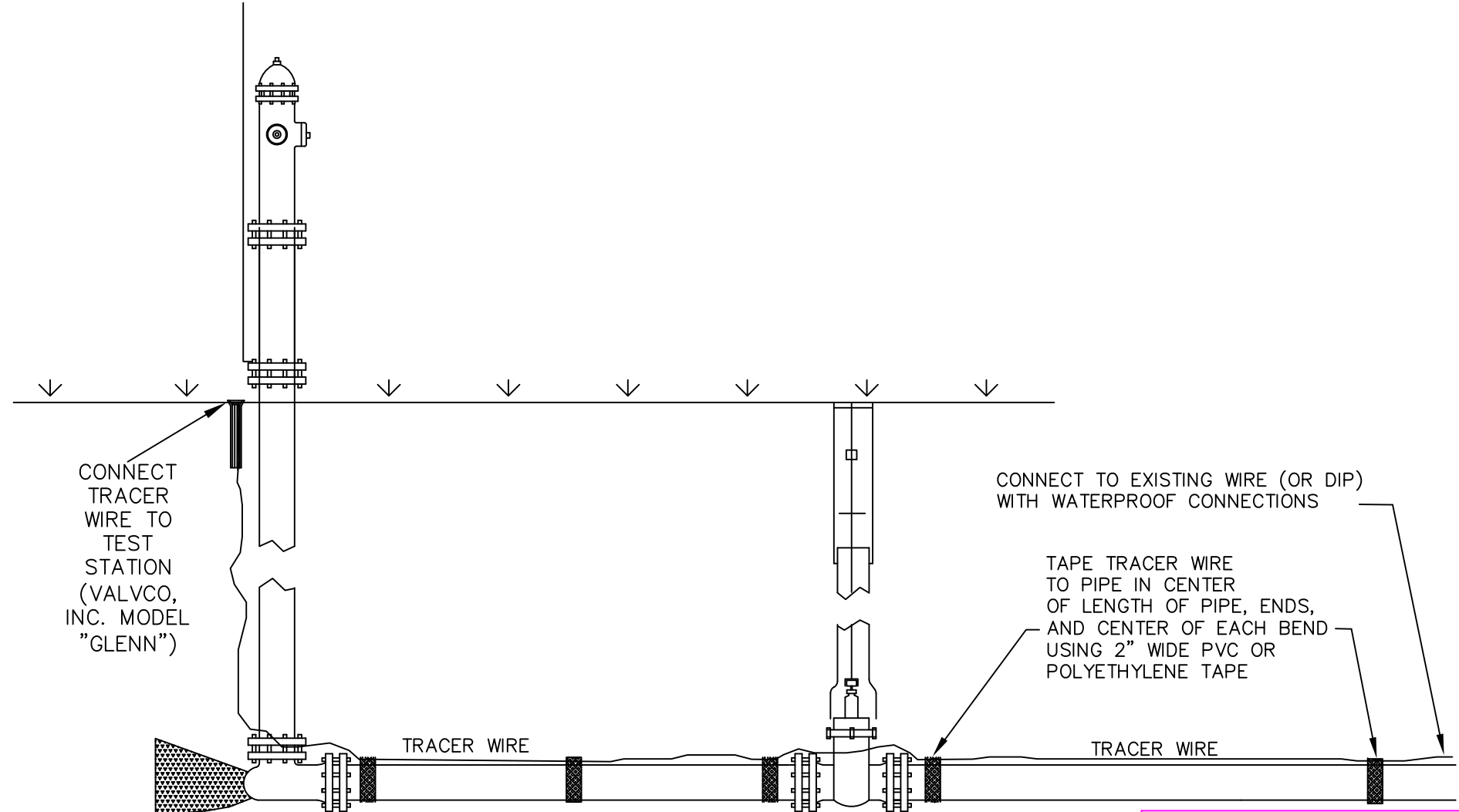
STANDARD DETAILS

Drawn by: JS

Scale: N.T.S. Date: April 2023

Revision description: Update

D-001	GENERAL
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CONNECT TRACER WIRE TO TEST STATION (VALVCO, INC. MODEL "GLENN")

CONNECT TO EXISTING WIRE (OR DIP) WITH WATERPROOF CONNECTIONS

TAPE TRACER WIRE TO PIPE IN CENTER OF LENGTH OF PIPE, ENDS, AND CENTER OF EACH BEND USING 2" WIDE PVC OR POLYETHYLENE TAPE

TRACER WIRE

TRACER WIRE

PRECAST THRUST BLOCK

TRACER WIRE

NTS

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STANDARD DETAILS

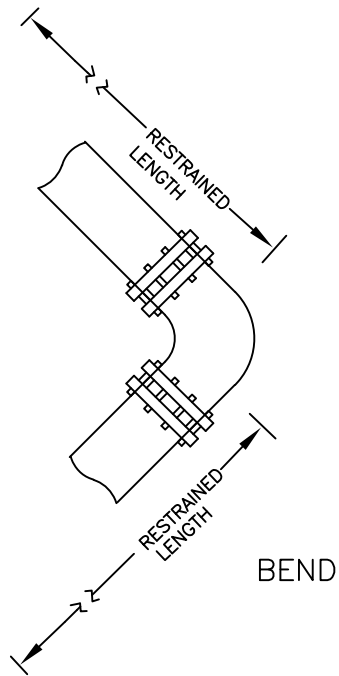
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Scale: N.T.S. Date: April 2023

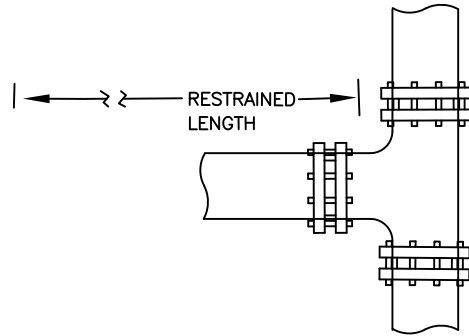
Revision description: Update

D-002

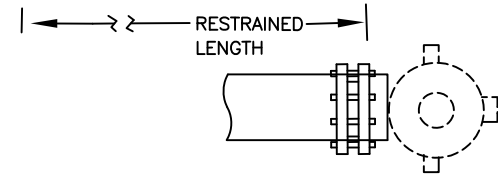
GENERAL



BEND



TEE



DEAD END OR FIRE HYDRANT

REQUIRED RESTRAINT LENGTH (FT)

FITTING TYPE	MAIN SIZE (INCHES)				
	4"	6"	8"	10"	12"
90° BEND, BRANCH OF TEE, IN LINE VALVE, OR DEAD END	30'	45'	60'	73'	86'
45° BEND	20'	20'	20'	21'	25'
22 1/2° BEND	20'	20'	20'	20'	20'
11 1/4° BEND	20'	20'	20'	20'	20'

NOTE: THRUST BLOCKS ARE REQUIRED IN ADDITION TO JOINT RESTRAINT.

RESTRAINT DETAIL

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 (970) 879-2060 FAX (970) 879-8851

STANDARD DETAILS

Drawn by: GLB

Scale: N.T.S.

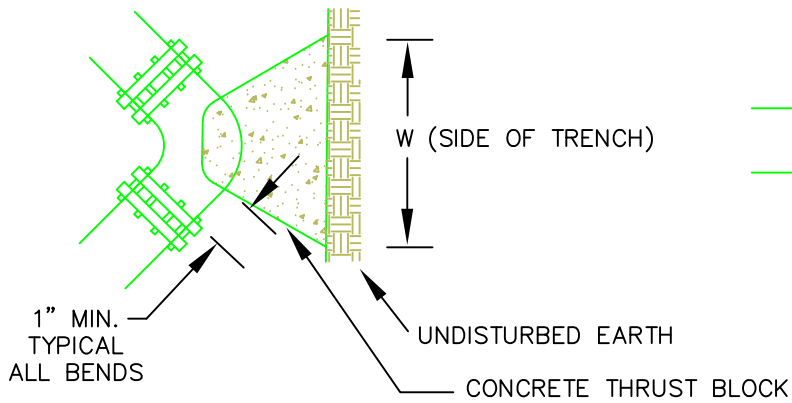
Date: April 2023

Revision description:

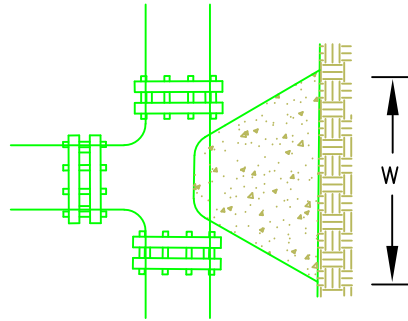
D-003

GENERAL

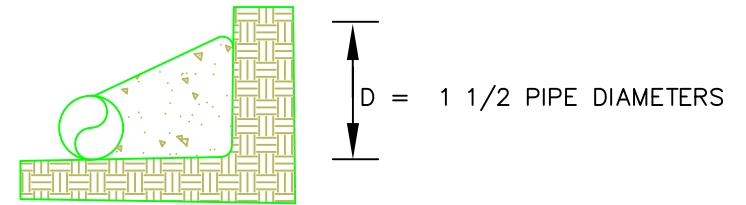
HORIZONTAL BENDS



TEE



CROSS SECTION



NOTES:

1. THRUST BLOCKS ARE REQUIRED IN ADDITION TO JOINT RESTRAINTS.
2. ALL THRUST BLOCKS SHALL BE PRE-CAST PRIOR TO PLACEMENT.
3. WRAP FITTINGS WITH POLYETHYLENE PRIOR TO PLACING THRUST BLOCKS SO THAT CONCRETE DOES NOT COME IN CONTACT WITH JOINT BOLTS.
4. THRUST BLOCKS SHALL BE INSTALLED SO THAT ALL JOINTS ARE ACCESSIBLE.
5. IF OVER-EXCAVATION OCCURS, THE CONTRACTOR SHALL PLACE COMPACTED CLASS 6 AGGREGATE BASE COURSE OR FLOW FILL BETWEEN THE THRUST BLOCK AND UNDISTURBED EARTH.

MINIMUM BEARING SURFACE (SF)
FOR 200 PSI AND LESS

SIZE OF PIPE	BENDS				TEE OR DEAD END
	11-1/4°	22-1/2°	45°	90°	
4"	1.3	2.5	2.5	4	6.4
6"	1.3	2.5	5.0	9.0	6.4
8"	1.3	2.5	5.0	9.0	6.4
10"	1.9	3.8	7.4	13.7	9.7
12"	2.7	5.4	10.5	19.3	13.7

MINIMUM BEARING SURFACE (SF)
FOR 201 TO 250 PSI

SIZE OF PIPE	BENDS				TEE OR DEAD END
	11-1/4°	22-1/2°	45°	90°	
4"	1.6	3.1	4	4	8.0
6"	1.6	3.1	6.2	11.4	8.0
8"	1.6	3.1	6.2	11.4	8.0
10"	2.4	4.7	9.25	17.1	12.0
12"	3.4	6.7	13.1	24.2	17.1

THRUST BLOCK BEARING AREA
IN SQUARE FEET. (AREA = W X D)

THRUST BLOCK DETAIL

NTS

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STANDARD DETAILS

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Scale: N.T.S.

Date: April 2023

Revision description: Update

D-004

GENERAL

THRUST BLOCK VERTICAL FITTINGS

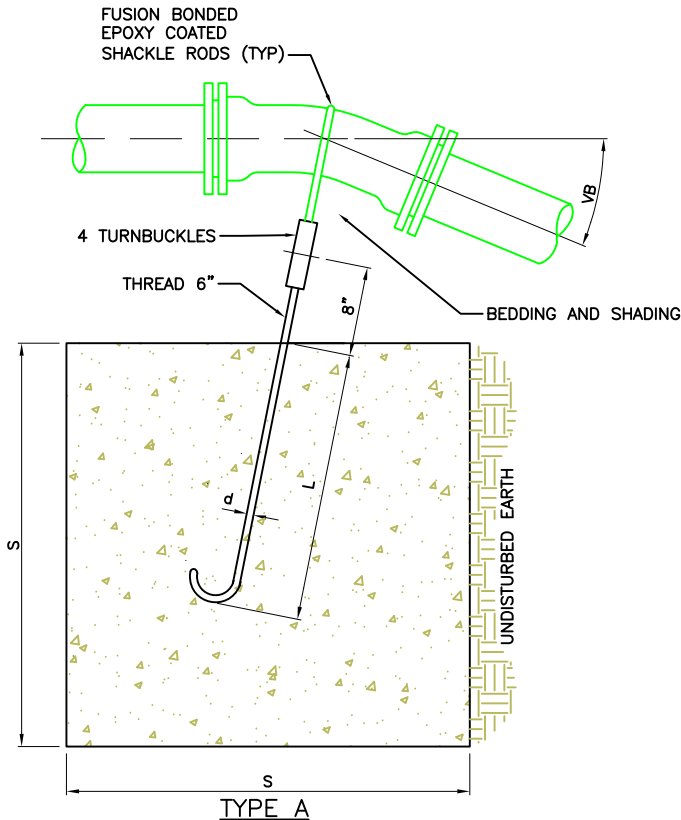
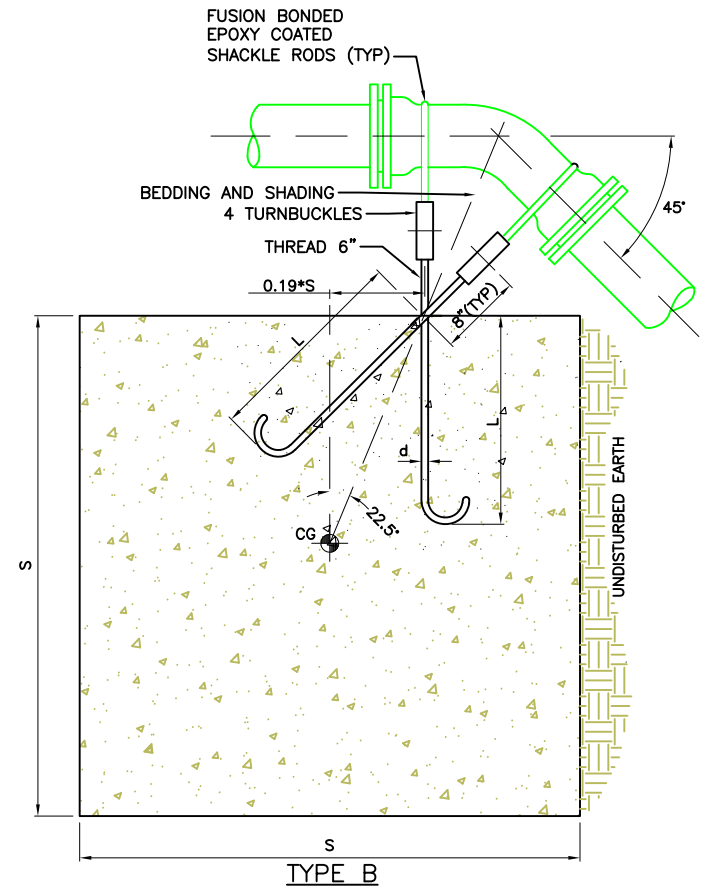
NTS

NOTES:

1. AFTER INSTALLATION, SHACKLE RODS AND TURNBUCKLES MUST BE CLEANED AND COATED WITH 2 COATS OF ASPHALTIC VARNISH, ROYSTON ROYKOTE #612M OR APPROVED EQUAL.
2. SHACKLE RODS MUST BE FUSION BONDED EPOXY COATED ROUND MILD STEEL, ASTM A 36, WITH THREADS ON ENDS ONLY.
3. AREA BETWEEN PIPE AND BLOCK TO BE BEDDED AND SHADED. DISTANCE FROM CENTER OF PIPE BEND TO THRUST BLOCK FACE SHALL BE 18".
4. IF OVER-EXCAVATION OCCURS, THE CONTRACTOR SHALL PLACE COMPACTED CLASS 6 AGGREGATE BASE COURSE OR FLOW FILL BETWEEN THE THRUST BLOCK AND UNDISTURBED EARTH.

TYPE B

TYPE B BLOCKING FOR 45° VERTICAL BENDS					
PIPE SIZE NOM DIA INCHES	VERTICAL BEND DEGREES	NO OF CU FT OF CONC BLOCKING	SIDE OF CUBE FEET (FT)	d DIA OF SHACKLE RODS (2) INCHES	L DEPTH OF RODS IN CONCRETE INCHES
4"	45	35	3.27	3/4	20
6"		48.6	3.65		
8"		48.6	3.65		
12"		102.6	4.68		



TYPE A

TYPE A BLOCKING FOR 11 1/4° & 22 1/2° VERTICAL BENDS					
PIPE SIZE NOM DIA INCHES	VERTICAL BEND DEGREES	NO OF CU FT OF CONC BLOCKING	SIDE OF CUBE FEET (FT)	d DIA OF SHACKLE RODS (2) INCHES	L DEPTH OF RODS IN CONCRETE INCHES
4"	11 1/4	5.4	1.75	3/4	14
	22 1/2	10.8	2.2		18
6"	11 1/4	5.4	1.75	3/4	14
	22 1/2	13.5	2.4		20
8"	11 1/4	5.4	1.75	3/4	14
	22 1/2	13.5	2.4		20
12"	11 1/4	8.1	2	1	18
	22 1/2	27	3		24

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STANDARD DETAILS

Drawn by: JSF

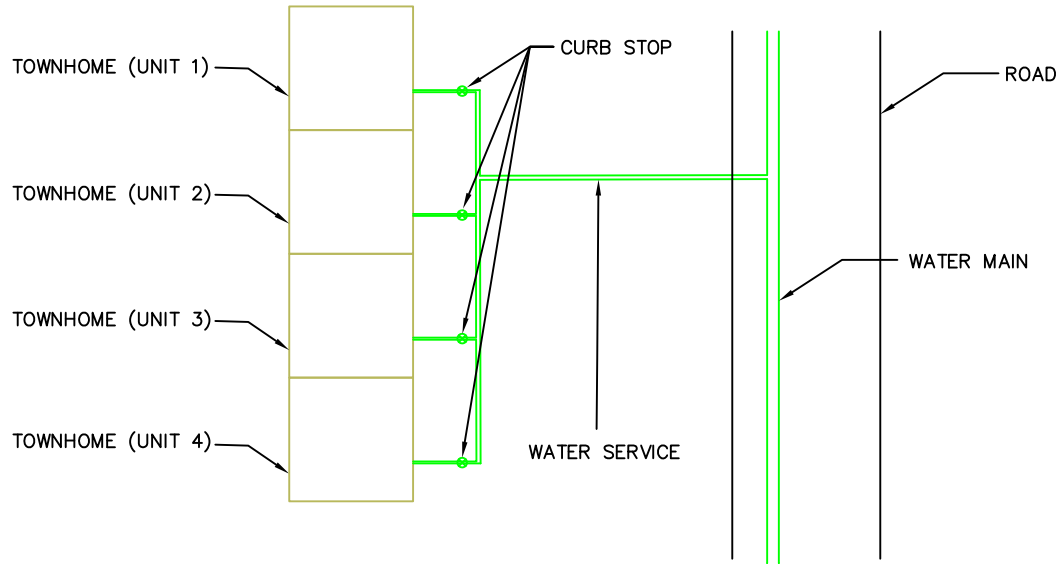
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Date: April 2023

Revision description:

D-005

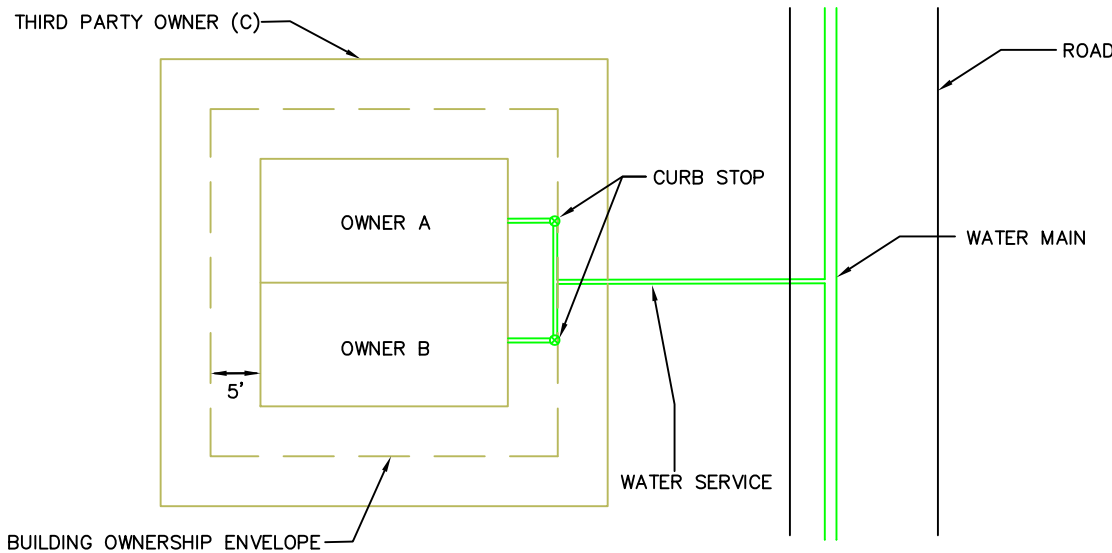
GENERAL



CONDITION 1
MULTI-UNIT SERVICE

TOWNHOUSE SERVICE ASSEMBLIES 1

NTS



CONDITION 2
ABC STYLE SERVICES

City Of
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Water & Sewer



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STANDARD DETAILS

Drawn by: JSF

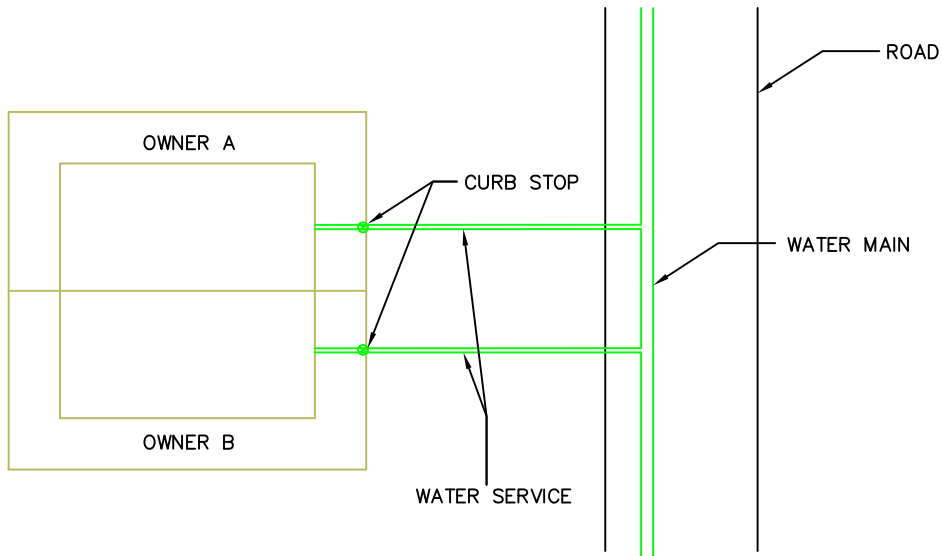
Scale: N.T.S.

Date: April 2023

Revision description:

D-006

GENERAL



TOWNHOUSE SERVICE ASSEMBLIES 2

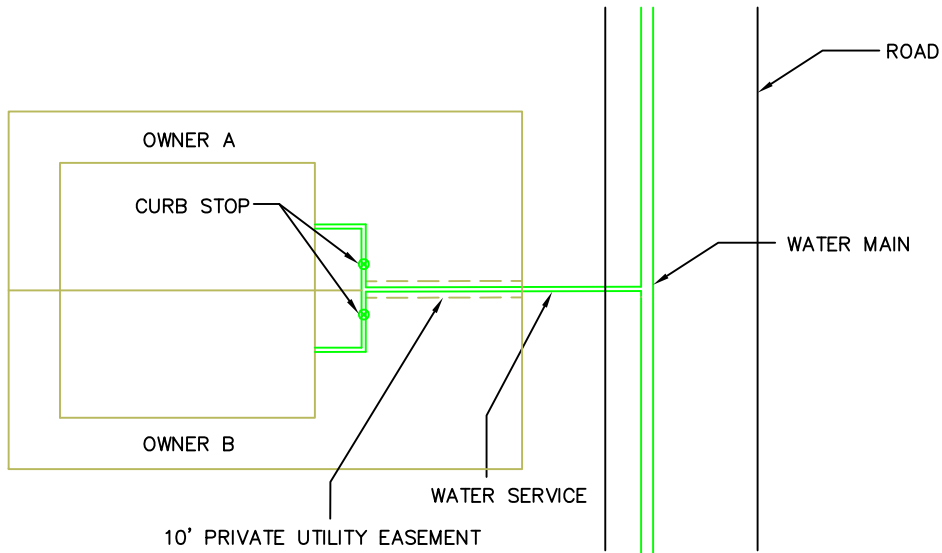
NTS

CONDITION 3

AB STYLE SERVICE 1

NOTE:

CURB STOPS SHALL BE PLACED AT PROPERTY LINE OR 5' INSIDE PROPERTY LINE.



CONDITION 4

AB STYLE SERVICE 2

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 Water & Sewer

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STANDARD DETAILS

Drawn by: JSF

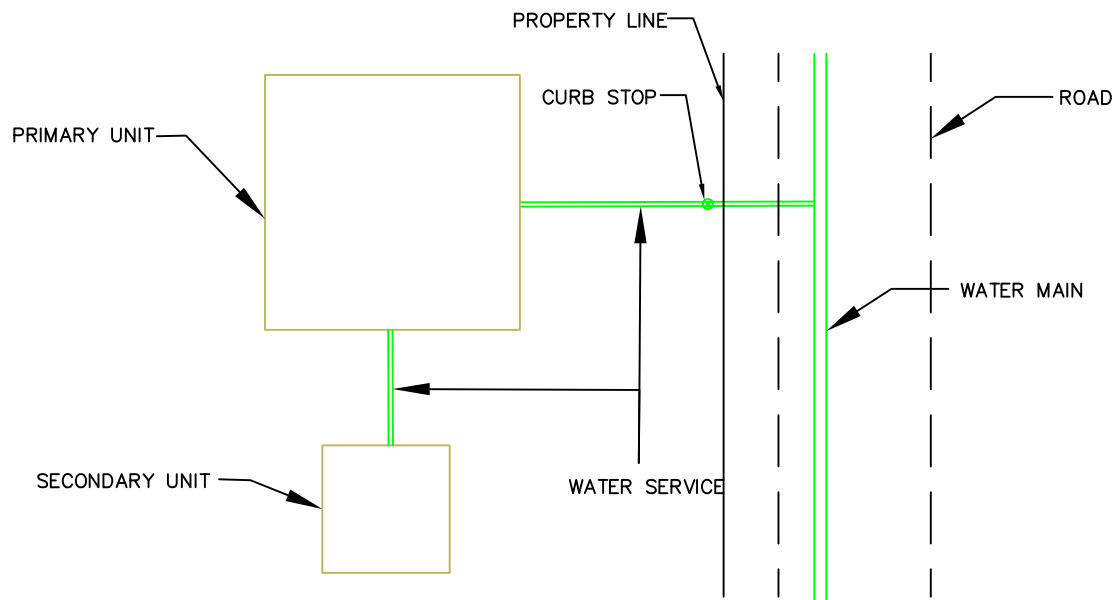
Scale: N.T.S.

Date: April 2023

Revision description:

D-007

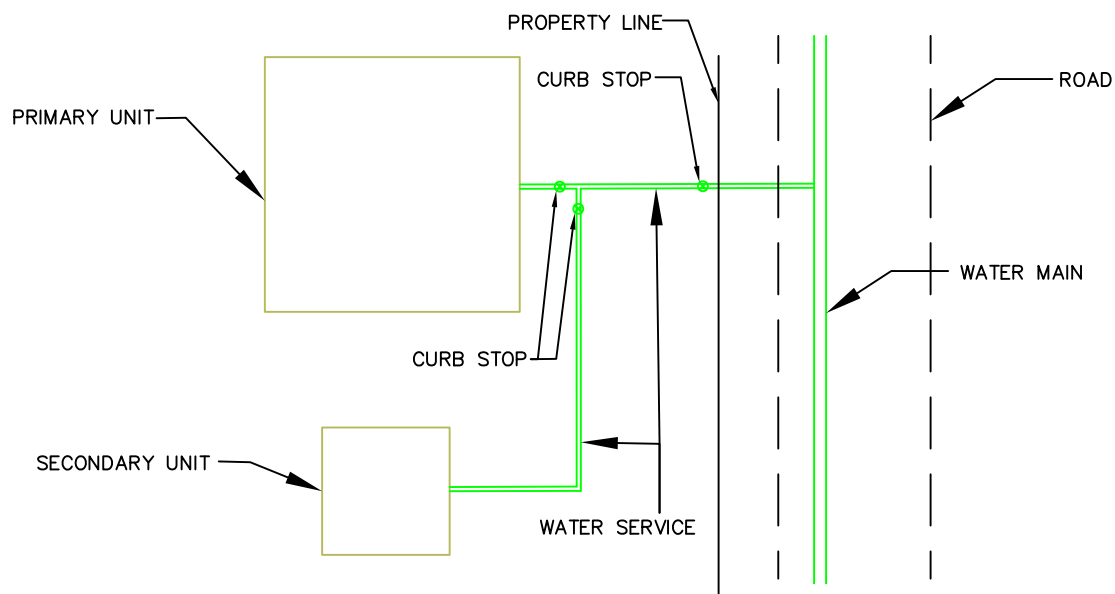
GENERAL



CONDITION 1

SECONDARY SERVICE LINE DETAIL

NTS



CONDITION 2

City Of
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 Water & Sewer

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STANDARD DETAILS

Drawn by: JSF

Scale: N.T.S.

Date: April 2023

Revision description:

D-008

GENERAL

APPENDIX A-SITE PLAN CHECKLIST

WATER AND SANITARY SEWER CONSTRUCTION DRAWING REQUIREMENTS

Detailed construction drawings for system extensions shall be prepared for approval with a submittal to the current permit/plan software. All construction drawings submitted shall be in strict compliance with the City of Steamboat Water and Sewer Standards and shall meet special conditions that may be reasonably required. The design and installation of all facilities shall ensure the development of an integrated system. No work shall commence on any facilities until the construction drawings are approved in writing by the Utility Engineer. Construction drawings are only valid for six months from the approval date. All construction plans shall be based on the North American Datum 1983 (1992). The vertical datum shall be NAVD 1929. If NAVD 1929 is not used, a conversion shall be shown on the plans. Names and phone numbers for the Owner, Developer, Consulting Engineer, and Site Surveyor shall also be included in the construction drawing set. All final plans shall contain, but are not limited to, the following information:

1. SHEETS

The following items are the minimum required for each sheet of the plan set:

- Size – All sheets shall be 24" x 36"
- Stamped Plans – All sheets shall be signed and stamped electronically by the Design Engineer.
- Scale – No greater than 1" = 100' on any sheet. Also, a bar scale shall be shown on each sheet.
- North Arrow – All design sheets shall have the north arrow oriented toward the top or right of the sheet.
- Legend of Symbols
- Key Map
- Benchmarks
- Project Datum
- Date
- Project name and number
- Title block

A. Title Sheet shall contain:

- Name of Project
- Development Name and Filing Number
- Sheet Index
- Legend
- Vicinity Map (at 1"=100' scale)
- Agency List
- Name and Address of Developer or Owner
- Name and Address of Engineer
- Signature line for Development Project Manager
- Legal Description
- Professional Engineer's Seal and Signature

B. Notes Sheet shall contain:

- General Construction notes
- Water notes
- Sewer notes
- Quantities List – table of quantities for water and sewer pipes, valves, manholes, and all related appurtenances.

C. Existing Conditions/Demolition Plan shall contain:

- Show and annotate existing contours at no greater than 2-foot intervals across the site and sufficiently beyond project limits to depict the existing drainage patterns. (Indicate PLS and date of survey.)
- Identify existing drainageways and water features.
- General vegetative cover types within 200 feet of water features (e.g., grass, fields, trees)

- Identify limits of any wetlands.
- Location of existing buildings and structures
- Location of other natural features such as outline of major tree stands and rock outcroppings
- Show, annotate, and dimension all property lines, lot lines, ROW lines, easements, and tracts.
- Show and annotate location and width of existing streets, bridges, guardrails, and driveways.
- Show and dimension full width of roadway corridor including centerline, lane markings, edge of pavement, shoulders, curbs, valley pans, roadside swales, and sidewalks.
- Show and annotate size, location, and type of all existing utilities, such as waterlines, water valves, fire hydrants, sanitary sewer, manholes, curb stops, cleanouts, storm drainage facilities, telephone, gas, and electric facilities.
- List type of Subsurface Utility Engineering (SUE) information Quality Level used – Quality Level A (QL A) or alternative with prior Utility Division approval.
- Benchmark locations identified.
- Identify existing items to be removed, removed and replaced, and to be protected-in-place.
- Identify markers for capped/abandoned service lines
- Identify project limits.
- All infrastructure, vegetation, buildings, etc., shall be included 100 feet beyond project limits.
- Legend

D. Overall utility plan shall contain:

- Locations, horizontal alignment, and dimensions of dedicated streets, easements (including ownership and bk/pg or reception # information) and rights of way.
- Street names or letters if names have not been assigned
- Lots to be served
- All existing or proposed curb-and-gutter and pavement (hatched/ separate line type so it is distinguishable)
- All existing or proposed utilities with correct sizes
- All existing utilities shall be shaded back.
- All existing or proposed obstructions such as vaults or manholes, catch basins, traffic islands, etc.
- The proposed alignment of the water mains and sewer mains and the location of all existing and proposed facilities such as valves, fire hydrants, fittings, vaults and/or manholes, cleanouts, water service lines, sewer service lines, and taps.
For water main or water service line construction, the overall plan must show any existing valve that can be used to isolate the proposed mains or service lines from the existing system during construction.
- Any gas, electric, cable TV, and/or telephone lines that will be impacted by the proposed construction.
- Existing and proposed contours to be shown at 1-foot intervals.
- Scale shall be no smaller than 1" = 50' (i.e. 1"=200' is not acceptable)
- Legend

E. Water plan (potable and non-potable) shall contain:

In plan view:

- Locations, dimensions, ownership, and recording information of existing dedicated streets, easements, and rights of way
- Location and dimensions of proposed easements
- Lot lines and lot labels
- Lots to be served
- Size and location (by station) of services
- Length of services
- Curb stop locations
- Hydrant bury line elevations
- All existing and proposed curb and gutter, pavement (hatched to be distinguished from unpaved areas), and sidewalks
- All existing utilities with correct sizes (shaded lightly and dashed)
- Nearest upstream and downstream line valve
- Proposed alignment of the water main and the location of all proposed water facilities such as valves, fire hydrants, fittings, kickblocks, and rodding

- Key map
- North arrow
- Bar scale
- Pipe or street centerline stationing
- Vertical information at utility crossings (smaller than 8 inches)
- A minimum scale of 1"=50'

Plans for backflow prevention must show, at a minimum:

- Water service type, size, and location
- Backflow prevention assembly manufacturer, size, type, and location
- Adequate drainage, as needed, if installed inside
- Thermal expansion tank as required by code
- Fire sprinkling system(s) service line, size, and type of backflow prevention assembly, if applicable
- Irrigation system(s) service line, size, and type of backflow prevention assembly. If it becomes necessary to install a booster pump on the water service line to any consumer's premises due to low pressure or special operating conditions, such service lines shall be protected by the installation of an approved air-gap separation or an approved reduced pressure principal assembly.

In profile view (for 4 inches or larger):

- Pipe centerline stationing
- Vertical alignment of waterline and all appurtenances
- All other existing and proposed utilities that cross the water line
- Top of pipe and bottom of pipe elevations at all utility crossings
- Pipe sizes, lengths, depths, slopes, elevations, and top-of-pipe elevations on all fittings
- Existing and proposed ground lines
- A maximum scale of 1" = 50' horizontal and 1" = 5' vertical

F. The sanitary sewer plan shall contain: Same as Water plan (excluding backflow) except:

- Profile for all sizes of sewer lines
- Stub elevation at lot line

G. Erosion control plans shall contain:

- See City of Steamboat Springs Stormwater Management Plan Checklist for the Applicant Checklist for City Stormwater Management Plan(s)

H. Detail sheet(s)

- All details shall be City of Steamboat Springs standard details and specifications and shall conform to these Water Standards.
- Detail sheets containing non-standard details shall be signed and stamped by a Colorado Professional Engineer

2. PRECEDENCE OF CONSTRUCTION DOCUMENTS

- a. Addenda and modifications to the drawings and specifications take precedence over the original documents.
- b. Should there be a conflict within the specifications or on the drawings, the Utility Engineer or Project Manager shall decide which stipulation will provide the best installation and their decision shall be final.
- c. In the drawings, calculated dimensions shall take precedence over scaled dimensions, and noted material over graphic indication.

3. MISCELLANEOUS

- a. Dedicated streets, rights of way, easements, and planned development complexes shall conform to the requirements of the City of Steamboat Springs Standards. A copy of the recorded subdivision plat, easements, or rights of way shall be furnished to the Utility Engineer.

- b. All public utility easements shall have a minimum easement width for one utility of 20-feet centered on the utility. Easement width for more than one utility shall be determined by the City. The pocket easement for hydrants shall be 10-feet around the hydrant.

4. VARIANCES

- a. Any request for a variance from the requirements of these Standard Specifications shall be submitted in writing to the Utility Engineer. Each variance request shall include a detailed description of the proposed variance together with the Professional Engineer's analysis of the impact of the variance. The decision of the Utility Engineer to grant or deny any variance will be final.

5. RECORD DRAWINGS

- a. Record drawings shall be made using the final construction documents for the project. Any item on the plans that was installed or constructed differently than was originally approved shall be indicated by crossing out in red the changed item and writing in the as-built value or description. All locations shall be in accordance with the requirements stated in Section 4: Engineering Services— Subsection 1.3.A.

Items that need to be updated include, but are not limited to:

- Pipe size
- Pipe slope
- Pipe or fitting material/manufacturer
- Pipe location (bearing and distance), separation distance from other utilities or structures
- Manhole rim elevations and pipe inverts (in and out) of sewer manholes
- Manhole size and location (northing and easting)
- Cleanout locations and inverts (in and out)
- Utility easement locations
- Accurate three-point ties and locations for all hydrants, valves, curb stops, ARVs, PRVs, manholes, cleanouts, blow-offs, bends, and underground facilities
- Pump station design capacity, pump type, manufacturer, and location
- Any new (not originally indicated on construction drawings) site or utility feature shall be added to the plans and called out in red.

6. PRELIMINARY INSPECTIONS

- a. The following criteria are to be used as guidelines when requesting preliminary inspections and acceptance on new water and wastewater infrastructure. All requests shall be in writing by the Consulting Engineer. All test results, a copy of the Construction Inspector's daily logs and the Consulting Engineer's letter of project completion shall be included with the request. In all areas where a water or wastewater line is located within an easement area, such easement shall be field staked prior to inspection. All roadways shall be at final road base grade.

Criteria looked at during inspections:

A. Water

Fire Hydrants:

- Shall be plumb,
- Steamer nozzle shall face the roadway,
- The bury line on the fire hydrant and finished grade of the adjacent travel surface shall be the same elevation without using riser kits,
- Benches and culverts shall be installed,
- Markers shall be installed,
- Hydrant repainted,
- Nozzles caps shall turn freely,
- Hydrants will be opened and closed to check ease of operation and drain back capability.

Service Lines:

- Markers shall be installed,
- Curb box lid shall be set at finished grade.

Valves:

- Shall have the operator extension installed,
- Boxes shall be straight,
- Grade shall be set except for the installation of a riser for paving purposes,
- Valves will be turned on and off for operational check, valve must turn freely without binding,
- Depths will be measured.

B. Sewer

Service Lines:

- Markers shall be installed,
- Clean out covers shall be set at finished grade.

Manholes:

- Shall be clean,
- Main shall be flushed (preferably 24 hours in advance),
- Grade shall be set except for the installation of pavement risers,
- Slope of ring and cover shall conform to the same slope as the road surface,
- Lines will be lamped during inspection,
- Inverts will be checked for video camera access,
- Cover will be checked for type and fit,
- Joints will be checked for rubber neck,
- Infiltration and inflow will be checked.
- Rim set $\frac{1}{4}$ " to $\frac{1}{2}$ " max below asphalt finished grade.

- b. Upon correction and approval of all punch list items, and record documents (as-builts) have been submitted and approved; a letter of preliminary acceptance will be issued. Service connection to buildings shall not be done until after The City has issued preliminary acceptance.

7. SINGLE FAMILY RESIDENTIAL (SFR) CONSTRUCTION AND DEMOLITION PLANS

APPENDIX B - Sample Certificate of Inspection Letter

Sample Certificate of Inspection Letter

Engineering Company Letterhead

Date

City of Steamboat Springs Utility Department Plan
Review Service
137 10th Street
Steamboat Springs, CO 80477
Phone: 970-871-8207, Fax: 980-879-8851

RE: Certificate of Inspection for: (Project Name/Address)
Type of Project (Water Main/Sanitary Sewer Main, etc.)
Company Job Number: (Optional)

I, _____, a registered Professional Engineer in the State of Colorado, PE No. _____, in accordance with Section 5.3 of the Bylaws and Rules of the State Board of Registration for Professional Engineers and Professional Land Surveyors, do hereby certify that I performed or supervised construction observation during construction operations that took place for the following: (Check all that apply)

- | | | |
|---|--|--|
| <input type="checkbox"/> Public Water Mains | <input type="checkbox"/> Private Water Mains | <input type="checkbox"/> Water Appurtenances |
| <input type="checkbox"/> Public Sanitary Sewers | <input type="checkbox"/> Private Sanitary Sewers | <input type="checkbox"/> Sewer Appurtenances |

Based on field inspections/observations, it is my professional opinion that the work has been installed and is in substantial compliance with City of Steamboat Springs Utility Department Specifications, and the approved Construction Documents. The As-Built drawings included accurately depict the final installation of the utility system.

Sincerely,

Engineer's Signature
P.E. Stamp/date

APPENDIX C – COMPUTATION FORMS

HYDROMECHANICAL GREASE INTERCEPTOR (HGI) DESIGN FORM

Name of Project: _____ Date: _____

Project Address: _____ Contact Number: _____

Contact Name: _____ Contact E-mail: _____

Step 1: Determine the total number of Drainage Fixture Units (DFU's) for the Food Service Facility. If the fixture is known, use "Fixture" column (on left) to determine DFU value. If the fixture is not known or listed, use the "Other Contributors" column (on right) to determine DFU value based on trap size or flow, as applicable. Total all DFU's to determine the "Total Drainage Fixture Unit Value" for the facility.

Drainage Fixture Unit Values (DFU)

Qty	Fixture	DFU	Total	Qty	Other Contributors	DFU	Total
	Commercial Sink w/ Food Waste	3			1¼ inch trap & trap arm	1	
	Food Preparation Sink	2			1½ inch trap & trap arm	3	
	Wok Sink	3			2 inch trap & trap arm	4	
	Bar Sink	2			3 inch trap & trap arm	6	
	Handwash Sink	2			4 inch trap & trap arm	8	
	Service or Mop Sink	3			Flow of 1.0 to 7.5 gpm	1	
	Food Waste Disposer/Pre-Rinse Sink*	3			Flow of 7.6 to 15 gpm	2	
	Commercial Dishwasher	Based on drain size (table 2)			Flow of 15.1 to 30 gpm	4	
	Floor Drain				Flow of 30.1 to 50 gpm	6	
	Trench Drains**	2/ l.f.					

DFU's are derived from the 2012 Uniform Plumbing Code

* Food Waste Disposer/Pre-Rinse Sink requires Solids Interceptor

** Use 2 DFU's per lineal foot of Trench Drain.

Total Drainage Fixture Unit Value: _____

Step 2:

Hydromechanical Interceptor: Select Discharge Flow Rate from table below based on the Total DFU Value determined in Step 1. Use manufacturer's product information to select the size and model of an HGI unit based upon minimum flow rate and grease capacity.

Gravity Interceptor: Select Interceptor Capacity (Size) from table below based on the Total DFU Value determined in Step 1. Round up to next size available grease interceptor size (e.g. 45 DFU's would require a 1,250 gallon interceptor).

Hydromechanical & Gravity Grease Interceptor Sizing Chart

DFU's	HGI Flow Rate (gpm)	HGI Grease Retention Capacity (lbs)	GGI Interceptor Capacity (gal)
10	25	50	-
13	35	70	-
20	50	100	-
35	75	150	1,000
90	-	-	1,250
172	100	200	1,500
216	150	300	2,000
307	-	-	2,500
342	200	400	3,000
428	250	500	4,000
576	350	700	5,000
720	500	1,000	7,500

Hydromechanical Grease Interceptor:

Minimum Flow Rate (gpm): _____

Grease Capacity (lbs): _____

HGI Manufacturer: _____

HGI Model #: _____

Material: _____

Flow-Thru Rating (gpm): _____

Liquid Capacity per Unit (gal): _____

Grease Capacity per Unit (lbs): _____

Number of Units: _____

Total Liquid Capacity (gal): _____

Total Grease Capacity (lbs): _____

Days per Pump-Out Cycle: _____

Gravity Grease Interceptor:

Minimum Liquid Capacity (gal): _____

Liquid Capacity per Unit (gal): _____

Number of Units: _____

Total Liquid Capacity (gal): _____

APPENDIX C – COMPUTATION FORMS
LIFT STATION AND FORCE MAIN DESIGN

Project No.: _____

Project Name: _____

Location: _____

Station Type, Configuration and Description: _____

Sanitary or Design study reviewed/approved (Y/N)? _____ Date _____

Flow Rates in cfs

	YEAR	PEAK	MAX 1 HR	MAX 6 HR	AVERAGE	MIN 1 HR
Initial						
Design						

APPENDIX C – COMPUTATION FORMS
LIFT STATION AND FORCE MAIN DESIGN

Pump Control

Type: _____

Adjustable levels? _____

Automatic alternation of lead pump? _____

Describe pump operating cycle: _____

Pump cycle time at initial flow-Peak: _____ Avg.: _____

Pump cycle time at design flow-Peak: _____ Avg.: _____

Controls accessible? _____ Explosion proof? _____

Elec. Equip. protected from water spray? _____

Power

Dual power source? _____

Describe? _____

On-site generation? _____

Describe? _____

Capacity / Phase? _____

Auto exercise on no load? _____

Manual exercise on full load? _____

Full auto transfer switch? _____

Day tank? _____ Type of fuel? _____

Trickle charge for battery? _____

APPENDIX C – COMPUTATION FORMS
LIFT STATION AND FORCE MAIN DESIGN

Wet Well

No. of wet wells: _____

All wet wells independent? _____

Proper fillets? _____

Complete wet well dewatering? _____

Describe: _____

Wash-down water? _____

Positive wet well ventilation? _____

Continuous? _____

Intermittent? _____

Air changes/Hour – Continuous: _____

- Intermittent: _____

Alarms

Type	Telemetered	Local	Internal
Main Power "Off"			
Alt. Power "On"			
High Level			
Low Level			
Intrusion			
Pumps "Off"			

G = General Alarm S = Specific Alarm N = None

Describe Telemetered Alarms: _____

Describe Local Alarms: _____

Describe Internal Alarms: _____

APPENDIX C – COMPUTATION FORMS
LIFT STATION AND FORCE MAIN DESIGN

Force Main

	No 1	No 2	No 3	No 4
Diameter (in)				
Type of Pipe				
Length (ft)				
Volume (gal)				
“C” Factor				
Static Head (ft)				

Automatic air release at high point(s)? _____ how many high points? _____

Manual drain or blowoff at low point(s)? _____ how many low points? _____

Provision to handle any pressure surge after pump shutoff? _____

Describe: _____

Valves to isolate multiple FM? _____

Emergency PS discharge to tank trucks? _____

Emergency gravity overflow (Y/N): _____ to: _____

FM discharge location: _____

FM discharge detail attached? _____

System head curve attached? _____

APPENDIX C – COMPUTATION FORMS
LIFT STATION AND FORCE MAIN DESIGN

Pumps/Dry Well/Control Room

No. of pumps: _____ Pump curves attached (Y/N)? _____

Hoist / Access to remove pumps? _____

Positive suction head? _____

Shut-off and check valves for each pump? _____

Types of check valve _____

Valves accessible? _____ in dry well? _____

Dry Well/Control Room dewatering? _____ Gravity drain? _____

Sump pump? _____

Discharge to? _____

Backflow into sump possible? _____

Wash-down / clean-up water / sink _____

Station security? _____

Station lighting? _____

Heater? _____ Dehumidifier? _____ Elec. _____ Outlets? _____

Phone? _____ Fire hydrant? _____ Distance _____

Special tools? _____ Safety Equipment? _____

Spare parts? _____ Manufacturer's literature? _____

Positive Dry Well/Control Room ventilation? _____

Continuous when attended? _____

Intermittent when unattended? _____

Dry Well/Control Room volume (CF): _____

Air changer/hour - Continuous: _____

- Intermittent: _____

APPENDIX C – COMPUTATION FORMS
LIFT STATION AND FORCE MAIN DESIGN

Wet Well Data

	Volumes (cf)		Detention at avg Q (min)	
	Total	Effective *	Alarm to Overflow	Pump 'Off' to Pump 'On'
No 1				
No 2				
No 3				
1 + 2				
1+ 3				
2 + 3				
1 + 2 + 3				

*Effective volume is volume between pump-off and high-water or alarm levels

Pump Data

No	Type*	Suction Size (in)	Disch. Size (in)	Solids Passed (in)	Impeller		Motor		
					Type**	Size (in)	HP	RPM	PHASE
1									
2									
3									
4									
5									

Note: In the case of interchangeable impellers or motors, list on a separate page.

**V = Vertical

*C = Closed

**H = Horizontal

*SO = Semi-open

**C = Centrifugal

*O = Open

**S = Submersible

*R = Recessed

