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Appendix A

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Table 6.07-1 Hydrostatic Test Requirements for 6” Ductile Iron/PVC Pipe

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Table 7.03-3 Wastewater Quantity Guidelines

Appendix B

Excavation/Construction in Public-Right-of-Way Permit



SECTION 1 GENERAL CONDITIONS

1.01 INTENT

These specifications are intended to set the basis for both design and construction of water and sewer systems for the City of Evans. Sections 1, 2, 3, and 7 communicate the basis for design of water and sewer systems, while Sections 4, 5, 6, and 8 convey the acceptable methods and materials for construction of water and sewer systems. The details included in Section 9 should be included in design whenever possible. These details should also be referred to for specific information during construction.

1.02 AUTHORITY

These standards are promulgated by the City Council of the City of Evans, Colorado, in accordance with the authority contained in the City Evans Home Rule Charter and Section 13.04.020 of the City of Evans Municipal Code.

Interpretation, enforcement, and revision of these standards have been delegated to the Director of Public Works or authorized designee.

No action, direct or indirect, of or by any person in making any connection, disconnection, repair, or otherwise doing work with respect to any water or sewer facility served by the City of Evans in violation of these standards shall continue after discovery of such violation.

These standards are composed of written standards of engineering practice, materials specifications, and standard drawings. Interpretation of each section or of any discrepancies between sections shall be made by the Director of Public Works.

1.03 EFFECTIVENESS

These standards supersede all former engineering standards for water and sewer utilities which are or may be in conflict with these standards.

1.04 AMENDMENT - NOTICE

These standards may be revised, amended, or added to at any time, and such revision, additions, or amendments shall be binding and of full force and effect as of the date of their adoption. The City is not responsible for the individual notification of amendment changes. The use of current standards is mandatory; therefore, the user is responsible for obtaining and complying with the most recent revised or amended specifications.

1.05 DEFINITIONS

Wherever the following words or phrases appear in these specifications they shall have the following meanings.

- A. ABILITY - that which a person can do on the basis of present development and training.
- B. ACCEPTANCE TESTING - shall mean test(s) that will be performed by the Contractor according to City's specifications or its authorized designee. Acceptance tests shall include but not be limited to the following: CONCRETE - slump, compressive strength, air content, and aggregate sieve analysis tests, GEOTECH -moisture density relationship and density tests, AGGREGATE BASE COURSE –moisture density relationship and density tests, HOT BITUMINOUS PAVEMENT tests.



1.05 DEFINITIONS (continued)

- C. BASE COURSE - The layer or layers of specified or selected material placed on a sub-base or a subgrade to support a surface course.
- D. CDOT Standard Specifications - Colorado Department of Transportation, "Standard Specifications for Road and Bridge Construction" latest edition.
- E. CITY - The City of Evans.
- F. COMPETENT - A person who has the natural powers, physical or mental, to meet the demands of a situation or work; the word is widely used to describe the ability to meet all requirements, natural, legal, or other of a given task.
- G. CONSTRUCTION DRAWINGS - Detailed and working drawings including plan, profile, and detail sheets of proposed utility improvements approved by the City.
- H. CONSULTANT - The partnership, corporation, or individual who is a Registered Professional Engineer in the State of Colorado hired by the Owner and is empowered to act as his agent for the project.
- I. CONTRACT DOCUMENTS - The Contract Documents include these Specifications, City approved Soils and Pavement Report and Drawings.
- J. CONTRACTOR - The corporation, association, partnership, or individual who has entered into an Agreement with the Owner to perform the work, and who is licensed and bonded in the City of Evans in accordance with the requirements of the City Code, for public right-of-way work.
- K. CROSS CONNECTION - Any physical arrangement whereby a public water supply is connected, directly or indirectly, with any nonpotable or unapproved water supply system, sewer drain, conduit, pool storage reservoir, plumbing fixture, or other device which contains or may contain any contaminated water, liquid, or other waste of unknown or unsafe quality that could impart a contaminant to the public water supply as a result of back flow.
- L. DAYS - Intended as calendar days, not normal working days, unless stipulated as working days.
- M. DESIGN ENGINEER - The partnership, corporation, or individual who is a Registered Professional Engineer, according to Colorado statutes, and who is hired by the Owner, and is empowered to act as his agent for the project.
- N. DESIGN SPEED - A speed established for design and correlation of the physical features of a street that influence vehicle operation; the maximum safe speed maintainable on a specified section of street when conditions permit design features to govern.
- O. DESIGNEE - An authorized designee of Director of Public Works for the City of Evans, pertaining to interpretation, enforcement, and revision of departmental standards.
- P. DEVELOPER - The owner, corporation, association, partnership, or individual who has entered into an agreement with the City and has entered into an agreement with the Contractor to perform the work.
- Q. DEVELOPER'S AGREEMENT - shall mean an agreement entered into between the City and Developer, which guarantees construction of public improvements by developer to be dedicated to the City.
- R. DIVISION - When referred to in the CDOT Standard Specifications shall mean the City of Evans Public Works Department.

1.05 DEFINITIONS (continued)

- S. DRIVEWAY APPROACH - That portion of concrete extending from the street gutter lip to the property line for the full width of the access from the public right-of-way to private property.
- T. ENGINEER - A term used to describe a qualified individual who is authorized to make a decision in situations where a decision or action may be required by the Utility, which is the Public Works Department of the City of Evans. The Engineer shall have the authority on behalf of the City to ascertain that all design and construction is equal to or exceeds the minimum requirements set forth in these criteria and standards.
- U. EYEBROW - A bulb or semi-circular extension of a curb on one side of a street or at an intersection to provide more frontages for adding more lots.
- V. LETTER OF FINAL ACCEPTANCE - At the expiration date of the warranty period and after all deficiencies are corrected to the satisfaction of the Director of Public Works a Letter of Final Acceptance will be issued.
- W. LETTER OF INITIAL ACCEPTANCE - At the end of the project and after all deficiencies are corrected to the satisfaction of the Director of Public Works a Letter of Initial Acceptance will be issued and shall constitute the initiation of the warranty period.
- X. MAY - A permissive condition. No requirement for design or application is intended.
- Y. MEDIAN RADII - The minimum radius for curbing when used for street medians; measured to flow line.
- Z. NORMAL WORKING DAYS - Monday through Friday. Saturdays, Sundays, and legal holidays shall not be considered normal working days.
- AA. OR AN APPROVED EQUAL - Approved as acceptable by the City.
- BB. OWNER - The developer, corporation, association, partnership, or individual who has title to real property.
- CC. PLANS - Detailed and working drawings including plan, profile, and detail sheets of proposed utility improvements, approved by the Engineer.
- DD. PROJECT AS BUILT RECORD DRAWINGS - Detailed drawings which have been prepared and sealed by the Design Engineer, upon completion and at the time of the certificate of completion, and show actual construction and contain field dimensions, elevations, details, changes made to the construction drawings by modification, details which were not included on the construction drawings, and horizontal and vertical locations of underground utilities which have been impacted by the utility installation.
- EE. PROJECT DESIGNEE - Shall mean an authorized designee of the City Engineer assigned to complete project observation and review for contract performances, standards, and contract compliance.
- FF. PROVIDE - Furnish and install complete in place.
- GG. REMOVE - Remove and dispose of legally.
- HH. ROAD - As used in this specification shall include the pavement section, right-of-way, sidewalks, driveways, bikeways, alleys, and alley approaches.

1.05 DEFINITIONS (continued)

- II. SHALL - A mandatory condition. Where certain requirements in the design of application are described with the “shall” stipulation, it is mandatory that these requirements be met.
- JJ. SHOULD - An advisory condition. Where the word “should” is used, it is considered to be advisable usage, but not mandatory. Deviations may be allowed when reasons are given which show that the intent of the standard is met.
- KK. STANDARD STREET SPECIFICATIONS - The current City of Evans Design Criteria and Construction Specifications for Streets.
- LL. STOPPING SIGHT DISTANCE - Shall mean that distance measured from the drivers’ eye, 3½ feet above the pavement to the top of any object 6 inches high on the pavement anywhere on the road.
- MM. STREET - As used in this specification shall include the pavement section, right-of-way, sidewalks, driveways, bikeways, alleys and alley approaches.
- NN. STREET WIDTH - That distance measured from curb face to curb face across a street which should generally include the gutter pans on each side.
- OO. SUB-BASE - The layer or layers of specified or selected material placed on a sub-grade to support a base course, surface course, or both.
- PP. SUB-GRADE - The top surface of a roadbed upon which the pavement structure, shoulders, and curbs are constructed.
- QQ. SURFACE COURSE - One or more layers of a pavement structure designed to accommodate the traffic load, the top layer of which resists skidding, traffic abrasion, and the disintegrating effects of climate. The top layer is sometimes called “Wearing Course.”
- RR. UTILITIES - Shall mean all utilities on site prior to the time of any design; such as but not limited to water lines, sanitary sewer lines, drainage lines, electric lines, gas lines, telephone lines, and cable television lines.
- SS. UTILITY REPORT - The design backup and documentation necessary to demonstrate that the design of the public improvements is adequate and meets City requirements.
- TT. WORK - The entire completed construction or the various separately identifiable parts required to be furnished for the project. Work is the result of performing services, furnishing the labor and furnishing and incorporating materials and equipment into the construction.
- UU. WORKING DAYS - Any day, exclusive of Saturdays, Sundays, and holidays, on which weather and other conditions not under the control of the Contractor will permit construction operations to proceed with the normal working force engaged in performing those items controlling the completion of the work.
- VV. WORKING HOURS - The Contractor shall restrict working hours to between 7:00 a.m. and 7:00 p.m. on normal City of Evans business days unless prior approval has been obtained from the City.
- WW. WARRANTY PERIOD - That 2 year time period between initial acceptance and final acceptance during which the developer/Contractor shall maintain and repair all public improvements to be dedicated to the City. Such improvements may include but are not limited to, repairs to any pipes, fittings, manholes, pavement, and sidewalks.

1.06 ABBREVIATIONS

Wherever the following abbreviations appear in these specifications they shall have the following meanings.

- A. AASHTO - American Association of State Highway and Transportation Officials
- B. ACI - American Concrete Institute
- C. ANSI - American National Standards Institute
- D. ASSE - American Society of Sanitary Engineers
- E. ASTM - The American Society for Testing Materials
- F. AWWA - American Water Works Association
- G. CDOT - Colorado Department of Transportation
- H. CDOT STANDARDS - Colorado Department of Transportation "Standard Specifications for Road and Bridge Construction," latest edition
- I. HDPE - High density polyethylene
- J. l.f. - Linear feet
- K. MUTCD - Manual of Uniform Traffic Control Devices
- L. OSHA - Occupational Safety and Health Administration
- M. psi - Pounds per square inch
- N. psig - Pounds per Square Inch Gage
- O. PVC - Polyvinyl Chloride
- P. PRV - Pressure reducing valve
- Q. SDR - Standard dimension ratio
- R. UNCC - Utility Notification Center of Colorado
- S. USCFCRC & HR - University of Southern California Foundation for Cross-Connection Control and Hydraulic Research
- T. WA - Water
- U. WW - Wastewater



SECTION 2 GENERAL SPECIFICATIONS

2.01 GRANTING OF SERVICE

Water and sanitary sewer services may be extended, at the applicant's expense, based upon the recommendation of the Evans Water and Sewer Board and approval by the Evans City Council. Provided it has been determined that the location to be served is within the Evans water and sewer service area, the City has the capability and capacity to serve the location, and the applicant can demonstrate evidence of fee ownership of the property to be served. The request for service must be in compliance with stipulations contained within all agreements entered into by the City of Evans and said applicant as set forth in Section 1.02 of these Specifications.

2.02 PERMITS

Permits shall be required for the construction of any water and sanitary sewer facility. Permits must be obtained from the City of Evans Public Works Department before any work is commenced, and such permits shall only be issued to contractors licensed and bonded in the City of Evans. A permit may not be required provided the Contractor has entered into a formal Developer's Agreement with the City of Evans.

2.03 PRE-APPLICATION CONFERENCE

In order to assist the Developer with the Application Procedure, a Pre-Application Conference may be held in which, the Developer or his designee should be in attendance along with key designees from the Public Works Department (see Section 2.04 Application Procedure).

2.04 APPLICATION PROCEDURE

The Evans Public Works Department will establish and may amend at any time procedures to be followed during work on water and sanitary sewer utilities. These procedures will include all requirements for documentation, submittals, fees, engineering design, construction, and acceptance.

- A. All drawings submitted must adhere to acceptable drafting standards as established by the Evans Public Works Department.
- B. Itemization of all quantities shall be shown on the cover sheet (i.e., LF of pipe by size and materials, number of valves, manholes, blow-offs, fire hydrants, etc.).

2.05 SUBMITTAL REQUIREMENTS

Plans will be submitted to the Director of Public Works or designee on 24 by 36 inch sheets in a scale ranging from 1 inch = 20 feet to 1 inch = 100 feet horizontal and 1 inch = 5 feet vertical and shall include the following on the final submittal:

- A. Lots and blocks which are to be served.
- B. Streets, rights-of-way, easements, curbs and gutters, sidewalks, and property lines.
- C. Existing and proposed utilities, including water, sanitary sewer, non-potable irrigation, gas, phone, fiber optics, electrical, cable TV, storm sewers, etc. illustrating all critical crossings in plan, profile views, and indicate all points of connection to any existing systems.
- D. Show all proposed water and sanitary sewer service lines; fire lines, meter pits, and cleanout structures.
- E. Show all adjacent streets for reference to the site.

2.05 SUBMITTAL REQUIREMENTS (continued)

- F. Proposed construction plans shall indicate all mains, valves, hydrants, manholes, and appurtenances, including thrust blocks.
- G. Pipe materials, diameters, lengths, depths, and slopes will be indicated for each section.
- H. Location and size of planned water and sanitary sewer services, meter pits, and remote registers.
- I. Plan and profile of all lines including complete dimensions referenced to street centerlines. Show any proposed or existing crossings of water mains, along with existing ground lines and limits of proposed cuts and fills.
- J. Locations of driveways required where deemed necessary by the Director of Public Works or designee in order to verify meter pit locations.
- K. North arrow (pointing to the top or right of page), scale, Professional Engineer's stamp, benchmark, and all elevations shall be included on each sheet.
- L. Traffic Study, Drainage Report, copy of Erosion Control Application, and the Utility Report.
- M. All survey point shall be tied to the City of Evans Horizontal and Vertical Controls: Horizontal Control: NAD 83-92 and Vertical Control: NAVD 88.
- N. Submittal shall include one-half-size set (11 inches by 17 inches).
- O. Upon receiving final approval and prior to the initiation of any work, three (3) full size blueprint copies, a 4 mil Mylar set, a half-size set of plans, an electronic version, in AutoCAD format, (preceding shall remain property of the City), shall be submitted to the Evans Public Works Department. The original prints shall be returned to the consulting Engineer, stamped for approval by the Department of Public Works. Prior to the initiation of any warranty period, four (4) complete sets of as-built record drawings consisting of one (1) set on 4 mil Mylar, two (2) full size blueprints and one (1) set of half-size plans shall be submitted to the Evans Public Works Department.

2.06 CONSTRUCTION PROCEDURE

Following final approval of the plans, the Owner may proceed with construction. In addition to all construction requirements contained in other portions of these standards, the owner and his Contractor shall observe the following:

- A. Prior to the commencement of work, a preconstruction conference shall be held between personnel representing Evans Public Works Department, the Contractor, all subcontractors who are scheduled to perform the work, the consulting engineer, all involved utilities, and any other entities involved in the construction.
- B. Construction shall commence within 12 months of the approval date shown on the plans or the plans become invalid and must be resubmitted for review and approval.
- C. Development phasing of any project must be shown on the initial Drawing Submittal and made a part of the application procedure. No phasing will be permitted unless this requirement has been adhered to.
- D. The work shall be surveyed and staked under the supervision of a licensed land surveyor in accordance with the approved plans.
- E. The Evans Public Works Department shall be notified at least 48 hours prior to start of work.

2.06 CONSTRUCTION PROCEDURE (continued)

- F. Adequate provisions for notification of any customers who may experience a loss of water or sewer services must be developed. Such outages shall be kept to a minimum in compliance with Section 2.11 of these standards.
- G. The Public Works Department shall be notified whenever it becomes necessary to open or close a valve on the existing water system. Only Public Works Department personnel are authorized to operate valves in the service area. Contractors may operate valves under the supervision of Public Works Department personnel at the City Inspector's discretion.
- H. Water mains shall be tested in accordance with Section 5 of these standards. Sewer mains shall be tested in accordance with Section 8.11
- I. All work relating to water, non-potable, storm sewer and sanitary sewer utilities should be inspected by a Public Works Department Inspector.
- J. Construction should adhere to the following sequence unless otherwise specified by the Director of Public Works or designee: 1) Sanitary sewer line installation, 2) Storm sewer line installation, 3) Non-potable water line installation, 4) water line installation, 5) curb and gutter installation. Installation of water lines will not be permitted until all compaction results for sanitary sewer lines have been submitted to and approved by the Evans Public Work's Department. Curb and gutter installation will not be permitted until all compaction results for water lines have been submitted to and approved by the Evans Public Works Department. Sleeves shall be installed for dry utilities at all utility crossings and roadway crossings.
- K. No work shall commence until the Contractor has an approved set of plans and current specifications from the Evans Public Works Department. The plans and specification shall be on the job site at all times. Approval from the Director of Public Works or designee will be for general conformity to the plans and will not constitute blanket approval of all dimensions, quantities, and details of the material or equipment shown. Nor shall such approval relieve the Contractor or consulting engineer of his responsibility for errors contained in the drawings.
- L. Paving will not be permitted until manhole, valve box, sewer service, and curb stop installations have been verified in the field, all utility testing is completed and passed, and the subgrade compaction has been confirmed in the field.

2.07 INSPECTION PROCEDURES

- A. Approval by the Director of Public Works or designee shall in no manner relieve the developer from responsibility for errors or omissions in the plans. Any errors shall be corrected by the developer to the satisfaction of the Public Works Department and at no expense to the City.
- B. Where a conflict occurs between or within standards, specifications and drawings, the more stringent or higher quality requirements shall apply.
- C. Installation of all new facilities within City service areas shall be inspected and approved by a Public Works Inspector.

2.07 INSPECTION PROCEDURES (continued)

- D. The Inspector shall see that materials are furnished and the work is performed in accordance with City of Evans Public Works Department-Approved plans and specifications. The Contractor shall furnish all reasonable aid and assistance required by the Director of Public Works, designee, and/or City Inspector for the proper examination of the materials and work. All work shall be performed in accordance with accepted workmanship practices and these engineering standards. Any work not accepted by the Director of Public Works, designee, and/or City Inspector shall be redone until compliance with these standards is achieved. Instructions given by the City Inspector relating to quality of materials and workmanship must be obeyed at once by the Contractor. The City Inspector shall not supervise nor set out work or give line and grade stakes.

All materials used shall be new and subject to the inspection and approval of the City Inspector at all times. The inspector has the right to perform any testing deemed necessary to ensure compliance of the material with these standards. No material shall be used before inspected and approved by the City Inspector. Failure or neglect on the part of the inspector to condemn or reject inferior materials or work shall not be construed to imply their acceptance should their inferiority become evident at any time prior to final acceptance of the work. City Inspectors have the authority to reject defective or inferior materials and/or defective workmanship and to suspend work until such time as the Contractor shall correct the discrepancies in question.

Whenever defective materials and work are rejected, the Contractor shall promptly remove such defective materials and construction from the jobsite and replace all defective portions to the satisfaction of the Director of Public Works or designees. In the event the Contractor fails to remove rejected materials from the jobsite within a reasonable length of time, not to exceed 10 working days, the Director of Public Works or designees may arrange for such removal at the expense of the Contractor.

Inspection shall not relieve the Contractor from any obligation to perform the work strictly in accordance with the plans and specifications or any modifications thereof. Work not so constructed shall be removed and corrected by the Contractor at his sole expense, whenever so ordered by the Director of Public Works or designee, without reference to any previous error or oversight in inspection.

- E. Except in cases of emergency, maintenance, or protection of work already done, no work shall be allowed between the hours of 7:00 p.m. and 7:00 a.m. nor on Saturday, Sunday, or legal holidays unless approved by the Director of Public Works or designee in each case. When inspectors are required to work overtime, it shall be at the Contractor's expense, provided, however, such inspectors shall remain employees of the City of Evans for all purposes. All requests for overtime shall be made to the Director of Public Works at least 48 hours in advance. Payment for such overtime shall be made by check to the City of Evans, prior to final acceptance.
- F. In the event one or more inspectors representing private consulting engineering firms are also inspecting a project, along with City of Evans Public Works Department Inspectors, the instructions given by the City of Evans Public Works Department shall prevail in the event of conflicting instructions.

2.08 TRAFFIC CONTROL

The Contractor shall obtain an approved City of Evans Application and Permit for Excavation/Construction in Public Right-of-Way, located in Appendix B, 48 hours prior to any construction within City's right-of-way.

The flow of traffic on public streets and roadways shall be maintained at all times during construction in accordance, with the rules and regulations of the governing authority at time of construction.

2.08 TRAFFIC CONTROL (continued)

The Contractor shall be responsible for the provision of a safe travel right-of-way on all roadways on and adjacent to the jobsite. The Contractor shall erect or cause erection of proper traffic control warning devices around all excavations, embankments and obstructions and shall be responsible for the proper maintenance of said erected devices throughout the course of construction. All traffic control warning devices and their installation shall conform to the MUTCD, current edition.

The Contractor shall cause suitable warning lights; or flares to be provided and kept lighted at night or other times when visibility is limited.

The Contractor shall provide flagmen and/or off-duty police protection as may be determined by the Director of Public Works or designee for the protection of the public, as well as workers on the jobsite.

The Contractor shall coordinate his work with the Director of Public Works or designee in order that arrangements may be made for detours, parking, and access to property adjacent to work, etc., 48 hours prior to their need.

The Contractor shall not close any street or portion of a street without receiving written permission from the Director of Public Works or designee 48 hours prior to such closure. It is the Contractor's responsibility to post advance road closure signs with their phone number and to notify the Weld County Dispatch, Weld County School District 6, Greeley Bus, and the police and fire departments having jurisdiction in the area of construction 24 hours prior to closing any street, which such closure has been authorized by the Director of Public Works.

The Contractor shall also notify the Weld County Dispatch, Weld County School District 6, Greeley Bus, and the police and fire departments immediately after opening of any street, alley, or fire lane.

The Director of Public Works or designee shall close down work (except in extreme emergencies) which is not controlled in accordance with approved City barricading procedures or on projects which require a traffic control plan and such has not been obtained by the Contractor.

No work shall be allowed at signalized intersections or on major arterial roadways which impedes normal traffic flow from 6:00 a.m. until 8:30 a.m., and 4:30 p.m. until 6:00 p.m., except during emergencies or with prior approval of the Director of Public Works.

2.09 STREET CUTS

Prior to proceeding with any work within the public right-of-way, the Contractor shall obtain a permit which shall be reviewed by the Public Works Department. The Public Works Department will specify minimum pavement sections for replacement on the basis of standards developed by that Department and the classification of the street cut for utility installation and may specify additional minimum requirements. Permits may not be required provided the Contractor has entered into a formal Developers Agreement with the City of Evans.

Contractors may use Flow Fill as a trench backfill in public rights-of-way.

The removal of pavement, sidewalks, driveways, or curb and gutter shall be performed in a neat and professional manner. Where utilities must cross these facilities, the exact width of the cut shall exceed the width of the trench at the subgrade by at least 12 inches on either side of the cut. Portland cement concrete or asphaltic concrete surfaces shall be cut with a pavement saw to a depth of 4 inches prior to breaking. Cutting shall be limited to straight lines and acute angles shall be avoided.

2.09 STREET CUTS (continued)

Within street pavement, driveways or street curbing areas, the entire trench shall be backfilled with road base, Class 6 material, placed and compacted in lifts of 6 inches or less, or a City approved alternative backfill material. The minimum asphalt replacement shall be 4 inches of hot bituminous pavement; Grading C. Hot bituminous pavement must be replaced with a minimum mat 1 thicker than the removed thickness not to exceed 7 inches. The replacement of Portland cement concrete sidewalks, driveways, or curb and gutter shall be to the same dimensions as that removed for the utility installation. Portland cement concrete sidewalks shall have a minimum thickness of 6 inches. Portland cement concrete driveways shall have a minimum thickness of 6 inches. Portland cement concrete design mix shall conform to any and all applicable City of Evans standards regarding streets, curb and gutter, and sidewalks.

2.10 PROTECTION OF EXISTING FACILITIES

The Contractor shall verify all utility locations prior to any excavation work. According to Colorado State Statute 93-155 anyone who engages in any type of excavation must provide advance notice to the underground facility owners. The notice must be at least two business days, not including the day of the call, prior to any excavation. City of Evans requires all contractors/developers to contact the Utility Notification Center of Colorado (UNCC) (at 1-800-922-1987) and the City of Evans Utility Locate Hotline.

Existing power lines, telephone lines, vegetation or landscaping, fences, water mains and services, gas mains, sewer mains and services, cables, conduits, drainage and irrigation ditches and pipes, embankments and other structures in the vicinity of the work not authorized to be removed, shall be supported and protected from damage by the Contractor during the construction.

The type, size, and approximate location of all known underground utilities shall be shown on the master utility portion of the construction drawings. It shall be the responsibility of the Contractor to verify the existence and location of all underground utilities along the route of the work. The Contractor shall be held liable for all damages done to existing facilities and structures.

In the event that during construction it is determined that underground utility conduit or any above ground utility facilities are required to be relocated, the Contractor shall notify the UNCC and the City of Evans, two business days, not including the day of the call, in advance of their approach to such utility.

2.11 OUTAGES

In the event that any interruption of utility services become necessary, the Director of Public Works and all affected customers must be notified personally by the Contractor in writing at least 24 hours in advance. Additionally, services shall in no case be interrupted for more than 8 hours. Outages for schools, medical clinics, and various commercial businesses must be conducted at approved times as specified by the owner and upon approval by the Director of Public Works. If outages for more than 4 hours are necessary, they must be conducted at times to cause the least inconvenience to the customers and upon the approval of the Director of Public Works. Under all circumstances work must be continuous until all customers are back in service. If in the process of installing a connection there exists an industry building that cannot be out of water, as designated by the Director of Public Works, such as a hospital, appropriate temporary means shall be taken to provide and convey water. The water and means of conveyance shall be approved by the Director of Public Works and be at the Contractor's expense.

2.12 SAFETY

Machinery, equipment, materials, and all hazards shall be guarded or eliminated in accordance with the "Manual of Accident Prevention in Construction" of the Associated General Contractors of America and all applicable Federal regulations, including OSHA (Occupational Safety and Health Act), State, County, and municipal laws. No blasting shall be done without the approval of the Evans' Fire Department and the Public Works Department. Safety equipment, devices, and clothing shall be utilized by personnel when required by Federal, State, and local laws.



2.13 MAINTENANCE GUARANTY

All developer agreements, escrows, and letters of credit to construct and maintain necessary water distribution, sewer collections, and other public improvements shall be approved by the Public Works Department and said agreements shall be entered into by Evans and the owner/developer of the property prior to the time such improvements are constructed; pursuant to these Specifications, pertinent ordinances, rules, regulations and procedures; of the City of Evans. The City may enter into such agreements with developer or contractors as may adequately protect the City's interests.

Developers and/or Contractors will be required to post bond to the City of Evans or a bond equivalent to provide protection against the following situations:

- A. Repairs or maintenance work performed by the City of Evans by reason of default by the Contractor.
- B. Necessary repair of damages caused by the Contractor.
- C. Necessary repairs caused by installing defective material.
- D. Necessary repairs caused by poor installation techniques.
- E. Costs incurred by the City due to the Contractor's failure to perform in accordance with these standards.

2.14 ACCEPTANCE OF WORK

Water and sewer utilities shall be inspected by the City throughout installation. Prior to paving operations all valves and manholes shall be at the top of the subgrade, the water and sewer line shall have passed all required tests, and the services shall be marked with a 2 by 4 inch board with the appropriate color painted on the 2 by 4 inch board and stamped on the curb and gutter.

Upon completion of installation and prior to paving operations, a punch list shall be formulated stating all discrepancies that relate to water and sewer utilities. This punch list, made by the City Inspector, shall be submitted to the Contractor, as well as the developer. Paving operations shall not commence until the punch list has been cleared.

Should any work require the cutting of the street, it shall be done at this time. Concurrently, the Contractor and developer shall check and ensure that all water and sewer services are offset from the centerline of each lot by 5 feet each side unless otherwise indicated on the engineering drawings. No services are to be located in concrete areas.

After paving operations have been completed and all manholes and valves have been raised, a second punch list shall be formulated and sent to both the Contractor and the developer. Prior to the issuing an initial letter of acceptance, the Contractor shall provide the Public Works Director with a final affidavit, signed by the developer; thereby, indicating that the improvements have been paid for, in full, by the Contractor. Upon the request of the Public Works Director or designee, the Contractor shall provide lien waivers (or some other acceptable assurance) from all subcontractors, suppliers, and material men who have furnished labor, material, services for the design, construction, or installation of improvements.

The 2 year warranty period should begin once the following conditions have been met:

- A. The second punch list has been completed
- B. The final affidavit and/or lien waiver(s) have been signed
- C. The maintenance guarantee has been accepted by the City
- D. A cost estimate has been given to the City

2.14 ACCEPTANCE OF WORK (continued)

- E. Acceptable as-built drawings for all utilities lines have been submitted to the Evans Public Works Department

The Director of Public Works shall send a letter to both the Contractor and developer stating this date. No water meters shall be installed prior to initiating the two-year warranty period; except for park sprinkler meters, which must be installed and accepted, for service prior to the initiation of the two-year warranty period. Warranty periods may be initiated by phase, if all public improvements in that phase meet the above referenced requirements and provided the phasing has been shown on the approved prints.

Just prior to the end of the two-year warranty period, a third inspection and punch list shall be formulated by the Public Works Department and sent to both the Contractor and the developer. Upon completion of this punch list to the satisfaction of the City, the Director of Public Works shall then send a letter to both the Contractor and the developer, stating the acceptance of responsibility for perpetual maintenance of the water and sewer utility lines by the City of Evans. Any deviations from this format shall be supported in writing by the Director of Public Works.

Any maintenance, repairs, or replacements on all public improvements that have defects during the two year warranty shall be performed by the Contractor at the Contractor expense. The Contractor shall be invoiced for all work performed during the two-year warranty period that is completed by the City of Evans. All payments for work performed shall be received by the Evans Public Works Department prior to the acceptance of responsibility for perpetual maintenance of the water and sanitary sewer utility lines.

2.15 MISCELLANEOUS

Where special conditions not covered by these specifications exist, detailed drawings and specifications shall be submitted to the City of Evans for approval before contracts are awarded or work is begun.

Written approval from an authorized designee of the City of Evans Public Works Department must be obtained before any materials other than those materials specified in these standard specifications may be employed in the construction of water and sewer lines connected to or made a part of the water and sewer system of the City of Evans



SECTION 3 DESIGN CRITERIA - WATER DISTRIBUTION SYSTEM

3.01 SCOPE

The purpose of this section is to set forth the general criteria to be used in the design of water mains and appurtenances within the City of Evans service area. Any deviation from these standards must be supported in writing and approved by the Director of Public Works or authorized designee.

3.02 GENERAL

All water mains and appurtenances shall be in conformance with these specifications and shall be designed by or under the direct supervision of a Registered Professional Engineer licensed to practice in the State of Colorado.

3.03 QUALITY OF THE DISTRIBUTION SYSTEM

The purpose of these standards is to ensure that only proven high-quality materials are professionally installed with first-class workmanship. Determination of the best materials and construction methods are based upon lowest life cycle costs, not necessarily upon lowest initial costs. The sizing and layout of the system are part of the total consideration of design, operation, and maintenance of a water supply system that yields optimum quality service at the lowest total cost to the consumer.

3.04 SIZING OF DISTRIBUTION MAINS

The minimum diameter for water mains in residential areas, including cul-de-sacs, shall be 8 inches. All schools, shopping centers, business parks, industrial parks, and high-density residential areas shall be looped with mains at least 8 inches in diameter. 6 inches in diameter pipe may not be used in stretches of more than 600 feet in length unless approved by the Director of Public Works or authorized designee. Sizing of all mains shall be accomplished by utilizing a flow network model incorporating anyone of the several acceptable flow network analysis methods. A Utility Report shall be submitted to and approved by the Public Works Department along with the engineering drawings. All water lines shall be looped. No dead-end lines will be permitted unless otherwise stated by the Director of Public Works or authorized designee.

Upon specific approval by the Director of Public Works, 6 inch water lines may extend into cul-de-sacs serving not more than eight single family residential units and not be looped. In no case shall a line of less than 6 inches in diameter be used to serve a fire hydrant. The maximum acceptable head loss shall be 2 feet per 1,000 feet of main. The Public Works Department reserves the right to oversize mains to provide service for future needs.

3.05 MATERIALS

Water mains constructed of ductile iron pipe or polyvinyl chloride pipe will be allowed.

All materials must conform to the material requirements as set forth in Section 4.02 of these specifications.

Transmission lines (16 inches and larger) shall be ductile iron pipe, steel, or pre-tensioned concrete steel cylinder pipe. Design calculations on pipe wall thickness, strength, and internal and external coating/lining must be submitted for approval along with the construction drawings.

All PVC pipe shall have copper tracer wire placed on top of the pipe and daylighted as per Copper Tracer Wire on PVC Pipe Detail (No. WA-5), Fire Hydrant Detail (No. WA-6), Water Valve Box - Potable Water Detail (No. WA-19), and Water Valve Box - Nonpotable Water Detail (No. WA-20).

3.06 PIPE DEFLECTION

Pipe deflection shall be defined as the axial deflection, either horizontal or vertical, at the joints of the pipe.

A. Ductile Iron Pipe

The maximum pipe deflection for 6 - 12 inch ductile iron pipe shall be 5° and the maximum pipe deflection for 14 - 64 inch ductile iron pipe shall be 3° in accordance with AWWA C600, unless approved by the Director of Public Works. For design proposes, pipe deflection should be limited to 80% of these values

B. Polyvinyl Chloride Pipe

Pipe deflection shall be no greater than 3° unless approved by the City. For design proposes, pipe deflection should be limited to 80% of this value.

3.07 GROUND COVER

All mains shall be designed so that a minimum of 4½ feet of cover exists over the top of the pipe after final grade has been established. No main shall have more than 5½ feet of cover unless specifically approved by the Director of Public Works.

When a water main crosses underneath a stream, irrigation ditch, storm drainage ditch, or other area which has surface water for a significant period of the year, there shall be a minimum of 4½ feet of cover over the pipe and the pipe shall be encased in concrete. Refer to the Stream and Drainageway Crossing Detail (No. WA-13), and the Concrete Encasement Detail (No. WA-3), located in Section 9, for complete specifications. Valves shall be located such that the water main at such crossings can be isolated with enough room to allow for maintenance. The type of material and class of pipe to be utilized will be specified by the Director of Public Works or designee.

3.08 LOCATION

All mains shall be installed in dedicated streets. Preferable location for these water mains is 10 feet plus the radius of the sanitary sewer line from the centerline on the north or east side of the street. (Refer to Figures 3.08-1 and 3.08-2 in Appendix A for approximate location of all wet utilities in the right-of-way) Water mains to be installed in exclusive easements and rights-of-way may be approved when, as determined by the Director of Public Works, it is not practical to make such an installation in the dedicated street. The request must be submitted in writing to the Director of Public Works. When such exceptions are made, the minimum width requirements for easements and rights-of-way are in Table 3.08. All water mains shall be located in an easement at least two times the depth to the invert in width unless otherwise specified by the Director of Public Works. The minimum width of easement shall be 20 feet.

Table 3.08
Easements and Rights-of-Way Minimum Width Requirements

One Utility Line	- Total Width of 20 feet - 15 feet on One Side of the Property Line
Two Utility Lines (Water & Sewer)	- Total Width of 30 feet - 10 feet on Either Side - 10 feet Between Lines

Water lines shall not be installed beneath any concrete, such as sidewalks, curb and gutter, and cross pans, except when the water lines are crossing the concrete installation.

Water line installations shall conform to all specifications as described in Design Criteria for Potable Water Systems, as published by the Colorado Department of Public Health and Environment - Water Quality Control Division.

3.08 LOCATIONS (continued)

The following paragraphs apply to utility line crossings:

A. Vertical Separation

Under no circumstances shall the vertical clearance between any lines involving a water or sanitary sewer line be less than 12 inches without written approval from the Director of Public Works. The corrosion protection must be adhered to Section 4.03 when ductile iron pipe is utilized, refer to Conduit or Storm Sewer Crossing Detail, (No. WA-4) and Utility Crossing Detail, (No. WA-15) located in Section 9, for placement information. In all cases, the crossing pipes shall be centered over each other so that the joints are at a maximum distance from the crossing.

B. Water Line Crossing Over a Sanitary/Storm Sewer Line

If there is less than 18 inches vertical clearance, encase the sewer line 10 feet each side of the crossing and the water line must be a 20 foot section of ductile iron pipe centered over the crossing. The proper corrosion protection must be adhered to whenever ductile iron pipe is utilized. Encasement of joints only shall be required on sewer lines 15 inches and larger in diameter. Polyvinyl chloride pressure pipe may be used in lieu of an encasement if the sewer line is AWWA C900 and C905, latest revision.

C. Sanitary/Storm Sewer Line Cross Over a Water Line

Encase the sewer line no matter what the vertical clearance is 10 feet each side of the crossing. If the vertical clearance is less than 18 inches, the water line must also be in ductile iron pipe. The proper corrosion protection must be adhered to whenever ductile iron pipe is utilized. Encasement of joints only shall be required on sewer lines 15 inches and larger in diameter. Polyvinyl chloride pipe may be used in lieu of an encasement if the sewer line is C900 and C905 pipe.

D. Water Line Crossing Over a Water Line

If there is less than 18 inch vertical clearance, both water lines must be ductile iron pipe and 20 feet in length centered over the crossing. The proper corrosion protection must be adhered to whenever ductile iron pipe is utilized.

All concrete encasements shall follow the Concrete Encasement Detail (No. WA-3), located in Section 9. Additional support may be required by the Director of Public Works where large diameter lines cross over utility mains. Encasement of joints on storm sewer lines shall be 6 inches thick and extend a minimum of 1 foot on each side of the collar.

3.09 VALVES

Valves shall not be located in concrete areas, such as sidewalks, cross pans, aprons, or curb and gutters. All valves shall have a concrete collar around the valve box as shown in the Water Valve Box Detail (No. WA-19), located in Section 9.

Residential distribution systems shall have valves be placed in such a manner so as to ensure that no more than 600 feet of main or one residential block may be out of service for any one single break. Valve placement shall be such that there are two (2) valves at every tee and three (3) valves at every cross. Valves shall be placed a maximum of three feet from a tee and/or a cross. When water mains are designed in such a way that a dead-end exists at the edge of a subdivision or at the boundary of a filing/phase within a subdivision, the main shall be terminated with an isolation valve, two full lengths of pipe and a temporary blowoff valve. Refer to Pipe Intersections & Dead Ends Detail (No. WA-11), and Blowoff Assembly Installation Detail (No. WA-2), located in Section 9 for additional specifications. When a new extension shall connect to an existing main not terminated with a valve, the new main must have valves at the connection in order that the entire, newly constructed system may be pressure tested and chlorinated.

3.10 BLOWOFF ASSEMBLIES

Blowoff assemblies are required at the end of water mains which terminate at the subdivision boundary in streets that will be extended at a future date as per Pipe Intersection & Dead Ends Detail (No. WA-11), located in Section 9.

Blowoff assemblies shall consist of valves, pipe and material necessary to install the blowoff valve complete in place. Blowoff assemblies will be required at the end of mains extended into cul-de-sacs. Refer to the Blowoff Assembly Installation Detail (No. WA-2), located in Section 9.

3.11 FIRE HYDRANTS

Maximum distance between hydrants shall be 500 feet in residential areas and 300 feet in business and other high-value areas measured along the centerline of the street unless approved otherwise by the Fire Department. No hydrants will be allowed at the end of cul-de-sacs. The number and location of fire hydrants in a given area shall be approved by the fire department. If hydrants are to be installed at locations other than street intersections, they shall be located on lines which are established by extending property lot side lines into the streets. The fire hydrant shall be located within the right-of-way and on the same side of the street as the water main unless otherwise specified by the Fire Department.

Fire hydrant branch lines shall be set at 90° to the street mains. The hydrant shall be set at the end of the branch line and shall face the branch line. No horizontal bends or offsets shall be used in installing fire hydrant branch lines. Under no circumstances shall service tap be made on a fire hydrant branch line. A 6 inch gate valve shall be a swivel tee or a hydrant tee on the main in order that the hydrant may be removed from the system for maintenance without affecting the distribution system. Refer to the Fire Hydrant Detail (No. WA-6), located in Section 9 for all other requirements.

3.12 BACKFLOW PREVENTION

To prevent possible backflow contamination of the City of Evans' potable water mains, a backflow prevention device shall be installed where any condition might exist that would create a higher pressure downstream of the water meter than exists in the main line. This unit shall be installed downstream of the water meter, between appropriate valves, either above ground, or inside a building with adequate drainage. No pit or vault installations will be approved. Backflow prevention installations are mandatory on buildings such as schools, packing plants, chemical plants, or any business or property that uses water for the base mixture of any type of chemical, whether said chemical is classified toxic or nontoxic in nature.

The City of Evans Public Works Department conforms to the Colorado Connection Control Manual, latest edition.

The backflow prevention apparatus, which must be approved by the Director of Public Works, shall meet all requirements and specifications of the American Water Works Association, the Uniform Plumbing Code, and the Colorado Cross Connection Manual, latest editions.

3.13 ACCEPTABLE BACKFLOW PREVENTION ASSEMBLIES

All backflow prevention assemblies shall be in conformance with the Colorado Cross Connection Control Manual, latest edition.

All manufacturers and models for backflow prevention assemblies shall carry the American Society of Sanitary Engineering (ASSE) and/or the USCFCCC & HR approval seals.

All backflow prevention assemblies shall be reviewed and accepted by the City of Evans Public Works Department prior to installation. All submittals should include the product information sheets for each apparatus, the type of installation (horizontal or vertical), and the intended use of the device.

3.14 THRUST BLOCKS

All bends, tees, plugs, dead-ends, wet taps, hydrants, and blowoff assemblies shall be designed and constructed with concrete thrust blocks as set forth in Section 4.02M of these specifications.

3.15 OPERATING PRESSURES

Pressures within the distribution system will be a minimum of 40 psi during the maximum hour demand and a maximum of 125 psi during low peak demand. A minimum of 20 psi residual pressure shall be provided at each hydrant for the required fire flow during maximum day demands. Pumping facilities will be allowed on mains or service lines only where specifically authorized by the Director of Public Works.

3.16 PRESSURE REGULATING STATIONS

Pressure reducing valve (PRV) installations are used to control pressures between distribution zones. When main extension plans are submitted for review, the need for a pressure regulating valve installation will be determined based on existing pressure zones and the existing distribution system. Plans shall be submitted indicating size, type, and location for the PRV installation. See Pressure Relief Valve Detail (No. WA-12), located in Section 9 for additional specifications. All calculations, drawings with all fittings shown, and shop drawings for the vault must be submitted and approved by the Director of Public Works prior to construction.



SECTION 4 CONSTRUCTION CRITERIA - WATER DISTRIBUTION SYSTEM

4.01 SCOPE

The purpose of this section is to set forth the general criteria to be used in the construction of water mains and appurtenances in the City of Evans service area. Any deviation from these standards must be approved by the Public Works Director.

4.02 MATERIALS

All materials furnished shall be new and undamaged. Everything necessary to complete all installations shall be furnished and installed, whether shown on approved drawings or not, and when complete, all installations shall be fully operational.

Acceptance of materials or the waiving of inspection thereof shall in no way relieve the developer of the responsibility for furnishing materials meeting the requirements of the specifications.

The City of Evans Public Works Department reserves the right to direct or deny use of certain types of materials in specific circumstances. All materials delivered to the job site shall be adequately housed and protected so as to ensure the preservation of their quality and fitness for the work.

A. Ductile Iron Pipe

All ductile iron pipes shall be manufactured in accordance with AWWA C151, latest revision, with the following additional requirements and/or exceptions:

A "Push-on single gasket" conforming to the applicable requirements of AWWA C111, latest revision, is required. Joint types other than a "push-on single gasket" type are acceptable only if specifically approved by the Director of Public Works.

Pipe shall be AWWA Thickness Class 52 and AWWA Pressure Class 350 unless otherwise specified by the Director of Public Works.

Pipe shall be furnished in nominal laying lengths of either 18 feet or 20 feet. Random lengths are not acceptable.

Pipe shall have standard thickness cement mortar linings in accordance with AWWA C104, latest revision, and the exterior coating shall be the standard outside bituminous coating as specified in AWWA C151, latest revision.

Corrosion protection shall be as specified in Section 4.03 of these specifications.

In general, ductile iron water pipe shall be installed per AWWA C600, latest revision.

B. Polyvinyl Chloride Pressure Pipe

All polyvinyl pressure pipes shall be manufactured in accordance with AWWA C900 and C905, latest revisions, with the following additional requirements and/or exceptions.

All AWWA Class 150 pipe shall meet the requirement of AWWA DR-18 and AWWA Class 200 shall meet the requirements of AWWA DR-14.

Solvent cement joints are strictly prohibited.

4.02 MATERIALS (continued)

Each length of pipe will be a standard laying length of 18 or 20 feet. Random lengths shall not be acceptable unless specifically approved by the Director of Public Works. Under no circumstances shall the random length be less than ten feet long.

PVC must conform to the cast-iron outside diameters. Pipe that will be stored outside and exposed to sunlight for more than 30 days shall be covered with an opaque material such as canvas. Clear plastic sheets shall not be used to cover the pipe. Air circulation shall be provided under the covering. Any sunburned pipe will not be permitted for installation and shall be removed from the job site immediately. All pipes must be Underwriters' Laboratory-approved.

C. Fittings

All ductile iron fittings shall be manufactured in accordance to AWWA C104, C110, C111, C116 and C153, latest revisions, with the following additional requirements and/or exceptions:

All fittings shall be furnished with a cement mortar lining or epoxy coating of standard thickness as defined in referenced specifications and given a seal coat of bituminous material, if cement mortar lining is applied.

All fittings shall be furnished with mechanical joint or ring-tite ends conforming to referenced specifications. In addition, the tee-head MJ bolts and hexagon nuts shall be fabricated from a high-strength, low alloy steel known in the industry as "Cor-Ten" or an approved equal. Swivel fittings as approved by the Director of Public Works may also be utilized.

All fittings shall have a pressure rating of 250 psi. All fittings shall be made from gray iron or ductile iron.

Corrosion protection shall be as specified in Section 4.03 of these specifications.

D. Gate Valves

All valves shall be manufactured and tested in accordance with AWWA C500, C509, & C515, latest revisions, with the following additional requirements and/or exceptions:

Valves meeting AWWA C500 shall be of a modified wedge disc construction, coated both inside and out with a tough durable epoxy to prevent corrosion, cast-iron body, fully bronze mounted with non-rising stems and resilient seats.

All valves shall be suitable for frequent operation and/or long periods of inactivity. The operating pressure for all valves 6 inches through 12 inches shall be 200 psi.

Valve stems shall be made of bronze and threaded so that valves shall open by turning to the left (counterclockwise).

Each valve shall be furnished with a 2 inch square operating nut. The operating nut shall have an arrow showing the direction of opening and the word "OPEN" cast on the nut. The stem seal shall consist of two O-rings, one or both positioned above the thrust collar with the valve under pressure in the full open position.

All components of the mechanical joint shall conform to AWWA C111. The tee-head bolts and hexagon nuts shall be fabricated from a high-strength, low alloy steel known in the industry as "Cor-Ten" or an approved equal.

4.02 MATERIALS (continued)

After approved factory assembly, each valve shall be given the operation and hydrostatic tests.

Wedge disc valves shall only be from a manufacturer pre-approved by the Public Works Department.

Resilient-sealed gate valves shall only be from a manufacturer pre-approved by the Public Works Department.

E. Valve Boxes

Valve box parts shall only be from a manufacturer pre-approved by the Public Works Department, and made of gray cast iron 5¼ inches screw-type shaft shall be adjustable from 45 to 66 inches. Valve box lids shall be marked with the word "WATER" and shall have a lip or flange extending into the valve box shaft. No slip-type boxes will be allowed. The valve box shall be of a design which will not transmit shock or stress to the valve and shall be centered and plumb over the operating nut of the valve with the box cover 1/4 to 3/8 of an inch below the surface of the pavement. See Water Valve Box Detail (No. WA-19), located in Section 9 for additional specifications.

Corrosion protection shall be as specified in Section 4.03 of these specifications.

F. Pressure Reducing and Regulating Valves

All pressure reducing valves shall only be from a manufacturer pre-approved by the Public Works Department. The valve shall be designed to reduce a high upstream pressure to a constant downstream pressure by way of a pilot control system.

Material shall be cast iron for valve body; flanges and covers shall conform to ASTM A-48.

All valves shall be furnished with flanged ends and drilled in accordance with ANSI B-16.1 Class 125 specifications. Flanges shall be machined to a flat face or machined to a flat surface with a serrated finish in accordance with AWWA Standard C207.

The needle valve shall be all bronze and included with the main valve to control the speed of piston travel.

The operating pressure shall be 150 psi.

All pressure reducing and regulating valves shall be installed in concrete vaults as specified in Section 4.02K. Refer to Pressure Relief Valve Detail (No. WA-12), located in Section 9 of these specifications for additional specifications. There shall be no dissimilar metals allowed in the piping in the PRV vaults without proper insulation.

G. Swing Check Valves

Swing check valves shall be manufactured in accordance with AWWA Standard C508, latest revision, with the following additional requirements or exceptions:

All valves shall be iron body; fully bronze-mounted, metal-to-metal seating, and the disc shall be swing-type.

Valves in vaults shall be installed to a horizontal position with exterior lever and adjustable spring operation.

4.02 MATERIALS (continued)

The operating pressure for all sizes shall be 175 psi.

All check valves shall be installed in vaults or manholes.

H. Air and Vacuum Valves

Air valves shall be one of the two types:

1. An Air Valve called for on the plans shall mean an Air and Vacuum Valve of the ball-type designed to permit the escape of air from a pipeline when the line is being filled and to permit air to enter the pipeline when the line is being emptied.
2. A Combination Air Valve called for on the plans shall mean a combination Air and Vacuum and Air Release Valve designed to fulfill the functions of an Air and Vacuum valve and also designed to permit the escape of air accumulated in the line at the high point when the line is under pressure while in operation. The valve shall be self-contained in one unit, not a combination of two valves. This type would normally only be used in large transmission mains with few connections.

Air valves shall be installed at each highpoint in all water mains of 12 inches in diameter and larger. Installation shall include 1 inch or 2 inch gate valves between saddle and air valve for maintenance purposes. They shall be installed in pre-cast concrete manholes or vaults as specified in Section 8.03E and 4.02K, respectively, and fitted with air vents of adequate cross section open to the atmosphere. A minimum of 1 foot of 1½ inch rock shall be placed under the pipe in air valve manholes. When air valves are required, specifications shall be submitted to the Director of Public Works for review and approval. These specifications shall include the size, type, and all calculations required. Refer to Air and Vacuum Relief Valve Detail (No. WA-1), located in Section 9, for additional specifications.

I. Blowoff Assemblies

Blowoff assemblies or drain valves shall be installed at each low point in all water mains of 12 inches in diameter and larger. All water mains installed having dead ends, where stagnant water may collect, shall be provided with blowoff devices which will allow flushing of the main without interruption of water service. Refer to Blowoff Assembly Installation Detail (No. WA-2), located in Section 9 of these specifications for water mains less than 12 inches in diameter. All water mains of 12 inches in diameter and larger shall have blowoff assemblies of at least 6 inches in diameter. Design for installations of 6 inches and larger shall be approved by the Director of Public Works. Fire hydrants may be used as a blowoff alternative with the approval of the Director of Public Works or designee.

J. Master Meter

Master Meter shall be designed according to the City of Greeley Design Criteria and Construction Specifications - Volume III and approved by the City of Greeley.

4.02 MATERIALS (continued)

K. Vaults

All vaults shall be designed to adequately house the valves and fittings therein contained, as well as to withstand all external loadings imposed by earth, thrust, and AASHTO H-20 highway live loading. Vaults located in areas other than those that will involve vehicular traffic may be designed for a loading other than AASHTO H-20 by a Registered Professional Engineer of the State of Colorado. Vaults shall be furnished with removable roof slabs to allow removal of all valves and fittings. They shall also be sized so as to allow sufficient room for valve maintenance and minor repair and shall be furnished with manhole rings for easy access. They shall be constructed in such a manner as to allow operation of all valves from above ground and shall be fitted with air vents open to the atmosphere. Vaults shall be constructed so that the vault opening opens directly over the meter. Vaults shall be made waterproof after construction by use of sealants, epoxies, or other approved methods. All vaults shall be designed with wall sleeves and approved seal at pipe penetrations and be capable of handling thrusts caused by removing valves. If the vault is not to be in a street, the roof shall be designed to support the overhead earth fill and any other reasonable loading that may occur.

Steps for vaults, which must be secured in concrete, may be Grade 60, 3/8 inch diameter deformed reinforcing rod and conform to ASTM A-1011 coated with a co-polymer polypropylene. These steps, which may be cast into the vault at time of forming or field installed, must conform to ASTM D-4101.

Concrete floors, shall have 12 inch diameter by 18 inch deep sump holes in the corner but not open to the outside of the vault. The designing engineer shall submit shop drawings along with design calculations including the electric layout to the Director of Public Works for approval prior to the installation.

L. Pre-cast Concrete Manholes

See Section 8.03E of these specifications.

M. Thrust Blocks

Thrust blocks shall be constructed at all bends and fittings which result in unbalanced line thrust. Care shall be taken not to block outlets or to cover bolts, nuts, clamps or other fittings or to make them inaccessible. A bond breaker shall be placed between the fitting and the thrust block to aid in ease of future removal. The vertical sides of the concrete thrust blocks shall be formed to allow for symmetrical thrust. All concrete thrust blocks shall be designed for shape and size as required by type of soil, and shall in every instance bear against undisturbed earth. If soil bearing strength is unknown, soil bearing capacities used in design must be approved by the Director of Public Works. When it is impossible through over excavation or other causes to pour a thrust block against undisturbed earth, deformed reinforced rods shall be required to anchor the fittings to the main upon approval of the Director of Public Works. Backfill may be placed over the thrust block once the surface has set sufficiently to resist the weight of the backfill. However, no tamping or compacting shall be allowed above the thrust block for a minimum of 24 hours after placement. Concrete must set a minimum of 48 hours prior to the performance of a hydrostatic test. Refer to the Thrust Block Detail (No. WA-14), located in Section 9 for detailed specifications.

N. Concrete

All cement used shall be Portland cement acceptable under ASTM C-150. Cement used shall be Type II. All concrete shall have a minimum 28 day compressive strength of 3,000 psi. The design mix of Portland cement, fine aggregate, coarse aggregate, water and admixtures shall be submitted along with test results of the design mix to the Director of Public Works for approval upon request.

4.02 MATERIALS (continued)

Concrete shall not be placed on frozen subgrade. Concrete shall be placed only in the presence of the Inspector unless inspection has been waived prior to the placement. When concrete is deposited against ground without the use of forms, the ground shall be thoroughly moistened or other provisions made to prevent the ground from drawing water from the concrete. Newly placed concrete shall be allowed to set undisturbed for a minimum curing time of 24 hours. When concrete is placed at temperatures below 40° Fahrenheit, the Contractor shall provide satisfactory methods and means to protect the mix from injury by freezing and comply with all American Concrete Institute (ACI) standards or latest revisions.

After placement of concrete, an 8 mil polyethylene covering shall be required for 24 hours in order to allow for proper curing.

No trucks shall be permitted to place concrete, if placement does not begin prior to 90 minutes from when the truck left the plant. Allowable slump shall be 3 inches \pm 1 inch.

Hand-mixed concrete will not be permitted.

O. Harness Rods

Harness rods shall not be allowed.

P. Concrete Reinforcement

All deformed reinforcing bars shall conform to ASTM A-615, Grade 40 or 60; or ASTM A-996, Grade 40 or 60. All welded steel wire fabric shall conform to ASTM A-185.

Q. Galvanized Material

Under no circumstances shall any galvanized fittings or material be used.

R. Fire Hydrants

All fire hydrants shall conform to and be tested in accordance with AWWA C502, latest revision. Fire hydrants shall be made of cast iron with full bronze mountings. Inlets shall fit 6 inch pipe with barrel length sufficient for a 5 foot trench. Hydrants shall have one - 4½ inch pumper connection and two - 2½ inch hose connections, and the main valve opening in the fire hydrant shall be not less than 5 inches in diameter. Threads on all nozzles shall be National Standard. All fire hydrants shall open counterclockwise.

A traffic breakaway feature shall be incorporated into the barrel of the hydrant and shall be 6 to 10 inches off the ground. The operating nut shall be National Standard pentagon measuring 1½ inches from point to opposite flat. Nozzle covers shall have the same size and shape nut as the operating nut. The hydrant shoe shall have a mechanical joint fitting with the tee-head bolt and hexagon nut made of "Cor-Ten".

Each hydrant shall have drain holes with a minimum of 24 inches of 1½ inch rock beneath them. Leave plug in place in high ground water condition. A sheet of 4 mil polyethylene should be placed over the rock to prevent dirt from filling the rock, and a minimum of 2 ounce per square yard filter fabric shall be placed around the sides and bottom of the rock. All hydrants shall stand plumb and shall be connected to the street main by a 6 inch branch line. The branch line shall be ductile iron pipe only. An independent 6 inch gate valve shall be installed on each fire hydrant branch with an approved swivel tee or hydrant tee. Fire hydrant thrust blocks shall be placed as per Fire Hydrant Detail (No. WA-6), located in Section 9 of these specifications

4.02 MATERIALS (continued)

No part of the fire hydrant assembly shall protrude over the edge of the sidewalk. Minimum distance from driveways shall be 5 feet. Depending upon hydrant location, the use of steel posts filled with concrete may be required for protection, as specified by the inspector. Fire hydrants shall be placed on property lines at corners, or in the middle of the block in residential areas, at 500 foot increments. Commercial fire hydrants shall be located at 300 foot increments. All hydrants shall be located within the right-of-way adjacent to public streets.

Corrosion protection shall be as per Section 4.03 of these specifications.

Each hydrant shall be painted Des Moines Safety Yellow product #6162.

Fire hydrants shall be Waterous Pacer 250 with National Standard Threads.

For additional information refer to Fire Hydrant Detail (No. WA-6), located in Section 9 of these specifications.

S. Mechanical Joint Restraint

All mechanical joint restraints shall be incorporated in the design of a mechanical joint gland. The gland shall be manufactured of ductile iron conforming to ASTM A-536. Dimensions of the gland shall be such that it can be used with the standardized mechanical joint bell and tee-head bolts conforming to AWWA C111, C153, and C605, latest revision.

The restraint mechanism shall consist of numerous individually activated gripping surfaces to maximize restraint capability. The gripping surfaces shall be wedges designed to spread the bearing surfaces on the pipe. Twist-off nuts, sized same as tee-head bolts, and shall be used to ensure proper actuate of restraining devices. When the nut is sheared off, a standard hex nut shall remain.

The mechanical joint restraint device for ductile iron pipe shall have a working pressure of at least 250 psi with a minimum safety factor of 2:1.

The mechanical joint restraint device for PVC shall have a working pressure of at least 150 psi with a minimum safety factor of 2:1.

The mechanical joint restraint devices shall be of the type listed below or equal, approved by the Public Works Department prior to construction:

For Ductile Iron Pipe: EBAA Iron, Inc., Mega lug 1100 series (4"-12")
Uni – Flange UFR-1400-D

For PVC Pipe: EBAA Iron, Inc., Mega lug 2000 PV series (4"-12")
Uni – Flange UFR – 1500 – C

4.03 CORROSION PROTECTION

All ductile iron pipe, fittings, valves, and valve boxes shall be protected as specified in this section.

All ductile iron pipe, fittings, valves, and valve boxes shall be hand-wrapped using polyethylene with a minimum wall thickness of 8 mils and a 2 inch wide, 10 mil thick, polyethylene pressure sensitive tape to close seams or hold overlaps.

All polyethylene encasement material shall be installed in accordance with AWWA C105, latest revision.

In all cases the polyethylene shall be so applied as to prevent the contact of backfill material with the fitting.

4.03 CORROSION PROTECTION (continued)

Other means of corrosion protection must be specifically pre-approved by the Director of Public Works or designee.

4.04 EXCAVATION

All excavations shall be made to the lines and grades as established by the approved drawings. Pipe trenches shall be excavated to a minimum depth of 6 inches below the bottom of the pipe. All areas shall be excavated in such a manner as will afford adequate drainage. Where material encountered within the limits of the work is considered unsuitable for a foundation by the Inspector, such material shall be excavated below the grade shown on the drawings to a depth necessary to ensure a stable, firm foundation and refilled with 1½ inch rock uniformly graded to provide a firm foundation, unless otherwise specified by the Director of Public Works or his designee.

All excavated materials which are considered unsuitable for backfill and any surplus of excavated material shall be disposed of by the Contractor.

Refer to Water Line Trench Cross-Section Detail (No. WA-17), located in Section 9 for additional specifications on trench excavations.

All existing asphalt or concrete surfacing shall be cut vertically in a straight line, as specified in Section 2.09, and removed from the job site prior to starting the trench excavation. This material shall not be used in any fill or backfill.

The trench shall be excavated so that a minimum clearance of 6 inches is maintained on each side of the pipe for proper placement and compaction of the bedding or backfill material. The maximum trench width measured at the top of the pipe shall be the outside diameter of pipe plus 24 inches.

If the trench width exceeds the maximum trench width, a stronger class pipe will be specified.

The trench shall be adequately supported and the safety of workers provided for as required by the most recent standards adopted by the Occupational Safety and Health Act. The City reserves the right to inspect construction sites for compliance to OSHA regulations. The City is not responsible for the safety of any party or parties constructing the utility project.

Excavation for structures shall be of such dimensions as to allow for proper installation and to permit the construction of the necessary pipe connections.

Blasting shall not be allowed.

4.05 DEWATERING

All pipe trench excavations shall be kept free from all water during pipe laying and other related work. All pipes shall be plugged with a temporary watertight plug at the end of the day. The method of dewatering shall remove all free standing water at the final lines and grades of the excavation. All water shall be disposed of in a suitable manner without creating a menace to public health or causing a public inconvenience. The dewatering operation shall continue until such time as it is safe to allow the water table to rise in the excavations. Pipe trenches shall contain enough backfill to prevent pipe flotation.

4.06 PIPE BEDDING

After completion of the trench excavation and proper preparation of the trench foundation, a minimum of 6 inches and a maximum of 12 inches of bedding material shall be placed on the trench bottom for support under the pipe. Bell holes shall be dug deep enough to provide a minimum of 2 inches of clearance between the bell and the bedding material. All pipe shall be installed in such a manner as to ensure full support of the pipe barrel over its entire length.

4.06 PIPE BEDDING (continued)

After the pipe is adjusted for line and grade and the joint is made, the bedding material shall be carefully placed and tamped under the haunches of the pipe, up to spring line in lifts not to exceeding 8 inches (loose thickness), and in the previously dug bell holes. The bedding shall then be installed to a minimum of 6 inches and a maximum of 12 inches above the top of the pipe, regardless of the type of pipe.

The bedding material shall be squeegee sand or in-situ material, if approved by the Director of Public Works, and shall conform to Table 4.06 limits when tested by means of laboratory sieves.

Table 4.06
Bedding Material Gradations

Sieve Size	Total Percent Passing by Weight
3/8"	100
No. 200	0-5

If in-situ material is used for bedding, all material greater than 3 inches in diameter shall be removed. Subgrade stabilization materials, if required, shall consist of 1½ inch angular crushed rock. Refer to the Water Line Bedding Detail (No. WA-16), located in Section 9 for additional bedding specifications.

4.07 INSTALLATION OF PIPE

All pipes shall be installed in accordance with AWWA C600 or C605, latest revisions, along with the following provisions:

Pipe and fittings shall be loaded and unloaded by lifting so as to avoid shock or damage. Under no circumstances shall such material be dropped. Before the placing of pipe in the trench, each pipe or fitting shall be thoroughly cleaned of all foreign material, kept clean at all times, and examined for cracks or defects before installation.

Joint lubricant shall be as supplied by the pipe manufacturer.

When laying pipe on curves, the pipe shall be kept in alignment by deflection joints or using short lengths of pipe. If the joints are being deflection, refer to Section 3.06 for specifications. Pipe shall be laid with the bell ends facing in the direction of lying unless directed otherwise by the Inspector.

Whenever the pipe is left unattended, temporary plugs shall be installed at all openings. Temporary plugs shall be water tight, standard cast iron, and of such design as to prevent children and animals from entering the pipe. All temporary plugs shall be approved by the Public Work Inspector.

No pipe or appurtenant structure shall be installed upon a foundation into which frost has penetrated or at any time when the Inspector deems there is a danger of ice formation or frost penetration at the bottom of the excavation. No pipe or related structure shall be installed unless backfilling can be completed before the formation of ice and frost.

Immediately before joining two lengths of pipe, the inside of the bell and the outside of the spigot end and the gasket shall be thoroughly cleaned. Caution shall be exercised to ensure that the correct type of gasket is used. A thin film of gasket lubricant shall be applied to either the inside face of the gasket or the spigot end of the pipe or both.

The spigot end of the pipe shall be placed in the socket with care to prevent the joint from contacting the ground. The joint shall be completed by pushing the pipe home with a slow steady pressure, without jerky or jolting movements. Stabbing shall not be permitted. Pipe furnished without a depth mark shall be marked before assembly to ensure insertion to the full depth of the joint.

Extra care should be used in handling PVC pipe during cold weather due to the reduced flexibility and impact resistance as temperatures approach and drop below freezing.

4.07 INSTALLATION OF PIPE (continued)

Harnessing of joints may be accomplished by use the use of mechanical joint restraint systems as specified in Section 4.02S, or by use of one of the several proprietary joint restraint systems supplied by pipe manufacturers. The proprietary systems will require approval of the Public Works Department prior to use. Regardless of the system used, restrained lengths of pipe for various fittings, where harnessing is utilized or required, shall be at least equal to the lengths shown on the construction drawings or as directed by the Director of Public Works.

Where joint restraint is required on PVC pipe, the designer may use a mechanical joint restraint system or one of the approved proprietary systems. Rods and clamps shall not be used on PVC pipe.

Refer to Water Line Trench Cross Section Detail (No. WA-17), located in Section 9 for additional specifications on pipe installation and backfill.

4.08 INSTALLATION OF VALVES AND VALVE BOXES

All valves shall be handled in such a manner as to prevent any injury or damage. All valves shall be thoroughly cleaned before installation. Valves shall be set in such a manner that the valve stems are plumb. Valves shall be located at points as specified in Section 3.09. Any deviation from this shall be at the discretion of the Director of Public Works.

Final elevation of valve boxes shall be left 1/4 to 1/2 inches below pavement surface. See Water Valve Box Detail (No. WA-19 and WA-20), located in Section 9 for more specifications on the installation of valves and valve boxes.

Valve boxes shall be installed plumb. Valve boxes which have shifted during backfill operations and are no longer plumb shall be re-excavated and realigned to the satisfaction of the Director of Public Works.

4.09 BACKFILL

It is expected that the trench excavation will provide suitable backfill material. Wet, soft, or frozen material, pieces of asphalt or concrete or other undesirable substances shall not be used for backfill. The backfill material shall be free from rubbish, stones larger than 5 inches in diameter, clods and frozen lumps of soil. If the excavated material is not suitable for backfill as determined by the Director of Public Works, suitable material shall be hauled in and utilized and the rejected material hauled away and disposed of. All snow shall be removed from the trench prior to proceeding with backfill operations.

Backfilling shall be conducted at all times in a manner to prevent damage to the pipe or its coating and shall be kept as close to the pipe laying operation as possible.

All backfill around structures shall be consolidated by mechanical tamping. Backfill shall be placed in lift thicknesses capable of being compacted to densities specified in Table 4.10.

In areas where existing pavement is to be cut and replaced, existing material excavated shall be removed from the site and the trench backfilled with gravel road base to finished or existing grade as specified in Section 2.09. Excess material shall be removed prior to surfacing. Squeegee sand shall not be considered backfill material and shall not extend more than 12 inches above the top of the pipe.

Soil resistivity tests and/or any other soil tests may be required at the sole discretion of the Director of Public Works. The developer/Contractor shall incur the costs of all soil testing, as required.

4.10 COMPACTION

Compaction shall be obtained by any method the Contractor desires except that water flushing for consolidation shall not be permitted. Compact trench backfill to density required in accordance with ASTM D698, ASTM D4253, and ASTM D4254. Comply with Table 4.10 trench compaction criteria.

4.10 COMPACTION (continued)

Table 4.10
Compaction Criteria

LOCATION	SOIL TYPE	DENSITY
Trench Backfill: Under Pavements Roadway Surfaces, Within R.O.W.	Cohesive Soil	95% (ASTM D698)
	Cohesive-less Soils	95% (ASTM D4253 & D4254)
Trench Backfill: Under Turf, Sod And Non-Traffic Area	Cohesive Soils	90% (ASTM D698)
	Cohesive-less Soils	90% (ASTM D4253 & D4254)

The minimum moisture content shall not deviate above or below the standard optimum by more than 2% or a recommended value made by a Geotechnical Engineer.

If, in the judgment of the Director of Public Works, the trench shows signs of being improperly backfilled or if settlement occurs, the trenches will be reopened to a depth required for proper compaction, refilled and re-compacted, all in accordance with these specifications.

Compaction tests, taken by an independent commercial laboratory, shall be taken every 500 feet or at the discretion of the Director of Public Works while construction is proceeding. All compaction tests shall be taken at depths below subgrade ranging from 1 foot above the top of squeegee sand to 1 foot below grade. The results shall be forwarded to the City of Evans Public Works Department.

4.11 TRENCH MAINTENANCE

For a period of 2 years after completion of the installation (2-year warranty period), the Contractor shall maintain and repair any trench settlement which may occur and shall make suitable repairs to any pipe, fitting, valve, valve box, pavement, sidewalks, or other structures which may be damaged as a result of backfill settlement as determined by the Director of Public Works. For a definition of "acceptance of work," see Section 2.14 of these specifications.

4.12 CHLORINATION AND BACTERIOLOGICAL TESTS

Refer to Section 5 of these specifications for complete testing procedure.

Under no circumstances shall a non-disinfected main which cannot be isolated be connected to an existing, disinfected main. The Contractor will assume any and all responsibility for damage done by heavily chlorinated water entering existing facilities due to negligence on his part.

4.13 HYDROSTATIC TESTING

See Section 5.07 for hydrostatic testing procedure.

4.14 REPAIR FITTINGS

Repair clamps shall be of stainless steel construction in the band, lugs, nuts, and stainless steel bolts. These devices should not be considered substitutions for careful installation of mains. Repair clamp design and make shall be submitted to the Director of Public Works for approval prior to the installation. Stainless steel clamps may be used to repair broken water mains during and after the 2-year service warranty.

4.15 WATER SERVICE LINES

A. GENERAL

All water service line construction connecting to the City of Evans water distribution system shall be done in accordance with the above specifications with the following additions. These specifications shall cover all new water service line construction from the water main to the meter pit or vault. Any deviations from these standards must be approved in writing by the Director of Public Works.

4.15 WATER SERVICE LINES (continued)

B. MATERIALS

Service lines shall not be constructed with galvanized pipe or plastic pipe. The minimum size allowable for a service line shall be 3/4 inch diameter.

1. Copper Service Pipe—Type K Only

Type K copper shall be used for service lines 3/4 inch through 3 inch diameter. 3 inch ductile iron pipe may be used upon approval by the Director of Public Works.

2. Ductile Iron Service Pipe

Ductile iron pipe used for service pipe shall conform to Section 4.02A of these specifications. Ductile iron pipe shall be used for all service lines; larger than 3 inches unless otherwise specified by the Director of Public Works.

3. Service Connection

All water service saddles shall be cast bronze with double silicone bronze straps and shall only be from a manufacturer pre-approved by the Public Works Department. Refer to the Water Service Connection Detail (No. WA-18) located in Section 9 for additional information.

Corporation stops shall be AWWA taper thread to copper flare connection or compression fittings and shall only be from a manufacturer pre-approved by the Public Works Department. Taps shall be inspected by Public Works Department when water is on and trench opened.

4. Curb Stops

A curb stop or valve of the same size as the service pipe and conforming to the following standards shall be installed on every service line between the water main and the meter, at a point at or near the property line.

Curb stops shall be flare-to-flare connections or compression fittings and shall only be from a manufacturer pre-approved by the Public Works Department.

The curb stop box shall be installed exactly center over the curb stop valve and in a vertical position. The top lid of the curb stop box shall be installed a maximum of 1 inch above the final grade.

C. PIPE BEDDING

All specifications are applicable except that K copper service lines require a minimum bedding depth of 6 inches of squeegee for up to a 3 inch service line. Any service line larger than 3 inches shall have typical water main bedding.

D. LOCATION

That portion of the service pipe between the main and the curb stop and/or meter when installed must be in a continuous straight line, with no joints and perpendicular, if possible, to the main line. Service lines stubbed into the property line shall be of sufficient length to allow direct connection to the shut-off valve.

The main to be tapped must extend along the entire length of the front lot line of the property to be served.

4.15 WATER SERVICE LINES (continued)

If service is requested for a lot at the end of a cul-de-sac street, the main to be tapped shall be a maximum of 25 feet from the curb line or the proposed curb line at the end of the cul-de-sac. The service pipe between the main and the property line in cul-de-sacs shall be in a continuous straight line. No service line may be constructed through or in front of any adjoining property. When possible, the service line shall be located towards the high side of the lot. Sewer and water service lines must be a minimum of 10 feet apart horizontally, or concrete encasement or special protection of the sewer line will be required. Service locations will also be marked with a “W” on the face of the curb during the placement of concrete.

E. DEPTH

All service pipe shall be provided with at least 4½ feet of cover below the established grade of the street in which they shall be laid, and all other places at least 4½ feet below the surface of the ground, unless otherwise approved by the Director of Public Works.

F. SEPARATE TRENCHES

Except as hereinafter provided, no service pipe may be installed in a trench containing other conduits which convey any substance other than potable water. The trench containing the service pipe shall be separated laterally from trenches containing other conduits by at least 10 feet of undisturbed compacted earth.

G. CONNECTIONS

Service pipes of 2 inches or less in diameter shall be connected to the main by means of a brass corporation cock of the same diameter as the service pipe.

No underground joints are allowed in the copper service pipe less than 2 inches in diameter between the corporation cock and the curb stop and/or meter. The use of underground joints may be allowed only on the repair of existing service lines with specific approval from the Director of Public Works.

Water taps shall be made by the Contractor utilizing material as specified in Section 4.15B. No taps will be made until the service line, and copper setter (on residential), and curb stop (on commercials) have been installed.

Care shall be taken to properly install water service lines so that enough slack is in the service lines to protect against pullout problems.

Water mains will be tapped at a 45° degree angle from the horizontal centerline of the water main on the same side of the pipe as the water meter. When tapping into water mains, an approved tapping tool shall be required.

Tapping mains may require digging out bedding material and cutting or removing part of the corrosion protective wrapping. After the taps are made, the wrap shall be repaired or replaced by the installing Contractor in such a manner as to protect both the service pipe and the main.

Service taps shall have a minimum separation of 24 inches and be no closer than 24 inches to a coupling or joint. No more than four service taps shall be permitted on any one joint of pipe.

H. PUMPS

The installation of pumps on service pipes is prohibited, except when specifically authorized by the Director of Public Works.



4.15 WATER SERVICE LINES (continued)

I. LAWN SPRINKLERS

Lawn sprinkler systems must be tapped on the outlet side of the meter pit in a separate pit. Approved vacuum breakers or other means of cross-connection control are required with each sprinkler system. All devices utilized for cross-connection control must meet the minimum requirements of AWWA, the Uniform Plumbing Code, latest edition, as well as the approval of the Director of Public Works. Refer to Sections 3.12 and 3.13 for cross-connection specifications.

Non-potable connections shall be in accordance with the Meter Setting for Non-potable Irrigation Detail (WA-10). A non-potable irrigation meter shall be a 1 inch meter, and shall be installed by the City Public Works Department

J. VIOLATIONS

If it is necessary to abandon an existing water tap, it shall be turned off and disconnected at the main. A charge will be assessed for all labor and materials necessary to perform this work. Service lines that have been installed in improper locations, such as side yards or corner lots, shall be moved to the location noted in these specifications, as long as such action does not require the cutting and patching of asphaltic concrete surfacing.



SECTION 5 WATER MAIN RELEASE PROCEDURE

5.01 SCOPE

The release procedure covers disinfection, bacteriological sampling, and reporting of results. This procedure is to be followed when: 1) releasing a newly installed water main, or 2) releasing a repaired pre-existing water main.

Flushing and disinfection will be completed in accordance with AWWA Standard C651, latest revision (more detailed instructions will be found below). A flow chart of the City of Evans testing procedure is attached as Figure 5.01-1 in Appendix A.

All water lines and appurtenances shall be disinfected, flushed and tested after backfill operations have been completed and acceptable compaction test results have been submitted to the City. All test results shall be submitted to the City within 10 working days from the day of testing. There shall not be any pipe in place for more than 90 calendar days prior to the completion of testing

5.02 NEW MAINS

Installation will be in accordance with established AWWA C600 or C605, latest revisions, with particular attention paid to the provision for cleanliness within the pipe itself. Sampling (bacteriological and chlorine residual) will be performed by personnel from the City of Evans Public Works Department and forwarded to the Weld County Health Department for analysis. Chlorine residual analysis will be performed using accepted test procedures in Standard Methods for the Examination of Water and Wastewater.

5.03 REPAIRED MAINS

After a main has been repaired and flushed, personnel from the City of Evans shall inspect the water for color, turbidity, and chlorine residual, prior to restoring the repaired main into service.

5.04 DISINFECTION

Disinfection will be accomplished using tablet-form Hypochlorite or by continuous feed. The Hypochlorite tablet will be affixed to the inside (top) with an approved adhesive (i.e., Permatex #1 or equivalent). Dosage will be calculated for concentration of chlorine equal to 25 mg per liter of water for volume of installed pipe. (This is to allow for the refilling of pre-existing pipe attached to the installed sections.) For calculating the weight of chlorine required, consult Table 5.04. The chlorine solution will remain in contact with the piping for a minimum of 24 hours (preferably 48 hours). At this time a designee from the City of Evans Public Works Department will test for high chlorine content.

Table 5.04
Minimum Number of Hypochlorite Tablets of 5g Strength for a Dose of 25 mg/l

Length of Section (ft.)	Diameter of Pipe (inches)								
	6	8	10	12	16	18	20	24	36
13 or less	1	1	2	3	4	6	7	9	21
18	1	2	3	4	6	7	9	13	28
20	1	2	3	4	7	8	10	14	31
30	2	3	4	6	10	12	15	21	47
40	2	4	5	7	13	16	20	28	62

Adapted from AWWA C651

5.05 FLUSHING

After chlorination or disinfection of the pipeline, flushing will commence to remove the chlorine solution. Flushing will continue for a minimum of five minutes beyond the time when chlorine residual is present at the same levels as normal distribution system residuals.

5.06 BACTERIOLOGICAL SAMPLING

Immediately after flushing, personnel from the City of Evans Public Works Department will collect samples for bacteriological contamination and send the samples to Weld County Health Department for analysis. A minimum of two samples will be analyzed. All samples will be collected in duplicate, that is, two samples from each location tested. If the samples show no bacteriological growth and are free from excessive turbidity, the City of Evans will release the main for hydrostatic testing. If samples do not warrant approval for main release from the City of Evans, lines must be re-flushed. If again, samples do not warrant approval for main release after flushing, re-chlorination shall be required.

5.07 HYDROSTATIC TESTING

No hydrostatic tests shall be made on any portion of the pipeline until all field-placed concrete has had adequate curing time as defined for thrust blocks in Section 4.02M of these specifications and all compaction test results have been submitted to and approved by the Director of Public Works.

The pipeline shall be tested in accordance with AWWA C600 or C605, latest revision, except as follows:

The pipeline shall be tested with water at a pressure of 150 psi or 150% of the working pressure, whichever is greater. All fire lines shall be tested at 200 psi.

The Director of Public Works shall be notified 24 hours in advance of testing. All acceptance testing shall be only after the pipeline is in a state of readiness for testing.

All air in the line shall be properly purged. Where blowoff assemblies or hydrants are not available or effective in purging air from the line, the Contractor shall install a tap to purge the line. The location and size of the tap shall be at the discretion of the Director of Public Works. The cost for such a tap will be the responsibility of the Contractor.

No leakage is allowed through the bonnet of the line valve. Any valve leaking through the bonnet shall be removed and replaced.

The pressure test shall be a 2 hour test taken at the high point in the line. Every time the water line pressure drops 5 psi, the pump will be started to bring the line pressure back to the initial pressure. At the discretion of the Director of Public Works or designee, a minimum 1 hour pressure test may be conducted in lieu of a 2 hour test.

The Director of Public Works or designee shall direct the Contractor to repair specific leaks regardless of test results if in his opinion; they are serious enough to endanger the future service of the pipeline. Pipelines shall be tested in sections as rapidly as such section may be isolated. Should any leakage of the pipeline become apparent during the 2-year warranty period, the City of Evans Public Works Department personnel or their authorized designees may perform or may direct Contractor to perform the necessary repairs. The Contractor shall be invoiced for all work performed during the 2-year warranty period. Blowoff assemblies, pressurizing pump, corporation stops and water measuring apparatus shall be provided by the Contractor, at his expense. At the Inspector's discretion, measuring apparatus may be required to be calibrated by City of Evans' personnel at the Contractor's expense.

The City of Evans Public Works Department shall not be held responsible for water tightness of its valves on existing facilities. If existing valves leak, the City will assist in reducing the influx of water, but the Contractor must use methods at his own disposal to work with the resulting leakage.

All fire hydrant lines shall be pressure tested. It is recommended that the fire hydrant be dry. All fire hydrants shall be tested by flushing each hydrant a minimum of 5 minutes. Tables 5.07-1 – 5.07-6 in Appendix A shall be utilized in determining the acceptance of the hydrostatic test.

SECTION 6 WATER METER INSTALLATION CRITERIA

6.01 GENERAL INFORMATION

A. Inside Installations

Water meter installations inside any building are specifically prohibited unless otherwise specified by the Director of Public Works.

B. Warranty

A 2-year warranty as to materials and workmanship will be in effect upon final acceptance of the meter pit or vault.

C. Water Meters

All water meters, regardless of size, connected to the City of Evans' utility system, shall be purchased from and remain the property of the City of Evans. Under no circumstances shall anyone other than City of Evans Public Works Department personnel remove a water meter once the pit or vault has been inspected and approved, unless otherwise specified by the Director of Public Works. Meters shall be Rockwell SR2 5/8 inch x 3/4 inch, unless otherwise approved by the Director of Public Works.

D. Special Meter Installation

For any installation where special or unusual conditions might exist, detailed drawings, accompanied by a letter of explanation, shall be submitted to the City of Evans Public Works Department.

E. Water Meters Over 4 inches in Size

For any water meter installation over 4 inches in size, detailed drawings of the proposed installation shall be submitted to the Director of Public Works for approval prior to any construction.

F. Easements

The City of Evans Public Works Department shall be provided easements for water meter installations, if required.

G. Electrical Wiring

There shall be no electrical wiring allowed in any water meter pit or vault with the exception of radio wiring, unless otherwise authorized by the Director of Public Works.

H. Inspection of Residential Pits and Commercial Vaults

Inspections of all residential pits and commercial pits or vaults shall be conducted by personnel from the City of Evans Public Works Department. Locations for commercial pits or vaults shall be determined by personnel from the City of Evans Public Works Department.

I. Meter Sizes

Maximum meter sizes for residential, commercial or industrial use shall be determined by Table 6.01. Any deviation from this table shall require approval from the Director of Public Works.

6.01 GENERAL INFORMATION (continued)

Table 6.01
Water Taps Inside City of Evans City Limits

TAP SIZE (Inches)	MAXIMUM RESIDENTIAL UNITS ALLOWED PER TAP
3/4	2
1	4
1 1/2	10
2	25
3	45
4	90
6	170
8	300
10	500
12	825

J. Re-inspection Fees

A re-inspection fee (as adopted by the City Council by Resolution) shall be assessed for every inspection after the initial installation inspection.

K. Variance from Standard Specifications

A variance may be applied for when certain conditions exist that cause a necessary deviation from these standard specifications. This variance shall be applied for in writing, accompanied by drawings and engineering calculations, and submitted to the City for approval.

6.02 INSTALLATION OF 24 INCH PITS

A. Extension

All extensions shall be approved by the City.

B. Copper Setters

Copper setters of the proper laying length to accommodate the water meter are required on all installations of water meters 5/8 inch x 3/4 inch and larger. The laying lengths are shown in Table 6.02.

Table 6.02
Laying Lengths

5/8" x 3/4" water meter	7 1/2"
3/4" x 3/4" water meter	9"
1" x 1" water meter	11"

Cutting of the copper setter for purposes of increasing or decreasing the span across the copper setter is specifically prohibited.

6.03 INSTALLATION OF 5/8 BY 3/4, 3/4 BY 3/4, and 1 INCH METERS

A. Meter Pits

Meter pits shall be constructed according to Meter Setting Detail for 3/4 and 1 Inch Meter (No. WA-7) and Meter Setting Detail for Non-potable Water Line (No. WA-10). The trench floor under the pit shall be compacted earth. Copper service pipe entering and leaving the pit beneath the bottom shall be of sufficient length so as to meet the depth specifications as outlined in 7.03B when the copper setter is installed. The pit shall not bear on the service pipe. Meter Pits shall be located in a greenbelt and not in concrete or in asphalt pavement. Refer to the Meter Setting Detail for 3/4 and 1 Inch Meter (No. WA-7) and Meter Setting Detail for Non-potable Water Line (No. WA-10), located in Section 9 for more information.

6.03 INSTALLATION OF 5/8 BY 3/4, 3/4 BY 3/4, and 1 INCH METERS (continued)

B. Copper Setter Installation

The copper setter shall be of an all copper and brass construction and shall have a positive 1/4 turn locking shut-off valve on the inlet side of the copper setter. The copper setter, when installed, shall be 8 to 10 inches from the frost lid, see Meter Setting Detail for 3/4 and 1 Inch Meter (No. WA-7) and Meter Setting Detail for Non-potable Water Line (No. WA-10). The copper setters shall only be from a manufacturer pre-approved by the Public Works Department. The outlet of the copper setter will be isolated from the service line with an isolator from a manufacturer pre-approved by the Public Works Department.

C. Water Meter Pit Covers

The dome shall be cast iron construction with a plastic top lid (outer lid), and a rubber frost cover (inner lid). As approved by the Director of Public Works or designee. Frost lids of neoprene construction are specifically prohibited. When installed, the dome shall be level and 2 inches above the final grade (curb and gutter, sidewalk, etc.). The center of the dome's top lid, when installed, shall be a maximum of two feet behind the public right-of-way line. The water meter pit cover shall only be from a manufacturer pre-approved by the Public Works Department. Meter pits shall be located a maximum of 6 feet behind back edge of curb when no sidewalk exists, as long as pit remains in the right-of-way. There shall not be holes in the water meter pit lids.

D. Check Valves

Approved backflow prevention devices are required on all water meter installations where any conditions may exist that would cause a higher pressure on the downstream side of the meter than in the water main. All such devices must be approved by the Director of Public Works prior to installation.

E. Installation

The water meter shall be installed by Public Works Department personnel. The Contractor(s) responsible for the installation of the meter pits covered in this section are specifically prohibited from installing these pits in any type of vehicular or pedestrian traffic zone.

F. Plastic Pipe

Plastic pipe and fittings are specifically prohibited

G. Galvanized Pipe

Galvanized pipe and fittings are specifically prohibited.

H. Pit Inspection and Acceptance

Water meter pit installations shall not be given final inspection until final grading around the structure has been completed. Necessary grade adjustments to the pit after the City of Evans Public Works Department personnel have given final inspection shall be the responsibility of the owner. Any service line material changes must occur outside the meter pit on the outlet side.

6.04 INSTALLATION OF 1½ AND 2 INCH METER

A. Water Meter Vaults

Water meter vaults for 1½ inch and 2 inch water meter installations shall be rectangular and constructed of reinforced concrete. The entry hole through the top (or roof) of the vault shall be located so that the center of the opening is over the water meter. All vaults shall be sealed at all major joints and be made as watertight as possible. The design of this vault must be submitted by a registered Professional Engineer to the Director of Public Works upon request. See Meter Setting Detail For 1½ and 2 Inch Meter (No. WA-8), located in Section 9 for more information.

B. Meter Vault Lids and Covers

Meter vault lids and covers shall only be from a manufacturer pre-approved by the Public Works Department.

C. 1½ and 2 Inch Meter Setters

All 1½ inch and 2 inch meters will be set in a factory made setter with a bypass. No built-on-site setters will be allowed. The Contractor shall purchase the meter from the City of Evans.

D. Valves

Valves shall be AWWA C500, C509, and C515, latest revision approved valves of all brass construction. The valve stems shall be of non-rising design. Valves shall be installed both upstream and downstream of the water meter within the vault. The valves shall open counterclockwise (Refer to Section 4.02D). All valves located in vaults shall have hand wheels in lieu of 2 inch square operating nut.

E. Unions

Unions will not be allowed. Only flange-type fittings are allowed for setting of meters.

F. Curb Stop Valve

Refer to Section 4.15B.

G. Check Valves on Bypasses for Backflow Prevention

Approved backflow prevention devices shall be installed on bypass service lines where the service line being bypassed has a backflow prevention device. The device shall be AWWA (C510, latest revision) approved and be of all brass construction. It shall be installed downstream of the bypass valve and approved by the Director of Public Works.

H. Backflow Prevention

To prevent possible backflow contamination of the City of Evans' potable water mains, a reduced pressure-type backflow prevention device shall be installed where any condition might exist that would create a higher pressure downstream of the water meter than exists in the main line. This unit shall be installed downstream of the water meter, between appropriate valves, either above ground, or inside a building with adequate drainage. No pit or vault installations will be approved. The backflow prevention apparatus, which must be approved by the Director of Public Works, shall meet all requirements and specifications of the American Water Works Association and the Uniform Plumbing Code. Backflow prevention installations are mandatory on buildings such as schools, packing plants, chemical plants, or any business or property that uses water for the base mixture of any type of chemical, whether said chemical is classified toxic or nontoxic in nature. Refer to Sections 3.12 and 3.13 for additional specifications.

6.04 INSTALLATION OF 1½ AND 2 INCH METER (continued)

I. Installation

Meter vault lids and covers shall be installed a maximum of 2 inches above the final grade level of the adjacent property. Easy accessibility must be maintained at all times. Meter vaults shall be installed in greenbelt areas only. Once installed, meter vault lids and covers shall be maintained level with the adjacent grade by the property owner. A two-year warranty as to materials and workmanship is required from the Contractor.

6.05 INSTALLATION OF 3 INCH AND LARGER METER

A. Water Meter Vaults

Water meter vaults for 3 inches and larger water meter installations shall be rectangular design and constructed of reinforced concrete. The entry hole through the top (or roof) of the vault shall be located as so that the center of the opening is over the water meter. All vaults shall be sealed at all major joints and be made as watertight as possible. The design of this vault must be submitted by a registered professional engineer to the Director of Public Works upon request. See Meter Setting Detail for 3 Inch and Larger, Detail (No. WA-9), located in Section 9 for more information.

B. Meter Vault Lids and Covers

Meter vault lids and covers shall be from a manufacture pre-approved by the City.

C. Piping Installation

Piping inside the vault for 3 inches and larger meter services shall be of ductile iron, flange joint design only. Insulation shall be provided between connections of dissimilar metals. The meter vault piping shall be of the same size as the water meter orifice, both entering and leaving the vault. Any service line material changes must occur outside the meter vault on the outlet side.

D. Valves

Gate valves installed shall meet all AWWA C500, C509, and C515, latest revisions, and be capable of withstanding 200 psi working pressure. The valves shall open counterclockwise and have non-rising stem-type construction with hand wheels in lieu of square operating nuts. Refer to Section 4.02D for additional specifications. Valves shall be installed both upstream and downstream of the water meter, within the vault. They shall be of bronze mounted, all cast iron body construction. The valves and operating stems shall be of a non-corrosive construction, open counterclockwise. Gate valves larger than 3 inches in size shall be wedge disc-type. Refer to Sections 4.02E and 4.08 for additional specifications.

E. Bypass Piping

Bypass piping shall be installed on these services to facilitate removal of the water meter without disconnection of service. A gate valve conforming to the same specifications as outlined in Section 6.05D shall be installed in the bypass line. Connection to the meter service may be made by means of a “Y” connection outside the vault.

F. Backflow Prevention

Refer to Section 6.04H.

6.05 INSTALLATION OF 3 INCH AND LARGER METER (continued)

G. Check Valve on Bypass for Backflow Prevention

Approved backflow prevention devices shall be installed on bypass lines where the service line being bypassed has a backflow prevention device. The device shall be AWWA C510, latest revision approved, installed downstream of the bypass valve, and must be approved by the Director of Public Works.

H. Installation

Refer to Section 6.04I.

6.06 RADIO READING SYSTEM

All water meters installed and made a part of the City of Evans utility system shall be equipped with a self-generating radio reading system as required by Public Works Director. The City of Evans shall install the self-contained generator, wire, and the register.

The location of the radio transmitter will be in the meter pit.

The ownership of the wire, meter, conduit, and radio transponder will belong to the City. Any damage to the readout system that is due to negligence or vandalism will be the responsibility of the property owner of record. All repairs to the remote readout system will be performed by City of Evans Public Works Department personnel. Routine maintenance of the radio readout system will be the City's responsibility.

6.07 COMMERCIAL METER SETTING PROCEDURE

The following procedure shall be adhered to for the installation of commercial meters:

- A. City of Evans personnel will install all meters up to and including 2 inches in size.
- B. City personnel will conduct a general inspection prior to the issuance of the engineering release to assure that all facilities conform to their specifications.
- C. If the meter pit or vault passes an inspection performed by City personnel, the meter will be set and the necessary paperwork forwarded to the Finance Department. This inspection will not be made until requested through the Finance Department by the Contractor. If the meter pit or vault fails the inspection performed by Public Works personnel, the Public Works Inspector will leave a list of failure items and the Finance Department phone number for re-inspection. The water meter shall be installed after the meter pit or vault passes inspection.
- D. If there is a jumper in the vault, this jumper will be allowed to stay in place for one week after the pit or vault failed inspection.

If all discrepancies have not been resolved in this 1 week time frame, personnel from the Public Works Department shall then pull the jumper and lock the service. This time frame and consequences for failure to bring the pit or vault up to specifications will also be indicated on the inspection list. Once all discrepancies have been resolved, a re-inspection should be scheduled through the Finance Department.

Meters larger than 2 inches in size will be installed by the Contractor. All meter setters will be purchased from the City of Evans.



SECTION 7 DESIGN CRITERIA - SANITARY SEWERS

7.01 SCOPE

The purpose of this section is to set forth the general criteria to be used in the design of sanitary sewers and appurtenances in the City of Evans service area. Any deviation from these standards must be authorized by the Director of Public Works.

7.02 GENERAL

All sanitary sewer mains and appurtenances shall be in conformance with these specifications and shall be designed by or under the direct supervision of a Registered Professional Engineer licensed to practice in the State of Colorado.

7.03 DESIGN FLOW

Sanitary sewers must be designed to carry the peak discharge with the pipe being no more than 60% full and be able to transport suspended material such that deposits in the sewer are precluded. It is essential that the sewer have capacity for peak hourly sewage flow and adequate velocity at minimum sewage flow.

All sewers shall be designed and constructed to give velocities, when flowing 80% of flow depth, of not less than 2 feet per second or more than 10 feet per second based on the Manning approximation of the Kutter Formula.

$$V = \frac{1.486}{n} * R^{\frac{2}{3}} * S^{\frac{1}{2}}$$

where V = Mean Velocity
R = Hydraulic Radius
S = Slope of Energy Grade Line
n = 0.013

Use of other practical "n" values may be permitted, if justified, on the basis of research and field data and approved by the Director of Public Works. "Table 7.03-1 shows the minimum allowable slopes for sanitary sewer lines.

Table 7.03-1
Min. Allowable Slopes

Sewer Size (Inches)	Minimum Slope
4	2.08%
6	1.04%
8	0.40%
10	0.28%
12	0.22%
15	0.15%
18	0.12%
21	0.10%
24	0.08%

Flow calculations shall be submitted by a Colorado Registered Professional Engineer and shall include the following.

The quantity of sewage flow expected to be generated by the project using the criteria set forth in this section; the nature of any wastes that are not ordinary domestic sewage; and the quantity and type of discharge of an unusual nature such as swimming pool drainage, cooling water, commercial boundaries, floor drains from auto repair garages, steam cleaning, chemical dairy, food processing or service, car washes, metal treating or plating operations, or other similar cases.

7.03 DESIGN FLOW (continued)

In addition to the quantity of flow generated within a project, the impact of the expected peak flow in the sewer system downstream should be investigated to ensure that adequate capacity is available, not only for the proposed project, but for all present users of the existing public sanitary sewer system at a minimum.

Table 7.03-2 shows the design sewage flow*. These flows shall be used as guidelines to determine estimated flows generated from the various types of land use for undeveloped parcels.

Table 7.03-2
Design Sewage Flow

Residential Areas**	
Laterals	400 Gallons/Capita/Day
Main, Trunk, and Outfall Sewers	250 Gallons/Capita/Day
Industrial Areas	1250 Gallons/Acre/Day
Commercial Areas	1000 Gallons/Acre/Day

*For pipes flowing at 60% of flow depth.

**For residential areas, the calculation shall be based upon 3.5 persons per single family unit, 2.2 persons per multi-family unit, and 2.6 persons per manufactured home.

If the number of users and type of establishment are known, the quantities of wastewater, as detailed in Table 7.03-3 in Appendix A, shall be utilized.

A peaking factor of four (4) shall be used when determining the peak flow rate.

If design flows other than those given in Table 7.03-3 are used, the consulting engineer must submit data supporting his design flows.

All calculations of flows to be generated by the proposed project are to be submitted to the City of Evans Public Works Department for review along with the engineering drawings.

7.04 SIZING OF MAINS

No sanitary sewer mains shall be less than 8 inches in diameter. All sanitary sewer mains shall be designed to carry peak flows at 60% depth.

The Public Works Department reserves the right to require oversized mains to provide service for future needs. Reimbursement agreements may be entered into so that the developer can recover costs from other properties that would contribute flows to the oversized main.

Sanitary sewer mains shall be constructed of the following materials will be allowed:

- A. Reinforced Concrete Pipe
- B. Polyvinyl Chloride Pipe
- C. Polyvinyl Chloride Pressure Pipe

All materials must conform to the material requirements as set forth in Section 8.03 of these specifications. Other pipe material may be allowed on a case by case basis with specific written permission from the City.

7.05 GROUND COVER

All sewer mains within the public right-of-way shall be designed so that a minimum of 4½ feet of cover exists over the pipe after final grade has been established unless specifically approved by the Director of Public Works.

7.05 GROUND COVER (continued)

No main or service line shall have more than 20 feet of cover unless specifically approved by the Director of Public Works.

Sewer mains which have less than 4½ feet or more than 20 feet of cover shall be installed utilizing polyvinyl chloride pressure pipe (see Section 4.02B). Sewer lines which must cross under irrigation ditches or through bogs or swamps where the soil is unstable and water infiltration may be high must be specially designed for such conditions by the Consulting Engineer and approved by the Director of Public Works.

7.06 LOCATION

All mains to be dedicated to the City of Evans shall be installed in dedicated streets. Preferable location for these sewer mains is the centerline of the street as determined by the Director of Public Works. Refer to Figure 3.08-1 and 3.08-2 in Appendix A for approximate location of all wet utilities in the right-of-way. Sewer mains may be installed in exclusive easements and rights-of-way when, as determined by the Director of Public Works, it is not practical to make such installation in the dedicated street. When such exceptions are made, the minimum width requirements for easements and rights-of-way are in Table 7.06.

Table 7.06
Minimum Easement of Right-of-Way

One Utility Line	- Total Width of 20 feet - 15 feet on One Side of the Property Line
Two Utility Lines (Water & Sewer)	- Total Width of 30 feet - 10 feet on Either Side - 10 feet Between Lines

All sewer mains shall be in an easement at least twice the depth to the invert in width unless otherwise specified by the Director of Public Works. The minimum width of easement shall be 20 feet. All sanitary sewer lines and manholes shall be located so that they are accessible to City of Evans maintenance crews at all times.

No curvilinear sewers shall be permitted.

Sanitary sewers shall not be installed in drainage ditches.

Sanitary sewer installations shall conform to all specifications as described in Design Criteria Considered in the Review of Wastewater Treatment Facilities, as published by the Colorado Department of Public Health and Environment, except that all distances shall be measured outside edge to outside edge.

A. Vertical Separation

Under no circumstances shall the vertical clearance between any lines involving a water or sanitary sewer line be less than 12 inches without written approval from the Director of Public Works. The corrosion protection must be adhered to Section 4.03 when ductile iron pipe is utilized, refer to Conduit or Storm Sewer Crossing Detail, (No. WA-4) and Utility Crossing Detail, (No. WA-15) located in Section 9, for placement information.

B. Water Line Crossing Over a Sanitary Sewer Line

If there is less than 18 inches vertical clearance, encase the sewer line 10 feet each side of the crossing and the water line must be a 20 foot section of ductile iron pipe centered over the crossing. The proper corrosion protection must be adhered to whenever ductile iron pipe is utilized. Encasement of joints only shall be required on sewer lines 15 inches and larger in diameter. Polyvinyl chloride pressure pipe may be used in lieu of an encasement if the sewer line is AWWA C900 and C905, latest revision.

7.06 LOCATION (continued)

C. Sanitary Sewer Line Crossing Over a Water Line

Encase the sanitary sewer line no matter what the vertical clearance is (10 feet each side of the crossing). If the vertical clearance is less than 18 inches, the water line must also be ductile iron pipe. The proper corrosion protection must be adhered to whenever ductile iron pipe is utilized. Encasement of joints only shall be required on sewer lines 15 inches and larger in diameter. Polyvinyl chloride pressure pipe may be used in lieu of an encasement if the sanitary sewer line is AWWA C900 and C905, latest revision.

D. Sanitary/Storm Sewer Line Crossing Over a Sanitary/Storm Sewer Line

If the vertical clearance is less than 18 inches, encase the sewer line 10 feet each side of the crossing. Encasement of joints only shall be required on sewer lines 15 inches and larger in diameter. Polyvinyl chloride pressure pipe may be used in lieu of an encasement if the sewer line is AWWA C900 and C905, latest revision.

All concrete encasements shall be as per Concrete Encasement Detail (No. WA-3), in Section 9.

Additional support may be required by the Director of Public Works where large diameter lines cross over utility mains.

7.07 MANHOLES

Manholes should be installed at the upper end of each line, at changes in grade, size, or alignment, at intersections, and at distances not greater than 400 feet for all sewers. See Section 8.03E for specifications on manhole construction.

A drop manhole shall be provided for a sewer entering a manhole at an invert elevation of 24 inches or more above the manhole invert. Where the difference in elevation between the incoming sewer invert and the manhole invert is less than 24 inches, the invert shall be shaped or filleted to prevent solids deposition.

The minimum internal diameter of the manhole barrel shall be 48 inches for sanitary sewers of 12 inches or less, 60 inches for sewers of 15 to 27 inches diameter, and 72 inches for sewers 30 inches and larger. When an inside drop manhole is utilized the minimum manhole barrel size shall be increased by 12 inches.

The flow channel through the manhole shall be made to conform to the shape and slope of the sewers. Under no circumstances shall a manhole be located in concrete areas, such as sidewalks, cross pans, aprons, or curb and gutters.

Sewers shall be located as per Section 7.06. Manholes shall not be installed beneath any concrete, such as sidewalks, curbs, gutters or cross pans.

Manholes shall be constructed as indicated in the Manhole Detail (No. WW-5), located in Section 9 of these specifications. All manholes under construction shall be sealed tightly to prevent storm or other non-sewage flows from entering the sanitary sewer system. All dead-end manholes shall have line laid through the manhole and plugged with an approved plug provided by the pipe manufacturer.

Sewer pipe connections to existing manholes where there is no existing pipe stubbed out shall be made in such a manner that the finished work will conform as nearly as practical to the essential requirements specified for new manholes. The Contractor shall break out as small an opening in the existing manhole as necessary to insert the new sewer pipe. The existing concrete foundation bench shall be chipped to the cross-section of the new pipe in order to form a smooth, continuous invert similar to what would be formed in a new concrete base. Portland cement grout shall be used as necessary to smoothly finish the new invert and to seal the new lines so the junction is watertight.



7.07 MANHOLES (continued)

Top elevation of the manhole shall be adjusted to exactly match final street grade prior to the initiation of the 2-year warranty period. If manholes are located in open fields, they should be left 18 inches above grade where practical. A locking ring and cover should be installed. In cultivated areas, manholes should be left below grade and properly marked by a Ballard post painted yellow, location direction shall be stamped onto the concrete on top of the post and distance to the centerline of the manhole cover shall be painted on the post in red. Final elevation of all manholes is to be at the discretion of the City. Manholes shall not be located in concrete areas.

7.08 CLEANOUTS

Cleanouts shall not be permitted in city streets unless specifically approved by the Director of Public Works.

7.09 UNDERDRAINS

Underdrains on sanitary sewer service lines shall be installed per Sanitary Sewer Line & Underdrain Trench Cross-Section Detail (No. WW-8) and Underdrain Cleanout Detail (No. WW-11). Such drains shall not discharge into sanitary sewers, on the surface, or to any other location not approved by the Department of Public Works.



SECTION 8 CONSTRUCTION CRITERIA - SANITARY SEWERS

8.01 SCOPE

The purpose of this section is to set forth the general criteria to be used in the construction of sanitary sewer mains and appurtenances in the City of Evans service area. Any deviation from these standards must be approved by the Director of Public Works.

8.02 SUBMITTALS

All submittals shall include the type of pipe material that will be used, the pipe manufacture specifications, the pipe manufacture's recommended installation technique, and bedding material specifications.

8.03 MATERIALS

All materials furnished shall be new and undamaged. Everything necessary to complete the installation shall be furnished and installed whether shown on approved drawings or not, and all installations shall be fully operational when complete.

Acceptance of materials or the waiving of inspection thereof shall in no way relieve the Contractor of the responsibility for furnishing materials meeting the requirements of the specifications.

The City of Evans Public Works Department reserves the right to direct or deny use of certain types of materials in specific circumstances.

All materials delivered to the job site shall be adequately housed and protected so as to ensure the preservation of their quality and fitness for the work.

A. Reinforced Concrete Pipe

Reinforced concrete pipe (RCP) shall be manufactured in accordance with ASTM C-76, and all applicable portions of ANSI/AWWA C300 and ANSI/AWWA C302 shall apply.

All fittings and accessories shall be as manufactured and furnished by the pipe supplier or approved equal, and have bell and/or spigot configurations compatible with the pipe. All gaskets shall be manufactured in accordance with ASTM C443.

B. Polyvinyl Chloride Pipe

All pipe materials and fittings shall meet the extra-strength minimum requirements of ASTM D-3034, SDR-35, or latest revision thereof.

All fittings and accessories shall be as manufactured and furnished by the pipe supplier or approved equal, and have bell and/or spigot configurations compatible with the pipe.

If pipe deflection limits exceed 7.5%, the Contractor shall be responsible for removing the existing pipe and installing a new pipe material under the direction of the Director of Public Works.

C. Polyvinyl Chloride Pressure Pipe

Refer to Section 4.02B of these specifications.

8.03 MATERIALS (continued)

D. Alternative Pipe

Before the installation of any alternative pipe, the Contractor shall acquire the approval from the Director of Public Works, based on the recommendation of the design engineer.

All pipe materials and fittings shall meet the extra-strength minimum requirements of ASTM D-3034, SDR-35, or latest revision thereof.

All fittings and accessories shall be as manufactured and furnished by the pipe supplier or approved equal and have bell and/or spigot configurations compatible with the pipe.

Prior to installation of alternative pipe type, the manufacture installation guidelines shall be provided to the City and available on site.

E. Manholes

Manholes shall be constructed of pre-cast concrete. Concrete bases shall be poured-in-place, Class A concrete, with a minimum thickness of 8 inches. Manhole inverts shall be formed as indicated in the Sanitary Sewer Flow Line Channel Detail (No. WW-9), located in Section 9 of these specifications, to ensure smooth flow through the manhole. Pre-cast bases may be used in lieu of poured-in-place bases.

Manhole steps shall be aluminum, or plastic - coated steel, and shall be spaced 16 inches on center, aligned away from the invert. The first step shall be a maximum distance of 24 inches from the final grade.

All cones shall be eccentric. Pre-cast manhole risers and cones shall be manufactured in accordance with ASTM Designation C-478. The cone section shall not extend closer than 12 inches to the top of the manhole cover. Pre-cast concrete, HDPE, or cast-in-place adjustment rings shall be used on top of the cone to support and adjust the manhole frame to the required final grade. Flat top sections may be used on shallow lines where cone sections are impractical to use as specified by the Director of Public Works. The Contractor shall minimize the amount of adjustment rings. The maximum adjustment with the use of adjustment rings is 12 inches.

The manhole barrels shall be watertight at all joints and riser sections. The performing flexible plastic joint sealing compound shall be "RAMNEK" or approved equal. The application of the priming compound and the sealing compound shall be accomplished in strict conformance with the manufacturer's instructions as to the quantity of material, the grade of the materials, and the application temperatures. This plastic joint compound shall be applied to all manhole joints.

Ring and cover shall be cast iron, 24 inches in diameter, with a combined weight of not less than 400 pounds, similar and equal to the "Denver Heavy" pattern. Manhole rings and covers shall be 30 inches in diameter for 60 inch and 72 inch diameter manhole barrels. Refer to the Manhole Ring and Cover Detail (No. WW-4), for additional specifications.

For additional specifications on manhole construction refer to the Manhole Detail (No. WW-5), in Section 9 of these specifications.

F. Drop Manholes

A drop manhole shall be constructed at all manholes where the incoming pipe invert is more than two feet above the manhole invert.

8.03 MATERIALS (continued)

Refer to Section 9 of these specifications for the Drop Manhole Detail - Inside Drop (No. WW-1), and the Drop Manhole Detail - Outside Drop (No. WW-2), for drop manhole specifications. Drop manholes shall be constructed in accordance with these details.

When the inside drop manhole is utilized, the diameter of the manhole sections shall be increased 12 inches from the typical manhole size as defined in Section 7.07, with a minimum diameter of 60 inches.

G. Concrete

Refer to Section 4.02N of these specifications.

8.04 EXCAVATION

All excavations shall be made to the lines and grades as established by the approved drawings. Pipe trenches shall be excavated to a minimum depth of 6 inches below the bottom of the pipe. All areas shall be excavated in such a manner as will afford adequate drainage. When unstable material is encountered within the limits of the work, such material shall be excavated below the grade shown on the drawings to a depth necessary to ensure a stable, firm foundation and refilled with a 1½ inch stabilization rock uniformly graded to provide a firm, stabilized foundation. All excavated materials which are considered unsuitable for back fill and any surplus of excavated material shall be disposed of by the Contractor in an approved area.

All existing asphalt or concrete surfacing shall be cut vertically in a straight line as specified in Section 2.09 and removed from the job site prior to starting the trench excavation. This material shall not be used in any fill or backfill.

The trench shall be excavated so that a minimum clearance of 6 inches is maintained on each side of the pipe for proper placement and densification of the bedding or backfill material. The maximum trench width, measured at the top of the pipe, shall be the outside diameter of pipe plus 24 inches, or be less than the outside diameter of the pipe barrel plus 12 inches when measured at any point below the top of the pipe bell, flange or collar.

Where the width of the lower portion of the trench exceeds the maximum width herein stated, the Contractor, at his expense, shall furnish and install special pipe embedment or concrete encasement to protect the pipe from the additional loading. The type and quantities of special pipe embedment shall be determined by the pipe supplier, using trench loading criteria based upon saturated backfill weighing 120 pounds per cubic foot and allowing for truck and other superimposed live loads.

Excavation in paved streets shall be confined to a minimum practical width. The pavement will be saw cut as specified in Section 2.09, or in a manner approved by the Director of Public Works.

Any pavement that is damaged by the Contractor outside the above-stated limits shall be replaced at the Contractor's expense.

The trench shall be adequately supported and the safety of workers provided for as required by the most recent standards adopted by the Occupational Safety and Health Act (OSHA). The City reserves the right to inspect construction sites for compliance to OSHA regulations. The City is not responsible for the safety of any party or parties constructing the utility project.

Excavation for structures shall be of such dimensions as to allow for proper installation and to permit the construction of the necessary pipe connections.

Blasting shall not be allowed.

8.05 DEWATERING

All pipe trenches or structure excavations shall be kept free of standing water during pipe laying and other related work. The method of dewatering shall remove all free standing water at the final lines and grades of the excavation. All water shall be disposed of in a suitable manner without creating a menace to public health or causing a public inconvenience. Ground water shall not be allowed to enter the pipe during installation. The dewatering operation shall continue until such time as it is safe to allow the water table to rise in the excavations. Pipe trenches shall contain enough backfill to prevent pipe flotation.

8.06 PIPE BEDDING

After completion of the trench excavation and proper preparation of the trench foundation, a minimum of 6 inches and a maximum of 12 inches of bedding material shall be placed on the trench bottom for support under the pipe. Bell holes shall be dug deep enough to provide a minimum of 2 inches of clearance between the bell and the bedding material. All pipe shall be installed in such a manner as to ensure full support of the pipe barrel over its entire length. After the pipe is adjusted for line and grade and the joint is made, the bedding material shall be carefully placed and tamped under the haunches of the pipe up to spring line and in the previously dug bell holes. The bedding shall then be installed to a minimum of 6 inches and a maximum of 12 inches above the top of the pipe, regardless of the type of pipe is being installed. The bedding material shall be as per manufacturer's specifications and shall be reviewed by the City Public Works Department.

8.07 INSTALLATION OF PIPE

Pipe and fittings shall be loaded and unloaded by lifting so as to avoid shock or damage. Under no circumstances shall such material be dropped. Before the placing of pipe in the trench, each pipe or fitting shall be thoroughly cleaned of all foreign material, kept clean at all times, and examined for cracks or defects before installation.

Joint lubricant shall be as supplied by the pipe manufacturer.

Pipe shall be laid upstream with spigot ends pointing downstream. All pipe is to be placed true to line and grade with ends abutting, carefully centered and with a smooth invert at the joint. The joint shall be made in a workmanlike manner so as to be watertight. New installations shall be complete and flushed prior to connecting to existing lines.

Whenever the pipe is left unattended, temporary plugs shall be installed at all openings. Temporary plugs shall be watertight, standard cast iron, and of such design as to prevent children and animals from entering the pipe. All temporary plugs shall be approved by the City.

No pipe or appurtenant structure shall be installed upon a foundation into which frost has penetrated or at any time when the City deems there is a danger of ice formation or frost penetration at the bottom of the excavation. No pipe or appurtenant structure shall be installed unless backfilling can be completed before the formation of ice and frost.

Immediately before joining two lengths of pipe, the inside of the bell, the outside of the spigot end, and the gasket shall be thoroughly cleaned. Caution shall be exercised to ensure the correct type of gasket is used.

A thin film of gasket lubricant shall be applied to either the inside face of the gasket or the spigot end of the pipe or both.

The spigot end of the pipe shall be placed in the socket with care to prevent the joint from contacting the ground. The joint shall be completed by pushing the pipe home with a slow, steady pressure. Stabbing shall not be permitted.

8.08 BACKFILL

It is expected that the trench excavation will provide suitable backfill material. Wet, soft, or frozen material, pieces of asphalt or concrete, or other undesirable substances shall not be used for backfill. The backfill material shall be free from rubbish and stones larger than 5 inches in diameter, clods, and frozen lumps of soil. If the excavated material is not suitable for backfill, as determined by the City, suitable material shall be hauled in and utilized and the rejected material hauled away. All snow shall be removed from trench prior to backfill operations. Backfilling shall be conducted at all times in a manner to prevent damage to the pipe or its coating, and shall be kept as close to the pipe laying operation as possible. All backfill around structures shall be consolidated by mechanical tamping.

In areas where existing pavement is to be cut and replaced, material excavated shall be removed from the site and the trench backfilled with gravel road base or approved native material, as specified in Section 2.09 of these specifications. The line, grade and joints of all pipelines shall be inspected by the City before any backfilling above the pipe is commenced. Squeegee sand shall not be considered backfill material and shall not extend more than 12 inches above the top of the pipe. Structural backfill may be used as backfill material in the City of Evans right-of-way.

8.09 COMPACTION

Refer to Section 4.10 of these specifications.

8.10 TRENCH MAINTENANCE

Refer to Section 4.11 of these specifications.

8.11 TESTING

All sanitary sewer pipe and appurtenances shall be cleaned and tested after backfill operations have been completed and acceptable compaction test results have been submitted to the City. All test results shall be submitted to the City within 10 working days from the day of testing. There shall not be any pipe in place for more than 90 calendar days prior to the completion of testing.

Should the City find that the completed line or any portion thereof fails on any of the specified tests; the City may halt construction of any new sewer line until such time as the previously placed sewer line meets the specifications. If the sewer line is completed, the City may require that the Contractor repair the line until it meets specifications before the line is released by the Director of Public Works.

The low pressure air test along with the TV inspection shall be required on the entire length of all pipeline installations. The use of alternate testing methods may be allowed or required in addition to those stated above, as indicated by the Director of Public Works. Alternate testing methods include vacuum manhole test, lamping test, water ex-filtration test, smoke test, infiltration test, and deflection test. All sewer lines must be cleaned, tested, and approved by the City. All work necessary to receive approval for cleaning and testing shall be completed within 15 days of backfilling.

The Contractor shall furnish all labor, materials, tools, and equipment necessary to clean the pipe and appurtenances, conduct the tests, and perform all work incidental thereto. Precautions should be taken to prevent joint drawing during the test. Any damages to the pipeline caused by cleaning or testing operations shall be repaired or replaced by the Contractor at his own expense. Should the pipeline fail to meet these requirements, the Contractor shall determine the source or sources of the leakage and shall replace all defective materials or workmanship, all at his own expense. Pipelines which fail to meet these requirements shall be repaired or replaced and retested in accordance with these requirements. The City or its designee reserves the right to be present during all sanitary sewer testing. The developers must notify the City 10 working days prior to any testing. At the City's discretion the Developer/Contractor may be responsible for any cost that the City may incur due to sanitary sewer testing inspection.

8.11 TESTING (continued)

A. Low Pressure Air Test

All pipe outlets shall be plugged with suitable test plugs. Pipe may be tested without pre-wetting if the pipe line to be tested is submerged in groundwater. The Contractor shall determine the groundwater elevation at the test location and provide it to the City. The backpressure on the pipe due to groundwater shall be determined and the internal pipeline test pressure shall be established at 4.0 psig in excess thereof. Air shall be slowly added to the portion of the pipe being tested. After the pipeline has been filled to the required pressure, at least 2 minutes shall be allowed for the air temperature to stabilize, while adding only the amount of air necessary to maintain the test pressure. After the 2 minute period, the air supply should be disconnected and allow the initial pressure allowed to drop to 3.5 psig in excess of the groundwater backpressure. The time interval required for the pipeline internal pressure to drop from 3.5 psig to 2.5 psig above the excess of groundwater backpressure shall be measured and recorded.

The basis for acceptance of the air test shall be the minimum time required for the internal pressure to drop 1 psig. The pressure must remain within the allowable limits for the time (min:sec) indicated by using the following formula:

$$T = 0.0237 (L) (D^2)$$

where

- T = time of test (in seconds)
- L = length of pipe being tested (in feet)
- D = diameter of pipe (in inches)

or as indicated in the Table 8.11-1;

Table 8.11-1
Allowable Pressure Drop Times

Pipe Diameter (Inches)	Length of Pipe Being Tested (Feet)						
	0-150	200	250	300	350	400	500
8	7:34	7:34	7:34	7:36	8:52	10:08	12:38
10	9:26	9:26	9:53	11:52	13:51	15:49	19:45
12	11:20	11:24	14:15	17:05	19:56	22:47	28:26
15	14:10	17:48	22:15	26:42	31:09	35:36	44:26

The minimum allowable pressure drop times for pipe 18 inches in diameter and larger (in seconds) shall be calculated using the above formula.

Section of pipe which fails the air test shall have the defects repaired and the test shall be repeated. Repair and repeat testing shall be continued until the testing requirements are met.

Pipelines 36 inches and larger in diameter shall be tested one joint at a time.

If it appears that excessive infiltration is present after the air tests have been completed, the Director of Public Works may require an infiltration test prior to final acceptance. Excessive infiltration may be the cause for rejection.

The Contractor shall follow all precautions necessary to perform a safe and successful test. Plugs used to isolate the line for the air test must be securely braced to avoid the unintentional release of the plug. Gauges, air piping manifolds, and control valves shall be located above ground. No one shall be permitted to enter a manhole when a plugged pipe is under pressure. Air testing apparatus shall be equipped with a pressure relief device designed to relieve the pressure when in excess of 6 psig.

8.11 TESTING (continued)

B. Television Inspection

The TV inspection tape shall show the entire inside periphery of the pipe. The Contractor shall furnish a recording of the inspection to the City on video tape or CD. The tape should include a voice narrative of the inspection. The television inspection shall be performed on one manhole section at a time. Unsatisfactory inspection results may be cause for rejection. The Contractor shall be responsible for any repairs or replacement of any portions of the pipeline which are determined defective as a result of the television inspections.

The City of Evans Wastewater Department may provide this service for an amount per linear foot to be determined upon request. The request for service shall be no later than 10 working days prior to completion of pipe installation or testing date.

C. Vacuum Manhole Test

Manholes shall be tested before the ring and cover and grade adjustment rings have been installed. All pipes entering the manhole shall be plugged and braced and a vacuum of 10 inches of mercury shall be drawn. The vacuum pump shall be turned off and the time monitored as the vacuum drops 1 inch. The vacuum must not drop more than 1 inch for the duration of the time indicated in Table 8.11-2. Manholes which fail the vacuum test shall have the defects located and repaired, and the test shall be repeated. Repair and repeat testing shall be continued until the testing requirements are met.

Table 8.11-2
Specified Test Duration for Diameter of Manhole

Manhole Diameter (inches)	Time (seconds)
48	60
60	75
72	90

D. Lamping Test

Prior to final acceptance of the pipeline installation, the Contractor may be directed to perform a lamp test to verify the alignment and condition of the pipe. The lamp test shall be performed after the backfill operation has been completed and the line has been cleaned. Should the lamp test indicate an alignment problem, the Director of Public Works shall be the sole judge of the need for replacement. Unsatisfactory alignment may be cause for rejection.

E. Water Ex-filtration Test

The test shall be performed after backfill operations have been completed.

Allowable leakages shall be 100 gallons per day per inch of pipe diameter per mile of pipeline with a minimum test pressure of ten feet of water column above the crown of the pipe at its midpoint or six feet above the surrounding groundwater table, whichever causes the greater head on the pipe. The maximum allowable pressure at any point in the pipeline during the test is a 16 foot column of water.

Table 8.11-3 indicates the maximum allowable leakage rate for the water ex-filtration test in gallons per hour.

8.11 TESTING (continued)

Table 8.11-3
Allowable Maximum Leakage, Gallons per hour

Pipe Dia. (In.)	Length of Pipe Being Tested (Feet)									
	50	100	150	200	250	300	350	400	450	500
8	0.32	0.63	0.95	1.26	1.58	1.89	2.02	2.52	2.84	3.16
10	0.39	0.79	1.18	1.58	1.97	2.37	2.76	3.16	3.55	3.94
12	0.47	0.95	1.42	1.89	2.37	2.84	3.31	3.79	4.26	4.73
15	0.59	1.18	1.78	2.37	2.96	3.55	4.14	4.73	5.33	5.92
18	0.71	1.42	2.13	2.84	3.55	4.26	4.97	5.58	6.39	7.10
21	0.83	1.66	2.48	3.31	4.14	4.97	5.80	6.63	7.46	8.28
24	0.95	1.89	2.84	3.79	4.73	5.68	6.63	7.5	8.52	9.47
27	1.06	2.13	3.20	4.26	5.33	6.39	7.46	8.52	9.59	10.65
30	1.18	2.37	3.55	4.73	5.92	7.10	8.28	9.47	10.65	11.84
36	1.42	2.84	4.26	5.68	7.10	8.52	9.94	11.36	12.78	14.20

The Contractor may fill the pipe anytime up to 24 hours prior to the performance of the test to allow for normal pipe wall absorption. It shall be the responsibility of the Contractor to determine the level of the water table at each manhole. Unsatisfactory test results may be the cause for rejection. The Contractor shall be responsible for the repair or replacement of any portions of the pipeline which have excessive ex-filtration rates

F. Smoke Test

The smoke test shall be performed as determined by the Director of Public Works. The test shall be performed after backfill operations have been completed and accepted. The Contractor shall supply the necessary smoke testing apparatus and shall conduct the test after the pipeline has been cleaned and prepared by the Contractor. If the tests reveal cracks or breaks in the pipeline, the Director of Public Works may require additional tests or replacement. The Director of Public Works shall be the sole judge of test results. Unsatisfactory tests may be cause for rejection.

G. Infiltration Test

The water infiltration test shall be used only if directed by the Director of Public Works. The test shall be performed after the backfill operations have been completed and accepted. Allowable infiltration shall be 100 gallons per day per inch of pipe diameter per mile of pipeline. The infiltration rate shall be measured with a V-Notch Weir. The maximum allowable infiltration rates are identical to the maximum allowable ex-filtration rates and are as indicated in Table 8.11-3 above. Unsatisfactory test results be the cause for rejection. The Contractor shall be responsible for the repair or replacement of any sections of pipeline which have excessive infiltration rates.

H. Deflection Test

When required by the Director of Public Works, all sanitary sewers constructed of flexible pipe may be tested for deflection not less than 30 days after the trench backfill and compaction operations have been completed and accepted. The Contractor shall supply a pointed mandrel which has an equivalent diameter equal to 95% of the diameter of the pipe being tested. The testing shall be performed on a manhole-to-manhole basis by the Contractor and shall be conducted by pulling the mandrel through the pipeline. The test shall be conducted only after the pipeline has been cleaned and prepared. Unsatisfactory test results may be cause for rejection. The Contractor shall be responsible for the repair or replacement of any sections of pipeline which fail to pass the test.

8.12 SEWER SERVICE LINES

A. GENERAL

All sanitary sewer service lines connecting to the City of Evans sanitary sewer system shall be established in accordance with these specifications. The specifications shall cover all new sanitary sewer service line construction and repairs to existing lines; from the sewer main to the building plumbing. Any deviation from these standards must be approved in writing by the Director of Public Works. No sanitary sewer service lines shall be less than 4 inches in diameter.

B. PIPE BEDDING

All specifications are applicable except that 4 inch and 6 inch service lines require a minimum bedding depth of 8 inches as shown on the Sanitary Sewer Bedding Detail (No. WW-6), located in Section 9 of these specifications.

C. LOCATION AND ALIGNMENT

Only one tap is allocated per unit. Sanitary sewer service lines shall be constructed on the shortest and straightest route possible. At no time shall the service line be closer than five feet to the side property line, and no service line may be constructed through or in front of any adjoining property. When possible, the service line shall be located five feet toward the low side of the lot from the centerline of the lot. Service lines are not to extend beneath driveways. Sewer and water service lines must be a minimum of ten feet apart horizontally unless the conditions set forth in Section 609 of the Uniform Plumbing Code are met. Refer to Section 8.07 for additional information.

D. STUB-INS TO PROPERTY LINE

Service stub-ins shall extend to the property line at a minimum. Stub-ins shall be plugged with a watertight compression stop, a Schedule 40 Glue Cap, or an approved equal. Adjacent to the end of the service stub-in, a four foot length of 2 by 4 inch wood shall be placed in a vertical position prior to backfilling. This 2 by 4 shall remain in place until service locations are stamped into the fresh concrete on the face of curb with an "S". If the 2 by 4 is not present at time of stamping, the Developer shall bear the expense of reaffirming the location of the service stub out by re-excavation. The Contractor shall take measurements of distances from manholes to service taps and give this information to the City.

No more than two - 45° bends shall be permitted in any sanitary sewer service line. A cleanout will be required, for each 100 feet of service line or fraction thereof. Where underdrain is present, a 4 inch underdrain service shall be placed under the sanitary sewer service and stub into property.

E. CONNECTIONS

Where Y have not or could not have been installed in the main sewer, the Contractor shall excavate around the main and prepare the main for tapping. The main shall then be tapped by the Contractor or a duly authorized designee at the expense of the Contractor. The connection shall be watertight and at a 45° angle above the pipe horizontal centerline. No projection of the sewer service pipe inside the sewer main that is being tapped shall be permitted. Approved tees or sewer service saddles shall be used to connect the service line to the sewer main. After Public Works Department personnel have inspected the sewer tap, pipe laying and all other work shall be performed by the Contractor.

A manhole shall be installed instead of a service tap when a 6 inch connection is to be made on an existing 8 or 10 inch line. 6 inch connections may be made without a manhole on new line installations with the use of a Y. Service taps to existing manholes shall not be permitted without the written approval of the Director of Public Works.

8.12 SEWER SERVICE LINES (continued)

No aluminum saddles shall be permitted. Only GPK and DFW sanitary sewer saddles shall be used. The City shall inspect the main and saddle at every tap prior to backfilling. In the event the tap is covered before it is inspected, it shall be dug out by the Contractor and all dirt around the fitting shall be removed to allow visual inspection of the tap and the main. If the main sewer line is cracked or broken during the process of locating and tapping, it shall be repaired immediately by replacing the broken section. All taps shall be a minimum of 5 feet apart and shall not be within 2 feet of the bell. Service taps shall not oppose each other.

Sewer mains shall be laid through manholes at the end of cul-de-sacs. A minimum of 20 feet of pipe, and Y's shall be installed in order that the end of the cul-de-sac may be serviced without tapping into the manhole. The end of this section shall be plugged with an approved watertight plug. Refer to Sanitary Sewer Connection Detail (No. WW-7) and Service Y Detail (No. WW-10) for additional information.

F. COMMERCIAL AND/OR INDUSTRIAL MANHOLES

A manhole may be required, where specified by the Director of Public Works, in order to have samples taken if industrial waste is suspected. Such a manhole would be located on the commercial service line, so samples could be taken before such fluids reach the sanitary sewer main line.

G. GREASE AND/OR SAND TRAPS

Grease and/or sand traps shall be required on all commercial facilities, such as a restaurant, and anywhere the possibility exists that a foreign substance may be discharged into the sewer system. All installations shall be approved by the Director of Public Works so that all substances introduced into the Evans sewer system shall conform to all requirements of the most recent City's NPDES permit. See Grease and Sand Interceptor Detail (No. WW-3), located in Section 9 for additional specifications.

H. INFILTRATION

The joints shall be made in a workmanlike manner so as to ensure a maximum infiltration of not more than 0.032 of a gallon per inch of diameter per hour per 100 feet of length.

Service lines to be abandoned shall be dug and plugged at the main with an approved watertight plug, unless otherwise specified. The plug shall not protrude into the main



SECTION 9 WATER AND SANITARY SEWER STANDARD DETAILS DRAWINGS

9.01 GENERAL

This section contains the detail drawing referenced throughout these specifications.

9.02 WATER SPECIFICATION DETAILS

DETAIL NO.	DETAIL TITLE
WA-1	AIR & VACUUM RELIEF VALVE
WA-2	BLOWOFF ASSEMBLY INSTALLATION
WA-3	CONCRETE ENCASEMENT
WA-4	CONDUIT OR STORM SEWER CROSSING
WA-5	COPPER TRACER WIRE ON PVC PIPE
WA-6	FIRE HYDRANT
WA-7	METER SETTING FOR ¾" AND 1" METER
WA-8	METER SETTING FOR 1½" AND 2" METER
WA-9	METER SETTING FOR 3" AND LARGER
WA-10	METER SETTING FOR NON-POTABLE IRRIGATION
WA-11	PIPE INTERSECTIONS AND DEAD-ENDS
WA-12	PRESSURE RELIEF VALVE – PLAN VIEW
WA-12	PRESSURE RELIEF VALVE – SECTION VIEW
WA-13	STREAM OR DRAINAGEWAY CROSSING
WA-14	THRUST BLOCKS
WA-15	UTILITY CROSSING
WA-16	WATER LINE BEDDING
WA-17	WATER LINE TRENCH CROSS SECTION
WA-18	WATER SERVICE CONNECTION
WA-19	WATER VALVE BOX – POTABLE WATER
WA-20	WATER VALVE BOX – NONPOTABLE WATER



9.03 SANITARY SEWER SPECIFICATION DETAILS

WW-1	DROP MANHOLE – INSIDE DROP
WW-2	DROP MANHOLE – OUTSIDE DROP
WW-3	GREASE AND SAND INTERCEPTOR
WW-4	MANHOLE RING AND COVER
WW-5	MANHOLE
WW-6	SANITARY SEWER BEDDING
WW-7	SANITARY SEWER CONNECTION
WW-8	SANITARY SEWER LINE & UNDERDRAIN TRENCH CROSS-SECTION
WW-9	SANITARY SEWER FLOW LINE CHANNELS
WW-10	SERVICE Y
WW-11	UNDERDRAIN CLEANOUTT