

**STANDARD SPECIFICATIONS
FOR
WATER AND WASTEWATER UTILITIES**

EFFECTIVE APRIL 1, 2010

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MODIFICATIONS TO THE 2010 SPECIFICATIONS

NOTICE: Modifications have been made this year to the following sections and standard details:

PROCEDURE FOR WATER AND WASTEWATER EXTENSIONS

- Subsection 2 has been modified to clarify existing policy that minimum water and wastewater main size is 8 inches.
- Subsections 2 and 5 have been modified such that plan review times have been reduced from 3 weeks per submittal to 2 weeks per submittal.
- Subsection 2 has been modified to clarify existing policy regarding test holes.
- Subsection 3 has been modified to include detailed provisions for changed conditions or deficient work encountered during the construction phase.
- Subsection 6 has been modified to clarify that sewer videos must be submitted to the City prior to the granting of final acceptance.
- Subsection 6 has been modified such that sewer videos shall be submitted in DVD format rather than VHS format.

SECTION 4: ENGINEERING SERVICES

- Subsection 1.1.III.A.4 has been modified such that electronic record drawings shall be submitted in an AutoCad version 2007 compatible format rather than an AutoCad version 2000 compatible format.

SECTION 24: TRENCHING, BEDDING AND BACKFILL

- Subsection 2.1.B.2 has been modified to encourage engineering design of impervious dam locations.
- Subsection 2.1.C.3 has been added to define flow fill.
- Subsection 3.4.A has been modified such that flow fill is required for all trenches crossing public streets.

SECTION 26: PAVEMENT REMOVAL AND REPLACEMENT

- Subsection 3.5 has been modified to clarify that sections 401.07-401.20 refer to the CDOT standard specifications.

SECTION 30: WATER DISTRIBUTION PIPING AND APPURTENANCES

- Subsection 3.3.A has been modified to clarify that fire hydrant clear distances include existing and proposed structures, utility pedestals, fences, trees, bushes, boulders, etc.
- Subsection 2.1.D.1 has been updated to reference the current AWWA gate valve standards.
- Subsection 2.1.D.5 has been updated to reference the current East Jordan Iron Works valve box catalog.
- Subsection 2.1.E.1 has been updated to reference the current Mueller fire hydrant catalog.
- Subsection 3.7 has been modified to require NSF 61 approved adhesive for calcium hypochlorite tablets.

SECTION 40: WASTEWATER COLLECTION PIPING AND APPURTENANCES

- Subsection 2.1.F has been modified such that Shear Guard couplings are allowed on 4" service lines.

SECTION 44: WATER AND SEWER LINE CROSSINGS

- Substantial edits have been made throughout the section.

TRENCH CROSS SECTION DETAIL

- The detail has been modified such that flow fill is required for all trenches crossing public streets.

WATER AND SEWER CROSSING CONDITION DETAILS

- Substantial edits have been made to the details.

ATTENTION CONTRACTORS!

TRENCH SAFETY NOTICE

Anybody digging a trench or working within a trench is subject to OSHA regulations regarding trench safety.

City of Steamboat Springs personnel will not enter any trench that does not meet OSHA regulations regarding trench safety or is otherwise deemed unsafe by City personnel.

In almost every instance, inspections of water and sewer lines involve City personnel entering the trench. **YOU WILL NOT RECEIVE AN INSPECTION, AND YOU WILL NOT BE GRANTED APPROVAL OF YOUR WORK, IF CITY PERSONNEL CANNOT ENTER A TRENCH DUE TO A FAILURE TO MEET PROPER TRENCH SAFETY REGULATIONS.**

This is for the safety of you, your workers, and City personnel. No injury or human life is worth the risk!

PROCEDURE FOR WATER AND WASTEWATER EXTENSIONS

The extension of water and wastewater mains generally proceeds as follows below. However, each project is evaluated on a case-by-case basis and additional requirements may be required of individual projects.

1.0 DEVELOPMENT REVIEW

The review of proposed water and wastewater extensions is performed in conjunction with the City of Steamboat Springs planning process. A preliminary engineered utility plan is required and will be reviewed in context to the other submitted plans such as site, grading and landscaping plans. The City of Steamboat Springs Utility Department will support approval of the development permit only after all major issues are worked out. However, water and sewer system designs are not approved until engineered construction drawings are approved.

2.0 APPROVAL OF CONSTRUCTION DRAWINGS, SPECIFICATIONS, AND PRE-CONSTRUCTION MEETING

The minimum size for public water and wastewater mains is eight inches, though larger sized mains may be required. Engineered water and sewer utility plans are required for any water or sewer main line extension; or any water line four inches in diameter or greater, whether public or private. An engineer registered in the state of Colorado shall certify the construction plans and specifications. The City requires two weeks to adequately review a project's plan, and an additional two weeks for each subsequent revised submittal. Any deviation from the Standard Specifications shall be submitted as the project's special conditions. Construction may not start until plans and special conditions are approved by the City Utility Department. City approval in no way relieves the Engineer of any responsibility for errors and omissions.

2.1 SPECIFICATIONS

The project specifications shall be the City of Steamboat Springs Standard Specifications for Water and Wastewater Utilities that are in effect at the time the project construction plans are approved. Any additional construction specifications required for privately funded developments shall be submitted to the Utility Department under the title of Special Conditions. The Special Conditions shall be used to propose modifications to the Standard Specifications, and/or include specifications for other areas of project construction, such as grading, road construction, etc. The Special Conditions 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 - (Reserved for Utility Department modifications)
2. Special Conditions - Specific to private projects as defined above
3. Standard Specifications
4. Construction Drawings

2.2 CONSTRUCTION DRAWINGS

The construction drawing set must include, as a minimum; bench mark & reference datum, a site plan, grading plan, water and wastewater plan, a preliminary plat with all water & sewer line easements, water main profile sheet, wastewater main profile sheet, detail sheet, a dry utility plan with the wet utilities shown, and a landscape plan with wet utilities and easements shown. In addition, a profile must be provided for all existing mains that are impacted by any proposed grading for the project. All construction plans are to be based upon the North American Datum 1983 (1992). The vertical datum shall be NVGD 1929. Names and phone numbers for the Owner, Developer, Engineer, Inspector, & Surveyor shall also be included in the construction drawing set.

For initial review one set of plans and specifications should be submitted. These will be red lined for correction and returned to the Engineer to make the needed revisions. Construction plans and/or specifications will not be approved with red line corrections. Two weeks is required for review of each submittal of construction drawings. Final construction plan approval shall not be granted until after test holes have been utilized 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. Less invasive means of field verification may be used as an alternative to test holes with prior Utility Department approval. After the City finds the plans and specs to be acceptable, three or more final sets with all revisions should be submitted along with the original red lined drawings. All red lined drawings shall become the property of the City.

2.3 PRE-CONSTRUCTION MEETING

Prior to commencing construction, a pre-construction meeting is required to be held between the project engineer, the contractor and a representative from City of Steamboat Springs Utility Department. In addition the following items will be reviewed and discussed:

- Review the staking and alignment
- Inspect the materials and discuss any substitutions
- Review the inspection requirements (both by the project engineer and City of Steamboat Springs Utility Department)
- Review the test methodology and operation of gate valves
- Ensure the contractor has a current set of the City of Steamboat Springs Standard Specifications for Water and Wastewater Utilities
- Any other topics relevant to the project dealing with water or sewer.

3.0 CONSTRUCTION, TESTING AND QUALITY CONTROL

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

The 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 but not be limited to water quality testing, pressure testing, leakage testing, lamping inspections, deflection testing if necessary, quality inspections, facility operation inspections, infiltration & inflow inspections, televised inspections, final grade, easements, and landscaping inspections.

3.1 CHANGED CONDITIONS OR DEFICIENT WORK

Changed conditions or deficient work from the approved plans and specifications shall be documented by the Engineer and presented with revised corrective actions to the Utility Department for review and final approval. 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 Department.

Plans by the Contractor to resolve a changed conditions or deficient installation issue shall be reviewed, approved and initialed by the Engineer, red-lined by the Engineer, or redrafted by the Engineer prior to submittal to the Utility Department. All such requests by the Contractor shall be incorporated by the Engineer into a Corrective Action Plan. All Corrective Action Plans shall ultimately bring the deficient work into conformance with Utility Department specifications and/or the approved project plans and specifications, whichever is in the best interests of the Utility Department.

During the course of the work, the Engineer shall immediately contact the Utility Department if the Engineer, or Others, witnesses work being completed by the Contractor, or Others, not conforming to Utility Department specifications.

4.0 CITY OF STEAMBOAT SPRINGS UTILITY DEPARTMENT INSPECTION

Upon completion of the work the Engineer must perform an inspection consistent with Utility Department preliminary acceptance inspection. Upon completion of the Engineer's preliminary acceptance inspection, the Engineer shall submit a punch list to the Contractor of all items that require correction.

After the Engineer's punch list has been completed to the Engineer's satisfaction, the Engineer must indicate in writing to the Utility Department that construction was completed in compliance with the plans & specifications. The Engineer must further provide a written request for a preliminary acceptance inspection by the City of Steamboat Springs Utility Department. All grading is to be to final grade, excluding pavement, prior to inspection. The request is to be accompanied by test results and all field notes. All utility easements shall be clearly staked prior to inspection.

A representative from the City of Steamboat Springs Utility Department is required to inspect every live tap, thrust block, sewer service from stub location to building, and water service from curb stop to building. The developer or the developer's representative shall be responsible for requesting all testing, inspections, re-inspections, and acceptance. All inspection requests shall be in writing. The results of all tests shall be documented, orderly tabulated/summarized, and delivered to the Utility Department.

If the joint inspection with the Engineer, Contractor, and the City of Steamboat Springs Utility Department reveals any deficiencies, a punch list shall be generated. Once items on the punch list have been corrected a re-inspection shall be requested. This shall be repeated until all punch list items have been corrected.

Inspections shall not be made between November 1 and April 30 when weather would prohibit a thorough inspection.

5.0 PRELIMINARY ACCEPTANCE

After all punch list items have been corrected, and after the record documents and testing results have been reviewed and approved by the City of Steamboat Springs Utility Department, preliminary acceptance will be granted. Two weeks of review time is required for each submittal of record documents. Record documents will be returned to the Engineer for corrections as many times as it takes before an acceptable submittal of record documents is produced. 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.

6.0 FINAL ACCEPTANCE

After two years from preliminary acceptance, a request for final acceptance should be made. Any deficiencies found during this inspection shall be corrected prior to granting final acceptance of the infrastructure.

After installation of a new sewer main system, the developer is required to contract with a sewer main line video company. The video must be produced between April 1 and June 1, after construction is complete and prior to the granting of final acceptance. The name of the video contractor must be submitted to the City for approval prior to contracting for the work. 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 have capability to produce the following:

1. DVD 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 following:
 - The video contractor
 - The project name
 - The date
 - The starting point / manhole number
 - Direction of travel
 - All tap locations including main line pipe tap locations relative to the spring line
 - Any deflection and low or high spots in the main
 - Any rolled gaskets or other problems at each pipe joint
 - Any infiltration
 - 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 City. The log shall include all of the information provided on the video.

The video and video log information is to be provided to the City prior to final acceptance and will become the property of the City. The developer will be responsible for correction of any discrepancies, errors or omissions shown by the video / log information. If the video and video log is not produced within the correct time of the year or prior to final acceptance, the developer's warranty period will be extended and surety for the video and video log shall be submitted to the City.

SECTION 1 SPECIAL PROVISIONS

The special provision section is the first section of the specifications and 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 sub paragraph in the specifications is in conflict 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 City of Steamboat Springs Utility Department and should be specified in the Special Conditions Section of the Project Specifications.

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 of Steamboat Springs. Methods for measurement and payment shall be negotiated between Contractor and Owner/Developer when the City of Steamboat Springs Utility Department 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 24 hours prior to the scheduled shut-off time.

Any water or wastewater main or service shut-offs must be pre-approved by the City of Steamboat Springs Utility Department. City facilities shall only be operated by City personnel.

SECTION 2 APPLICABLE STANDARDS

PART I GENERAL

1.1 DESCRIPTION

- A. Work included: Throughout the Contract Documents, reference is made to codes and standards which establish qualities and types of workmanship and materials and which establish methods for testing and reporting on the pertinent characteristics.

Where materials or workmanship are required by these Contract Documents to meet or exceed the specifically named code or standard, it is the Contractor's responsibility to provide materials and workmanship that meet or exceed the specifically named code or standard.

It is also the Contractor's responsibility, when so required by the Contract Documents or by written request from the Engineer, to deliver to the Engineer all required proof that the materials or 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 Engineer, and generally will be required to be copies of a certified report of tests conducted by a testing agency approved for that purpose by the 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. 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. Rejection of non-complying items: The Engineer reserves the right to reject items incorporated into the work that fail to meet the specified minimum requirements. The Engineer further reserves the right, and without prejudice to other recourse the Engineer may take, to accept non-complying items subject to an adjustment in the Contract Amount as approved by the Engineer and the Owner.

- C. Applicable standards listed in these Specifications include, but are not necessarily 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

7. AWWA – American Water Works Association, Inc., 6666 West Quincy Ave., Denver, CO 80235 www.aws.org/
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.cdphe.state.co.us/
10. CRSI – Concrete Reinforcing Steel Institute, 933 North Plum Grove Road, Schaumburg, IL 60173 www.crsi.org/
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

PART II PRODUCTS

No products are required in this section.

PART III 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.

PART IV 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.

SECTION 4 ENGINEERING SERVICES

1.0 GENERAL

1.1 DESCRIPTION

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 City of Steamboat Springs Utility Department. 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.

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

I. QUALIFICATIONS OF PROJECT OBSERVATION PERSONNEL:

- A.** 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 who is 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.

II. WATER AND WASTEWATER MAIN INSTALLATION, INCLUDING WATER INSTALLATION FOR ANY PRIVATE LINE 4" IN DIAMETER OR GREATER:

- A.** Limits of right of way and easements shall be established prior to staking of mains.
- B.** Stake the center-line of main and location of all appurtenances.
 - 1.** Manhole invert elevation to be staked with offset hub elevations with cuts and stationing.
 - 2.** Wastewater mains shall be staked for grade.
- C.** 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.** The Engineer shall document as-constructed conditions prior to backfill.

5. Pipelines to receive construction observation as required to assure compliance with specifications.
6. Some pipelines, at the discretion of the City of Steamboat Springs Utility Department, shall require full time construction engineering observation as construction and pipeline installation proceeds.

D. Observation - backfill

1. The moisture/density testing shall meet the requirements of Field Quality Control as described in Section 24: Trenching, Bedding and Backfill.

E. Testing - Pipeline

1. Observe and document sampling and testing per specifications including: bacteriological, hydrostatic and leakage tests.

III. FINAL SUBMITTALS FOR WASTEWATER, WATER, AND ROAD ACCEPTANCE:

A. Record Documents - Water and Wastewater

1. Prior to preliminary acceptance, the Engineer shall provide the City Utility Department with blue line record documents of all infrastructures included in the project. These are for initial review only.
2. After initial review, the City Utility Department will either approve or return for corrections.
3. To maintain the integrity of the City of Steamboat Springs System Maps, all ground level appurtenances (e.g., valve boxes, manholes, fire hydrants, PRV's, etc.) are to be located and surveyed using State Plane Coordinates, North American Datum 1983 (1992) – NAD83. The northern and eastern coordinates are to be included on the record documents for the appurtenances. Unless otherwise stated on a project-specific basis, it is not required to survey curb boxes. In addition to northern and eastern coordinates on NAD83, manhole rim elevations, the top of pipe in instances where the City Utility Department 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 who was in responsible charge of the survey shall certify the surveyed data. Ground level appurtenances do not require as-built surveys for projects that do not include water or wastewater main lines or public infrastructure, unless specifically required by the City Utility Department.
4. Provide professional civil engineer certified reproducible 24"x 36" mylars of plan and profile sheets and 8.5"x11" bond paper reductions of plan and profile sheets of record documents after approval. Provide electronic drawings of plan sheets in an AutoCAD version 2007 compatible format.

The electronic drawings shall be drawn in State Plane Coordinates, North American Datum 1983 (1992) – NAD83. The engineer that certifies the as-built drawings must be the same engineer that was in responsible charge of the construction observations. 24"x36" record drawings, as well as electronic drawings, are not necessary for projects that do not include water or wastewater main lines or public infrastructure, unless specifically required by the City Utility Department; rather, a legible 8.5"x11" bond paper record drawing is required.

5. Minimum criteria to be included in record documents:

- a)** Benchmark and reference datum per project as required by the City. Benchmarks are to be from the City of Steamboat Springs 2003 Control Network. Use of a project benchmark is permitted. However, the project benchmark must be tied in to no less than two established benchmarks from the City of Steamboat Springs 2003 Control Network. If geography renders tying into two established benchmarks impossible, the Engineer or the Surveyor may request a waiver of this requirement, provided that the waiver is put in writing and approved by the City Utility Department prior to approval of construction documents. Projects that include private water lines four inches in diameter or greater but that do not include water or wastewater main lines or public infrastructure do not require benchmarks from the City of Steamboat Springs 2003 Control Network unless specifically required by the City Utility Department.
- b)** Distance or stations along mainline between valves, fittings, manholes, cleanouts, taps, etc.
- c)** Position of mainline relative to centerline of roadway, edge of pavement, structures, etc.
- d)** Enumeration of all fire hydrants and manholes per the City Utility Department numbering system.
- e)** Location of service line connections to main.
- f)** 3-point tie sheets (8.5 x 11) locating all appurtenances including: valve boxes, manholes, curb boxes, cleanouts, service stub-outs, vaults, misc. items, etc. 3-point ties shall be measured from permanent, fixed, above ground objects or structures. The exact location on the object or structure shall be specified (e.g. operating nut on a fire hydrant, the specific corner on an electrical box, the exact center of a manhole cover, etc.). Ties shall be measured at a minimum of 120 degrees from each other, with measured distances being less than 100 linear feet. All tie dimensions are to be field-measured. Tie dimensions pulled from construction drawings or electronic drawings are not acceptable. Each appurtenance shall have its own unique sheet. The title block of each sheet shall contain a description of the tied item. Disclaimers as to the accuracy of 3-point ties shall render the ties unacceptable.
- g)** Manhole invert and rim elevations, manhole stationing, manhole diameters, pipeline material and diameters, wye connections, stub-out elevations.
- h)** Profiles: Sewer main profiles are required on all projects involving sewer mains, and shall include existing ground, finished grade, manhole rim and all invert elevations, and pipe slope. Water main profiles may be required at the discretion of the City Utility

Department. If water main profiles are required for a given project, the City Utility Department will notify the Engineer in writing.

- i) Elevations at stub-out location, slope, size, type, length and location of all sewer service lines.
- j) Elevations at stub-out location, size, type, length and location of all water service lines, including any profile information where there may have been a significant change in elevation or cover on a water service line.
- k) Type, make, size, manufacturer, model, and style of all components.
- l) Main line easements noted as public or private.
- m) Any additional items required.
- n) Copy of final recorded plat.
- o) Projects that include private water lines four inches in diameter or greater, but that do not include any water or wastewater main lines or public infrastructure, do not require preliminary or final acceptance. City approval will be provided via a letter of allowance for water service.

B. Daily Observation Logs

- 1. The Engineer shall keep a log of daily site observations. The Engineer shall make entries to note any conditions that will be of assistance to the City Utility Department after construction is complete and assure the City that the Engineer has performed the necessary service to provide certified as-constructed documents.
- 2. The Engineer shall submit copies of all of the logs to the City Utility Department.
- 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 the Contractor.
 - e) Acceptance - partial and final.
 - f) Quality control test results indicating: conditions, pressures, durations, volumes, rates, etc., indicating acceptance or failure to specifications.
 - g) Weather.
 - h) Personnel involved.
 - i) Time the Engineer was on site.

C. Statement by the 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 the observations made by him or the engineering technician performing work under his direct supervision.

2. The professional engineer responsible for the project must complete and submit an original Certificate of Inspection Letter (see Attachment 1).

Definition: 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.

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, Owner, and Engineer prior to or at the pre-construction meeting.

2.0 PRODUCTS

No products this section.

3.0 EXECUTION

3.1 CONSTRUCTION STAKING

A. Engineer's responsibility: In general the following construction staking shall be provided by the Engineer.

- 1. Wastewater collection systems**
 - a.** Manhole and cleanout centerline stakes.
 - b.** Offset stakes at manholes for invert grade control set 25-ft outside 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 – max. 50' intervals. Sewer line to be constructed/placed at centerline location. Easements shall not be less than 20-ft in width.
- 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 – max. 50' intervals. Water line to be constructed/placed at centerline location. Easements shall not be less than 20-ft in width.

B. Contractor's responsibility: In general, the following construction staking is to be provided by the Contractor:

- 1. Wastewater collection systems and water distribution systems**
 - a.** Periodic verification of grade between the stakes established by the Engineer. The Contractor shall promptly notify the engineer if stakes are missing.
 - b.** Placement of additional grade stakes between those provided by the 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 & sewer lines are centered within easements during construction.

3.2 QUANTITY SURVEYS

The Contractor shall furnish personnel to assist the Engineer in making such surveys as are necessary to determine the quantities of work performed. Unless waived in writing in each special case, quantity surveys shall be made under the direction of the Engineer or his 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 Engineer. Quantity surveys shall be used to the extent necessary in determining the amount of payments due to the Contractor.

3.3 NOTIFICATION

The Contractor shall notify the Engineer 48-hours in advance of needed staking. The Contractor shall notify the 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 Engineer shall be able to certify all as-built dimensions and elevations.
- B. The Engineer may, in conjunction with the Contractor, maintain a complete set of prints of all contract drawings upon which the Engineer in conjunction with the Contractor shall maintain a neat and accurate record of all contract work. The 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 Engineer for final inspection and certification. The Contractor shall correct, amplify, and do all other work as may be required by the Engineer to complete the as-built record in a manner satisfactory to the Engineer for certification by the Engineer.
- C. Information required: The Contractor's record shall include, for example, location of valves, fittings, connections, service lines, cleanouts, and manholes. 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, PRV's, etc.) are to be located and surveyed using State Plane Coordinates, North American Datum 1983 (1992) – NAD83. The northern and eastern coordinates are to be included on the record documents for the appurtenances. Unless otherwise stated on a project-specific basis, it is not required to survey curb boxes. In addition to northern and eastern coordinates on NAD83, manhole rim elevations, the top of pipe in instances where the City Utility Department 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 who was in responsible charge of the survey shall certify the surveyed data. Ground level

appurtenances do not require as-built surveys for projects that do not include water or wastewater main lines or public infrastructure, unless specifically required by the City Utility Department.

- E.** Provide professional civil engineer certified reproducible 24"x 36" mylars of plan and profile sheets and 8.5"x11" bond paper reductions of plan and profile sheets of record documents after approval. Provide electronic drawings of plan sheets in an AutoCAD version 2000 compatible format. The electronic drawings shall be drawn in State Plane Coordinates, North American Datum 1983 (1992) – NAD83. The engineer that certifies the as-built drawings must be the same engineer that was in responsible charge of the construction observations. 24"x36" record drawings, as well as electronic drawings, are not necessary for projects that do not include water or wastewater main lines or public infrastructure, unless specifically required by the City Utility Department; rather, a legible 8.5"x11" bond paper record drawing is required.
- 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.

SECTION 8 SUBMITTALS AND SUBSTITUTIONS

1.0 GENERAL

1.1 DESCRIPTION

Work included: Preparation and submittal of shop drawings, cut sheets, certifications of compliance, documentation of material types and ratings or other documents or samples as required by the Contract Documents in order to ensure that the specified products are furnished and installed in accordance with the 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 require review by the 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 the system of which it is a part. Pre-approved product substitutions will only be acceptable where it is authorized by the statement "or approved equal". All submittals require pre-approval by the Engineer. All substitutions require pre-approval by the Engineer and the City. Per Section 4: Engineering Services, subsection 1.1.II.C.1, the Engineer shall document that all pipeline materials meet approved specifications.

2.0 PRODUCTS

2.1 SUBMITTAL SCHEDULE

- A. General:** At the pre-construction conference or within 10 days after Notice of Award, whichever comes first, compile and submit two copies of a complete and comprehensive schedule of all submittals anticipated to be made during progress of the 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 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 their understanding of the importance of adhering to the approved schedule and their ability to so adhere. Coordinate as required to ensure grouping of submittals as described in Subsection 3.2 below.
- C. Revisions:** Revise and update the schedule on a monthly basis as necessary to reflect conditions and sequences. Promptly submit revised schedules to the engineer for review and comment.

2.2 SHOP DRAWINGS AND COORDINATION DRAWINGS

- A. Scale and Measurements:** Make all shop drawings accurately to a scale sufficiently large to show all pertinent aspects of the item and its method of connection to the work.

- B. Prints required: Submit four copies of all shop drawings. Shop drawings shall not be made on copies of the Contract Documents.

2.3 MANUFACTURER'S LITERATURE

Submit two 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

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

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 in a specified product, submit accurate color and pattern charts to the 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 Engineer and the City. The City requires a minimum of ten 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 to his satisfaction that all specified items will be available in time to allow orderly and timely progress of work.
- B. Notification: In the event specified items will not be available, the Contractor shall notify the Engineer prior to receipt of bids.
- C. Delays: The costs of delays resulting from 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: Consecutively number all submittals. Accompany each submittal with a letter of transmittal containing all pertinent information required for identification and checking of submittals.
- B. Internal Identification: On each copy of each submittal, 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, transmit under a new letter of transmittal.

- D. Submittal Log: Maintain an accurate submittal log for the duration of the Contract, showing current status of all submittals at all times. Make the submittal log available for the Engineer's review upon request.

3.2 COORDINATION OF SUBMITTALS

- A. Prior to submittal for approval, use all means necessary to fully coordinate all material including, but not limited to:
 - 1. Determine and verify all interface conditions, catalog numbers, and similar data.
 - 2. Coordinate with other trades as required.
 - 3. Clearly indicate all deviations from requirements of the Contract Documents.
- 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 when it is received. Partial submittals may be rejected as not complying with the provisions of the Contract Documents and the Contractor shall be strictly liable for all delays so occasioned.

3.3 TIMING OF SUBMITTALS

- A. General: Make all submittals far enough in advance of scheduled dates for installation to provide all time required for reviews, for securing necessary approvals, for possible revisions and re-submittals, and for placing orders and securing delivery.
- B. Engineer's Review Time: In scheduling, allow at least 10 calendar days for review by the Engineer following receipt of the submittal.
- C. Delays: Delays caused by tardiness in receipt of submittals will not be an acceptable basis for extensions of the contract completion date.

3.4 ENGINEER'S REVIEW

- A. General: Review by the Engineer or the City shall not be construed as a complete check, but only that the general method of construction and detailing is satisfactory. Review shall not relieve the Contractor from the responsibility for errors that may exist.
- B. Authority to Proceed: The notations "NO EXCEPTION TAKEN", "MAKE CORRECTIONS NOTED", and others, authorize the Contractor to proceed with fabrication, purchase, or both, of the items as noted, subject to the revisions, if any, required by the Engineer's or the City's review comments.
- C. Revisions: Make all revisions required by the Engineer or the City. If the Contractor considers any required revisions to be a change, he shall so notify the Engineer as provided for 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 Engineer or the City.
- D. Revisions after Approval: When a submittal has been reviewed by the Engineer, resubmittals for substitution of material or equipment will not be considered unless accompanied by an acceptable explanation as to why the substitution is necessary. All substitutions require pre-approval by the Engineer and the City.

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.

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) it is intended to be installed. They shall be of standard first grade quality, produced by expert workmen, and be intended for the use for which they are designed. Materials or equipment which, in the opinion of the Engineer, are inferior or of lower grade than indicated, specified or required will not be accepted.

All material and equipment supplied shall meet specified performance requirements at the elevation of the project site.

Any two or more pieces of material or equipment of the same kind, type or classification, and being used in similar types of services, 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: 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 they are to be used.

All equipment supplied shall be in accordance with the requirements of the contract documents.

Equipment shall be of the approximate dimensions indicated on the Drawings or as specified, shall fit in the spaces shown on the drawings with adequate clearance, and shall 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 of the 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 of sufficient strength to withstand all stresses that may occur during fabrication, testing, transportation, installation and all conditions of operation. 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 as well as utility. Protruding membranes, joints, corner, gear covers and the like, shall be finished in appearance. All exposed welds shall be ground smooth and the corners of the 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 high-grade apparatus of standard design. The equivalent parts of identical machines shall be made interchangeable. All grease lubricating fittings on equipment 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 to be incorporated in the work shall be handled and stored by the Contractor in a manner satisfactory to the Engineer and in such a way as to prevent damage or theft of the same.

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 Engineer.

All material which, in the opinion of the Engineer, has become so damaged as to be unfit for the use intended or specified 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 necessary traffic or with construction progress.

2.0 PRODUCTS

No products this Section

3.0 EXECUTION

General requirements for installation of equipment specified for use on the project shall be as follows:

All equipment shall be installed, equipped and serviced as per the manufacturer's recommendation except as supplemented or modified by the requirements of these Specifications or as directed by the Engineer.

All equipment shall be leveled, plumbed, aligned and placed into position to fit connecting piping and assemblies without transmitting stresses to the equipment.

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.

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 on the floor or elsewhere.

All equipment shall be greased, lubed, oiled and in all ways properly prepared for start-up by the Contractor per the manufacture's written recommendations. Where required by these Contract Documents, a qualified service technician shall provide the necessary start-up services.

Ceiling lifting hooks shall be installed above most plant equipment. All hooks shall provide a safety factor of 5 against failure for equipment gross weight.

All concrete work shall be of first grade quality, meeting the requirements specified in these Contract Documents. All floors shall be free from ponding, irregularities, and shall drain to the outlets provided.

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.

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.

SECTION 14 TRAFFIC REGULATION

1.0 GENERAL

1.1 DESCRIPTION

Work under this section shall include the regulation of vehicular and pedestrian traffic during performance of the work. The Contractor shall be responsible for the safe and orderly flow of traffic through and around the project site at all times.

1.2 QUALITY ASSURANCE

Work shall be per:

1. “Flagging and Traffic Control Supervisors’ Training Manual”; Colorado Department of Transportation.
2. “Manual on Uniform Traffic Control Devices” (MUTCD); Federal Highway Administration; current edition.
3. “Colorado Supplement” to the MUTCD.
4. City of Steamboat Springs – Road cut permit.

2.0 PRODUCTS

All signs, barricading, and other necessary items shall conform to the above references.

3.0 EXECUTION

3.1 GENERAL

The Contractor shall provide all necessary signs, barricades, lights, and flag persons necessary for the safe and orderly flow of pedestrian and vehicular traffic. Every attempt to keep traffic flow at a normal pace must be made whenever possible. The Contractor shall confine his occupancy of public traveled ways to the smallest space compatible with the efficient and safe performance of the work. Traffic is to be restored to normal flow at the end of each working day. If unable to restore normal traffic flow, all required signs, cone barricades or other warning devices are to be in place prior to the Contractor leaving for the day.

It shall be the Contractor’s sole responsibility to notify the appropriate authorities at least 48 hours in advance of significant changes in traffic patterns or possible hazards due to reductions of travel surface width or other work in public right of ways. The Contractor is to coordinate all detours and temporary road closings with the appropriate authorities. The appropriate authorities shall include but not be limited to the following: Steamboat Springs School District, Steamboat Springs Ambulance Department, Steamboat Springs Transit, Steamboat Springs Fire Department, Steamboat Springs Police Department, Routt County Sheriffs Office, and Routt County Communications.

3.2 SIGNS AND BARRICADES

Properly lighted, adequately sized, concise, legible signs shall be furnished as necessary for the safe regulation of traffic. Any backfilled areas that present a hazard to traffic must be properly protected and signed.

Suitable lighted barriers or barricades shall be furnished by the Contractor and put up and maintained at all times during the night or daytime, around all open ditches, trenches, excavations, or other work potentially dangerous to pedestrians and vehicular traffic. Barricades shall be placed on all sides and throughout the entire length of all open ditches, trenches, excavations, or other work that must be barred to the general public. Barricades shall be properly painted in order to retain a high degree of visibility at all times to vehicular and pedestrian traffic.

3.3 TRAFFIC CONTROL PLAN

The Contractor shall submit a traffic control plan for all major detours and for all complicated traffic control operations to the Engineer and the applicable regulatory agencies for review and concurrence well in advance of implementation. The plan must be developed by an American Traffic Safety Services Association (ATSSA) certified individual.

3.4 NON-PERFORMANCE

The Owner immediately, and without notice, may furnish, install and maintain barricades or lights if the Contractor fails to comply with the requirements of this section. The cost thereof shall be borne by the Contractor and may be deducted from any amount due or to become due to the Contractor under this contract.

4.0 MEASUREMENT AND PAYMENT

Traffic regulation shall be measured and paid for per the lump sum bid item traffic regulation. A percentage of the total bid amount will be paid as work progresses proportionate to the traffic regulation effort provided for the pay period.

The above payment shall include the cost of all signs, barricades, lights, equipment, tools, and labor incidental or necessary for completion of the work.

If no bid item for traffic regulation is listed, no separate payment will be made for the work under this section. Its cost shall be considered incidental to the project.

**SECTION 15
WATER POLLUTION CONTROL**

1.0 GENERAL

1.1 DESCRIPTION

- A. This section is intended as a supplement to the requirements of the Army Corps of Engineers, the Colorado Department of Public Health and Environment (CDPHE) Water Quality Control Division Stormwater Program, the “Erosion and Sediment Control During Construction” document published by Routt County, and the construction site management requirements of the City of Steamboat Springs. In the event that the methods and procedures mentioned herein are in conflict with the policies of other jurisdictions, the other jurisdictions’ policies shall dictate.

- B. Work included: The work under this section shall include all temporary measures to control water pollution and soil erosion as may be specified or directed during the construction of the work and for such a length of time after completion of the work as may be required.

- C. Related work described elsewhere: Revegetation, Section 22.

1.2 QUALITY ASSURANCE

The Contractor shall comply with the requirements of the Colorado “Water Quality Control Act” and amendments thereto, Article 8 of Chapter 25, CRS 1973 and all rules and regulations adopted there under, including obtaining all necessary permits, as well as the requirements of this section.

1.3 SUBMITTALS

Prior to commencing construction, the Contractor shall submit a Construction Site Management Plan to the City. Construction shall not begin until a Construction Site Management Plan has been approved by the City. Required in the Construction Site Management Plan are all proposed elements relating to temporary water pollution control and soil erosion control. Please be advised that water pollution control and soil erosion control are not the only elements required for a Construction Site Management Plan.

2.0 PRODUCTS

2.1 MULCH AND SEED

All revegetation shall be in accordance with the requirements of Section 22.

3.0 EXECUTION

In general, all construction activities shall proceed in such a manner so as not to pollute any watercourse, water body, conduit carrying water, etc., to the satisfaction of the City, and in accordance with required federal, state, and county permits, as well as this specification. The City may direct the Contractor to provide immediate temporary pollution or erosion control measures to prevent contamination of adjacent streams, other watercourses, or impoundments.

The Contractor shall be responsible for limiting the surface area of earth materials exposed by construction methods, to immediately provide permanent and temporary pollution control measures to prevent contamination of adjacent watercourses and water bodies, and to minimize erosion of the site and abutting property.

All slopes of stockpiled and excavated materials, all borrow stored on the site, all embankments and/or filling operations sloping into or near watercourses, water bodies, wetlands, etc., and all other disturbed areas shall be protected as identified in the approved Construction Site Management Plan. A temporary system of anchored bales of hay or straw or Envirofence shall be placed at or near the toe of all exposed earth surfaces with a gradient of 25 percent or greater, around the perimeter of the work area and at other locations as the City may direct, until such areas are reduced in grade or permanently stabilized.

The City has the authority to direct the Contractor to divert surface water runoff away from exposed raw earth surfaces through the use of temporary berms, dikes, dams, and diversion channels as considered appropriate.

The Contractor shall at all times have at hand the necessary materials and equipment to provide for early slope treatment and corrective measures to damaged slopes. All damaged areas shall be repaired as soon as possible.

The erosion control features shall be installed and maintained by the Contractor, and shall be checked periodically and after each severe rainstorm for damage, until such features are no longer needed. All sediment traps and sediment basins shall have the accumulated sediment and/or clear water regularly removed so as to maintain their storage volume and function.

The Contractor shall be responsible for the preservation of all stream banks within and adjacent to the limits of work. No excavation, stockpiling, or construction equipment will be permitted within 10-feet of the top of any stream bank or water body, unless required for the work shown on the approved construction documents. Any stream bank disturbed by the Contractor's operations shall be in accordance with a pre-approved permit from the Army Corps of Engineers.

All cases involving work in a river or a stream or any other water body defined as "Waters of the State" shall be in accordance with applicable pre-approved permits from the Army Corps of Engineers.

If a permit from the Army Corps of Engineers is not applicable, the Contractor's work shall meet the following minimum standards:

- A. In all cases involving work in a water body, every effort should be made to return the water body to the highest possible standard for aesthetic value, water quality and fish habitat.
- B. Construction, which impacts a body of water or wetland area, shall not be allowed prior to obtaining the required permits. All work shall be performed within conformance of the required permits
- C. Sufficient flow of water shall be maintained at all times to sustain aquatic life downstream.
- D. Any divergence of the stream shall provide a V or dish shaped channel to concentrate flow during periods of low water.
- E. Disturbance of the streambed shall be kept at an absolute minimum, and the streambed shall be returned as nearly as possible to its original condition or better. Where possible, in modifying a streambed, the centerline shall be 8 to 12 inches lower than the toe of the channel bank to concentrate the flow of water.
- F. Disturbed banks shall be returned to original slope, and rip rapped and/or planted with suitable grasses, trees, and shrubs so as to prevent erosion.
- G. Any dike or cofferdam required to facilitate construction shall be erected in such a manner that stream flow will not be sufficiently reduced to endanger fish life downstream. Such dike or cofferdam shall be erected of materials that will not contribute substantially to the turbidity or siltation of the stream.

Care shall be taken to prevent any damage to any water body from pollution by debris, sediment or other materials, or from the manipulation of equipment and/or materials in or near such water bodies. Water that has been used for washing or processing, or that contains oils or sediments that will reduce the quality of the water in the stream shall not be directly returned to the stream. Such waters shall be diverted through a settling basin or filter before being directed into the water body.

If the water is taken from a water body for construction purposes and an impounding structure is necessary, such structure shall be erected in a manner causing the least possible disturbance to the water body, adjacent property, and the proposed project.

4.0 MEASUREMENT AND PAYMENT

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

SECTION 16 DUST CONTROL

1.0 GENERAL

1.1 DESCRIPTION

- A.** Work included: The work under this section shall include all equipment, labor and materials necessary to control dust relating to or resulting from performance of the project work.
- B.** Related work described elsewhere: In addition to the requirements described herein, comply with specific requirements for dust control as may be detailed in other sections of these specifications or as noted on the Drawings.

1.2 QUALITY ASSURANCE

- A.** Standards: Comply with all pertinent requirements of Federal, State or Local agencies that may have jurisdiction over dust control procedures and additives used to aid in dust abatement.
- B.** Inspection: The Engineer, Contractor and Owner shall periodically review the adequacy of dust control efforts and procedures to assure they are satisfactorily meeting the needs of the project.

1.3 SUBMITTALS

- A.** Dust Control Procedures: Prior to commencing the project work, the Contractor shall meet with the Owner and Engineer to review the proposed dust control plan and methods to assure their compliance with the specific needs of the project.
- B.** Additives: All Additives proposed for use as an aid in dust control other than Specified in Section 2.2 shall be reviewed with the Engineer prior to their application. Manufacturers' literature along with recommended application rates shall be provided.

2.0 PRODUCTS

2.1 WATER

Water used for dust control shall be non-polluted. The use of water from fire hydrants is not allowed.

2.2 CHEMICAL ADDITIVES

Calcium Chloride: Shall conform to the requirements of AASHTO M 144 (ASTM-D-98) except that either pellet or flake shall be acceptable. Magnesium Chloride may also be used.

3.0 EXECUTION

3.1 GENERAL

During the performance of the work required by these specifications or any operations appurtenant thereto, the Contractor shall furnish all labor, equipment, materials, and means required, and shall carry out proper and efficient measures wherever and as often as necessary to reduce the dust nuisance, and to prevent dust which has originated from his operations from damaging landscaping, dwellings, air quality or causing a nuisance to persons.

3.2 WATER

- A.** Procurement: The Contractor shall be responsible for arranging for the necessary supply of suitable water for dust abatement.
- B.** The Contractor shall apply water and/or water with additives on all access and haul roads, excavations, surfaces or filled trenches, stockpiles, waste areas, and other work areas as may be necessary to adequately control dust.
- C.** Quantity: The quantity of water required for adequate dust control is variable and depends on climatic factors, soil types, and potential for nuisance. Dust control requirements shall be as discussed, established, and reviewed periodically during the course of project work.

3.3 WORK AREAS

The Contractor shall make a reasonable effort to keep work areas free of excessive dirt and mud that may unnecessarily contribute to a dust nuisance.

The Contractor shall keep adjacent areas free of excessive dirt and mud that may unnecessarily contribute to a dust nuisance.

4.0 MEASUREMENT AND PAYMENT

Payment for all costs of equipment and materials required to provide dust control shall be made on a lump sum basis per the Dust Control Bid Item. A percentage of the total bid amount will be paid as work progresses proportionate to the dust control effort provided for the pay period.

If no separate bid item is provided, no separate payment will be made for the work under this section. Its cost shall be considered incidental to the project.

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 described elsewhere: 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 requirements of cleanliness are being met.
- B.** Codes and Standards: In addition to the standards described in this section, comply with all requirements of other agencies having jurisdiction.

2.0 PRODUCTS

2.1 CLEANING MATERIALS AND EQUIPMENT

Provide all personnel, equipment and materials to maintain the specified standards of cleanliness.

2.2 COMPATIBILITY

Use cleaning materials and equipment that are compatible with the surface being cleaned, as recommended by the manufacturer of the material and which will not damage the surface being cleaned.

3.0 EXECUTION

3.1 STORAGE OF MATERIALS AND PERIODIC CLEANUP

Store all items to be 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 a 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 of the project on the work site.

At least twice each month, and more often if necessary, collect and remove all scraps, debris, and waste material from the job site and dispose of the same in an appropriate disposal area.

The site and adjacent roadway shall be cleaned on a daily basis to control any tracked mud and dirt.

Storage of all items awaiting removal from the job site shall be done in such a manner as to minimize fire hazard or environmental damage.

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 Engineer, broom clean all paved areas on the site and all public paved areas adjacent to the site which were contaminated because of the work. Completely remove all resulting debris.

Graveled parking or driveway areas within or adjacent to the work site which have had 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 Section 22: 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 payment for the work covered in this Section, its cost shall be considered incidental to the project.

**SECTION 22
REVEGETATION**

1.0 GENERAL

1.1 DESCRIPTION

Work included: This specification shall govern the work associated with the revegetation of all areas disturbed by the Contractor. Revegetation shall include application of native or lawn seed, or sod fertilizer, sod, mulch and soil retention blanket.

1.2 SUBMITTALS

- A. Seed and Fertilizer: The Contractor shall submit the seed and fertilizer mix proposed for use on the project for approval prior to application.
- B. Sod: The Contractor shall submit a sample of the sod he proposes to furnish. The sample shall serve as the standard for the project. Sod furnished which is not compatible with the standard sample will not be accepted.
- C. Mulch and Soil Retention Blanket: Suppliers shall certify that laboratory and field testing of their product has been accomplished and that it meets the material requirements contained herein. Test results shall be made available to the Engineer upon written request.

2.0 PRODUCTS

2.1 MATERIALS

- A. Native Seed: Shall consist of a mixture of the following or an approved equal:

Smooth Brome (Manchar)	8 lbs.	PLS/ac
Crested Wheatgrass (Standard)	6 lbs.	PLS/ac
Hard Fescue (Durar)	3 lbs.	PLS/ac
Western Wheatgrass	8 lbs.	PLS/ac
Intermediate Wheatgrass	11 lbs.	PLS/ac
Alsike Clove	2 lbs.	PLS/ac
Kentucky Bluegrass	2 lbs.	PLS/ac
Total	40 lbs.	PLS/ac

PLS=Pure Live Seed

- B. Fertilizer: The fertilizer shall be standard brand commercial lawn fertilizer having a minimum of 18% available nitrogen, 46% phosphorous and 0% potash (18-46-0).
- C. Lawn Seed: Seed to be applied to lawn areas shall be a mixture of 1/4 lb. PLS Merion Bluegrass, 1/4 lb. PLS Bluegrass and 1/2 lb. PLS Perennial Rye.
- D. Sod: Bluegrass sod shall be nursery grown, 99% Kentucky Bluegrass and 99% weed free. The 1% allowable weed shall not include any undesirable perennial or annual

grasses or plants. Soil thickness of sod cuts shall not be less than 3/4 inch nor more than 1 inch. Sod shall be cut in uniform strips 18 inches in width and not less than 6 feet long.

E. Mulch

1. Straw mulch: Shall consist of straw of oats, barley, wheat, or rye that does not contain seed of noxious weeds. Straw in such an advanced stage of decomposition as to smother or retard the normal growth of the grass, or old dry straw which breaks in the crimping process in lieu of bending will not be accepted.
2. Hay mulch: Shall consist of good clean field or marsh hay that does not contain seed or noxious weeds. Hay in such an advanced stage of decomposition as to smother or retard the normal growth of grass will not be accepted.
3. Hydraulic mulch: Wood cellulose fiber for hydraulic mulch shall not contain any substance or factor that might inhibit germination or growth of grass seed. It shall be dyed an appropriate color to allow visual metering of its application. The wood cellulose fibers shall have the property of becoming evenly dispersed and suspended when agitated in water. When sprayed uniformly on the surface of the soil the fibers shall form a blotter-like ground cover that readily absorbs water and allows infiltration to the underlying silt. Weight specifications from suppliers, and for all applications, shall refer only to air-dry weight of the fiber, a standard equivalent to 10 percent moisture. The mulch material shall be supplied in packages having a gross weight not in excess of 100-pounds and shall be marked by the manufacturer to show the air dry weight content.

F. Soil Retention Blanket.

1. Jute: The blanket shall consist of heavy jute mesh of a uniform open plain weave of unbleached yarn. The yarn shall be of a loosely twisted construction having an average twist of not less than 1.6 turns per inch and shall not vary in thickness by more than one-half its normal diameter. The jute mesh shall be furnished in approximately 90 pound rolled strips and shall meet the following requirements:
 - a. Length - approximately 75 yards
 - b. Width - 48-inches plus 1-inch; 78 warp ends per width of cloth; 41 weft ends per yard.
 - c. Weight of cloth to average 1.22-pounds per linear yard with a tolerance of plus or minus 5 percent.
2. Plastic Net: The plastic net shall be a biodegradable extruded oriented net with a rectangular mesh opening of approximately 1.5 x 1 strands per square inch and a nominal weight of 2.6 pounds per 100 square feet.
3. Pins and Staples: Pins or staples shall be made of wire .091 inch or larger in diameter. "U" shaped staples shall have legs 6-inch long and 1-inch crown. "T" shaped pins shall have a minimum length of 8-inches after bending. The bar of the "T" shall be at least 4 inches long with the single wire and bent downward approximately 3/4-inch.

3.0 EXECUTION

3.1 PREPARATION

- A. General:** In all disturbed areas, all topsoil is to be salvaged and replaced. Imported topsoil may be required to provide a minimum of a 4" topsoil layer. Prior to any revegetation activity, the topsoil shall be tilled to provide at least 4-inches of loose surface. Sticks, stones, debris and other similar material more than 1/2-inch in diameter shall be removed.
- B. Sod:** Preparatory to sodding, all irregularities in the ground surface shall be removed. Sticks, stones, debris and other similar material more than 1/2-inch in diameter shall be removed. Any objectionable depressions or other variances from a smooth grade shall be corrected. Areas to be sodded shall be smooth before any sodding is done.

3.2 APPLICATION

A. Native Seed:

- 1. 3:1 Slopes or flatter:** Seeding shall be accomplished by means of an approved drill-type seeder at a rate of 20lbs. per acre PLS or broadcast at 40 lbs. per acre PLS.
- 2. Slopes steeper than 3:1:** Seeding shall be accomplished by means of an approved drill-type seeder whenever possible at a rate of 20lbs. per acre PLS or broadcast at 40 lbs. per acre PLS.
- 3. Otherwise seed shall be sown with an approved broadcast-type seeder.** The seeded area shall then be raked lightly to provide about 1/2-inch of cover over the seed unless hydraulic broadcasting and mulching is used.
- 4. Seeding Maintenance:** The Contractor shall be responsible for maintaining and adequately watering seeded areas after the time of seeding. Areas in which there is not an acceptable stand of revegetation shall be reseeded. An acceptable stand of revegetation exists when the revegetation is equal to or better than the pre-construction vegetation. Seed shall not be sown during windy weather or when the ground is frozen or otherwise untillable.

- B. Lawn Seed:** Seeding shall be accomplished by means of an approved broadcast-type seeder at a rate of 1-pound per 300 sq. ft. PLS. The seeded area shall then be raked to provide about 1/4-inch of cover over the seed unless hydraulic broadcasting and mulching is used. Seed shall not be sown during windy weather or when the ground is frozen or otherwise untillable.

The Contractor shall be responsible for maintaining and watering seeded lawn areas after the time of seeding. If areas or patches exist without an acceptable stand of grass, the Contractor shall reseed and maintain until an acceptable stand of revegetation exists. An acceptable stand of revegetation exists when the revegetation is equal to or better than the pre-construction vegetation.

- C. Sod:** The sod shall be laid by staggering joints. On any slopes, the sod shall run parallel to a 90-degree angle to the slope. After installation the sod shall be thoroughly soaked.

1. After soaking, the sod shall be permitted to dry to the point where it is still wet enough for effective rolling. It shall then be rolled in two directions with a lawn roller weighing not less than 150 pounds to secure a tight bond of sod to subgrade and between strips.
 2. The Contractor shall be responsible for maintaining and watering sodded areas after the placement of sod. The Contractor shall guarantee the sod and any areas of dead or dying sod shall be replaced and maintained until it is self-sufficient.
- D. Fertilizer:** Fertilization is applicable on jobs only when a separate bid item is included in the bid section. The fertilizer shall be tilled into the top 2-inches of the soil at a rate of 300 pounds per acre.
- E. Mulching:**
1. General: All mulching procedures shall be done after the seeding operation is completed and not in conjunction with seeding.
 2. Hay or straw mulch: Hay or straw shall be applied to the seeded surface at a rate of 1 1/2 to 2 tons per acre and shall be crimped into the soil with approved equipment. Hay shall not be used as mulching material in lawn areas. On steep slopes where crimping is not possible, a tackifier, such as Terra Tack or J-Tak shall be applied at a rate of 120 lbs./acre in lieu of crimping. An asphaltic tackifier shall not be acceptable.
 3. Hydraulic mulching: The hydraulic mulching material shall be spray applied to the seeded area at a rate of 1 ton/acre. Hydraulic mulching shall not be done in the presence of free surface water resulting from rain, melting snow or other causes, and shall not be done during windy weather.

F. Soil Retention Blanket:

The tackifier included in the mulching specification shall not be necessary where a soil retention blanket is required.

The blankets shall be placed immediately after seeding and mulching operations have been completed in each location as specified on the Plan.

The material shall be applied smoothly but loosely on the silt surface without stretching. Workers should avoid, as much as possible, walking directly on the seedbed either before or after the mesh is applied. The up slope end of each piece of mesh shall be buried in a narrow trench six (6) inches deep. After the mesh is buried, the trench should be tamped firmly closed.

In cases where one roll of mesh ends and a second roll starts, the up slope piece should be brought over the second roll so that there is a 12-inch overlap to form a junction slot. Where two or more widths of mesh are applied side by side, an overlap of at least four inches must be made.

Check slots should be made before the mesh is rolled out. A narrow trench should be dug across the slope perpendicular to the direction of flow. A piece of mesh, cut the same length as the trench, is folded lengthwise. The fold is placed in the trench and the trench

is tamped closed. The portion of the mesh remaining above ground is unfolded and laid flat on the soil surface. Check slots will be spaced so that one check slope or junction slot occurs within each 50-feet of slope. Overlaps that run down the slope, outside edges and centers shall be of staples down the center as well as along each edge. Check slots and junction slots will be stapled across at 6-inch intervals. For extra hard soil, use sharp pointed hardened steel 3-inch fence type staples.

Matting must be spread evenly and smoothly and be in contact with the seeded area at all points. It shall be pressed into the soil with a light lawn roller or by a similar method. The Contractor shall maintain the mesh areas until all work on the entire Contract has been completed and accepted. Maintenance shall consist of the repair of areas damaged by erosion, wind, fire, or other causes. Such areas shall be repaired to establish the condition and grade of the soil prior to application of the mesh and shall be refertilized, reseeded and remulched as directed.

4.0 MEASUREMENT AND PAYMENT

A. NATIVE OR LAWN SEED APPLICATION

Payment shall be per acre seeded per the appropriate bid item and is to include all work related to preparation and seed application. The Contractor shall supply the Engineer with all weight and mixture tickets for native seeding materials used.

B. FERTILIZER

Payment shall be per acre fertilized per the appropriate bid item and is to include all work related to preparation and fertilizer application. The Contractor shall supply the Engineer with weight tickets for fertilizer used.

C. SOD

Payment shall be made per square yard per the appropriate bid item and is to include all work related to preparation and installation.

D. MULCH

Payment for mulch application shall be per acre mulched per the appropriate bid item. The Contractor shall supply the Engineer with weight verification for all mulch materials used.

Areas not properly mulched or damaged due to the Contractor's negligence shall be repaired and remulched in an acceptable manner at the Contractor's expense.

Mulch removed by circumstances beyond the Contractor's control shall be repaired and remulched as ordered. Payment for this corrective work shall be at the unit bid price.

E. SOIL RETENTION BLANKET

Payment for soil retention blanket shall be per acre covered per the appropriate bid item. The Contractor shall supply the Engineer with material verification for all retention blanket used.

4.1 LIMITATIONS

The Contractor will not be paid for revegetation of disturbed areas that resulted from the Contractor's carelessness or negligence in performing the Work.

**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 Engineer. The Contractor shall assist the Engineer as necessary to complete the testing and shall provide a safe trench for the Engineer. All trench work shall be performed in accordance with OSHA regulations.

1.3 SUBMITTALS

Samples: Supply samples of all imported material to the Engineer if requested.

1.4 DEFINITIONS

- A. Earth excavation: Shall include all soils and loose, broken and laminated ledgerock 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.
- B. 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.
- C. 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 Engineer as unsuitable for providing a proper foundation or backfill.

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 Standard Specifications (Dry conditions only).
- b. 3/4 inch washed: Number 6 or Number 67 Coarse Aggregate for Concrete, per Section 703 of the 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 to be approved by the Engineer, are to be placed every 50' of pipe installed from the trench bottom to a height of 16" below finish grade, spanning the width of the trench, and a minimum length of 2' in the pipe laying direction. Engineers are encouraged to identify specific locations of impervious dams on the construction drawings so as 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 as-built drawings.

3. Imported

- a. 3/4 inch minus: Class 6 Aggregate Base Course, per Section 703 of the Standard Specifications (Dry conditions only).
- b. 3/4 inch washed: Number 6 or Number 67 Coarse Aggregate for Concrete, per Section 703 of the Standard Specifications.
- c. 3/8 inch screened rock or Squeegee Sand, with 100% of the material passing a 3/8 inch screen and 0-3% 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 as small an area as possible in order 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 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 that the pipe can be installed to the alignment and grade indicated on the Drawings or specified. Under certain field conditions the Engineer may authorize, after consultation and approval from the City Utility Department, 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. A 6-inch minimum clearance spacing between utility line crossings, including related encasements, shall be 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 installation of the line.

- 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 be maintained dry so that 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 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 the 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 a sound stable trench bottom free from soft, loose, rocky, excessively hard or other unsuitable native material exists before proceeding. Per Section 4: Engineering Services, subsection II.C.2, the Engineer shall certify the trench foundation preparation to the City Utility Department.
- 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, overexcavate the trench bottom to the depth authorized by the Engineer and bring the foundation to grade with the appropriate imported foundation material authorized by the Engineer and compacted in 6" to 8" 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 main-line pipes and appurtenances. In dry conditions a ¾" minus road base material shall be used. In trench conditions with excessive ground water, ¾" minus washed rock may be used if approved by the Engineer.
- C. Procedures for Bedding and Shading: The following procedure shall be used for all types of pipe. 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 the pipe haunches. The use of 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 as well as succeeding lifts for pipe diameters larger than 12-inches or where dictated by trench width.

Depending on the diameter of the pipe being installed, 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 shading the pipe. 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 Engineer's review. If the specified compaction is not being obtained, the Contractor will be required to modify his

compaction procedures to meet specified requirements. This may require the use of other types of compaction equipment or a reduction in size of lifts being compacted.

Any damages 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 compaction equipment which is narrower than full trench width is used, 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% 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.

Paved Areas (including paved and graveled roadways, paved and graveled parking lots, sidewalks, paved and graveled trails, curb 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 Department. Utility Department authorization 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.

- B.** 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 recommended not to exceed 6 to 8-inches.

- C.** 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 Engineer may waive the compaction requirement, or may authorize the Contractor to use imported backfill material. If the Engineer wishes to waive the compaction requirement, the Engineer must first submit written documentation to the City Utility Department. 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 any and all requirements for minimum settling. The City Utility Department 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 Contractor shall install geotextiles as authorized by the 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.

D. 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 the same 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 City Utility Department 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 above. The moisture content of bedding or backfill materials shall be within ± 2.0 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 Engineer may require the Contractor to re-excavate to a lower depth to conduct additional testing.

When requested by the 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 Engineer may require that the backfill be removed and recompacted in 6 to 8-inch lifts or be replaced with imported material at the Contractor's expense.

Testing frequency shall be as 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 the testing reports submitted to the Utility Department.
- C. Testing Quality of Materials: All material proposed to be imported from off site 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.
1. Class 6 Aggregate Base Course shall be tested for conformance with section 703.03 of the 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 along with inconsistencies in compactive 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 Engineer during construction shall not relieve the Contractor of the responsibility to assure that the trench backfill does not settle beyond the limits established below. The Contractor shall be responsible for repair of 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 1/4 inch but less than 1-1/2 inches, as measured by a 16' 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 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: Typically trench settlement warranty shall be for 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 costs for this work shall be included in the prices bid for the item being installed, except that rock excavation 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 costs for this work shall be included in the prices bid for the item being installed, except that rock excavation 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 per the Unit Price per Cubic Yard measured by the length of material installed times the payment width limit shown on the Drawings times the actual authorized thickness of material replaced under the item Foundation Zone by material type.
- D. IMPORTED BEDDING AND SHADING MATERIAL: Measurement and payment for imported bedding and shading material shall be made at the Unit Price per Cubic Yard measured by the length of material installed times the average width authorized times the actual depth of material authorized less the volume of the pipe installed per the Bedding Zone or Shading Zone item by material type.
- E. IMPORTED BACKFILL: Measurement and payment for imported backfill shall be per 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.
- F. 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 upon 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 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 Engineer's confirming measurements.

SECTION 26 PAVEMENT REMOVAL AND REPLACEMENT

1.0 GENERAL

1.1 DESCRIPTION

- A. Protection of existing pavement.
- B. Removal and replacement of pavement structures that may include surface, base, and sub base courses as required for trench and test hole excavation or as otherwise required by the Engineer.
- C. Installation and removal of temporary pavement structures consisting of base course.

1.2 QUALITY ASSURANCE

Refer to Sections 401.01 to 401.20 of the current edition of the Standard Specifications for Road and Bridge Construction, Colorado Department of Transportation, herein called Standard Specifications.

Only contractors with proven experience in the type of work to be performed shall be allowed to construct bituminous pavements.

1.3 SUBMITTALS

Submit references and proof of experience to the Engineer prior to scheduling installation of bituminous pavement.

Submit method of cutting and removing pavement as well as equipment and method to be used for pavement replacement to the Engineer prior to performing the removal.

Submit to the City Utility Department the name and phone number of the person responsible for maintaining the traveled surface prior to performing the excavation.

2.0 PRODUCTS

Pit Run: 2-½ inch minus. Class 1 Aggregate Base Course per section 703 of the Standard Specifications.

Base Course (Surface Course for Gravel Roads): ¾ inch minus. Class 6 Aggregate Base Course per Section 703 of the Standard Specifications.

Surface Course: Bituminous pavement shall meet the requirements of Sections 401.01 to 401.06 of the Standard Specifications, 5/8 inch mix, unless otherwise directed by the City of Steamboat Springs Public Works Department.

3.0 EXECUTION

3.1 PROTECTION OF EXISTING PAVEMENT

The pavement adjacent to an excavation shall be protected from damage caused by movement of construction equipment or other work. Planking, mats or other appropriate means of protection shall be used. Any paved surface damaged due to the Contractor's activities shall be replaced or repaired at no expense to the Owner. The area to be replaced or repaired shall be as designated by the Engineer.

3.2 CUTTING AND REMOVAL

Pavement shall be neatly cut along the lines shown on the Drawings or as approved in the field by the Engineer. Pavement shall be cut by saw, or other method as approved by the Engineer.

Care shall be exercised so that adjacent pavement outside the cut will not be disturbed or damaged. Excavated pavement shall be removed and disposed of off site. Removed pavement may not be used as trench backfill.

3.3 BASE COURSE (SURFACE FOR GRAVEL ROADS)

Construct a base course section compacted to 95 percent of maximum dry density as determined by ASTM D 1557 (modified proctor test) in lifts not to exceed 6-inches. The top of the section shall be the bottom of the bituminous pavement section. In gravel roads the top of the section shall be the traveled surface. The thickness of the base course section shall be 12-inches unless directed otherwise.

3.4 TEMPORARY TRAVEL SURFACE

If bituminous pavement is not replaced within 24 hours following backfill completion, the Contractor shall install additional base course to match the existing traveled surface. The Contractor shall maintain the traveled surface as necessary to keep it smooth, free from soft spots and dust free. The Contractor shall provide the City of Steamboat Springs Utility Department with the name and phone number of the person responsible for maintaining the traveled surface prior to performing the excavation. The Contractor shall be available for maintenance on a 24 hr. basis. Just prior to bituminous pavement replacement, the Contractor shall remove and dispose of the additional base course.

3.5 BITUMINOUS PAVEMENT REPLACEMENT

Prior to installation of bituminous pavement, cut and remove additional pavement per 3.2 above to provide a clean, straight and uniform line without sharp jogs. The edge of the existing pavement shall be cut back from the damaged area so that at least one foot of bituminous pavement will be placed upon undisturbed material outside of the actual trench excavation area on each side of the trench.

Replaced pavement shall be 4-inches minimum thickness placed in two equal lifts and compacted to 95-percent of maximum density. Pavement shall be placed in accordance with the appropriate requirements of Section 401.07 to 401.20 of the CDOT Standard Specifications.

3.6 FIELD QUALITY CONTROL

The degree of compaction specified for non-bituminous material shall be 95-percent of maximum dry density as determined by ASTM D 1557 (modified proctor test).

The moisture content of non-bituminous material shall be within 2.0 percent of optimum moisture as determined by ASTM D 1557 (modified proctor test).

Contractor provided periodic compaction tests shall be performed by a soils engineer to determine if the requirements of this section are being met. The Contractor may wish to conduct additional compaction tests to monitor the installation procedure and assure the quality of the work. Compaction tests by the Engineer will not relieve the Contractor from responsibility for the work.

4.0 MEASUREMENT AND PAYMENT

4.1 PAVEMENT REMOVAL AND REPLACEMENT

- A. ALONG BITUMINOUS PAVEMENT SURFACED TRENCHES** will be measured and paid for at the Unit Price per Square Yard under the item Trench Patch based upon bituminous pavement thickness and base course thickness. Payment width shall be the actual width of bituminous pavement installed within the authorized pay limit width. The length measurement shall be the actual length of the patch. Where trenches intersect, the length of the intersecting patch shall not be included in the measurement. Payment shall include protection of existing pavement; cutting; excavation and removal of the pavement structure; installation of base courses; installation and removal of temporary pavement; installation of bituminous pavement with a lay-down machine and all other incidental materials or work required.
- B. ALONG GRAVEL SURFACED TRENCHES** will be measured and paid for at the Unit Price per Square Yard under the item Pavement Removal and Replacement Along Gravel Surfaced Trenches per base course thickness. Payment width shall be the backfill zone pay width as shown on the Drawings. The length measurement shall be the actual length of the trench measured through manholes. Where trenches intersect, payment for only one of the trench lengths shall be paid for. Payment shall include protection of existing pavement, excavation and removal of the pavement structure, installation of base courses, and all other incidental materials or work required.
- C. AT MISCELLANEOUS BITUMINOUS PAVEMENT SURFACED LOCATIONS** such as at test holes or other locations designated by the Engineer. Measurement and payment for the bituminous pavement, to exclude base course material, will be at the Unit Price per Square Yard under the item Pavement Removal and Replacement As Directed based upon bituminous pavement thickness and actual square yards in place. Payment shall include protection of existing pavement; cutting, excavation and removal of the pavement structure; installation and removal of temporary pavement; installation of bituminous pavement and all other incidental materials or work required.
- D. AT MISCELLANEOUS GRAVEL SURFACED LOCATIONS** such as at test holes or other locations designated by the Engineer. Measurement and payment for the base, to include base course material beneath Miscellaneous Bituminous Pavement Surfaced Locations per C above, will be at the Unit Price per Cubic yard under the item Pavement Removal and Replacement As Directed ¾" Minus Base Course per actual cubic yards

installed measured in place, excluding the volume of base course material for temporary pavement. Payment shall include protection of existing pavement; excavation and removal of the pavement structure or other unsuitable material authorized by the Engineer; installation of base course, and all other incidental materials or work required.

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/SUBSTITUTIONS

- A. No substitutes will be considered for items listed by manufacturer's name and/or model number in this section unless the words "or equal" are included as a part of the description
- B. Submittals are required for all proposed substitutions and all items not specifically listed by manufacturer's name and model number. All proposed substitutions must be approved by the City of Steamboat Springs Utility Department prior to installation.
- C. A certification is required for all buried bolts.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. All Material: Shall comply with AWWA standard C600 and C900 and as follows. Material shall be handled by lifting with hoists or skidding in order to avoid shock or damage. Slings, hooks, or pipe tongs shall be padded and used in such a manner as to prevent damage to the exterior surface or internal lining of the pipe. Under no circumstances shall any materials be dropped. Valves and hydrants shall be drained and stored in a manner that will protect them from damage by freezing. The interior of all pipe, fittings, and other appurtenances shall be kept free from dirt or foreign matter at all times.
- B. Pipe may be stacked per the manufacture's recommendations but shall not be stacked higher than 5-feet. In distributing material at the work site do not interfere with access to

private property, parking or traffic. Stockpile materials as close to the installation site as feasible. It is recommended that only as much pipe as is expected to be laid during the 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.
- 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 manufactured unless otherwise approved by the City.

1.5 JOB CONDITIONS

- A. Pipe laying during the period from November 1 through May 1 shall only occur with site specific approval from the City of Steamboat Springs Utility Department. Approval shall require full time observation by a professional engineer registered in the State of Colorado or a properly trained engineering technician who is under the direct supervision of a professional engineer. Request for such work between November 1 and May 1 must be made in writing to the City Utility Department, and such work shall proceed only with written approval from the City Utility Department.
- B. Excavation within a dedicated right of way shall not occur between Nov. 1 and May 1.
- 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 is to 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 10:00 am temperature is below 30-degrees Fahrenheit.
 - 3. A succession of three consecutive days with the 10:00 am temperature below 30-degrees Fahrenheit 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 with the 10:00 am temperature above 30-degrees Fahrenheit provided there is no frozen backfill or bedding material.
 - 4. The Contractor shall coordinate with the Engineer when temperatures approach the conditions for shut down of the pipe laying operations. The Contractor may propose and institute suitable protective measures to continue work if given written authorization by the City of Steamboat Springs Utility Department.

2.0 PRODUCTS

2.1 MATERIALS

A. Ductile Iron Pipe:

1. Pipe: ANSI/AWWA C151/A21.51
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 (use only when specified by the City of Steamboat Springs Utility Department):

1. Pipe: AWWA C900
2. Wall thickness: Class 200 with a dimension ratio (DR) 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 min. 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 washer shall be coated with C5A copper based anti-seize.

10. Tapping Sleeve: 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.
 - a. 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. Minimum working pressure shall be 200 PSI.

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 the 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 per Gate Valves this section.
4. Combination Air Valve: All combination air and vacuum release valves shall be in accordance with AWWA C512 and shop assembled and shipped as a complete unit ready for field installation. The valve shall be the single body type: APCO 145C with 2" 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" 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. 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 detail on fire hydrant detail.

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, 1-1/2 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. Hydrant shall be Mueller Super Centurian 250 three-way, 2 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 shall be of the year of construction plus or minus one year.
2. Hydrant Marker: Shall be Fire Hydrant marker by BARCO (11 N. Batavia Ave, Batavia, IL 60510, 1-800-338-2697) with a 7-foot length. The marker should be

attached to the back of 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 a 12" offset is allowed. Both ends are to be restrained.
4. Blow off hydrants: Kupferle model #77 with 2½" NST nozzle and 2" FIP inlet from the side.

F. Service Lines and Appurtenances with diameters 2-inches or less:

1. Service line: Shall be Type K, seamless soft copper tubing unless indicated otherwise on the Drawings.

2. Corporation stop:

¾" and 1"	Ford FB-1000G, or Mueller B-25008
1-1/2" and 2"	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, 7-1/2 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 ductile iron pipe: 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 and shall be double strap and shall be designed for use with C-900 pipe such as the Ford S90 and S91.

G. 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.

H. Encasements and Thrust Blocks:

1. Concrete: Shall be a minimum 3000 PSI compressive strength, 6 sacks per cubic yard, Type II Portland Cement.
2. Reinforcing steel: Grade 40, ASTM A 615.

I. Water Marker Posts: Blue carsonite utility marker with water decal 112-CW model CUM-375 CRM 307208 (72 inch length) by Carsonite International.

- J. Stub Markers: New metal posts extending down to the stub and up to within 1 foot of the designated grade.
- K. Polyethylene Encasement: Per AWWA C105. Required only when called for in Special Provision.
- L. Tracer Wire: Shall be #10 solid copper wire coated with 45 MIL polyethylene. THHN wire is not acceptable as tracer wire.
- M. Tracer Wire Test Station: Required at all fire hydrants or other locations as specified by the Engineer. Model "Glenn Test Station" by VALVCO, Inc.

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 Engineer shall stake the locations of pipe and appurtenances prior to installation.

3.2 PIPE INSTALLATION

- A. General: Comply with the manufacturer's recommendations and ANSI/AWWA C 600 and C 900.

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.

Materials shall not be dropped into the trench but shall be lowered by hand or machine. Blocking under the pipe shall not be used.

The interior of all pipe and fittings shall be kept in a clean, sanitary condition at all times. 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 watertight plug.

All lumps, blisters and excess coal-tar coating on ductile iron pipe shall be removed from the bell-and-spigot end of each pipe, and the outside of the spigot and the inside of the bell shall be wire-brushed and wiped clean and dry and free from soil and grease before the pipe is laid.

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.

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 axis of the pipe. Pipe cutting shall be done without damaging the remainder of the pipe or the cement lining. The flame cutting of pipe by means of an oxyacetylene torch shall not be allowed. The cut end shall be beveled to allow the pipe to be joined without damage to or displacement of the rubber gasket.

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. 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 the water mains or service lines.

B. Deflection or Curvature:

- 1. PVC, Push-on Joints: Refer to Manufacturer’s Recommendations.
- 2. Ductile Iron, Push-on Joints:

ALLOWABLE DEFLECTION PER JOINT
(Unless specified differently by the Manufacturer)

<u>Diameter (inches)</u>	<u>Minimum Radius of Curvature (feet)</u>	<u>Deflection in inches per 18-foot length</u>
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 or greater	Refer to Manufacturer	Recommendations

- 3. PVC, Mechanical Joints: Refer to Manufacturer’s Recommendations.

4. Ductile Iron, Mechanical Joints:

ALLOWABLE DEFLECTION PER JOINT
(Unless specified differently by the Manufacturer)

<u>Diameter (inches)</u>	<u>Minimum Radius of Curvature (feet)</u>	<u>Defection in inches per 18-foot length of pipe</u>
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	

C. Warning Tape and Electric Conductivity:

1. Ductile Iron Pipe:

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 18-inches below the surface. The tape must be blue in color and be made by Thortec or approved equal. Warning tape is optional, though recommended, over services.

Electric Conductivity: Install brass wedges on all push-on joints to provide electrical conductivity. Install 3 wedges equally spaced per joint for 12-inch and smaller diameter pipe and 4 equally spaced wedges for pipe larger than 12 inches diameter.

In addition to brass wedges, tracer wire shall be attached directly on top of all ductile iron 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 polyethylene pressure sensitive tape. The wire shall be installed in such a manner that there is two inches of flex between the wire and the pipe. Splicing of the tracer wire shall be per the manufacturer's recommendation, and shall also be waterproof. Tracer wire shall be connected to existing adjacent pipeline systems such that conductivity between new and existing infrastructure is achieved. All tracer wire connections shall be waterproof. Tracer wire shall be installed such that 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 four inches in diameter or greater, the test station shall either be located outside of the building, accessible to the City, 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.

2. PVC Pipe:

Warning Tape: Above all PVC mains install a 6-inch wide detectable aluminum foil plastic backed tape indicating a buried water line and place 18-inches below the surface. The tape must be blue in color and be made by Thortec or approved equal. Warning tape is optional, though recommended, over services.

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 in such a manner that there is two inches of flex between the wire and the pipe. Splicing of the tracer wire shall be per the manufacturer's recommendation, and shall also be waterproof. Tracer wire shall be connected to existing adjacent pipeline systems such that conductivity between new and existing infrastructure is achieved. All tracer wire connections shall be waterproof. Tracer wire shall be installed such that 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 four inches in diameter or greater, the test station shall either be located outside of the building, accessible to the City, 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.

D. Thrust Blocks: All plugs, caps, tees, bends and hydrants shall be thrust blocked as required to resist vertical and horizontal reactions. Thrust blocks are to 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 come in contact with the joint bolts. Thrust blocks shall be installed so all joints are accessible. Cure concrete 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 Engineer's review and approval. All thrust blocks are to be inspected by a representative of the City of Steamboat Springs Utility Department prior to backfill.

E. Restrained Joints: Joint restraint devices shall be required for the following installations:

1. Fire hydrants
2. Reducers
3. Vertical and horizontal offsets
4. On all bends
5. Caps and plugs

- 6. On the side branch of all tees
- 7. In-line valves

Horizontal and vertical offsets and reducers shall be restrained 1 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:

TABLE 30-1

LENGTH OF RESTRAINED PIPE

Pipe Size	4-Inch	6-Inch	8-Inch	10-Inch	12-Inch
Fitting					
90° Bend, Tee, Caps, Plugs, Fire Hydrant & In line valves	30'	45'	60'	73'	86'
45° Bend	18'	18'	18'	21'	25'
22 1/2° Bend	18'	18'	18'	18'	18'
11 1/4° Bend	18'	18'	18'	18'	18'

- F. 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 come in contact with the pipe or the fittings.

Prior to placing the concrete, temporary supports consisting of concrete blocks or bricks shall be used to support the pipe in place. Not 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.

No reinforced concrete encasements shall be poured until the 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.

- G. Water Marker Posts:** 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 2-1/2 feet and extend above grade 3-1/2 feet.

- H. 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 are to be located on the fill side of the right of way. Fire hydrants are to be located a minimum of 15' from all existing and proposed structures, utility pedestals, fences, trees, bushes, boulders, etc.
- B.** Hydrant locations shall be staked by the Engineer and Contractor, location 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 pavement of the public streets. Hydrants shall be set to the established grade as staked by the Engineer with 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 City of Steamboat Springs Utility Department. When pre-approved by the City of Steamboat Springs Utility Department, the use of cast offsets on hydrant laterals, or changing the length of the operating shaft for aiding in meeting grade requirements, is allowed. Only a single 6" or 12" 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 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.

If high groundwater is encountered during construction the Engineer may, with the approval of the City of Steamboat Springs Utility Department, direct the Contractor to delete the drainage pit and convert the hydrant to a wet barrel hydrant by installing a threaded plug into the weephole. Hydrants so converted shall have the top cap of the hydrant painted with a rust inhibitive yellow paint.
- 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 Engineer based upon 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 requirements, and pavement removal and replacement requirements.
- G.** After installation, hydrants are to be cleaned with a course 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. Location: Shall be subject to final approval by the Engineer. Valves shall have the interior cleaned of all foreign matter and shall be inspected in opened and closed positions before installation to insure 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 shall be responsible for adjusting the final height of all new valve boxes and curb boxes to the specified levels or as may be directed by the Engineer. The valve boxes shall typically be set to the following grades:
 - Paved Streets ¼ to ½ inch below grade
 - Gravel roads, shoulders & driveways 1 to 2-inches below grade
 - Areas not in road easements or affected by snow plowing operations set flush to grade or as agreed with Engineer

Valve Operator Nut Riser: Valve operator nut risers shall be provided on all valves to bring the operating nut to within 6” of finished grade.

3.5 SERVICE LINES

All taps to existing mains shall be performed by the City of Steamboat Springs Utility Department.

The City does not provide three inch taps.

No service lines from a building to a curb stop or water main shall be installed until the main line has gained preliminary acceptance from the City of Steamboat Springs Utility Department and a building permit has been obtained.

Curb stops shall be located on or near the property line or edge of right of way.

Size: No service line shall be less than 3/4 inch diameter. All service lines shall be in conformance with the currently-adopted International Plumbing Code (IPC) to adequately supply the property being served.

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 main line and in line with the service line.

Taps: No taps for services shall be made prior to the main being tested and approved. 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 authorized otherwise by the 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.

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.

Inspection: The City of Steamboat Springs Utility Department shall inspect all water services prior to backfilling and use. A minimum of 24-hours advanced notification is required for inspection scheduling. In instances where a water service stub-out is being installed on a new main not yet accepted by the City as part of new mainline infrastructure construction, the Engineer shall inspect the stub-out from the tap to the curb stop, and the City of Steamboat Springs Utility Department shall inspect the service from the curb stop to the building.

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. All services shall be a minimum of 5-feet from any lot line or property corner unless authorized otherwise by the City.

Separate Trenches: All domestic water services shall be laid so that no point is nearer than 10-feet horizontal 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.

3.6 TAPPING SLEEVE AND VALVE (LIVE TIE)

Unless waived by the Utility Department, a test hole is required in order to establish horizontal location and depth for any proposed connection prior to construction plan approval. A test hole may be required to confirm existing pipe size, material and location prior to ordering live tie materials.

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 City of Steamboat Springs Utility Department.

The City of Steamboat Springs Utility Department will make the wet tap for all live ties up to 10-inches at no charge to the Contractor on City of Steamboat Springs Utility Department initiated projects using materials furnished by the Contractor. The same applies to privately initiated projects except that a fee will be charged. 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 Engineer prior to commencing the work.

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

3.7 DISINFECTING AND FLUSHING

Permanent connections to the existing system shall not be made until authorized by the City of Steamboat Springs Utility Department. Looped pipelines shall be connected only at one end prior to completion and approval of the disinfection tests. Permanent connections must be cleaned and disinfected per the current revision of AWWA C651. The Engineer 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 City of Steamboat Springs Utility Department 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, and the City requires a minimum of three working days to process a request.

The 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. 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 one foot/second. After 24 hours, the Engineer shall test the chlorine residual. If a minimum residual of 10 mg/L is not met, the disinfecting procedure shall be repeated.

After disinfecting of the water line(s) 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 dechlorination if necessary must be followed to prevent heavily chlorinated water from entering streams or irrigation ditches. The Owner shall make 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 has been completed. The Contractor shall be responsible for any rechlorination 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 City of Steamboat Springs Utility Department 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 a sufficient quantity of water is not available from the existing water system. In such a case the Contractor shall present his flushing program to the Engineer before proceeding.

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.

3.8 FIELD QUALITY CONTROL

A. General

1. Conduct Pressure and leakage tests in accordance with ANSI/AWWA C600.
2. Schedule with the Engineer at least 48 hours in advance of conducting tests so that he may be present during the test.
3. Test completed sections of pipeline as soon as practical after installation. No more than 1,000-feet of pipeline or 10% of the total pipeline (whichever is greater) shall be installed without testing the completed portions.
4. All valves shall operate smooth on opening and closing. All boxes shall be centered and plumb and to the grades specified.
5. Joints that cannot be pressure tested, such as tie-in points, shall be visually inspected for leaks by the 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 City of Steamboat Springs Utility Department does not warrant the condition of any existing valves.
7. Looped pipelines shall be connected only at one end prior to completion and approval of the disinfection tests.

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 thereof shall be subjected to a hydrostatic pressure of 200 PSI for mains 12 inch diameter or less and 150 PSI for mains greater than 12-inch 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. Test shall be of at least a two hour duration.
 - 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).
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 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 Engineer.
5. Examination: Any exposed pipe, fittings, valves, hydrants and joints shall be examined carefully during the test. Any damage 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 Engineer.

C. Leakage Test: The 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 of time.
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:

$$L = \frac{(SD)\sqrt{P}}{133,200}$$

in which 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; and P is the average test pressure during leakage test, in pounds per square inch gage. These 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 are to be tapped to the main prior to the passing of all tests of that portion of the main which is to be tapped. 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 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.

- E. Conductivity:** The Engineer may require the Contractor to verify the electrical conductivity of new mains. The method of verification shall be at the Engineer's discretion.

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 pipe to existing 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 existing grade) of 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 Water Mains 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 upon 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 upon 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 upon 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. ABANDONMENTS:** Payment for abandonments is addressed in the Special Provision.
- H. 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.

- I. 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.
- J. REINFORCED CONCRETE ENCASUREMENT: 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.
- K. 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 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.
- L. SERVICE LINE TAPS: To the water main shall be measured and paid for at the Unit Price per Each per the Corporation Stop item or Corporation Stop With Tapping Saddle item based upon size.

4.2 GENERAL

The 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 or necessary for completion of the 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.

SECTION 40
WASTEWATER COLLECTION PIPING AND APPURTENANCES

1.0 GENERAL

1.1 DESCRIPTION

- A. Work included: Wastewater collection main lines, 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

1.2 QUALITY ASSURANCE

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

1.3 SUBMITTALS/SUBSTITUTIONS

- A. No substitutes will be considered for items listed by manufacturer's name and/or model number in this section unless the words "or equal" are included as a part of the description.
- B. Submittals are required for all proposed substitutions and all items not specifically listed by manufacturer's name and model number. All proposed substitutions must be approved by the City of Steamboat Springs Utility Department prior to installation.
- C. A certification is required for all buried bolts.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. All Material: Material shall be handled by lifting with hoists or skidding in order to avoid shock or damage. Slings, hooks, or pipe tongs shall be padded and used in such a manner as to prevent damage to the exterior surface or internal lining of the pipe. Under no circumstances shall any materials be dropped. Extra care shall be taken when the temperature approaches or is below freezing.
- B. Pipe may be stacked per the manufacturer's recommendations but shall not be stacked higher than 5-feet. Evenly support the barrel of all stored pipe. In distributing material at the work site do not interfere with access to private property, parking or traffic. Stockpile materials as close to the installation site as feasible. It is recommended that only as much pipe as is expected to be laid during the 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.
- 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 manufactured unless otherwise approved by the City.

1.5 JOB CONDITIONS

- A. Pipe laying during the period from November 1 through May 1 shall only occur with site specific approval from the City of Steamboat Springs Utility Department. Approval shall require full time observation by a professional engineer registered in the State of Colorado or a properly trained engineering technician who is under the direct supervision of a professional engineer. Request for such work between November 1 and May 1 must be made in writing to the City Utility Department, and such work shall proceed only with written approval from the City Utility Department.
- B. Excavation within a dedicated right of way shall not occur between Nov. 1 and May 1.
- 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 is to 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 10:00 am temperature is below 30-degrees Fahrenheit.
 - 3. A succession of three consecutive days with the 10:00 am temperature below 30-degrees Fahrenheit 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 with the 10:00 am temperature above 30-degrees Fahrenheit provided there is no frozen backfill or bedding material.
 - 4. The Contractor shall coordinate with the Engineer when temperatures approach the conditions for shut down of the pipe laying operations. The Contractor may propose and institute suitable protective measures to continue work if given written authorization by the City of Steamboat Springs Utility Department.

2.0 PRODUCTS

2.1 MATERIALS

- A. Polyvinyl Chloride (PVC) Pipe and Fittings:

- 1. Service lines 4-inch to 8-inch inside diameter: ASTM D 3034, SDR35

2. Main lines 4-inch to 15-inch inside diameter: ASTM D 3034, SDR35
3. 18-inch to 27-inch inside diameter: ASTM F 679, Wall thickness T-1
4. Joints: ASTM D 3212, rubber gasketed bell and spigot type with integral bell.

B. Ductile Iron Pipe (DIP):

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

C. Saddles: 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.

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 3000 PSI compressive strength, 6 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" 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 are to be plugged with an appropriate size wastewater plug. Pipes not making 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 are to be placed in the trench or final joints 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 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 come in contact with the pipe or the fittings.

Prior to placing the 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 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 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 City of Steamboat Springs Utility Department utilizing a saddle provided by the Contractor.

Provide all bends required for proper vertical or horizontal alignment.

The minimum slope for a sewer service line shall be 2%.

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 City of Steamboat Springs Utility Department.

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 to be backfilled. 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, 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 also 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 main line or wastewater service stub shall be installed until the main line has gained preliminary acceptance from the City of Steamboat Springs Utility Department and a building permit has been obtained.

3.3 CLEANOUT INSTALLATION

Cleanout structures shall be located and constructed as shown in the Drawings, or as directed by the 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 one hundred (100) feet in straight runs and for each aggregate horizontal change in direction exceeding forty five (45) degrees. Sizing locations and installation shall be in accordance with the International Plumbing Code (IPC).

Final grade of the cleanout cover shall be as specified for manhole lids.

3.4 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 Engineer. 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 48 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 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 1/2 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 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 Engineer prior to proceeding. All lines shall be pressurized in the Engineer’s presence and all pressurized lines shall have the pressure released in the 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 least.

Deflection testing may be required if the Engineer suspects excessive pipe deflection or if the Contractor's pipe bedding procedures, in particular tamping and compaction of the bedding, are questionable in the opinion of the Engineer.

The deflection test will be performed by the Contractor in the presence of the 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 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.

4.0 MEASUREMENT AND PAYMENT

4.1 WASTEWATER MAINS

- A. 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 depth of main 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.
- B. REINFORCED CONCRETE ENCASUREMENT:** Shall be measured and paid for at the Unit Price per Linear Foot per the Reinforced Concrete Encasement item per pipe size.
- C. 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.
- D. CLEANOUTS:** Shall be measured and paid for at the Unit Price per Each 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 the 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.

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/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

Pre-cast 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. 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 unless called out otherwise on the plans or in the Special Provisions. 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 be 24-inch diameter. Minimum slab thickness is 6-inches for risers up to 48-inch diameter, and 8-inches for larger riser diameters. 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: Pre-cast concrete. Per ASTM C 478.

5. Joint and Joint Sealant:

- a.** Between Manhole Sections to Include Pre-cast Base, Riser, Conical Sections, 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 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.

- 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:

- 1) Pre-cast Base: Flexible rubber boot in a cored hole per ASTM C 923. Connectors shall be KOR-N-Seal, A-Lok or approved equal.
- 2) 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.

- 1) 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.

- e.** Between Cast Iron Frame and Concrete Surfaces.

- 1) 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.

- 6.** Steps: Per ASTM C 478 modified as follows. Type PS-2PF or PS-2PFS 1/2 inch diameter Grade 60 steel reinforcing rod completely encapsulated in Copolymer Polypropylene as manufactured by M.A. Industries, Inc. or approved equal. 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 six 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. MH-400-24 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.

Lids shall be lettered "SEWER" or "WATER" depending upon application.

8. Adjusting Rings (Extension Rings): Gray cast iron, ASTM A 48, Class 25, Neenah R-1979 or equal to match lid opening.
9. Exterior coating: THOROSEAL Foundation Coating or approved equal shall be applied the full manhole height prior to backfill. Chips or scrapes shall be repaired prior to applying THOROSEAL.
10. Grout: Non-shrink, non-metallic, either cement or epoxy based as recommended by the manufacturer for the application.
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).

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 City Utility Department.

B. Bases:

1. Pre-cast Bases: Install pre-cast bases unless specific connection requirements dictate a cast-in-place structure authorized by the City Utility Department.
2. Cast-in-Place Bases: The use of cast-in-place bases must be authorized by the City Utility Department prior to installation. Cast-in-place bases over existing mains shall be poured over the existing pipe, and the top of existing pipe shall be removed to form the invert trough.
3. Cure cast-in-place base for a minimum of 24 hours at no less than 40 degrees Fahrenheit prior to placement of pre-cast rings. Provide insulation for curing whenever the temperature is less than 45 degrees.
4. Precast inverts are not allowed without prior City Utility Department approval.

- C. Inverts:** Invert channels are 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 a radius as the size of manhole 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 City Utility Department 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:** Stubouts 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.
- 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".
- 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 will be permitted. A two-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 the Drawings, or stated in the Special Provisions or Special Conditions. If the final grade is not indicated, submit a clarification request to the 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 2 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 the manufacturer's 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 water tight 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 Engineer prior to installing manhole covers

partially within a paved area and prior to constructing the pavement transition to clarify exactly how to proceed.

- K. Drop Manholes:** 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 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 (i.e. jet truck) along the bench and to back directly up to each manhole. The access shall provide an access point and an exit point at each end of the sewer main or a turn around 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, etc. If swales or ditches exist, they shall be culverted to allow vehicles to cross. The access shall be located in a legally documented access or utility easement.

- M. 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.

In the event that an abnormally dry winter occurs resulting in low spring run-off and a low groundwater table, the Owner's Engineer at his sole option may elect to re-inspect the manholes for leakage the next following spring. The Owner will notify the Contractor of his decision to re-inspect the 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 MEASUREMENT AND PAYMENT

4.1 MANHOLES

- A. MANHOLES:** Will be measured and paid for at the Unit Price per Each under the item Manholes 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.
- C. DROP MANHOLES:** Will be measured and paid for at the Lump Sum Price under the Drop Manhole item per specific manhole.

4.2 GENERAL

The prices for the 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, stubouts, dewatering, flushing, testing and inspection, and the cost of all materials, equipment, tools and labor incidental or necessary for completion of the 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.

**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

Five different crossing conditions have been identified for separate consideration. Each of the conditions is visually represented within the standard details (sheets 12 & 13) 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. Engineers are encouraged to analyze pipe type 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

Condition #1:

When a new water line crosses less than 18-inches above a new sewer line, or when a new sewer line crosses less than 18-inches above a new water line, the following shall be done.

1. A 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 that 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 $\frac{3}{4}$ " minus gravel.
4. Minimum vertical separation between the bottom of the higher pipe and the top of the lower pipe shall be six inches.

Condition #2:

When a new water line crosses less than 18-inches above an existing sewer line the following shall be done:

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 one foot into each side of the bank of the water line trench. Encasement shall extend from the springline of the sewer line to a point six 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 six inches around the pipe across the full width of the trench plus extending one foot into each bank on both sides of the trench and/or one 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 $\frac{3}{4}$ " 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 six inches.

Condition #3:

When a new water line crosses below an existing sewer line the following shall be done.

1. A full length of water pipe shall be centered under the sewer line.

2. The sewer shall be protected from any vertical or horizontal deflection during the excavation. Upon completion of the installation of the water line the sewer shall be concrete encased with flow fill six inches around the pipe for the full width plus one foot into each side of the bank of the water line trench. The encasement shall be allowed to reach adequate strength based on best industry standards and practices prior to completion of the backfill. If the sewer is damaged or allowed to deflect either horizontally or vertically, a full section of PVC sewer pipe shall be used to replace the damaged or deflected sewer. Such section of pipe shall be centered over the water line and shall be fully concrete encased with flow fill to one foot beyond the replaced pipe sleeves or couplings or joints. All concrete encasement shall be placed on fully compacted materials. Concrete shall be allowed to fully cure prior to backfill.
3. Backfill between the water line and the concrete encasement shall be fully compacted imported ¾" minus gravel.
4. Minimum vertical separation between the bottom of the concrete encasement and the top of the water line shall be six inches.

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 six inches around the pipe and extending to one foot beyond each pipe end joint. All encasement shall be placed on fully compacted material. Such encasement shall be allowed to fully cure using best industry standards and practices prior to backfill.
3. Backfill between the two pipes shall be fully compacted imported ¾" minus gravel or flow fill.
4. Minimum vertical separation between the bottom of the water line and the top of the sewer line encasement shall be six inches.

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 ten feet of the water line shall be flow fill or lean concrete encased for one foot 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" each side from the springline of the water line to a point six inches above the top of the water line.

3. Backfill between the two pipes shall be fully compacted imported ¾" 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 six inches.

3.3 LOCATIONS OF LINES AND SERVICES

The Owner of the distribution or collection system will attempt to provide, upon 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

When excavating in the area of existing water and sewer mains or services, the Contractor shall notify the system Owner and request field locations. When excavating for crossings of existing lines, the Contractor shall use extreme caution to avoid damaging them. If the Contractor accidentally damages existing lines he shall exercise the following repair procedures in addition to the standard crossing requirements specified in Section 3.2.

- A. Damage to Existing Sanitary Sewer Main or Service: 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 Engineer and the operator of the sanitary sewer system prior to their use. All repairs are to be inspected and approved by the City Utility Department prior to backfill.
- B. Damage to Existing Water Main or Service: 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. New pipe for repair shall be of similar material to the existing pipe or class 52 D.I.P. for mains. 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 Engineer and the operator of the water system prior to their use. All repairs are to be inspected and approved by the City Utility Department 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

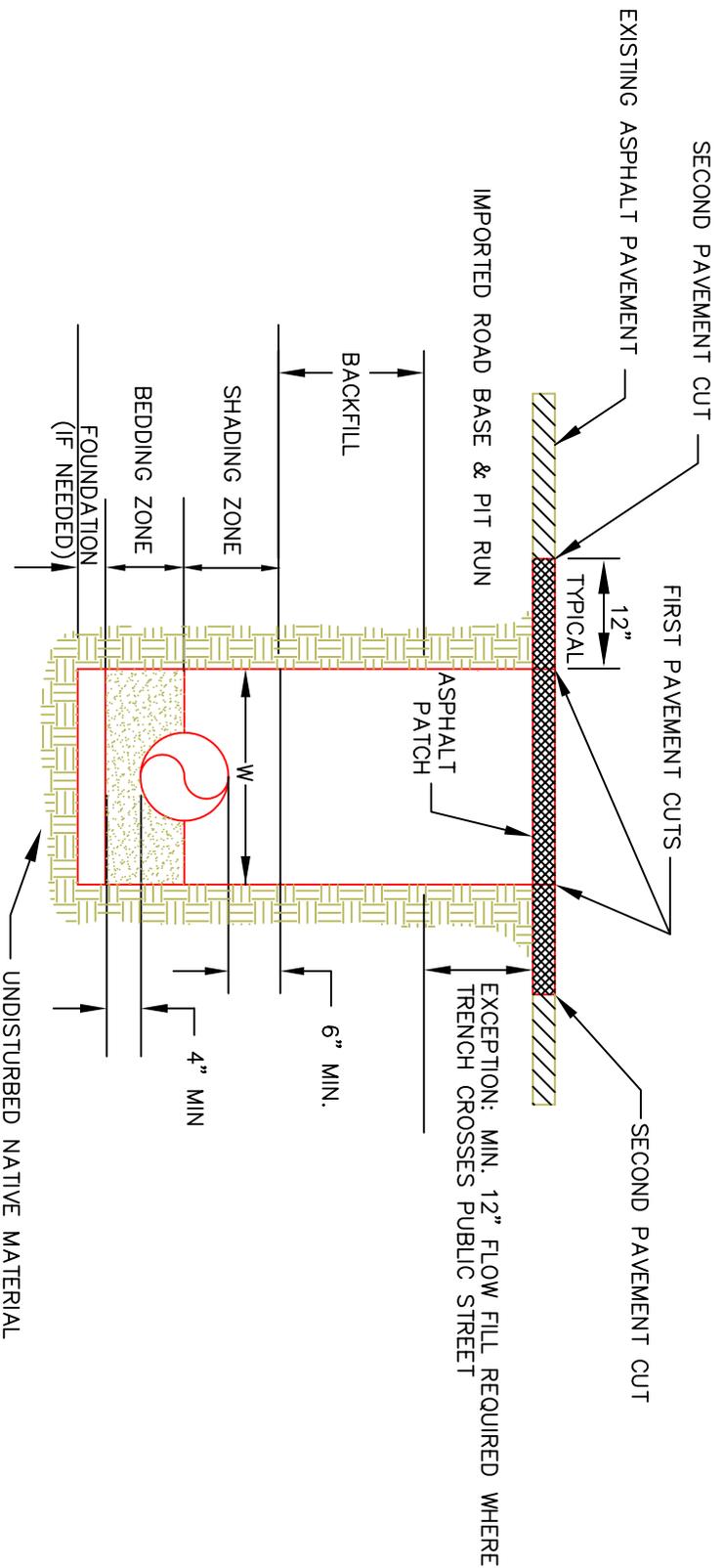
In general, no separate payment will be made for crossing water service lines located by the system Owner. If a water service line is not located by the system Owner or is incorrectly located, and the Contractor subsequently damages the service line, payment for repair shall be made by Change Order.

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 City Utility Department.

If in the Contractor's opinion damage to a line is a result of conditions beyond his control, the Contractor shall within 5 days of the event present a written request to the Engineer for reimbursement of costs incurred.



NOTES:

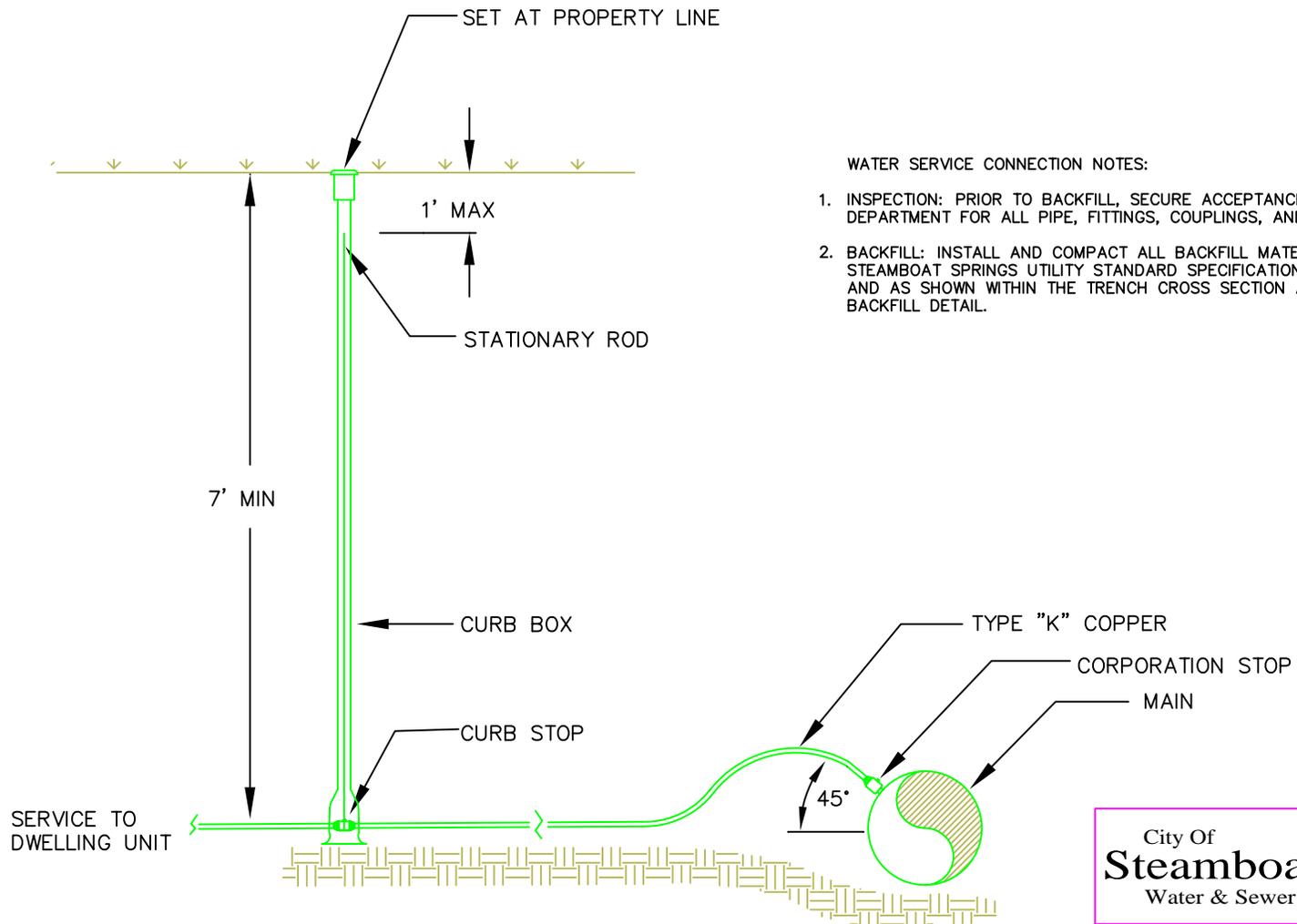
A GUIDE FOR DESIRABLE TRENCH WIDTH (W) AT THE TOP OF THE PIPE SHALL BE THE NOMINAL DIAMETER OF THE PIPE PLUS 12-INCHES ON EACH SIDE OF THE PIPE.

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.

<p>City Of Steamboat Springs Water & Sewer</p> 	
<p>PO BOX 775088 STEAMBOAT SPRINGS, CO (970) 879-2060 FAX (970) 879-8851</p>	
<p>STANDARD DETAILS</p>	
Drawn by: JS	Date: 3/01/10
Scale: N.T.S.	
Revision description:	
Sheet number	1 of 17



WATER SERVICE CONNECTION 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.

WATER SERVICE LINE DETAIL

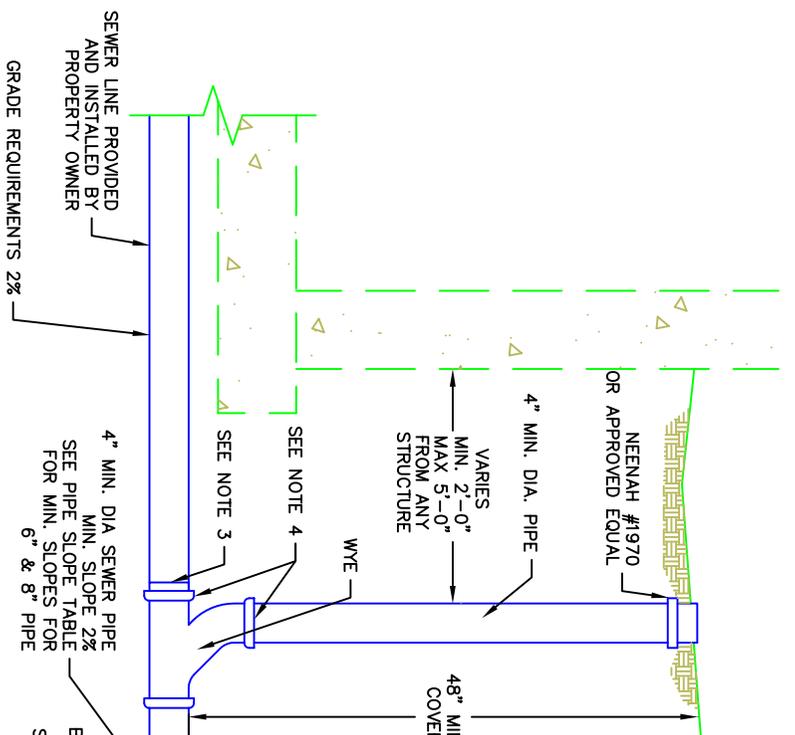
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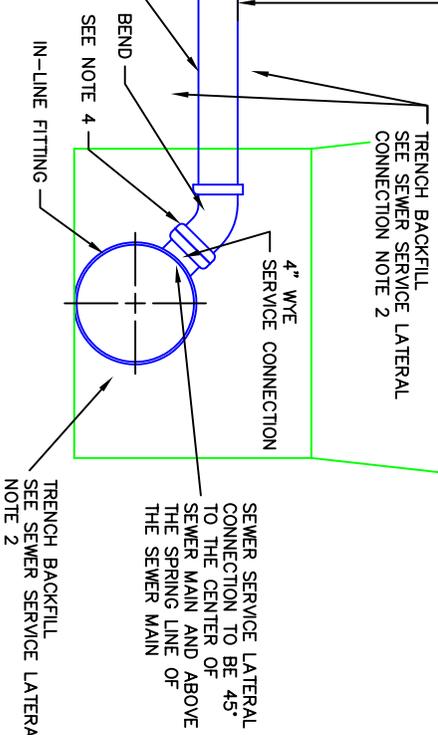
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STANDARD DETAILS

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Scale: N.T.S.	Date: 2/24/00
Revision description:	



- 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

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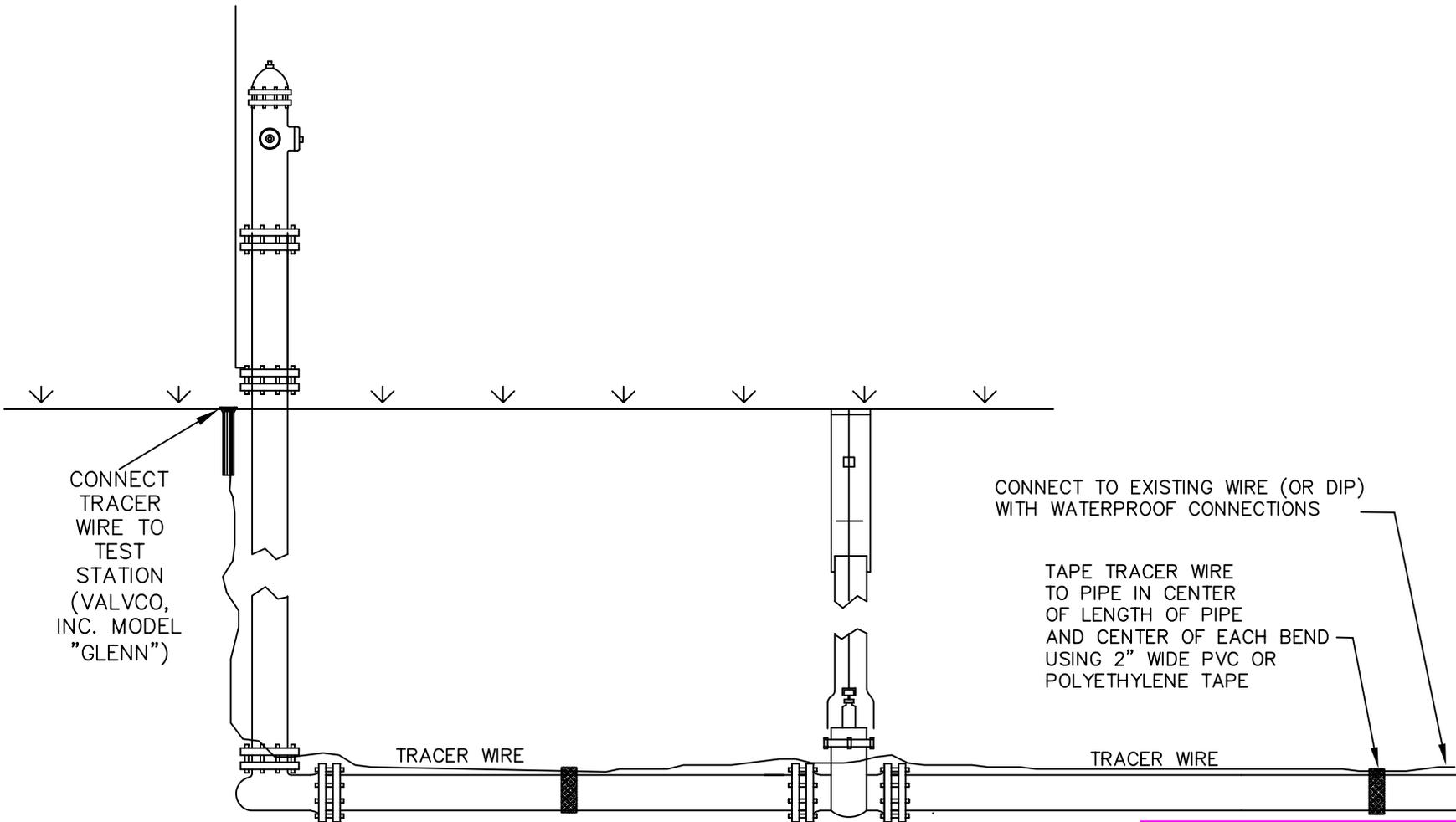
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Revision description:

Sheet number 3 of 17



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 AND CENTER OF EACH BEND USING 2" WIDE PVC OR POLYETHYLENE TAPE

TRACER WIRE

TRACER WIRE

TRACER WIRE
NTS

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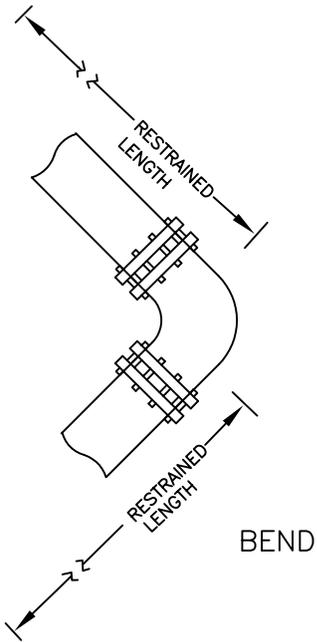
STANDARD DETAILS

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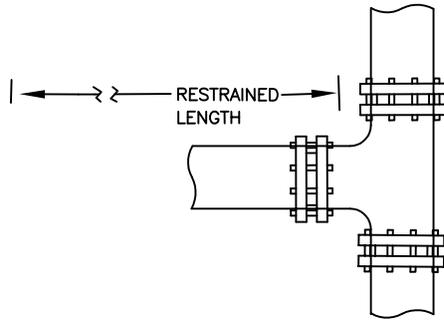
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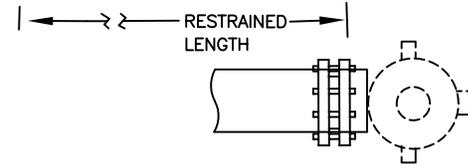
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BEND



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	18'	18'	18'	21'	25'
22 1/2° BEND	18'	18'	18'	18'	18'
11 1/4° BEND	18'	18'	18'	18'	18'

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

RESTRAINT DETAIL

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STANDARD DETAILS

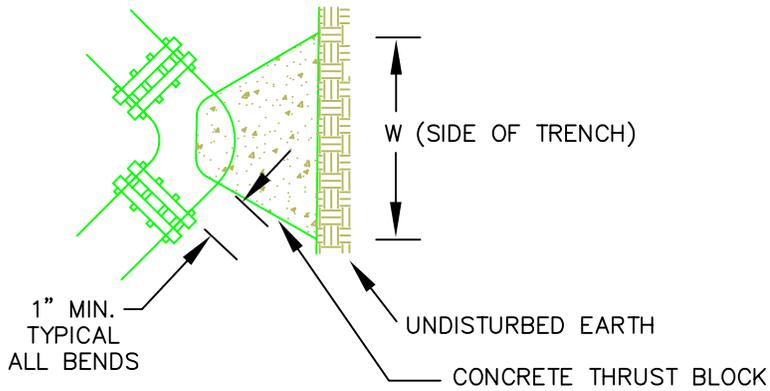
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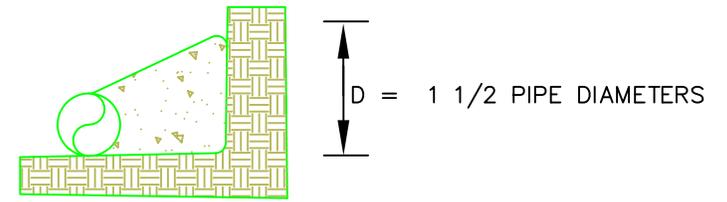
Date: 2/24/00

Revision description:

HORIZONTAL BENDS



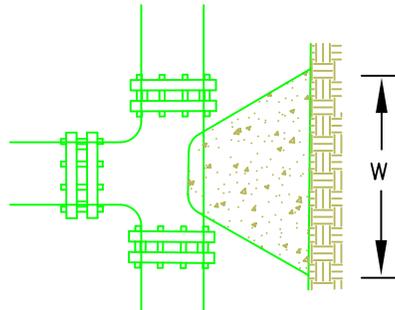
CROSS SECTION



NOTES:

1. THRUST BLOCKS ARE REQUIRED IN ADDITION TO JOINT RESTRAINTS.
2. ALL THRUST BLOCKS TO BE SUITABLY FORMED. EARTH EXCAVATED FORMS WILL NOT BE ACCEPTED.
3. WRAP FITTINGS WITH POLYETHYLENE PRIOR TO POURING 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.

TEE



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

MAIN SIZE (INCHES)

FITTING TYPE	<6"	8"	10"	12"
45° OR LESS BEND	3	3	3	5
90° BEND	3	4	6	9
TEE OR PLUG	3	3	4	6

THRUST BLOCK DETAIL

NTS

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STANDARD DETAILS

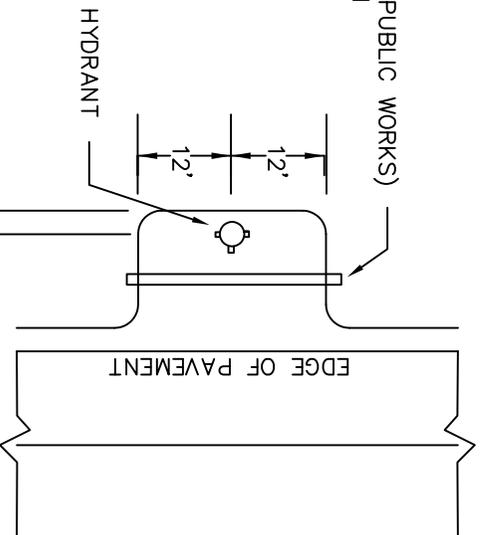
Drawn by: GLB

Scale: N.T.S.

Date: 2/15/06

Revision description:

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



VARIABLE - TO BE
DETERMINED BY THE CITY
UTILITY DEPARTMENT
PRIOR TO CONSTRUCTION

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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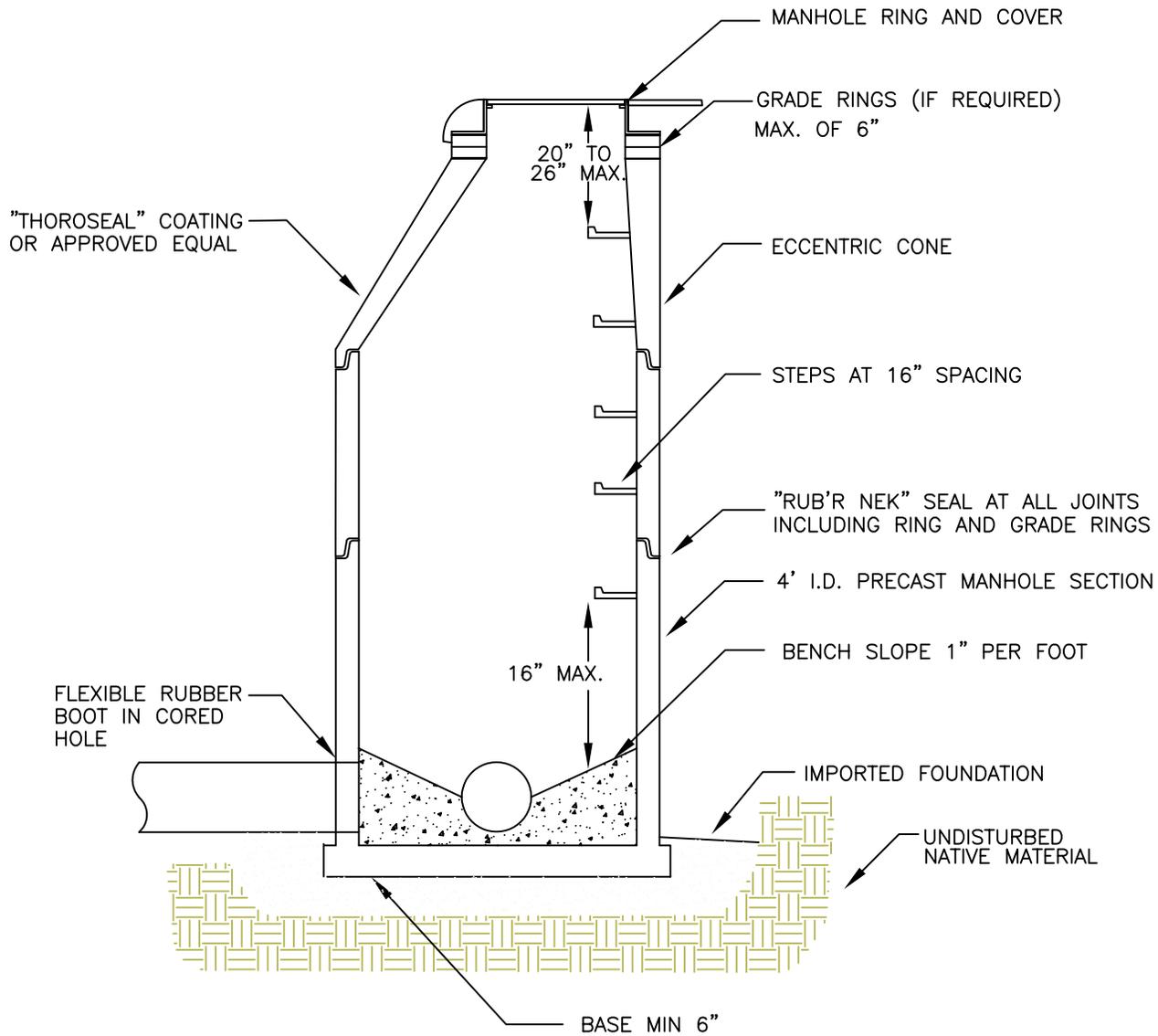
STANDARD DETAILS

Drawn by: GLB

Scale: N.T.S. Date: 2/7/02

Revision description:

Sheet number 8 of 17



STANDARD MANHOLE CROSS SECTION

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STANDARD DETAILS

Drawn by: GLB

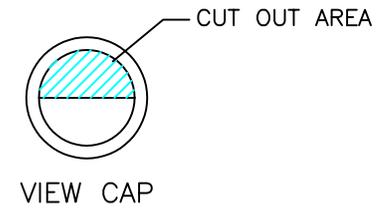
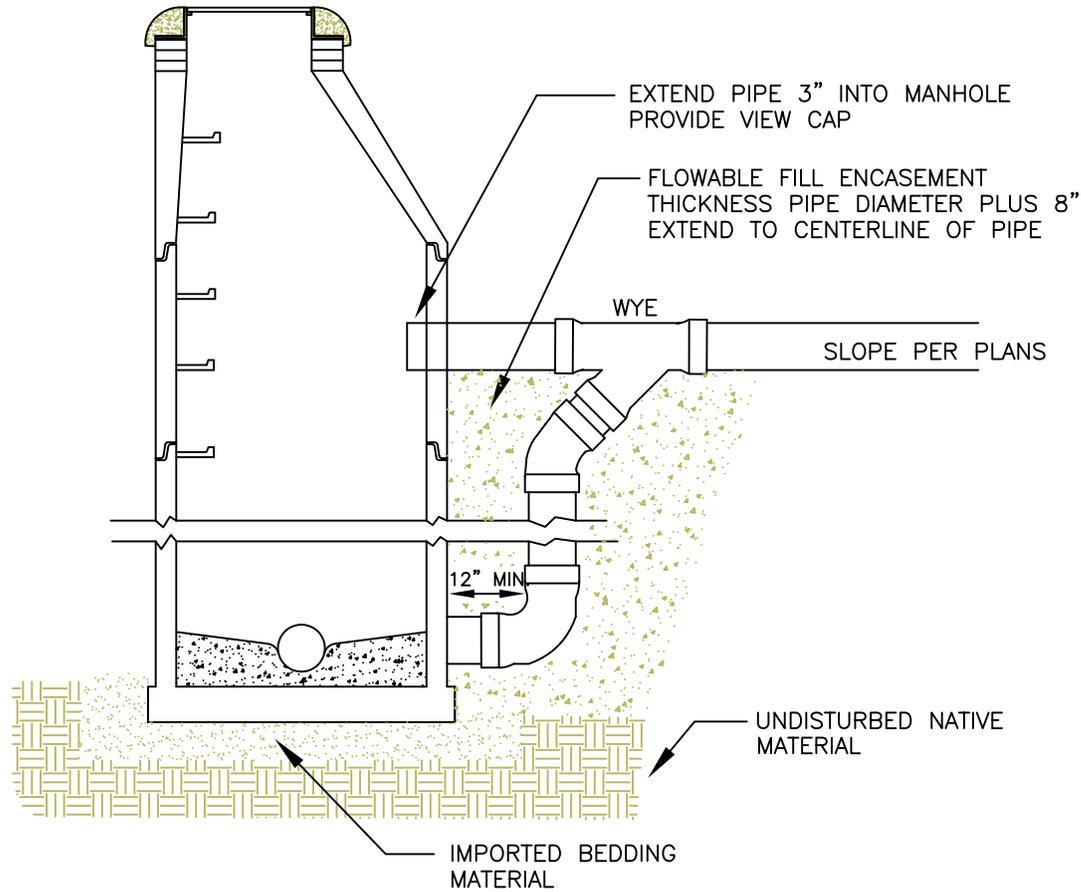
Scale: N.T.S.

Date: 2/7/02

Revision description:

Sheet number 9 of 17

SEE STANDARD MANHOLE
DETAIL FOR ADDITIONAL
DETAILS



DROP MANHOLE CROSS SECTION

NTS

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STANDARD DETAILS

Drawn by: GLB

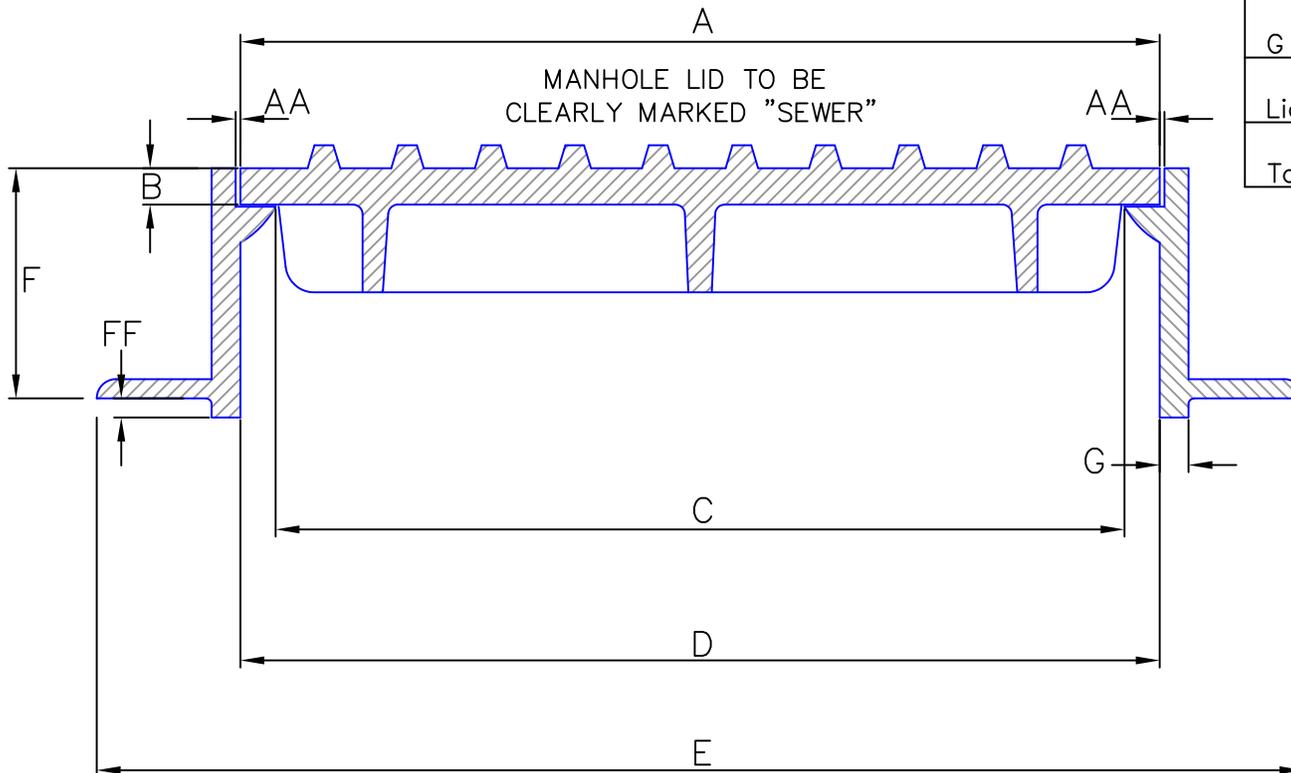
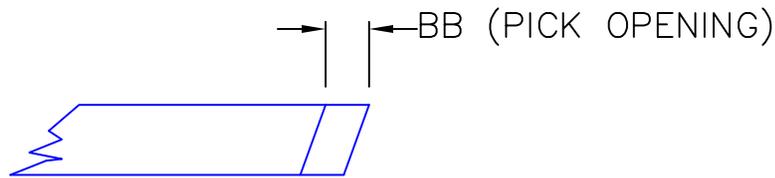
Scale: N.T.S.

Date: 2/24/00

Revision description:

Sheet number 10 of 17

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

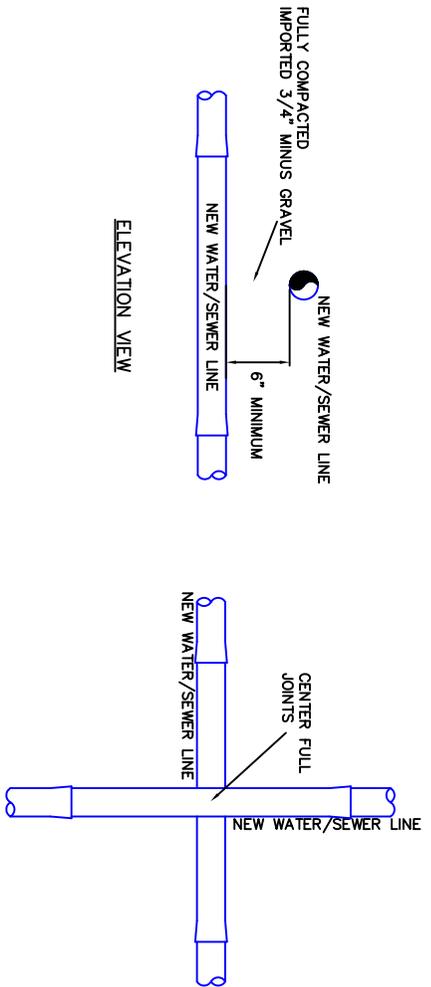
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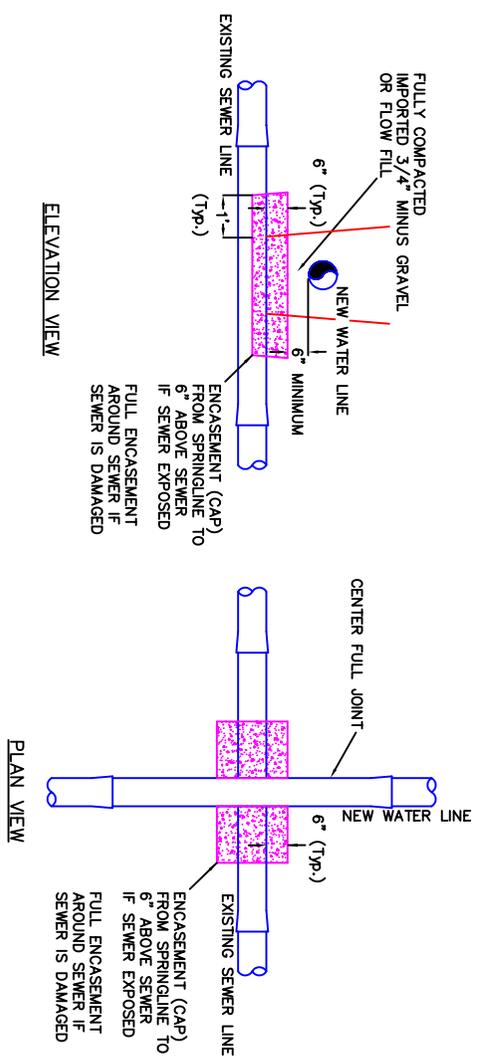
Date: 4/10/03

Revision description:

NOTE:
CROSSING CONDITIONS APPLY TO ALL MAIN AND SERVICE LINES



CONDITION #1: NEW WATER LINE LESS THAN 18" ABOVE NEW SEWER LINE OR NEW SEWER LINE LESS THAN 18" ABOVE NEW WATER LINE

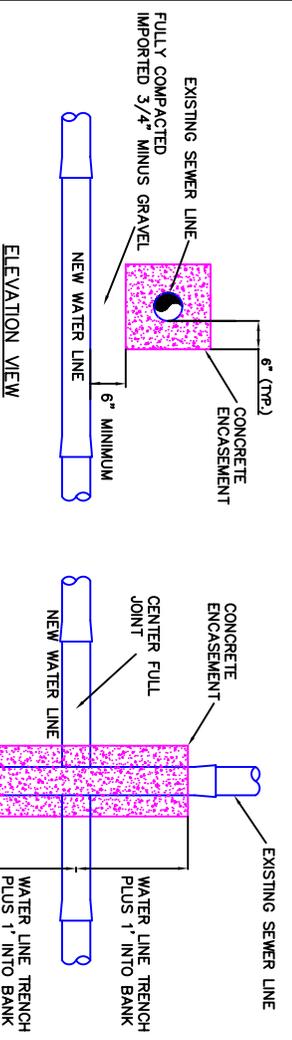


CONDITION #2: NEW WATER LINE LESS THAN 18" ABOVE EXISTING SEWER LINE

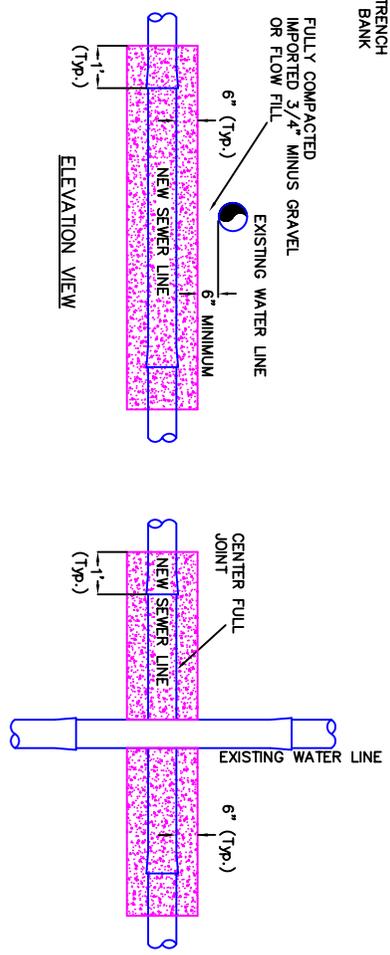
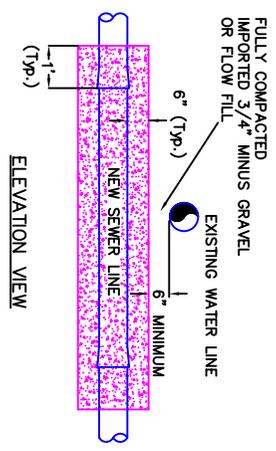
WATER AND SEWER CROSSING CONDITIONS (SHEET 1 OF 2)

NTS

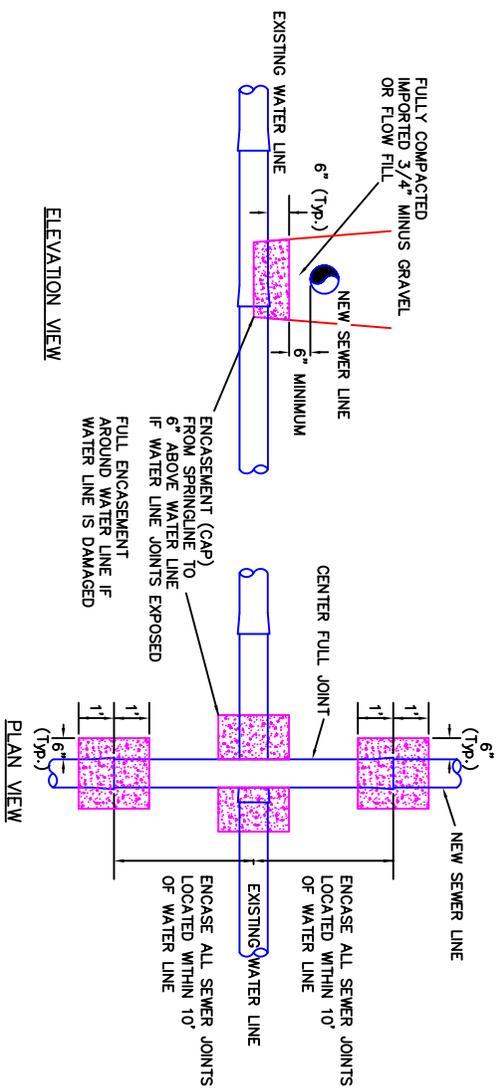
<p>City Of Steamboat Springs Water & Sewer</p> 	
<p>PO BOX 775088 STEAMBOAT SPRINGS, CO (970) 879-2060 FAX (970) 879-8851</p>	
<p>STANDARD DETAILS</p>	
<p>Drawn by: JS</p>	
<p>Scale: N.T.S.</p>	<p>Date: 3/16/10</p>
<p>Revision description:</p>	
<p>Sheet number 12 of 17</p>	



CONDITION #3: NEW WATER LINE BELOW EXISTING SEWER LINE



CONDITION #4: NEW SEWER LINE LESS THAN 18" BELOW EXISTING WATER LINE



CONDITION #5: NEW SEWER LINE ABOVE EXISTING WATER LINE

NOTE:
CROSSING CONDITIONS APPLY TO ALL MAIN AND SERVICE LINES

WATER AND SEWER CROSSING CONDITIONS (SHEET 2 OF 2)

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STANDARD DETAILS

Drawn by: JS

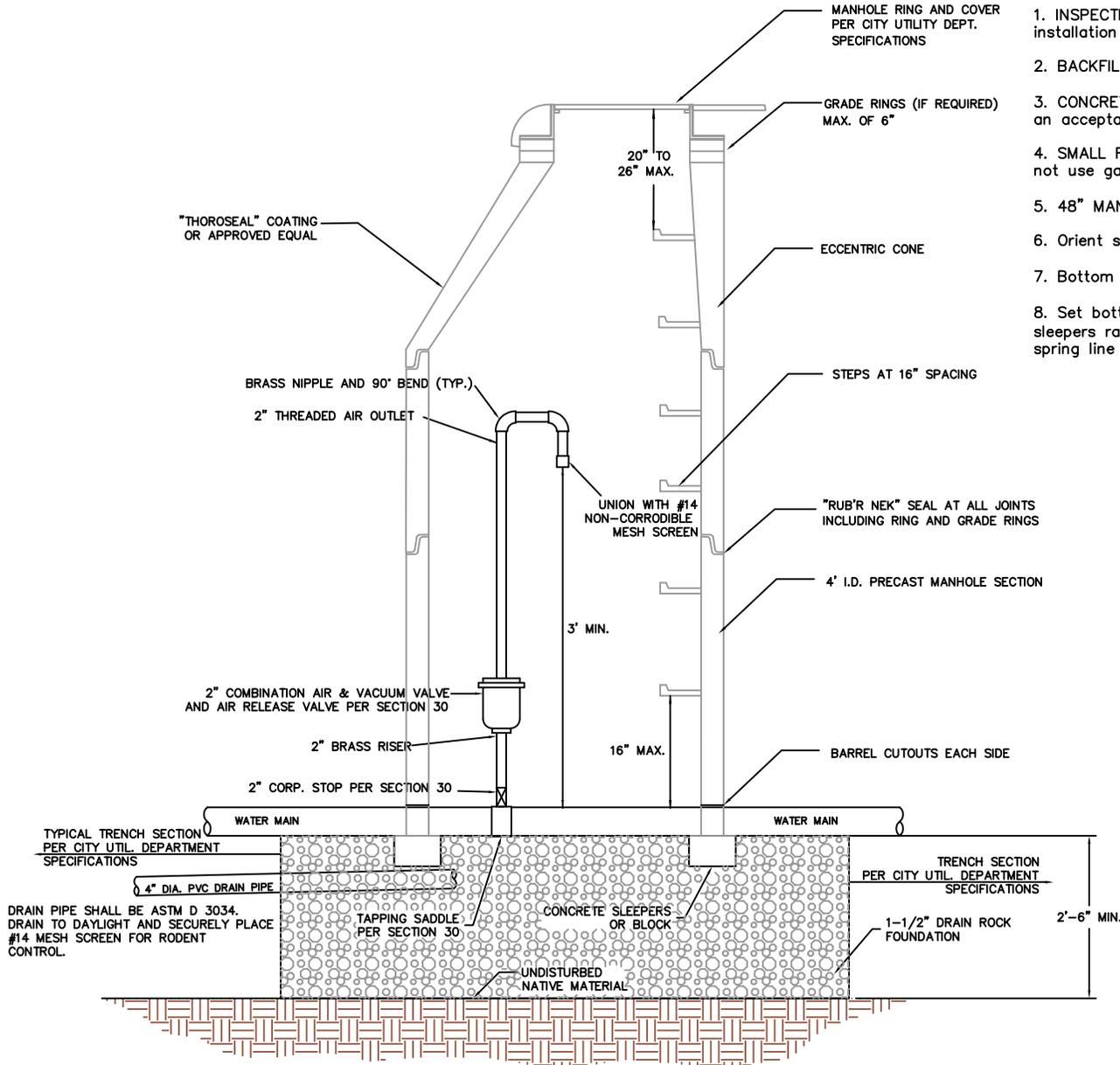
Scale: N.T.S. Date: 3/16/10

Revision description:

Sheet number 13 of 17

AIR RELEASE ASSEMBLY

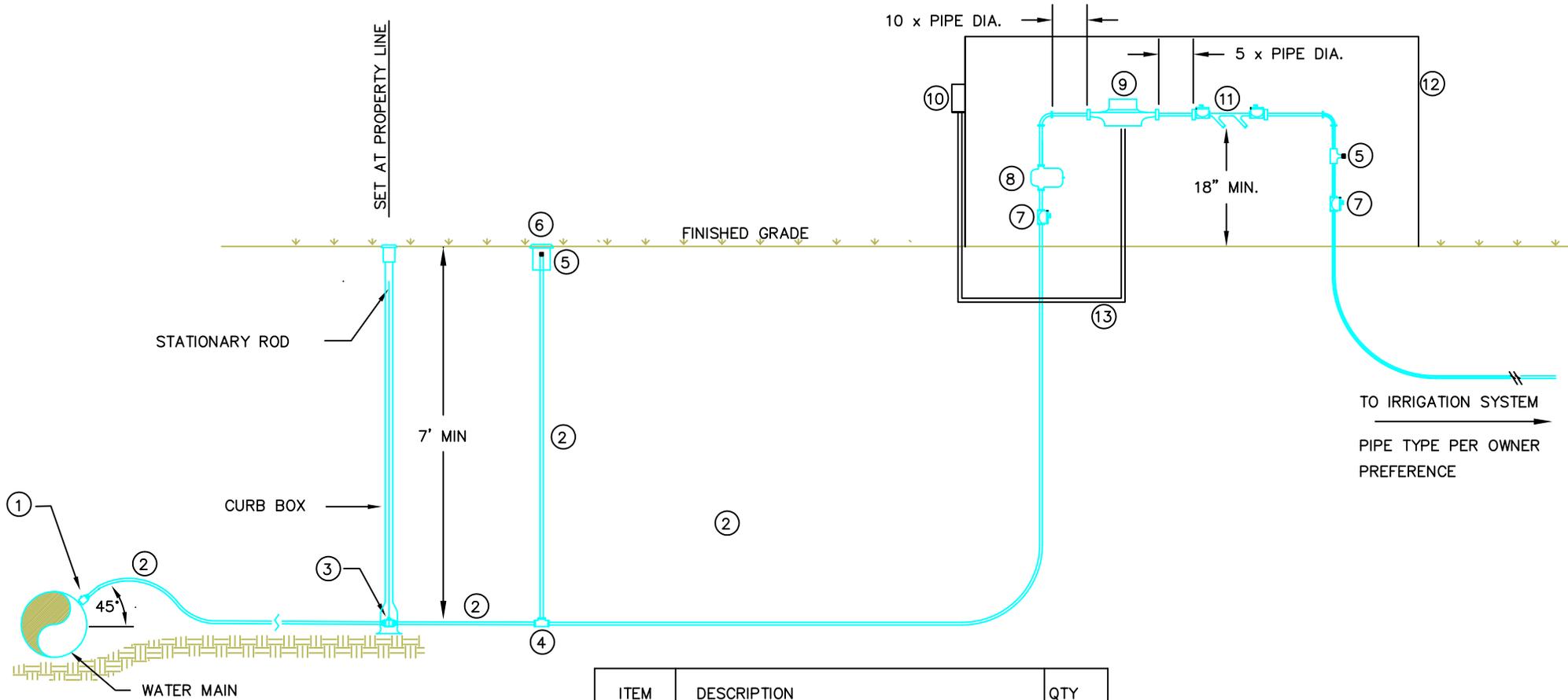
1. INSPECTION: Prior to backfilling around the assembly, secure inspection of installation by ENGINEER.
2. BACKFILL: Install and compact all backfill material per Section 24.
3. CONCRETE: 4000 PSI strength concrete. Apply a sealing/curing compound or use an acceptable alternate curing compound.
4. SMALL 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

<p style="text-align: center;">City Of Steamboat Springs Water & Sewer</p>	
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<p>STANDARD DETAILS</p>	
<p>Drawn by: GLB</p>	
<p>Scale: N.T.S.</p>	<p>Date: 2/7/01</p>
<p>Revision description:</p>	
<p>Sheet number 14 of 17</p>	



IRRIGATION SERVICE DETAIL

NTS

ITEM	DESCRIPTION	QTY
2	TYPE "K" COPPER	-
3	CURB STOP	1
4	TEE	2
5	AIR CHUCK	2
6	VALVE BOX TOP	1
7	BALL VALVE	2
8	PRESSURE REDUCING VALVE (IF REQUIRED)	1
9	METER (SEE NOTE 1)	1
10	REMOTE READ OUT (SEE NOTE 2)	1
11	RPP BACKFLOW PREVENTER (SEE NOTE 3)	1
12	VAULT (PRE-APPROVED BY CITY)	1
13	1/2" OR LARGER PVC CONDUIT	-

GENERAL NOTES:

1. PLANT INVESTMENT FEE REQUIRED. METER ISSUED BY THE CITY OF STEAMBOAT SPRINGS UTILITY DEPARTMENT. TYPE AND SIZE TO BE APPROVED BY CITY UTILITY DEPARTMENT.
2. OTHER REMOTE READ OUT LOCATIONS MUST BE PRE-APPROVED BY THE CITY OF STEAMBOAT SPRINGS UTILITY DEPARTMENT.
3. RPP BACKFLOW PREVENTER TO BE APPROVED PER THE MANUAL OF CROSS CONNECTION CONTROL NINTH EDITION, AS PUBLISHED BY THE FOUNDATION FOR CROSS-CONNECTION CONTROL AND HYDRAULIC RESEARCH.

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STANDARD DETAILS

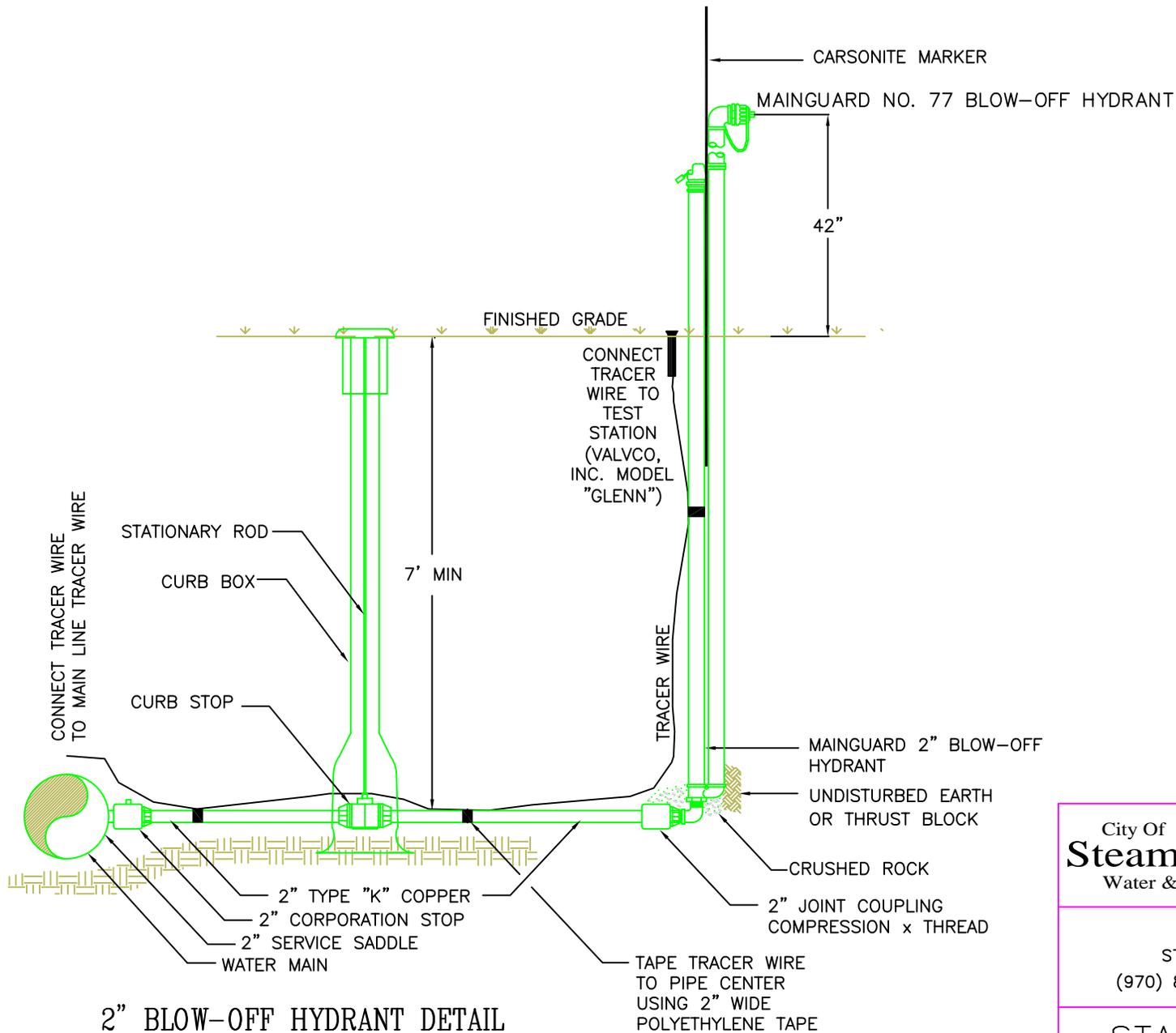
Drawn by: GLB

Scale: N.T.S.

Date: 4/23/02

Revision description:

Sheet number 15 of 17



2" BLOW-OFF HYDRANT DETAIL

NTS

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.

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<p>STANDARD DETAILS</p>	
<p>Drawn by: GLB</p>	
<p>Scale: N.T.S.</p>	<p>Date: 4/23/02</p>
<p>Revision description:</p>	
<p>Sheet number 16 of 17</p>	

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