RESOLUTION NO. 1464

A RESOLUTION OF THE GOLDEN CITY COUNCIL
ADOPTING SPECIFICATIONS FOR WATER AND SANITARY
SEWER SYSTEMS

WHEREAS, the City wishes to revise and adopt new water and sanitary sewer specifications; and

WHEREAS, the Engineering Division of the Department of Public Works has revised such specifications; and

WHEREAS, City Council wishes to adopt the new specifications by reference in full, including the introduction, table of contents, reference documents and appendices.

THEREFORE, BE IT RESOLVED BY THE CITY COUNCIL OF THE CITY OF GOLDEN, COLORADO:

Section 1. The council hereby adopts, by reference, the provisions of that certain document entitled "Water and Sanitary Sewer Specifications — City of Golden", which document was drafted, compiled and published by the Engineering Division of the City of Golden, Colorado, Department of Public Works and which is dated December 2003.

Section 2. The City Clerk shall maintain a copy of the document for public inspection certified as true and correct, of the "Water and Sanitary Sewer Specifications". Copies shall be available for purchase by the public at the office of Public Works.

Adopted the 11th day of December, 2003.

Charles J. Baroch
Mayor

ATTEST:

[Signature]

Susie M. Brooks, MMC
City Clerk

[Seal]

APPROVED AS TO FORM:

[Signature]

James A. Windker
City Attorney

I, Susan M. Brooks, City Clerk of the City of Golden, Colorado, do hereby certify that the foregoing is a true copy of a certain Resolution adopted by the City Council of the City of Golden, Colorado at a regular meeting thereof held on the 11th day of December, A.D., 2003.

(SEAL)

ATTEST:

[Signature]

Susie M. Brooks, City Clerk of the City of Golden, Colorado
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CITY OF GOLDEN

WATER AND SANITARY SEWER SPECIFICATIONS

PART I – ENGINEERING STANDARDS
SECTION 1

PURPOSE

The water and sanitary sewer system specifications contained in this publication are intended to provide information to all concerned parties performing waterline and sewerline construction dedicated to or accepted by the City of Golden. In addition, all work within any public right-of-way is governed by these specifications.

The specifications apply to any new developments which are not constrained by existing improvements. The City Engineer may allow variation of these specifications if applicable. The term "City Engineer" shall mean the City Engineer or an authorized representative, firm, or corporation appointed or retained by the City of Golden.

Construction plans will be reviewed using the plan review check lists provided in the Appendix and must conform to the minimum design standards set forth in these specifications. The check list provides a guideline in the plan review process allowing for a uniform objective review of water and sewer facility construction. An approved set of construction drawings and these specifications must be on the job site at all times during construction.

This document replaces the Water and Sewer Specifications, January 1991. Any previous specifications addressing sanitary sewer construction or water meter installation are also replaced by this publication.

END OF SECTION
PART 1 - ABBREVIATIONS AND DEFINITIONS

1.1 Abbreviations.

Wherever used in these specifications, the following abbreviations shall have the meanings indicated:

- **AASHTO**: American Association of State Highway & Transportation Officials
- **ACI**: American Concrete Institute
- **ANSI**: American National Standards Institute
- **ASCE**: American Society of Civil Engineers
- **ASTM**: American Society for Testing and Materials
- **AWWA**: American Water Works Association
- **CONC**: Concrete
- **CPS**: Centipoise
- **DIA**: Diameter
- **DIP**: Ductile Iron Pipe
- **FPS**: Feet Per Second
- **FS**: Federal Specifications
- **FT**: Feet
- **GAL**: Gallon(s)
- **GPM**: Gallons Per Minute
- **ID**: Inside Diameter
- **IP**: Iron Pipe
- **MAX**: Maximum
- **MFG**: Manufacturer
Mg/ℓ  Milligrams Per Liter
MH     Manhole
MIN    Minimum
MJ     Mechanical Joint
Mm     Millimeter
MUTCD  Manual on Uniform Traffic Control Devices
Nat Std National Standard
NFPA   National Fire Protection Association
NO     Number
NTS    Not To Scale
OC     On Center
OD     Outside Diameter
OSHA   Occupational Safety and Health Administration
PE     Profession Engineer
PL     Property Line
PLS    Professional Land Surveyor
PPM    Parts per Million
PRV    Pressure Reducing Valve
PSI    Pounds per Square Inch
PSIG   Pounds per Square Inch Gauge
PVC    Polyvinyl Chloride Pipe
R&C    Ring and Cover
ROW    Right-of-Way
RTD    Regional Transportation District
SEC    Second
1.2 Definitions.

Wherever used in these specifications, the following definitions apply:

CITY     Any representative of the City of Golden during approval or construction process.

CONTRACTOR The construction company that has been retained by the developer to perform the Work.

DEVELOPER The owner or representative of a development that requires improvements.

DRAWINGS The City-approved construction drawings.

ENGINEER The Engineer of record on the City-approved construction drawings.

WORK     All public and private improvements shown on the drawings that is associated with the development of a site.

PART 2 - CONTRACTOR'S REQUIREMENTS

2.1 General.

A. Contractor shall not enter or occupy with men, tools, equipment, construction materials, or materials excavated from the Work, any private property outside the designated construction areas, easement boundaries or public right-of-way without written permission from that Owner or tenant of such property.

B. Contractor shall confine operations to the area designated by the Drawings and be responsible for all areas at the site used by Contractor or Subcontractors in the performance of the Work. Contractor will exert full control over the actions of all employees and other persons with respect to the use and preservation of property and existing facilities, except such controls as may be specifically reserved to Developer or others. Contractor has the right to exclude from the site all persons who have no purpose related to the Work or its inspection, and may require all persons on site to observe the same regulations as required of Contractor’s employees. Developer will
coordinate the responsibilities and rights provided for herein with similar responsibilities and rights of other prime contractors (if any) on the Project.

2.2 **Construction Hours.**

A. Construction hours (except for emergencies) shall be limited to 7:00 a.m. to 7:00 p.m., Monday through Friday, unless otherwise authorized.

2.3 **Damage to Adjacent Property.**

A. Contractor shall minimize damage to property located adjacent to any Work. Prior to final acceptance by the City, the Contractor, at his expense, shall repair or replace any disturbance including but not limited to landscaping, sod or retaining walls to a condition equal to the existing condition prior to construction as determined by the City.

2.4 **Clean-up of Construction Disturbed Areas.**

A. Demolition:

1. Contractor shall remove all demolished concrete and debris from within the public right-of-way within twenty-four (24) hours after demolition or request by the City. A $500 per day penalty shall be strictly enforced for non-compliance with this request. It is recommended to load and haul off debris immediately upon removal.

B. Placement:

1. Prompt placement and compaction of fill material behind and around structures, concrete curb and sidewalk, repair of any landscaping, sod, or retaining walls disturbed during construction and patching of asphalt removed to facilitate construction will be required.

2. Site clean-up shall be completed within ten (10) days following the completion of Work within the or site. Any clean-up items remaining to be completed following the allowed ten (10) day period which are determined by the City to be hazardous, aesthetically objectionable, or disruptive to automobile traffic access or pedestrian safety will be performed by City personnel at the Contractor's expense.

2.5 **Maintenance of Continuous Operations.**

A. This section covers activities, procedures, items of Work, and responsibilities of both Contractor and City to maintain continuous operation of existing water and sewer systems.

B. Conduct of Work:

1. Contractor shall conduct the Work in a manner to avoid unnecessary noise, dust, and dirt.
2. All workers employed in connection with the Work property are to confine their activities to the designated Work areas.

3. Contractor shall cooperate with other occupants of the site for efficient utilization of available space.

C. The existing gas, phone, cable, electric, water, and sewer systems must remain in operation during performance of the Work. Existing water and sewer lines that are being replaced or abandoned by the Work shall remain in service and workable until the Work has been tested, disinfected, and accepted by the City. Contractor must coordinate work activities to provide continuous service while connecting any new system piping to the existing system piping. If there is any disruption of continuous service, the Contractor shall be solely responsible for the payment of any fines, fees, repairs, temporary operating expenses, or other associated costs arising out of the disruption.

D. The City will cooperate with Contractor in arrangements for continuity of service and operation of valves, gates, and other control facilities.

2.6 Utilities.

A. It shall be the responsibility of the Contractor to contact the appropriate representatives of utility companies at least forth-eight (48) hours prior to the commencement of work, which might affect utility installations, and to secure from such representatives information as to accurate location, size and type of such installations.

2.7 Connections to Existing Facilities.

A. Unless otherwise specified or indicated, Contractor shall make all necessary connections to existing facilities including structures, drain lines and utilities such as water, sewer, gas, telephone, and electric. Contractor shall in each case notify the City and/or owning utility prior to undertaking connections to their facilities unless otherwise authorized by that Owner to proceed.

B. Connections shall be made in the following manner:

1. Verify all measurements for such connections on the site.

2. Protect breached facilities against the intrusion of deleterious substances and against damage.

3. Where existing facilities are in service and outages are significant, all activities pertaining to the connections will be thoroughly planned in advance and all equipment, materials and labor required therefore will be on hand at the time of undertaking such connections. Arrangements will be made to work continuously (around the clock) if necessary to complete connections within the minimum time.
2.8 **Water and Sanitary Sewer Service Interruptions.**

A. The Contractor shall submit for the City's approval a schedule of service interruptions or shutdowns required for performance of the Work. The schedule shall include the date of the proposed shutdown and the length of shutdown.

B. No shutdowns will be approved without at least forty-eight (48) hours notice to the affected parties. The Contractor shall be responsible for notifying all affected parties of shutdowns in writing. Copies of the notifications with dates and times of delivery shall be given to the City.

C. City personnel shall operate all existing facilities.

2.9 **Ownership.**

A. Existing rings, covers, hydrants, and valves removed or replaced as part of this work shall remain the property of the City. Contractor shall remove and store such items in a convenient manner and place for retrieval by City at some future date.

B. Items identified by the City as waste shall be removed and disposed of by the Contractor off site in a legal manner at Contractor's expense.

2.10 **Work Sequence with Public Rights-of-Way.**

A. Any streets affected by the Work shall have, as a minimum, one lane of traffic open at all times.

B. Contractor shall provide local and emergency vehicle access at all times. Coordination with residences and businesses as to access shall be the responsibility of the Contractor. A detailed plan for coordination with residences and businesses shall be prepared by the Contractor and reviewed and approved by the City. As a minimum, plan shall provide for hand delivery of notices by Contractor to those affected by the Work seventy-two (72) hours in advance.

C. Driveways shall not be blocked longer than eight (8) hours. Contractor shall give affected persons twenty-four (24) hours minimum notice.

D. The Contractor shall coordinate his work with all other contractors on the project and with the Engineer and City's personnel for allocation of storage space, scheduling of particular phases of work which affect other contractors, and keeping informed regarding interfaces, working space conflicts and other problems of coordination with others.

E. Contact utilities and other concerned agencies at least forty-eight (48) hours prior to work in traffic areas or excavating near underground utilities or pole lines.

F. Where street closures have been approved by City, Contractor shall notify RTD, Police, Fire, and Ambulance dispatch twenty-four (24) hours in advance of closing.

END OF SECTION
SECTION 3

TRENCHING, BACKFILLING, AND COMPACTING

PART 1 - GENERAL

1.1 Description.

A. This section covers excavation and trenching, including drainage, preparation of subgrades, pipe bedding, backfilling, compacting, and finish grading for underground pipelines, conduits, cables and appurtenances.

1.2 Submittals.

A. Test Certificates: Submit test certificates to enable Engineer to determine compliance with the Specifications of each of the following materials from each proposed source or supplier:

1. Stabilization material.
2. Granular material.
3. Imported trench backfill material.
4. Barrier material.

1.3 Job Conditions.

A. Right-of-Way: Haul and stockpile excess material or erect suitable bulkheads to prevent deposition of excavated material where permanent right-of-way or temporary construction easement is not adequate to stockpile all excavated material without depositing it on private property.

B. Blasting: No blasting or other use of explosives will be permitted.

C. Drainage and Groundwater.

1. Maintain excavations and trench free from water during construction.

2. Remove water encountered in the trench to the extent necessary to provide a firm subgrade, to permit joints to be made in the dry, and to prevent the entrance of water into the pipeline.

3. Divert surface runoff and use pumps, gravel blankets, well points, drain lines or other means necessary to accomplish the above.

4. Maintain the excavation or trench free from water until the structure, or pipe to be installed therein, is completed to the extent that no damage from hydrostatic pressure, floatation, or other cause will result.

5. Obtain approval of individual owners and ditch companies for discharge to or
through their property or facilities.

6. Prevent puddling or continuous running water around trees or cultured plants.

D. Sheeting and Shorings: Use sheeting and shoring where banks are not cut back on a stable slope and as necessary to prevent caving or sliding and to protect workmen, the Work and adjacent structures and facilities.

E. Sequence of Operation.

1. Install the pipeline within no more than one hundred (100) linear feet of trench excavation.

2. Backfill the trench within a maximum of one hundred and fifty (150) linear feet of the pipe installation.

3. Clean up the right-of-way within a minimum of two hundred (200) linear feet of trench excavation.

4. All excavated material shall be stockpiled in a manner that does not endanger the Work or workers and that does not obstruct sidewalks, streets, and driveways. The Contractor at the end of each day shall backfill and open to traffic all excavations and ditch lines, remove excess excavated material from travelways, and thoroughly clean all streets, alleys, and sidewalks affected by the excavation. If it becomes necessary, all streets and sidewalks shall be washed and/or swept as needed.

5. Materials encountered during excavation such as rubbish, organic, frozen, and other material which is not suitable for use as backfill in the opinion of the City shall be removed from the site and dispose of by the Contractor on a daily basis at the Contractor's expense. All objects larger than six (6) inches in diameter shall be deemed unsatisfactory for use as backfill and removed by the Contractor.

6. Failure by the Contractor to comply with these requirements may result in an order to stop the excavation in progress until compliance has been achieved.

F. Underground Obstructions.

1. Notify each utility owner and request utilities be field located by surface reference at least forty-eight (48) hours prior to trenching or excavation.

2. Expose and verify size, location and elevation of underground utilities and other obstruction where conflicts might exist sufficiently in advance to permit changes in the event of conflict.

   a. Notify Engineer in case of conflict.

   b. In case of conflict the proposed Work may be changed by Engineer.

3. Maintain, protect and support by shoring, bracing or other means existing utilities and appurtenances.

SECTION 3 - 2
4. Take such protective measures as the utility may direct where alterations or moving of utilities is required.

5. If Contractor elects to remove underground obstructions, such as sprinklers, drainage culverts, catch basins or other structures, the following shall apply:
   a. Drainage culverts may be salvaged, stored and reused if not damaged unless otherwise directed by the City.
   b. Replace all other underground obstructions with new materials.

6. Maintain the flow in field drains at the quantity, quality, and velocity present prior to the temporary removal of the drain pipe, unless otherwise noted on the Drawings.

1.4 Product Delivery, Storage and Handling.
   A. Select transportation schedule and truck routes with approval of City to minimize impacts to the public.
   B. Do not mix stabilization material or bedding material with topsoil or job excavated material.

1.5 Maintenance and Correction.
   A. Maintain and correct all trench settlement and make necessary repairs to pavement, sidewalks or other structures which may be damaged as a result of backfill or settlement for a period of one (1) year after Initial Acceptance.
   B. Damage to facilities caused by the Contractor during construction or the one-year correction period shall be repaired by the Contractor at the Contractor’s expense.
   C. If an emergency situation arises during the one-year correction period, City personnel will respond and back charge the Contractor for all cost associated with the repair.

PART 2 - PRODUCTS

2.1 Stabilization Material.
   A. Top six (6) inches of pipe subgrade: Granular bedding material as specified below.
   B. Subgrade below top six (6) inches:
      1. Pit-run gravel or crusher-run rock meeting ASTM D448 gradation No. 357 (2" to No. 4 sieve) or
      2. Same as top six (6) inches except that broken concrete and rock may be included in size permitting compaction specified without discernible voids.
2.2 Bedding Materials.

A. Concrete (Type A): Meet requirements of Section 14 with a minimum 28-day compressive strength of 2,000 psi.

B. Granular Material (Type B): Crushed rock or gravel with 100% passing a 1" sieve, 95% passing a 3/4 inch sieve and not more than 5% passing No. 4 sieve. Or well graded crushed, stone or gravel meeting requirements of ASTM D448, gradation 67.

C. Select Soil (Type C) from site is not allowed unless approved by the City.

D. Barrier Material: Finely divided job excavated material free from stones organic matter and debris meeting a soil classification of GC, SC, CL, or ML-CL.

2.3 Trench Backfill Material.

A. Trench backfill may be job excavated material or select material as specified below.

B. Job Excavated Material shall be free of frozen material, stumps, roots, brush, other organic matter, cinders or other corrosive material, debris, and rocks or stones greater than the following dimensions:

1. Three (3) inches in any dimension for material placed within one foot of pavement subgrade or finished surface in unpaved areas.
2. Six (6) inches in any dimension for the remainder of the trench provided they are distributed in the finer material.

C. Imported Backfill Material: Pit-run gravel or crusher-run rock with the following gradation:

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<tr>
<td>No. 10</td>
<td>80</td>
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<tr>
<td>No. 200</td>
<td>0 to 15</td>
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1. Material passing a No. 40 sieve shall have a liquid limit less than 35 and a plastic index less than 6 when tested in accordance with AASTHO T-89 and T-91, respectively.

D. Backfill for all piping shall be accordance with the City of Golden details.

E. Rights-of-way: Obtain approval by the agency having jurisdiction over the right-of-way maintenance for alignment and materials placed within the limits of that right-of-way.
PART 3 - EXECUTION

3.1 Preparation.

A. Clearing.
   1. Remove and dispose of trees, shrubs, bushes, downed trees, upturned stumps, weeds, and other vegetation within the limits of clearing.
   2. Limit clearing to as narrow a width as practical within the rights-of-way, permanent easements, temporary easements, and all other alignments.
   3. Remove only non-cultured shrubs, bushes, and other vegetation within the limits of the temporary easements.
   4. Trim trees in lieu of removal when practical.
   5. Apply wound paint to cuts or scarred surfaces of trees and shrubs that are to remain in place.
   6. Protect root zones of trees and cultivated plants not removed.

B. Topsoiling.
   1. Remove topsoil from all areas to be disturbed by construction.
   2. Minimum depth of removal: Equal to depth of existing topsoil or eight (8) inches, whichever is greater.
   3. Stockpile topsoil and keep segregated from granular materials and inorganic materials and debris.

C. Sod Removal.
   1. In lawn areas, cut and roll back sod before trenching.
   2. If sod is to be re-used, store and protect sod from damage and drying.
   3. Do not reuse when stored for more than forty-eight (48) hours.

D. Pavement Removal.
   1. Remove pavement, drives, curbs, and sidewalks to clean straight lines. Saw cutting is required.
   2. On concrete surfacing if saw cut would fall within three (3) feet of a construction joint, cold-joint or edge, remove concrete to that location.

3.2 Trenching.

A. Excavate trenches by open cut methods, except where boring or tunneling is indicated on the Drawings, required by jurisdictional agencies, or desired by
Contractor to avoid removal of obstruction.

1. Excavate only safe and stable slopes in accordance with OSHA regulations. The City will not be responsible for determining the safety or stability of any of the Work.

B. Do not use mechanical equipment in locations where its operation would cause damage to trees, buildings, culverts, or other existing property, utilities, or structures above or below ground. In all such locations, hand excavating methods shall be used.

C. Use mechanical equipment so designed and operated that the rough trench excavation bottom elevation can be controlled with uniform trench widths and vertical sidewalls from an elevation one foot above the top of the installed pipe to the bottom of the trench, and trench alignment sufficiently accurate to permit pipe to be aligned properly with adequate clearance between the pipe and sidewalls of the trench. Do not undercut the trench sidewall to obtain clearance.

D. Excavation in Rock.

1. Over excavate a minimum of:
   a. For pipe twenty-four (24) inches or less: Six (6) inches below the bottom of the pipe.
   b. For pipe greater than twenty-four (24) inches: Nine (9) inches below the bottom of the pipe.

2. Backfill overdepth with Granular Material.

E. Preparation of Trench Bottom

1. Grade trench bottoms uniformly to provide clearance for each section of pipe.

2. Remove loose materials, water and foreign objects.

3. Provide firm subgrade suitable for application of bedding material.

4. Wherever unstable material that in the opinion of the Engineer is incapable of supporting the pipe is encountered in the bottom of the trench, over-excavate such material to a depth suitable for construction of a stable subgrade. Backfill over-depth with Stabilization Material and compact.

F. Stockpiling Excavated Materials.

1. Pile suitable material for backfilling in an orderly manner a sufficient distance from banks of the trench to avoid overloading and to prevent slides or cave-ins.

2. Remove and dispose of excess excavated materials not suitable or not required for backfilling.

3. Do not stockpile excavated material against existing structures,
appurtenances, trees or cultivated shrubs.

G. Limiting Trench Widths.

1. Excavate trenches to provide adequate working space and pipe clearances for proper pipe installation, jointing and embedment. Provide a minimum clearance of six (6) inches on each side of the pipe for pipe twelve (12) inches in diameter or less, eight (8) inches for pipe between fourteen (14) inches and thirty (30) inches in diameter, and twelve (12) inches for pipe larger than thirty (30) inches in diameter.

2. Provide higher strength pipe, special pipe bedding, or arch concrete encasement as required by loading conditions and as determined by the Engineer where, for any reason, the width of the trench below twelve (12) inches above the top of the pipe exceeds the outer pipe diameter by more than thirty (30) inches.

H. Overdepth Excavation.

1. Restore over-excavated subgrades to proper elevation with Stabilization Material.

3.3 Pipe Bedding.

A. Bedding classes: Place pipe bedding in accordance with the details shown on the Drawings. Bedding shall be Class B or better except where other Classes are specifically indicated on the Drawings. Provide higher class bedding where maximum trench width is exceeded and the higher class is required to avoid overloading the strength of pipe being placed as determined by Engineer.

B. Placement and Compaction.

1. Distribute and grade bedding material to provide uniform and continuous support beneath the pipe at all points between bell holes or pipe joints.

2. Deposit bedding material and compact uniformly and simultaneously on each side of the pipe to prevent lateral displacement.

3. Compact carefully to meet the requirements of these specifications.

4. Compact lightly compacted bedding material to a density at least equal to the density of the adjacent undisturbed soil.

C. Ground Water Barriers.

1. To impede passage of ground water through bedding material, construct a ground water barrier that spans the width of the trench plus twelve (12) inches on both sides, twelve (12) inches deeper than the bottom of the trench, and to a minimum of twelve (12) inches above the pipe.
2. Location.

   a. Sanitary and Storm Sewer: Approximately ten (10) feet downstream of each manhole, inlet, outlet, and headwall/flared end section at the upstream end of a culvert crossing.

   b. All other pipelines: Approximately five hundred (500) feet apart.

3.4 Backfilling and Compaction.

   A. Sheeting Removal.

      1. Do not remove sheeting prior to backfilling.
      2. Use effective methods to protect the construction, other structures, utilities and properties during sheeting removal.
      3. Fill voids left by sheeting removal with dry sand.

   B. Deposit backfill material in uniform layers not exceeding eight (8) inches in uncompacted thickness. Increased layer thickness may be acceptable provided it is demonstrated that the specified compacted density will be obtained.

   C. Use methods and equipment appropriate for the backfill material. Do not use equipment or methods that will transmit damaging shocks to the pipe.

      1. Do not perform compaction by jetting or puddling.

   D. Import material for trench backfill if compaction can not be obtained with job excavated material.

   E. Topsoiling: Replace topsoil to a depth of stripping over all areas disturbed by construction operations and which will not receive other surface treatment. Depth of topsoil shall be a minimum of three (3) inches.

   F. Obtain a site for and dispose of excess excavated materials and material not suitable for backfilling.

   G. All excess excavated materials and material not suitable for backfilling shall be disposed of off-site by the Contractor.

3.5 Field Quality Control.

   A. A Geotechnical Engineer shall be on-site to provide continuous observation during the backfilling and compaction operations and shall be responsible to inspect the placement of all backfill on the project. The Geotechnical Engineer shall approve all materials prior to their use, the methods of placing, and the degree of compaction obtained.

   B. Moisture Density Tests: The following tests shall be conducted on representative samples of each type of material encountered or utilized and will be used as a basis for compaction control.
1. ASTM D698 or AASHTO T99 - Standard Method of Test for Moisture Density Relations of Soils Using a 5.5 lb Rammer and a 12 inch drop.
   a. Use method A, B, C or D as appropriate, based on soil condition and judgement of the testing laboratory.
   b. Determine and provide optimum density curve for each type of material encountered or utilized.
   c. Include Atterberg Limits, grain size determination and specific gravity.

2. ASTM D2049 - Test for Relative Density of Cohesionless Soils.

C. Compaction Control.

1. Field tests will be conducted to determine compliance of compaction methods with specified density in accordance with one of the following methods:
   a. ASTM D2922 - Tests for Density of Soil and Soil-Aggregate In Place by Nuclear Methods.
   b. ASTM D1556 - Tests for Density of Soil In-Place by the Sand Cone Method.
   c. ASTM D2167 - Tests for Density of Soil In-Place by Rubber-Balloon Method.

2. Conduct as minimum of five (5) tests for every one thousand (1000) linear feet of trench at locations and depths designated by Engineer. Excavate to designated depths and backfill test holes in accordance with the backfilling and compacting specifications.

D. Compaction shall be to the following minimum densities.

1. Subgrade.
   a. Under footings or foundations: 100%
   b. All other locations: 95%.

2. Barrier material: 95%.

3. Pipe bedding.
   a. Barrier Material: 95%.
   b. All other locations: 90%.

4. Trench backfill.
1) 100% for paved areas and shoulder slopes.

2) 95% for all other areas.

b. Paved roadways, sidewalks, and other areas to receive pavements: 95%.

c. Gravel Roadways: 95%

d. Sodded or lawn areas: 90%.

e. Under footings, foundations, or structures: 100%.

f. All other locations: 95%.

E. Moisture Content: Compact soils within two percent plus or minus ("2") of optimum moisture. Add water, harrow, disc, blade, or otherwise work material as required.

END OF SECTION
SECTION 4
SANITARY SEWER DESIGN AND CONSTRUCTION

PART 1 B GENERAL

1.1 Description.

A. This section covers the design, installation and testing of the sanitary sewer pipelines plus the furnishing and installation of manhole materials, and other appurtenances.

B. Sanitary sewer pipeline and appurtenances shall be installed in accordance with approved plans designed by a registered Professional Engineer. A copy of these plans along with a copy of those specifications must be kept at the job site at all times during construction.

C. All contractors must notify the City, in writing, at least forty-eight (48) hours prior to the start of construction. No work shall be backfilled (including bedding material along the springline of the pipe) without approval from the City.

D. All contractors performing work within the City of Golden must be properly licensed with the City and obtain all necessary permits before construction.

1.2 Location of Pipe Lines.

A. Sewers in Streets: When the sewers are placed in streets, they shall be placed as follows:

1. On streets running north and south, the sewer line shall generally be placed ten (10) feet west of the centerline of the street.

2. On streets running east and west, the sewer line shall generally be placed ten (10) feet south of the centerline of the street.

3. On streets shaped as a $A_{\infty}$ or on streets having unusually sharp turns, the sewer line will conform to the above specifications as near as is practical, but the final location shall be as determined by the ENGINEER or his representatives. Curvelinear sewer mains shall not be allowed without prior approval of the CITY. Designs must attempt to minimize the use of manholes.

4. In no case shall the sewer line be installed closer than three (3) feet to the lip of the pan or gutter. In this case, the manhole ring and cover shall be placed on the street side of the line.

5. Sewer lines in streets shall be designed to provide a minimum horizontal separation of ten (10) feet as measured between the centerline of the sewer pipe and any water line or water appurtenance. A minimum edge to edge separation of five (5) feet is required for any other utility.
6. The minimum depth of any sewer line shall be six (6) feet as measured from finished grade to top of pipe.

B. Sewers in Easements: When the sewers are placed in easements, they shall be placed as follows:

1. The sewer line shall be placed in the middle of the easement.

2. The standard easement width for a sewer placed at depths of ten (10) feet and less shall be twenty (20) feet.

3. For any sewer that is greater than ten (10) feet in depth, the easement shall increase symmetrically by one (1) foot for every additional foot in depth over ten (10) feet.

4. Sewer lines in easements shall be designed to provide a minimum horizontal separation of ten (10) feet as measured between the centerline of the sewer pipe and any water line or water appurtenance. A minimum edge to edge separation of five (5) feet is required for any other utility.

5. The minimum depth of any sewer line shall be six (6) feet as measured from finished grade to top of pipe.

6. The location of the easement shall be completely in one lot or tract and not straddle any lot lines.

1.3 Size of Pipe

A. No public sewer main shall be less than eight (8) inches in diameter. The minimum and maximum slopes for sewer lines shall be as shown in Table 4-1. The slope between manholes must be uniform.

<table>
<thead>
<tr>
<th>Size of Sewer</th>
<th>Minimum Slope</th>
<th>Maximum Slope</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inches</td>
<td>Feet Per Hundred</td>
<td>Feet Per Hundred</td>
</tr>
<tr>
<td>4</td>
<td>2.0</td>
<td>25</td>
</tr>
<tr>
<td>6</td>
<td>0.6</td>
<td>20</td>
</tr>
<tr>
<td>8</td>
<td>0.4</td>
<td>15</td>
</tr>
<tr>
<td>10</td>
<td>0.28</td>
<td>12</td>
</tr>
<tr>
<td>12</td>
<td>0.20</td>
<td>11</td>
</tr>
<tr>
<td>15</td>
<td>0.15</td>
<td>8.5</td>
</tr>
<tr>
<td>18</td>
<td>0.12</td>
<td>6.5</td>
</tr>
</tbody>
</table>

B. If necessary to design or install sewers with greater slope than the maximum indicated in Table 4-1, special provisions shall be made to protect against pipe displacement and erosion. Prior approval must be obtained from the City in any case involving such slopes. The table is based on two (2) fps minimum and ten (10) fps maximum velocity and Mannings n = 0.013. Reference: ASCE Manual.
and Practice No. 37. Larger sizes require approval of the City.

C. Sanitary sewer lines shall be designed to transport wastewater, exclusive of storm run-off, at peak flow rates corresponding to the population and land use saturation density of all land area tributary to the outfall point of the line. The density of the tributary areas shall conform to the requirements set forth in applicable City of Golden ordinances.

Design flow rate of a sanitary sewer line shall be the accumulative total of all wastewater contributions from each of the various types of land use areas; within a tributary basin, sub-basin or development to its outfall point; plus an allowance for infiltration/inflow and peak flows where applicable. The design flow rate shall be developed using the average daily flow rates, peak hour factor and Infiltration/Inflow allowances as set forth in Table 4-3 of this Section.

All calculations made in determining the design flow rate shall be submitted for approval, at time of platting or submission of development plans, whichever occurs first.

D. Hydraulic Design.

Sanitary sewer collector lines, those subject to having service connections thereon and hereafter referred to as laterals and mains, shall be sized to flow seventy-five (75) percent full at peak hour flow rates. CITY designated interceptor and trunk lines (lines void of service connections) shall be sized to flow full at peak hour flow rates.

The minimum allowable velocity shall be two (2) feet per second and the maximum ten (10) feet per second. The velocity shall be calculated using Mannings n = 0.013. Manholes shall have a maximum spacing of five hundred (500) feet. As measured from center of manhole to center of manhole. Types of allowed sewer pipe are listed in Section 4.2.1 and the design criteria for average day flows, peak hour factor, and infiltration/inflow allowances shall be as set forth in Table 4-3 of this Section.

Flow through inverts in manholes shall provide a minimum of: 0.1-foot drop in a straight through manhole; 0.2-foot drop in a manhole angled at forty-five (45) degrees or less; and 0.3-foot drop in manholes angled greater than forty-five (45) degrees. In manholes where the downstream sewer line is larger in diameter than the upstream line, the pipe crown elevations of the two pipes shall match. The maximum allowable deflection through a manhole connecting eighteen (18) inches and larger diameter lines shall be forty-five (45) degrees.

E. Miscellaneous.

An approved cut off wall or plug shall be installed in the trench, around, under and over a sewer line that crosses under an open ditch, channel or stream. The wall or plug shall be constructed on the downstream of downhill side, parallel to the open flow so as to prevent water from following the sewer trench.

All sewer and service line pipe joints that are installed within ten (10) feet of a
potable water line shall be concrete encased when the sewer line: crosses over a water line; crosses under and within two (2) feet of the water pipe invert; or parallels the waterline such that the sewer pipe crown elevation is less than two (2) feet below the water line pipe invert.

The use of any public or private sanitary sewer trench for pipe or gravel underdrain is prohibited.

1.4 Job Conditions.

A. Precaution shall be taken to minimize damage to newly installed pipeline.

1. Prevent foreign material from entering the pipe.
2. Do not place debris, tools, clothing, or other materials in the pipe.
3. Whenever pipe laying is interrupted close the open end of the pipe with a tight fitting plug or cap to prevent the entry of foreign material into the pipe. No pipe shall be left open overnight or during lunch breaks.
4. Use effective measures to prevent the uplift or floating of the line prior to completion of the backfilling operation.
5. Under no circumstances shall the sewer line be used to remove excess water which has infiltrated into the trenches.

PART 2 - PRODUCTS

2.1 Pipe Materials.

A. Type: Polyvinyl Chloride (PVC), refer to Section 6.

2.2 Manhole Materials.

A. Refer to Section 5.

2.3 Flexible Couplings.

A. When jointing two pipes of dissimilar material or two pipes with different outside diameters use the following:

1. Pipe sized fifteen (15) inches or smaller.
   a. Fernco, Inc.
   b. Mission Rubber Company
   c. Or equal.

2. In pipe sizes larger than fifteen (15) inches inside diameter wrap the joint with two laps of rubber or vinyl and band each pipe with a stainless steel band.

SECTION 4 - 4
a. Lap joint downward at springline of pipe.

b. Rubber or vinyl shall extend at least six (6) inches on each pipe past the joint, minimum thickness 1/16 inch rubber or 32-ounce vinyl.

B. Encase flexible couplings in a concrete collar a minimum of six (6) inches thick and extending a minimum of six (6) inches either side of the joint.

PART 3 - EXECUTION

3.1 Preparation.

A. Perform excavation in accordance with Section 3.

B. Where connections are to be made to existing pipes or appurtenances, the exact location of which cannot be determined without exposing the existing appurtenance, excavate and expose the existing improvement before installing any pipe. ENGINEER will examine pipe or appurtenance and specify any necessary adjustments in line or grade of the proposed pipe to accomplish the connection.

3.2 Pipe Installation.

A. General:

1. Utilize equipment, methods, and materials ensuring installation to lines and grades indicated.

   a. Maintain within tolerances specified or acceptable laying schedule.

      1) Alignment: +1 inch per 100 feet in open cut or tunnel.

      2) Grade: +1 inch per 100 feet.

   b. Do not lay on blocks unless pipe is to receive total concrete encasement.

B. Pipe Laying.

1. Begin pipe laying at the lowest point, unless otherwise directed by the Engineer, and install the pipe with the spigot ends pointing in the direction of flow.

2. Lay pipe true to line and grade and join in such a manner that the offset of the inside of the pipe at any joint is held to a minimum at the invert. The maximum offset at the invert shall be one (1) percent of the inside diameter, or 3/8-inch, whichever is smaller.

3. As each length of pipe is placed in trench, complete the joint in accordance with the applicable pipe material specification and adjust the pipe to the correct line and grade. Make adjustments by scraping away or filling pipe
bedding under the body of the pipe, and not by wedging or blocking up the bells.

4. Secure the pipe in place with the specified bedding tamped under and around the pipe. Do not walk on small diameter pipe or otherwise disturb any pipe after the jointing has been completed.

5. Clean interior of all pipe, fittings, and joints prior to installation. Exclude entrance of foreign matter during discontinuance of installation.
   a. Close open ends of pipe with snug-fitting closures.
   b. Do not let water fill trench. Include provisions to prevent flotation should water control measures prove inadequate.
   c. Remove water, sand, mud and other undesirable materials from trench before removal of end cap.

6. Brace or anchor as required to prevent displacement after establishing final position.

7. Perform only when weather and trench conditions are suitable. Do not lay in water.

8. Observe extra precaution when hazardous atmospheres might be encountered.

C. Waterline Crossing.
   1. Where sewer lines cross watermains, and the sewer is above the watermain or less than 18 inches clear distance vertically below the watermain, construct the crossing by one of the following methods:
      a. Using one length of pipe, PVC, or DIP, at least eighteen (18) feet long centered over or under the watermain. Use Flexible Couplings when jointing two pipes of dissimilar materials or two pipes with different outside diameters. Encase couplings in concrete as specified herein.
      b. Encase the sewer pipe with reinforced concrete at least six (6) inches thick at all locations within ten (10) feet either side of the waterline and in conformance with Standard Detail S-16.

   2. In all cases, provide suitable backfill or other structural protection to preclude settling or failure of the higher pipe.

D. Service Lines and Connections.
   1. General: Sanitary sewer service lines shall be four (4) inches or larger in diameter and connected, by means of a wye, watertight saddle, or fused adaptor to a lateral or a main. The wye or adaptor shall be mounted such that the service line effluent enters at an angle equal to or in excess of forty-five (45) degrees to the springline of the lateral or main. Vertical risers shall
be installed when the top elevation of the wye, installed through the service saddle or adaptor, is more than twelve (12) feet below finished grade. Riser connections shall reach a grade of nine (9) feet below finished grade within a horizontal distance of two (2) feet from the vertical centerline of the lateral or main. Lateral lines will not be allowed to connect directly to a CITY interceptor or collector. Connection to these lines shall be made by means of a manhole. All services greater than six (6) inches must be connected by a manhole.

2. On all new main, install forty-five (45) degree "Y" branches in the direction of flow as per Detail S-13 for future service connections at locations designated by the Engineer. Verify that service connection locations have been marked prior to commencing construction of any segment of sewer line.

3. Where an existing sewer is being replaced at the same alignment, locate and connect all existing services to the new sewer.

4. Install service connection on existing sewers using saddles securely fastened on the main. Cut a neat hole in the main by means of a tapping machine designed for such use. The finished connection shall be watertight and there shall be no projections inside the sewer main.

5. Incline the centerline of the branch upward at an angle of forty-five (45) degrees per Detail S-13.

6. Lay services for future service connections to five (5) feet outside of roadway surface (edge of asphalt, back of curb, or back of sidewalk) at a minimum grade of two (2) percent unless otherwise instructed by Engineer.

7. Install removable watertight plugs in each unused service branch and each unconnected lateral stub-out.

8. Mark the end locations of each unconnected branch with a steel fence post marker extended from the branch vertically to within one foot of the ground surface. Anchor markers and maintain in a vertical position during backfilling. The letter "S" shall be etched into the curb face directly above the service for future reference. Record location of each marker on the Drawings.

3.3 Manhole Construction.

A. Construct manholes in accordance with Section 5.

B. Connections to existing manholes.

1. Construct in such a manner that the finished work conforms to the requirements specified for new manholes (where practical).

2. Where no provision has been made for additional tie-ins, break out as small of an opening as necessary to insert the new pipe.

3. Chip out existing invert to accommodate the cross section of the newly inserted pipe, finish with mortar to form a smooth, continuous invert, and seal
space between the new pipe and the manhole wall with non-shrink grout.

4. In general, individual sewer service lines will not be allowed to connect to manholes. One service line will be allowed to connect to a manhole located on the end of a sewer main in a cul-de-sac. This service line must be installed prior to the placing of the manhole base and shall have a maximum drop of six (6) inches into the manhole. No service line shall connect to the main line closer than five (5) feet from the outside diameter of the manhole.

3.4 Cleanouts.

A. Cleanouts on public sewer lines will not be permitted. Cleanouts shall be installed on private sewer services under the following guidelines:

1. Cleanouts are placed at all vertical and horizontal bends.

2. A maximum spacing of one hundred (100) feet between cleanouts.

3. Cleanouts shall be located such that all portions of the line can be cleaned by rodding.

3.4 Field Quality Control.

A. Each section of sewer shall meet the requirements of the following tests. Furnish all equipment, labor and incidentals necessary and conduct tests in the presence of Engineer and City.

B. Stop all work, locate leaks, make repairs, and correct construction methods as needed as indicated as a result of any of the following tests.

C. Alignment Tests.

1. Engineer or City may lamp each section of sewer between manholes to determine whether any displacement of the pipe has occurred. Provide suitable assistants to help City. A full diameter (“full moon”) of the pipe should be visible when viewed between manholes.

D. Air Tests.

1. Air testing shall be used for testing PVC sewer pipe, but not for manholes or reinforced concrete pipe. At the direction of the City, manholes shall be tested using infiltration or exfiltration tests. Comply with the requirements of Uni-Bell PVC Pipe Association, Uni-B-6 – Low Pressure Air Testing of Installed Sewer Pipe.

2. Preparation for test: Flush and clean the sewer line prior to testing in order to wet the pipe surfaces and produce more consistent results. Plug and brace all openings in the main sewer line and the upper connections. Provide pressurizing equipment with a relief valve set at Five (5.0) psi to avoid over-pressurizing and damaging an otherwise acceptable line. Check all pipe plugs with a soap solution to detect any air leakage. If leaks are found release the air pressure, eliminate the leaks and start the test procedure over again.
3. Pressure Stabilization: Add air until the internal pressure of the sewer line is raised to approximately four (4.0) psi gauge at which time the flow of air shall be throttled to maintain the four (4.0) psi air pressure for two (2) minutes to allow the air temperature to come to equilibrium with the temperature of the pipe.

4. Timed Pressure Loss: After pressure stabilization, shut off air supply. The continuously monitoring pressure gauge shall be observed while the pressure is decreased to 3.5 psi. Upon reaching the 3.5 psi pressure, timing shall commence (using a stopwatch or sweep hand watch) to measure the time interval for the pressure to drop to 0.5 psi, or to 3.0 psi. If the timed pressure loss is greater than the minimum time outlined in the following Table 4-2, the section being tested is considered to pass the test.

5. Air Pressure Adjustment: When the groundwater table is above the pipe, a correction factor must be added to the 3.5 psig normal test starting pressure according to the following criteria: Divide the average vertical height of groundwater above the invert of the sewer pipe to be tested by 2.31 and add this factor to 3.5 psi.

### TABLE 4-2

<table>
<thead>
<tr>
<th>Diameter (Inches)</th>
<th>Minimum Time (min:sec)</th>
<th>Minimum Length (feet)</th>
<th>Time For 0.5 PSI Drop (sec)</th>
<th>Additional Length 100 ft</th>
<th>Additional Length 150 ft</th>
<th>Additional Length 200 ft</th>
<th>Additional Length 250 ft</th>
<th>Additional Length 300 ft</th>
<th>Additional Length 350 ft</th>
<th>Additional Length 400 ft</th>
<th>Additional Length 450 ft</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>7:05</td>
<td>159</td>
<td>2.671 L</td>
<td>7:05</td>
<td>7:05</td>
<td>8:54</td>
<td>11:08</td>
<td>13:21</td>
<td>15:35</td>
<td>17:48</td>
<td>20:02</td>
</tr>
</tbody>
</table>

SECTION 4 - 9
6. If section being tested fails, the Contractor may be required to video tape the sewer line to determine the location of the defective area. The defective pipe shall be repaired and the pressure air test performed until the test requirements are satisfied.

E. Exfiltration Tests.

1. Conduct exfiltration tests on section of sewer where the groundwater table is less than five (5) feet above top of the sewer pipe at any point.

2. Test between manholes by plugging all pipe entrances at manholes except between those connecting the reach being tested.

3. Fill the upper manhole and pipe with water to a depth of five (5) feet above the invert of the sewer at the center of the upper manhole, or if groundwater is present, fill to a depth of five (5) feet above the groundwater level at the upper manhole for a period of seventy-two (72) hours prior to testing.

4. Duration of Test: Two hours minimum, maximum allowable exfiltration shall be two hundred fifty (250) gallons per day per inch of pipe diameter per mile of the pipe length.

5. For the purpose of determining the maximum allowable leakage, manholes shall be considered sections of equivalent size pipe.

6. Remove all water from sewer used for testing, at completion of test.

F. Infiltration Tests.

1. Conduct infiltration tests where infiltration appears to exceed specified limits.

2. Conduct tests by placing a calibrated V-notch weir or flume in the line as it enters the manhole and plugging the line as it enters the higher manhole.

3. Allow sufficient time for the water level behind the weir to stabilize before reading. Take successive readings until consistent results are obtained. Groundwater dewatering shall not occur adjacent to the lines being tested for a period of seventy-two (72) hours prior to testing.

4. Maximum allowable infiltration shall be:
   
   a. Fifty (50) gallons per inch of pipe diameter per mile per day
   
   b. Zero point zero four (0.04) gallons per inch of pipe diameter per one hundred (100) feet of pipe length per hour.

5. If the infiltration rate exceeds the maximum allowable, suspend construction and provide electronic or photographic visual inspection of the interior of the pipeline.
G. Manholes and pipe lines shall not have any visible leaks or damp spots.

H. Retest lines that fail tests until satisfactory results are obtained.

3.5 Cleaning.

A. Prior to initial acceptance, remove all accumulated construction debris, rocks, gravel, sand, silt and other foreign material from the sewer system. Use mechanical rodding or bucketing equipment as required. After all paving activities have been completed, all mains must be flushed and cleaned.

B. At the time of final acceptance, all mains must be flushed and cleaned again.

3.6 Acceptance.

A. Initial Acceptance. After the completion of paving, all public mains will be considered initially accepted by the City for a period of one (1) year upon:

1. Successful inspection of all “initial punch list” item remedies.

2. Successful lamp test and visual inspection of the manhole rings and covers.

3. Successful flushing of all mains.

4. Receipt of paper and electronic as-buils. Format for the electronic version shall be confirmed with the City.

5. Receipt of full system video record, taken at the time of request of initial acceptance. Format for the video shall be confirmed with the City.

B. Final Acceptance. At the end of the one (1) year initial acceptance period, all public mains will accepted by the CITY upon:

1. Successful inspection of all “final punch list” item remedies.

2. Successful flushing of all mains.

3. Receipt of full system video record taken at the end of the one (1) year period.
### TABLE 4.3
SANITARY SEWER DESIGN FLOW RATES

<table>
<thead>
<tr>
<th>Residential</th>
<th>Average Daily Contribution (Gallons per day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multifamily</td>
<td>(100 g/c/d) x (2 c/u)</td>
</tr>
<tr>
<td>Townhouses</td>
<td>(100 g/c/d) x (2 c/u)</td>
</tr>
<tr>
<td>Apartments</td>
<td>(100 g/c/d) x (2 c/u)</td>
</tr>
<tr>
<td>Duplex</td>
<td>(100 g/c/d) x (2.5 c/u)</td>
</tr>
<tr>
<td>Single Family</td>
<td>(100 g/c/d) x (3.3 c/u)</td>
</tr>
<tr>
<td><strong>Commercial (1)</strong></td>
<td></td>
</tr>
<tr>
<td>Hotel-Motel</td>
<td>50 x (No. employees + No. Beds)</td>
</tr>
<tr>
<td>Hospitals</td>
<td>200 x (No. employees + No. Beds)</td>
</tr>
<tr>
<td>Restaurants</td>
<td>15 x (No. employees + 4 x (meals/day))</td>
</tr>
<tr>
<td>Offices</td>
<td>15 x (No. employees)</td>
</tr>
<tr>
<td>Service Station</td>
<td>15 x (No. employees + 2 x No. pumps + 10 x No Bays)</td>
</tr>
<tr>
<td>Schools</td>
<td>20 x (No. employees + No. students)</td>
</tr>
<tr>
<td>Self Service Laundry</td>
<td>50 x (No. of machines)</td>
</tr>
<tr>
<td>Theatre</td>
<td>5 x (No. of seats)</td>
</tr>
<tr>
<td>Warehouses</td>
<td>15 x (No. of employees)</td>
</tr>
<tr>
<td><strong>Industrial (1)</strong></td>
<td></td>
</tr>
<tr>
<td>Factories</td>
<td>15 x (No. employees) + (Industrial and Cafeteria Waste)</td>
</tr>
<tr>
<td>Other</td>
<td>Evaluate Separately</td>
</tr>
</tbody>
</table>

**Peak Hour Factor = PHF***

\[
PHF = 1 + \frac{14}{(4 + P^{0.5})} \quad \text{or} \quad PHF = 1 + \frac{14}{(4 + 10Q^{0.5})}
\]

Where: \( P \) = saturation population in 1000’s or fraction thereof.
Where: \( Q \) = average day flow in cfs.

**Infiltration/Inflow**

<table>
<thead>
<tr>
<th>Pipe Diameter (inches)</th>
<th>Type</th>
<th>I/I Gal/Day/Inch Dia./Mile</th>
</tr>
</thead>
<tbody>
<tr>
<td>8-27</td>
<td>PVC (Polyvinyl Chloride)</td>
<td>50</td>
</tr>
<tr>
<td>24-54</td>
<td>PVC (Polyvinyl Chloride)</td>
<td>200</td>
</tr>
</tbody>
</table>

Design Flow Rate = \( Q \) = cfs = Summation of all Average Daily Contributions converted to cfs x PHF where applicable + I/I

(1) Average daily flow rates set forth in Appendix I, Table 1-3 of the Uniform Plumbing Code shall govern in case of discrepancies.
SECTION 5
MANHOLES

PART 1 - GENERAL

1.1 Description.
A. This section covers manholes, including ring and covers, steps, grade rings, fittings, and other appurtenances.

1.2 Quality Assurance.
A. Manhole inverts shall not deviate from elevations shown on the Drawings by more than (\"\") 0.03 ft.

1.3 Product Delivery, Storage and Handling.
A. Do not deliver precast concrete sections to job until concrete has attained at least eighty (80) percent of specified strength.

1.4 Alternatives.
A. Manhole bases may be either monolithically precast or cast-in-place. See Section 14 for concrete specifications.

PART 2 - PRODUCTS

2.1 Concrete.
A. Cast-In-Place.
1. Meet the Requirements of Section 14 - Cast-in-Place Concrete.
2. Strength: 3000 psi at 28 days.
3. Cement: Type II or Type I/II.
4. Slump: 2".
5. Air Entrapment: 3 to 5 percent.

B. Mortar.
1. One part Portland Cement, ASTM C150, Type II.
2. Three parts sand, ASTM C144.
3. 2 part hydrated lime, ASTM C207, Type S.
C. Grout (non-shrink).
   2. Job Mixed:
      a. One part Portland Cement, ASTM C150, Type II.
      b. One part sand, ASTM C144.
      c. One part shrinkage correcting aggregate, Master Builders "Embco Aggregate," "Sonneborn "Ferrolith G-D.S.," or equal.

2.2 Precast Concrete.
A. Bases, barrels, cones and flat tops.
   1. Cast base and first barrel section monolithic.
   3. Cement: Type II or Type I/II.
   5. Provide horseshoe shaped openings for manholes to be installed in existing lines.

2.3 Manhole Gaskets.
A. Meet Requirements of: F.S. SS-S-00210, Type I, Rope Form.
B. Diameter:
   1. 48 inch manholes: 12 inch.
   2. 60 inch manholes: 1 3/4 inch.
   3. 72 inch manholes: 2 inch.
C. Approved Manufacturers.
   1. K.T. Snyder Co., "Ram-Nek" or "Rubr'-Nek."
   3. Or equal.
2.4 **Pipe Penetration Gaskets.**

A. **Approved Manufacturers.**

1. Dukor Co., “Ko-N-Seal”.
3. Or equal.

2.5 **Ring and Cover.**

A. **Material:** Gray Iron meeting requirements of ASTM A48.

B. **Construction.**

1. **Size:** Min. Clear opening twenty-four (24) inch diameter.
2. **Weight:** Heavy duty four hundred (400) pounds minimum.
3. **Bearing surfaces:** machined.
4. **Lid pattern:** checkered top or indented top.
5. **Pick hole:** concealed.
6. **Utility type (SANITARY SEWER) and City Logo shall be cast into the cover, see Detail S-7.**

2.6 **Steps.**

A. **Materials:** Polypropylene plastic coated steel. See Detail S-9.

B. **Construction.**

1. **Reinforcing rod:** 2 inch dia. Grade 60 steel.
2. **Length:** Nine and three-quarters (9 ¾) inches, designed for 6-3/8 inch protrusion from manhole wall.
3. **Width:** Fourteen (14) inches clear.
4. **Tread:** notched ridge with retainer lugs on each end.

C. **Spacing.**

1. **Eight (8) inches above bench.**
2. **Twenty (20) inch maximum below rim.**
3. **Twelve (12) inch vertical spacing between steps.**
2.7 **Pre-cast Manufacturing.**

A. Forms must be rigid, adequately braced, free from dents, gouges or other irregularities which would impair quality, appearance, or performance of members.

B. Holes and Openings. Incorporate into design and fabrication, openings indicated on the approved plans.

C. Surface Finish and Formed Surfaces. Provide a smooth, transverse broom finish at top surface of flat-top slabs. Provide smooth, uniform texture and color for formed surfaces. Remove fins and other projections.

D. Shop Marking. Label or paint, on each section, a shop marking to indicate location and position of each member.

E. Curing. Cure precast sections in accordance with ACI 308 to attain specific design strength.

**PART 3 - EXECUTION**

3.1 **Inspection.**

A. Examine each precast section, ring and cover and appurtenance for cracks and other defects. Remove all defective materials from the site.

3.2 **Manhole Size.**

A. Unless directed otherwise on the Drawings use forty-eight (48) inch diameter manholes on sewers eight (8) inch through eighteen (18) inch in diameter, sixty (60) inch manholes on sewers twenty-one (21) inches through thirty (30) inches in diameter, and seventy-two (72) inch manholes on sewers thirty-three (33) inches through forty-two (42) inches in diameter.

B. Use eccentric cones where manhole depth is sixty (60) inches or greater on forty-eight (48) inch manholes and seventy-two (72) inches or greater on sixty (60) inch manholes. Use flat top manholes when manhole depth is less than the above and on all seventy-two (72) inch manholes.

C. Manholes installed at depths greater than twenty (20) feet measured from finished grade to invert shall have an intermediate platform as shown on Detail S-6.

3.3 **Installation of Precast Manhole Sections.**

A. Connect all pipes to precast manhole sections using pipe penetration gaskets.

B. If inverts are not constructed by precaster and wherever grade and alignment permit, lay the main sewer continuously through the manhole and split the pipe after construction of the invert. Where this is not possible, terminate pipe flush with interior manhole wall and construct transition smooth and of proper radius for uninterrupted flow. In no case shall the invert flow section through the manhole be
greater than that of the outgoing pipe. Finish invert with a steel trowel prior to adding riser section to the base.

C. Set each manhole riser section plumb. Use sections of various heights to bring ring and cover to grade. Join manhole sections using mortar or pre-formed flexible plastic gaskets. The last barrel section prior to placement of the eccentric cone or the flat top slab shall be the manufacturer's shortest, but in no case greater than twenty-four (24) inches in height. All joint surfaces shall be clean, dry and warm during installation. Where mortar joints are used, set each section in a one (1) inch minimum full bed of mortar. If flexible gaskets are used, prime entire joint on both barrel sections prior to placement of gasket material.

D. Install ring and covers on one or a maximum of two (2) pre-cast adjusting rings of varying heights, not to exceed eight (8) inches in height each. On buried manholes the total allowable height of adjusting rings and the ring and cover shall be one inch less than the manufacturer's shortest precast barrel section. Set rings in a full bed of mortar and encase in mortar around the entire perimeter. Unless otherwise indicated, set the top of the rings twenty-four (24) inches below finished grade in farmed fields, six (6) inches below finish grade in gravel roadways and such that no part of the ring or cover will project above a point one-quarter (\(\frac{3}{4}\)) inch below the finish surface of pavement in paved areas subject to cleaning by snowplows.

E. Fill all lifting holes and other imperfections with mortar. Neatly point inside of joints no matter what joint material is used.

3.4 Construction of Cast-in-Place Bases.

A. Set stubs and mains before concrete is placed and recheck for alignment and grade before concrete has set. Where grade and alignment permit, lay the main sewer continuously through manholes and split the pipe after construction of the base. Where this is not possible, terminate the pipe flush with the interior manhole wall and construct transitions smooth and of proper radius for uninterrupted flow. In no case shall the invert flow section be larger than that of the outgoing pipe. Shape the base with a wood float and finish with a steel trowel. Allow the base to set a minimum of twenty-four (24) hours before continuing construction.

B. When thermoplastic pipe is used, connections to the manhole base shall be made using approved manhole couplings cast into the base or a minimum of three (3) pipe gaskets spaced two (2) inches apart on the end of each pipe and cast into the base.

C. If the pipe connection is to a precast section, use pipe penetration gaskets as specified above.

D. Install precast manholes risers, cones, and tops and the ring and covers as specified in paragraphs 3.3.C through 3.2.E above.

3.5 Drop Manholes.

A. Requirements: Drop manhole bases shall be constructed large enough to form a base for the concrete encasing the sewer drop entering the bottom of the manhole. The drop entering the manhole shall be completely encased in concrete up to the
spring line of the main sewerline as shown on Detail S-4 for sewerline up to fifteen (15) inches and twelve (12) inches above the pipe as shown on Detail S-5 for sewerline eighteen (18) inches and larger.

B. Drop Distance. All manholes in which the vertical drop is eighteen (18) inches or greater must be constructed with an outside drop. The maximum vertical drop shall be ten (10) feet.

C. Cleanout. Install a cleanout in the manhole at the level of the main sewerline, as shown in Details S-4 and S-5.

D. Lining. All drop manholes must be completely lined as shown in the Details S-4 and S-5.

3.6 Underdrain.

A. The use of all sanitary sewer trench for either a pipe or gravel underdrain is prohibited.

B. Foundation perimeter pipe or gravel are prohibited from connecting to a service or main line trench, and a positive method shall be used to prevent water collected in the foundation perimeter drain from flowing through the service line trench to the the main line trench.

C. Sump pumps and foundation perimeter drains are prohibited from connecting directly, or indirectly as through a floor drain, to the sanitary sewer line.

3.7 Field Quality Control.

A. Inspect each manhole for and repair all visible leaks and damp spots.

END OF SECTION
PART 1 - GENERAL

1.1 Description.

A. This section covers non-pressure plastic pipe and fittings to be furnished complete with all jointing materials.

1. Related Work specified elsewhere:
   a. Section 3 - Trenching, Backfilling, and Compacting.
   b. Section 4 - Sanitary Sewer Design and Construction.
   c. Section 5 - Manholes.
   d. Section 8 – Water Distribution and Transmission Main Construction.

1.2 Product Delivery, Storage and Handling.

A. Do not damage the pipe by impact, bending, compression or abrasion during handling and storage.

B. Store pipe on a flat surface which provides even support for the barrel with bell ends overhanging.

C. Do not stack pipe higher than five (5) feet.

D. Do not store pipe and fittings in direct sunlight for periods in excess of one week.

E. Ship rubber gaskets in cartons and store in a clean area away from grease, oil, ozone producing electric motors, heat and the direct rays of the sun.

F. Use only nylon protected slings or hands to handle pipe. Do not use hooks or bare cables.

PART 2 - PRODUCTS

2.1 Polyvinyl Chloride (PVC) Sewer Pipe.

A. Conform to the following standards:

1. Pipe 15" and smaller: ASTM D3034, Type PSM, SDR 35.

2. Pipe 18" and larger: ASTM F794.

2.2 **Polyvinyl Chloride (PVC) Pressure Pipe.**

A. Conform to the following standards:

1. All Pipe: ASTM D2241, D2122, and D3139.
2. Pipe 4" to 12": AWWA C900-97 or AWWA C909-98, Pressure Class 200.
4. Joints: Gasket bell end or gasket couplings.

2.3 **Joints To Other Pipe Materials.**

A. Approved Manufacturers:

1. Mission "Bushing Adapters."
2. Fernco "PVC Donuts" or "Flexible Couplings."
3. Or approved equal.

**PART 3 - EXECUTION**

3.1 **Inspection.**

A. Examine pipe and fittings and do not use individual sections containing:

1. Cracks, dents, abrasions, or other defects.

B. Mark rejected pipe and remove from the site.

3.2 **Installation.**

A. Install pipe in accordance with Sections 4 and/or 8 as applicable.

B. Cutting the Pipe:

1. Cut pipe square with saw or pipe cutter designed specifically for the material.
2. Bevel the end in accordance with the manufacturer's recommendations.
3. Remove burrs and wipe off all dust and dirt from the jointing surfaces.

C. Jointing the Pipe:

1. Remove all dirt and foreign material from the pipe ends, gasket and gasket groove.
2. Apply lubricant furnished by the pipe manufacturer to the spigot end of the pipe.
3. Insert the spigot to the reference mark.

4. Do not disturb previously installed joints during jointing operations.

3.3 Field Quality Control.

A. Pipe Deflection Tests:

1. Test each reach of sewer between manholes for vertical ring deflection after backfill has been completed for not less than one month.

2. Maximum allowable deflection is five (5) percent of the base internal diameter.

3. Uncover all pipe sections exceeding the maximum allowable deflection and replace the bedding and backfill to prevent excessive deflection.

4. Retest repaired sections after one (1) month.

B. Leakage Tests:

C. Test as outlined in Section 4 or 8.
PART 1 - GENERAL

1.1 Description.

Distribution and/or lateral mains and service lines conveying water from transmission lines to fire protection systems and customers shall be laid out and designed according to the following minimum standards. When installed, the top of distribution and lateral lines shall be buried a minimum of four and one-half (4-1/2) feet under compacted backfill, below finished grade.

1.2 New Development Water Usage Criteria.

The following criterion was developed to predict water consumption within specific developments or annexations. This criterion is intended to create input for the computer models when the specific land uses, locations, and use mixes are known. The computer model can then be used to evaluate the impact of new developments and assist the City to evaluate system improvements required to preserve levels of service.

Developers are responsible for designing new facilities located in previously established areas, such that the total demand fire flow does not exceed total available fire flow. This may require the developer to reconstruct existing or install additional lines to serve the project.

Developments can be evaluated in detail to determine particular infrastructure requirements. Forecasting the impact of new development will allow the City to negotiate line extensions and over sizing requirements with the developer to maintain the integrity of the Amended Master Plan. Water usage shall be based on the following criteria:

**Single Family**

<table>
<thead>
<tr>
<th>Density</th>
<th>3.5 unit/acre</th>
</tr>
</thead>
<tbody>
<tr>
<td>Occupancy</td>
<td>3.2 residents/unit</td>
</tr>
<tr>
<td>Usage</td>
<td>70 gallons/capita/day</td>
</tr>
<tr>
<td>Lawn Area</td>
<td>0.1 acre/lot</td>
</tr>
<tr>
<td>Irrigation Application</td>
<td>2.5 acre feet/year/acre*</td>
</tr>
</tbody>
</table>

Usage B 1560 gal/day/acre

**Multi-Family**

<table>
<thead>
<tr>
<th>Density</th>
<th>6.0 units/acre</th>
</tr>
</thead>
<tbody>
<tr>
<td>Occupancy</td>
<td>2.4 residents/unit</td>
</tr>
<tr>
<td>Usage</td>
<td>70 gal/capita/day</td>
</tr>
<tr>
<td>Lawn Area</td>
<td>0.25 acre/gross acre</td>
</tr>
<tr>
<td>Irrigation Application</td>
<td>2.5 acre feet/year/acre*</td>
</tr>
</tbody>
</table>

Usage – 1560 gal/day/acre
### Commercial/Office

- **Floor Space**: 10,000 sf/acre
- **Occupancy**: 1 worker/300 sf
- **Usage**: 30 gpd/worker
- **Lawn Area**: 0.15 acre/acre
- **Application**: 2.5 acre feet/acre*

Usage B 1300 gal/day/acre

### Parks and Open Space

- **Irrigation**: 2.5 acre feet/acre/year*

Total Usage B 3900 gal/day/acre

### Fire Flows

<table>
<thead>
<tr>
<th>Land Use</th>
<th>Flow (gpm)</th>
<th>Duration Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential</td>
<td>1500</td>
<td>2</td>
</tr>
<tr>
<td>Light Industrial/Office/Commercial</td>
<td>4000</td>
<td>4</td>
</tr>
<tr>
<td>Downtown</td>
<td>5000</td>
<td>5</td>
</tr>
<tr>
<td>Industrial/Large Commercial</td>
<td>6000</td>
<td>6</td>
</tr>
</tbody>
</table>

*Irrigation application is based upon a seven (7) month irrigation season.

1.3 **Water System Development Guidelines.**

Any new development shall be evaluated for conformance to the Amended Water Master Plan to insure that each component is totally compatible with the long range plan. The financial responsibility for these improvements is primarily the developers with the City of Golden supporting the over-sizing costs. The following table is a recommended guideline for water distribution system development and will define the developer’s responsibilities for distribution lines within new developments.

<table>
<thead>
<tr>
<th>Land Use</th>
<th>System Classification</th>
<th>Location</th>
<th>Minimum Pipe Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential SF</td>
<td>Major Distribution Line</td>
<td>Arterial Streets</td>
<td>12@</td>
</tr>
<tr>
<td></td>
<td>Distribution Lines</td>
<td>Collector Streets</td>
<td>10@</td>
</tr>
<tr>
<td></td>
<td>Local Lines</td>
<td>Local Streets</td>
<td>6@</td>
</tr>
<tr>
<td>Residential MF</td>
<td>Major Distribution Line</td>
<td>Arterial Streets</td>
<td>12@</td>
</tr>
<tr>
<td></td>
<td>Distribution Lines</td>
<td>Collector Streets</td>
<td>10@</td>
</tr>
<tr>
<td></td>
<td>Local</td>
<td>Local</td>
<td>8@</td>
</tr>
<tr>
<td>Commercial/Industrial</td>
<td>Major Distribution Lines</td>
<td>Arterial Streets</td>
<td>12@</td>
</tr>
<tr>
<td></td>
<td>Distribution Lines</td>
<td>Collector Streets</td>
<td>12@</td>
</tr>
<tr>
<td></td>
<td>Local</td>
<td>Local</td>
<td>10@</td>
</tr>
</tbody>
</table>
These are guidelines and are recommended for developments that are typical in a Golden P.U.A. Development plans should be reviewed on a case by case basis, using the criteria presented in the Design Criteria Section with fire flow as the critical design consideration.

1.4 Layout.

Distribution and lateral mains shall be installed in dedicated easements and public right-of-way. Pipe alignment shall be parallel to property lines and located ten (10) feet north or east of the street centerline or in the easement. Water mains shall extend to the extremities of the subdivision served. A main serving one (1) lot shall extend across the entire frontage of that lot.

Distribution mains, sixteen (16) inches to twenty (20) inches in diameter, shall be grid spaced at one mile intervals. Secondary distribution mains, twelve (12) inches to fourteen (14) inches in diameter, shall be intermediately spaced at one half (1/2) mile intervals and connected at each end to the larger distribution main. Lateral lines eight (8) to ten (10) inches in diameter, shall be looped to the distribution mains and used to deliver water to fire hydrants and the individual customer service and fire protection lines.

A. Laterals, Six (6) Inches in Diameter: Conditions under which six (6) inch secondary branch laterals will be approved to serve single family detached residences are where:

1. A branch lateral interconnects between two (2) eight (8) or ten (10) inch lateral lines no more than 600 feet apart.
2. A branch lateral ends in a cul-de-sac at a fire hydrant no more than three hundred (300) feet from its point of connection with an eight (8) inch or larger lateral.
3. A branch lateral ends in a cul-de-sac not more than one hundred fifty (150) feet from its point of connection with an eight (8) inch or larger lateral and serves four (4) or less single family residences.

B. Temporary Lateral: Mains and laterals shall be interconnected or looped. However, when a main or lateral is allowed to temporarily terminate, such as between filings of a subdivision, a fire hydrant or blow-off shall be installed at the point of termination. Mains and laterals shall be extended to the boundaries of filings and completely across the frontage of individual lots.

C. Easements and Right-of-Way: The minimum width ROW or easement for City use, in which a water main will be installed, is twenty (20) feet, except as authorized for Planned Unit Developments (PUD).

1.5 Planned Unit Developments.

In Planned Unit Developments, the City will allow the installation of lateral mains under the following conditions:

A. The main is installed in a non-exclusive easement which is no less than thirty (30) feet in width and the City is provided unobstructed use of twenty (20) feet thereof, except for right angle utility crossings.
B. The main is installed in a forty-five (45) foot minimum width dedicated street which meets all the requirements for a subdivision filing.

1.6 **Line Valves.**

Line valves are required at approximately every six hundred (600) feet in all distribution and lateral lines. Where City blocks exceed six hundred (600) feet in length, an intermediate line valve shall be installed such that no more than twenty (20) residential units nor more than one (1) commercial or industrial user will be out of service during maintenance.

Four-way and three-way street intersections require four (4) and three (3) valves respectively, one on each extended property line. For a succession of short blocks perpendicular to the direction of major feed and without residential or commercial services between, one or more intersections may have the valve omitted in that direction, but should retain the 600 foot dictum. Line valves shall also be placed:

A. Such that no more than one (1) fire hydrant is isolated at any one time.

B. At each end of a line running through an easement on private property.

C. On each side of a major creek or channel crossing.

D. On each side and at property lines extended, of a service line that feeds a hospital, school or large industrial user.

E. On fire hydrant laterals.

1.7 **Air Vacuum Relief Valves.**

Air vacuum relief valves shall be installed at the crown or high point elevation on distribution and lateral lines. Valves shall be installed in a manhole or vault specifically designed for the application. The use of a fire hydrant to relieve air from six (6) inch secondary lateral will only be allowed when the fire hydrant is installed at the end of a cul-de-sac which is also the high point in the lateral.

1.8 **Blow-Off Valves.**

Provision shall be included to allow flushing distribution and lateral lines at the sag or low point in the line, between line valves and at temporary dead ends, when approved. Fire hydrants located such that the pumper nozzle outlet elevation is no less than three (3) feet above and within seventy-five (75) feet of the low point in the line, may be allowed to serve as a blow-off when installed on side property lines extended.

Blow-off valves shall be installed perpendicular to and on the down hill side of the main and drain to the nearest gutter line. The standard blow-off shall be through a two (2) inch ball valve with two (2) inch gate valve operating nut, box, piping and cover. See Standard Detail W-5.
PART 2 - FIRE PROTECTION SYSTEM

2.1 Fire Hydrants.

Fire hydrants shall be installed within dedicated streets or easements. The number and location of fire hydrants in a given area is determined by the City Engineer and the governing fire protection district. Normal practice is to install fire hydrants on the northeast corner of the street intersection. If fire hydrants are to be installed at other than street intersections, they shall be located on one side of the street right-of-way on lines which established by extending property lot side lines into the street or in easements.

The maximum spacing between fire hydrants, when measured along the street curb line or directly from the hydrant to the unit, for types of structure use and maximum floor areas being served shall not exceed the distances shown below:

<table>
<thead>
<tr>
<th>Type</th>
<th>Family Units</th>
<th>Industrial/Professional</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Detached</td>
<td>Multi</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Multi</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Single</td>
</tr>
<tr>
<td>Unit Separation/Ft.</td>
<td>15+</td>
<td>0 B 14.9</td>
</tr>
<tr>
<td>Floor Area/Sq. Ft.</td>
<td>150,000</td>
<td>125,000</td>
</tr>
<tr>
<td></td>
<td>100,000</td>
<td>90,000</td>
</tr>
<tr>
<td></td>
<td>90,000</td>
<td>20,000+</td>
</tr>
<tr>
<td>Hydrant Spacing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Curb Line/Ft.</td>
<td>500</td>
<td>350</td>
</tr>
<tr>
<td></td>
<td>300</td>
<td>300</td>
</tr>
<tr>
<td></td>
<td>300</td>
<td>250</td>
</tr>
<tr>
<td>From Unit/Ft.</td>
<td>300</td>
<td>300</td>
</tr>
<tr>
<td></td>
<td>250</td>
<td></td>
</tr>
<tr>
<td>From Exterior Doors/Ft.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2.2 Fire Sprinkler Lines.

Fire sprinkler lines shall be installed at right angles to the distribution main or lateral and be extended directly to the property line. No horizontal bends, off-sets or taps are to be installed in these lines. The size of the fire sprinkler lines shall be determined by the City of Golden Fire Department.

2.3 Residential Standby Fire Protection.

Single tap combination domestic water service and standby fire protection to a single family residence, may be used when the following conditions are met:

A. The combination system is approved by both the Golden Fire Department and the Building Inspection Division of the Public Works Department.

B. The line is one continuous length of type AK copper extending perpendicular from the corporation stop in the main to a curb-stop and box, located on the property side of the vertical curb or sidewalk.

C. The residential domestic service line is teed off the fire line, one (1) foot downstream of the curb stop.

D. A meter and pit is installed in both the domestic and stand-by fire line at property line.
The domestic meter shall be sized for residential service while the fire line meter shall be the size as approved by the Utilities Division of the Public Works Department.

E. The fire protection service line shall be equipped with rubber faced check valve or backflow prevention devices and a flow monitor alarm system.

PART 3 - SERVICE LINES

Service lines with appurtenances to convey water from a distribution or lateral main in a street or easement to a structure shall conform to the following minimum standards.

The corporation stop, the meter, and that portion of the service pipe between the meter and the corporation stop on the main, shall all be of the same size. This portion of the service line must be installed in public right of way or an easement.

3.1 Sizing Services.

Service lines shall be adequate to supply the requirements of the property being served. The minimum size allowed for a water service line is three-quarter (\( \frac{3}{4} \)) inch.

The size of a service line from the City water main to any unit being served shall be selected such that the following design criteria are not exceeded during total peak demand flow:

A. Eighty (80) percent of the manufacturer's maximum meter capacity.

B. Service line pipe flow velocity does not exceed fifteen (15) fps.

C. The pressure drop from the City water main to any unit being served shall not be greater than thirty (30) psi and the minimum residual pressure at the foundation at any unit shall not be less than thirty (30) psi.

The water requirements of the property being served shall be defined as a total peak flow of the property.

Peak domestic water requirements shall be as calculated per the latest edition of the Uniform Plumbing code.

The irrigation demand flow and continuous load demands (when applicable) shall be added to the peak domestic flow to obtain the total peak demand flow. The service lines and meter shall be designed on the basis of the total peak demand flow. Consideration should be given to metering domestic and irrigation demand flows separately in some instances.

Peak demand flows for commercial, industrial or professional properties are to be approved by the City prior to sizing their service lines. In the event that these flows are not known during the construction of the service, the developer will be allowed to construct a stub out of one and one-half (1\( \frac{1}{2} \)) inch service for commercial and a one (1) inch service for residential, with the ultimate size of the rest of the service determined by meter size. If the size of the service is larger or smaller than the stub out, a reducer will be allowed at the tie in point of the service.

3.2 Layout of Service Line.

That portion of the service pipe between the main and the property line shall be one
continuous length of copper pipe, installed perpendicular from the main to a meter or curb stop and box at property line.

Service lines shall be installed ten (10) feet laterally, on the uphill side from any foreign non-potable conduit and a minimum of five (5) feet from the side property line of the lot being served. Services are not allowed to cross lot lines.

When serving lots at the end of a cul-de-sac, the length of service line between the main and the meter at property line shall not exceed 50 feet. Meters and/or curb stops with boxes shall not be installed in driveways or sidewalks. In instances where this requirement cannot be met, the curb stop/meter pit and lid must be of heavy duty construction as approved by the City Engineer.

PART 4 - PLANNED UNIT DEVELOPMENT TOWNHOME COMPLEX

Each building, regardless of the number of units contained therein, in a P.U.D. shall be metered and the service line from the meter tapped directly to a main located in public right-of-way or to a lateral supply line in the common area. The service line to the meter shall be on continuous section of copper pipe installed perpendicular to the main or lateral supply line. Meter shall be installed at property line or at a point in the common area that is easily accessible and void of vehicular traffic at all times. The location of lateral supply lines and meter, to be installed in common areas; easements must be approved by the City Engineer.

In a town home complex, each town home unit shall have its own separate meter. The service line from each meter shall be directly tapped to a supply line, as set forth above for a P.U.D. building. In addition, the service line shall only cross the common area and the unit lot of the town home being served.

PART 5 - SERVICE LINES AND FIRE PROTECTION LINE:

A property requiring both a fire line and a domestic service line shall be served from separate taps. The fire protection service line shall extend straight from the main to the property line and shall have a gate valve located two (2) feet minimum from the property line on the street side of the property line. A tee shall be placed on the fire protection service line on the inlet side of the gate valve for the domestic service line. A domestic service tee may not be placed on an existing fire line. A fire line from the main to the service by the service tee must be sized to accommodate the flow requirements of both lines, and approved by the City Engineer.

The domestic service and fire protection line may be placed in the same trench provided that there is a minimum of three (3) feet separation between the outside diameters of each line.

PART 6 - COMMON TRENCH

Service lines shall be separated laterally from a foreign conduit by a minimum of ten (10) feet and shall not be installed in trenches containing any substance other than potable water, except when the following conditions are met:

A. The service line is one continuous length of copper pipe.

B. The foreign pipe is polyvinyl chloride (PVC) pipe in 20 foot sections with concrete encased joints.
C. The bottom of the service pipe is at least twelve (12) inches above the top of the foreign pipe and placed on a shelf excavation on one side of the common trench.

D. The conditions set forth in Part 5 of this section.

E. Specifically approved by the City in writing.

PART 7 - BACKFLOW PREVENTION DEVICES:

7.1 General.

The City has adopted the Colorado Cross-Connection Manual (latest edition) as a guide. Technicians are encouraged to utilize Colorado Training Centers, manufacturers’ information, trade organizations, and trade magazines for additional information. Backflow prevention assembly installations shall be inspected and approved by the City of Golden.

Backflow prevention assemblies shall be installed on all of the following water service lines:

A. All commercial applications.

B. All fire protection systems.

C. All irrigation applications.

D. Any location where it is determined that a hazardous or aesthetically objectionable condition does or could exist.

E. All service lines one and one half (1 1/2) inches and larger.

7.2 Hazardous Condition.

A hazardous condition shall mean any unprotected actual or potential connection or structural arrangement between a public or a consumer’s potable water system and any other system through which it is possible to introduce to any part of the potable system used water, industrial fluid, gas, or any other substance other than the potable water with which the system is supplied. The degree of hazard shall be determined by the City based on the degree of the potential health or pollution hazard.

A. Hazardous requires the installation of a reduced pressure principle backflow assembly or air gap.

B. Aesthetically Objectionable requires the installation of a double check valve assembly and a pressure vacuum breaker or air gap.

7.3 Approved Models.

Only those models that have met completely the latest laboratory and field performance specifications of the Foundation for Cross Connection Control and Hydraulic Research, of the University of Southern California, and the Colorado Cross-Connection Control Manual, will be permitted by the City. In addition, the design for installation of backflow prevention assemblies shall, where applicable, address the following:
A. Water service size and location; meter size and location; backflow prevention assembly size, type, and location.

B. Backflow prevention assemblies shall be installed in the horizontal plane and inside a building.

C. Vertical clearance between floor and the lowest point of the device shall be no less than twelve (12) inches or no more than thirty (30) inches.

D. Horizontal clearance between any wall and the device shall be no less than twenty-four (24) inches on the test cock side and no less than twelve (12) inches on the opposite side.

E. Continuous service systems shall be provided with parallel back flow prevention assemblies. One device shall be operable while the other is being tested.

F. No installation of a backflow prevention device will be allowed above electrical or other equipment, where water could cause a hazard.

G. Backflow prevention devices are required on all sprinkler systems. A pressure vacuum breaker shall only be used where the device is never subjected to back pressure and installed a minimum of twelve (12) inches above the highest piping or outlet downstream of the device in a manner to preclude back pressure.

H. Backflow prevention assemblies, connecting lines, and drains shall be protected from freezing and thawing cycles.

END OF SECTION
SECTION 8
WATER DISTRIBUTION AND TRANSMISSION LINES

PART 1 – GENERAL

1.1 Description.
   A. This section covers the installation of water distribution and transmission lines.
   B. Water distribution pipeline and appurtenances shall be installed in accordance with
      CITY-approved plans designed by a Colorado-registered Professional Engineer. A copy
      of the plans, along with a copy of these specifications, must be kept at the job site at all
      times during construction.

1.2 Quality Assurance.
   A. Do not deviate from alignment more than 0.5 feet.
   B. Do not deviate from grade more than 0.3 feet where the pipeline is laid to grade.
      1. Measure at the pipe invert for grade, not at the top of pipe.

1.3 Job Conditions.
   A. Prevent foreign material from entering the pipe.
   B. Do not place debris, tools, clothing, or other material in the pipe.
   C. Close the open ends of pipe with a blocked, watertight plug when pipe laying is not in
      progress to prevent the entrance of water, debris, and animals into the pipe.
      1. Do not remove the plug, if water is present in the trench, until the trench is
         pumped dry.
   D. Use effective measures to prevent uplifting or floating of the pipeline prior to completion
      of backfilling operations.
   E. Do not lay pipe under the following conditions:
      1. In water.
      2. Unsuitable weather conditions.
      3. Unsuitable trench conditions.

PART 2 - PRODUCTS (Not used)

PART 3 - EXECUTION

SECTION 8 - 1
3.1 Preparation.

A. Perform trenching, backfilling and compaction in accordance with Section 3.

B. Connections: Where connections are to be made to existing pipes or appurtenances, the exact location of which cannot be determined without exposing the existing pipe or appurtenance, excavate and expose the existing improvement before installing any pipe.

Engineer or City will examine the existing pipe or appurtenance and specify any necessary adjustments in line or grade of the proposed pipe to accomplish the connection.

3.2 Pipe Installation.

A. Pipe Laying

1. Lay pipe with the bells pointing the direction the Work is progressing.

2. On down slopes of 10 percent or more:
   a. Hold the last pipe laid in place by some means, such as a which, while joining the next pipe to it to prevent moving or reverse the direction of pipe laying.
   b. Take effective measures to prevent opening of joints during bedding and backfilling operations.

3. Complete the joint in accordance with the applicable pipe material specification and adjust the pipe to the correct line and grade as each length of pipe is placed in the trench. Make adjustments in line and grade by scraping away or filing pipe bedding under the entire length of the pipe, except at bells, and not by wedging, blocking, or mounding up the pipe or bells.

4. Secure the pipe in place with the specified bedding tamped under and around the pipe except at the joints. Do not disturb the pipe after the jointing has been completed.

5. Install the pipeline so that a positive or negative grade is maintained between high and low points. Record the location of high and low points so they may be readily located if permanent air vents or blow-offs are not provided.

6. Provide a minimum depth of cover from finished grade to top of pipe of four and one-half (4.5) feet.

B. Connections to existing pipelines.

1. Use wedges for tracing. Make each connection at a time authorized by Engineer which will least interfere with service.

2. Use suitable fittings for the conditions encountered.

3. Dewater and dispose of water from dewatered lines.
4. Use effective measures to prevent contamination to existing potable water lines. Do not permit trench water, mud or other contaminating substances to enter pipelines.

5. Swab the interior of new pipe, fittings, and valves installed in existing pipelines with a solution of five (5) percent (50,000 ppm) chlorine solution prior to installation.

6. Only City staff shall operate existing valves, hydrants, blow-offs, curb stops, and other control units.

C. Encasements.

1. Provide concrete encasement where indicated on the Drawings.

2. Sewer line crossings. Where water mains cross sewer lines, and the sewer is above the water main or less than eighteen (18) inches clear distance vertically below the water main, construct the crossing by one of the following methods:
   a. Install one length of ductile iron pipe in the sewer line centered on the intersection with the watermain. Ductile iron pipe shall be the same size as sewer line, or nearest size larger, then sewer line. Use approved adapters for joints between the ductile iron pipe and the sewer line or encase the joints in a concrete collar as shown on the Drawings.
   b. Encase the sewer pipe with reinforced concrete at least six (6) inches thick at all locations within ten (10) feet either side of the watermain. Minimum reinforcement shall be one of the following:
      1) Reinforcement per Standard Detail S-16.
      2) 6 x 6 - W4 x W4 with 8 inch minimum lap, tied every 12 inches.
   c. Provide suitable backfill or other structural protection to preclude settling or failure of higher pipe.

3.3 Anchorage and Blocking.

A. Provide concrete thrust blocks and anchors or mechanical joint restraint for preventing pipe movement at push-on or mechanical joint plugs, tees, crosses, bends deflecting 113 degrees or more, reducers, and valves according to Details W-6, W-7, and W-8.

B. Extend concrete from the fitting or valve to solid undisturbed earth. Construct so joints and drain holes are clear and accessible.

C. Reducers and valves shall be restrained with the use of tie rods and clamps, or wedge-type retainer glands.
D. Provide a concrete thrust block under flanged valves that have valve boxes. Also provide a thrust block at water tap tees on existing mains according to the detail on the drawings. Wrap plastic around the pipe and fittings to eliminate contact with concrete.

3.4 Installation of Pipeline Appurtenances.

A. Install valves, meters, hydrants, and other equipment appurtenances to the water distribution and transmission lines at the locations shown on the Drawings or as designated by ENGINEER or CITY to accommodate field conditions.

1. Record measurements of actual location of appurtenant equipment prior to backfill.

3.5 Protection of Metal Surfaces.

A. Apply two coats of coal tar paint to ferrous metal rods, rebars, clamps, bolts, nuts and other accessories subject to submergence or contact with earth or fill material and not incased in concrete.

1. Apply first coat to dry, clean surface.
2. Allow first coat to dry before applying second coat.

B. Loose Polyethylene Encasement.

2. Methods, either of the following:
   a. A or B (tube type encasement involving advancing a bunched length of material around each length of newly laid pipe).
   b. C (sheet encasement wrapped around newly laid pipe to produce an overlapping seam at top of pipe).
3. Repair rips, punctures or other damage with adhesive tape of with a short length of polyethylene encasement wrapped around pipe and secured in place.
4. Maintain a sealed encasement with the polyethylene taped to the pipe at exist lines at the end of the encasement section.
5. Use loose polyethylene encasement at the following locations:
   a. Valves and fittings with flanges or mechanical joints.
   b. Bolted fittings, such as couplings.
   c. Tie rods and joint harnesses.
   d. On cast iron pipe and ductile iron pipe at all locations.

END OF SECTION

SECTION 8 - 4
SECTION 9
POTABLE WATER PIPE

PART 1 - GENERAL

1.1 Description.

A. This section covers ductile iron and polyvinyl chloride pipe, fittings, flanges, specials, and other accessories.

B. Related Work specified elsewhere:

1. Section 3 - Trenching, Backfilling, and Compacting.
2. Section 8 - Water Distribution and Transmission Line Construction.
3. Section 10 - Valves.
4. Section 14 - Cast-in-place Concrete

1.2 Product Delivery, Storage and Handling.

A. Handling.

1. Use slings, pipe tongs or skids.
2. Do not drop pipe or fittings including dropping on old automobile tire or other cushions.
3. Do not skid or roll pipe into pipe already on the ground.
4. Do not damage coating or lining.
5. Do not use hooks.

B. Storage.

1. Maintain lubricant in a sanitary condition during storage.
2. Store rubber gaskets in a cool, dark location away from grease, oil, and ozone producing electric motors and the direct rays of the sun.
3. Do not exceed maximum stacking heights listed in AWWA C600, Tables 1 and 2.
4. Do not store polyvinyl chloride pipe in direct sunlight for periods in excess of two weeks

PART 2 - PRODUCTS

2.1 Ductile Iron Pipe.

A. Pipe.

2. **Thickness Class**: Pressure Class 350 for all diameters.

**B. Flanged Pipe.**


### 2.2 Polyvinyl Chloride (PVC) Pressure Pipe:

**A. Conform to the following standards:**

1. **All Pipe**: ASTM D2241, D2122, and D3139.
2. **Pipe 4" to 12"**: AWWA C900-97 or AWWA C909-98, Pressure Class 200.
3. **Pipe 12" to 48"**: AWWA C905-97, Pressure Class 200 SDR 14.
4. **Joints**: Gasket bell end or gasket couplings.

### 2.3 Fittings

**A. Flanges, Mechanical Joint, Push-on.**

1. **Standard**: ANSI A21.10 (AWWA C110).
2. **Material**: Ductile Iron.
3. **Pressure Rating**: 350 ps.

### 2.4 Joints

**A. Mechanical and Push-on.**

1. **Standard**: ANSI A21.11 (AWWA C111)
2. **Gaskets**: Synthetic Rubber.
3. **Lubricant**: Furnished by pipe manufacturer.

**B. Flanged.**

1. **Standard**: ANSI A21.15.
2. **Flanges**: ANSI B16.1.
3. **Drilling**: 125 LB., unless otherwise indicated.

**C. Restrained.**

1. **Furnish joint restraint where required to offset internal pipeline forces.**
2. **Fittings required shall be indicated on the drawings with thrust blocks. In lieu of thrust blocks, joints may be restrained at the appropriate distances indicated on Detail W-8 by the following:**
   
   a. **Restrained mechanical joint, wedge type retainer gland by EBBA Iron or equal.**
   b. **Restrained push-on joint.**
2.5 **Couplings.**

A. Mechanical Couplings.
   1. Type: Mechanical compression sleeve.
   2. Omit pipe stop unless indicated otherwise on the Drawings.
   4. Dresser Style 138, Smith-Blair Type 411 Baker Series 228, or equal.

2.6 **Pipe Lining.**

A. Cement Mortar.
   2. Thickness: Standard.

2.7 **Pipe Coatings.**

A. Underground or Submerged Locations.
   1. Type: Bituminous.
   2. Thickness: Approximately 1. mil.

B. Exposed Locations.
   1. Pipe: Primer; Tnemec "77 Chem-Prime, Mobil "13-R-50 Chromox Q.D.,” or equal.
   2. Flange faces: Rust-Oleum "R-9." Houghton "Rust Veto 344," or equal.

2.8 **Accessories.**

A. Tie Rods.
   2. Steel Pipe: ASTM A120, stand weight.

B. Clamps.
   1. ASTM A36.

C. Polyethylene Tubing.
   2. Method: A.
PART 3 - EXECUTION

3.1 Inspection

A. Examine pipe and fittings and do not use individual section's containing:

1. Cracks.
2. Flaws.
3. Broken or loose lining.
4. Other defects.

B. Mark defective pipe and remove from the site.

C. Refer to Section 8 for additional installation requirements.

D. Cutting the pipe.

1. Cut pipe smooth, straight and at right angles to the pipe axis.
2. Do not damage the pipe or cement lining.
3. Use only mechanical pipe cutters for gray iron pipe except where this is impracticable.
4. Use a saw, abrasive wheel, or oxyacetylene torch for ductile iron pipe.
5. Do not use an oxyacetylene torch for cutting holes for saddles.
7. Bevel the cut end for push-on joints.

E. Polyethylene Encasement.

1. Install polyethylene encasement on ductile iron pipe at all buried locations.
2. Cut polyethylene tube to a length approximately two (2) feet longer than that of the pipe section.
3. Slip the tube around the pipe, centering it to provide a one (1) foot overlap on each adjacent pipe section, and bunching it accordion fashion lengthwise until it clears the pipe ends.
4. A shallow bell hole must be made at joints to facilitate installation of the polyethylene tube.
5. After assembling the pipe joint, make the overlap of the polyethylene tube.
6. Pull the bunched polyethylene from the preceding length of pipe, slip it over the end of the new length of pipe, and secure in place.
7. Then slip the end of the polyethylene from the new pipe section over the end of the first wrap until it overlaps the joint at the end of the preceding length of pipe.

8. Secure the overlap in place.

9. Take up the slack width to make a snug, but not tight, fit along the barrel of the pipe, securing the fold at quarter points.

3.3 Joint Installation

A. General.

1. Use push-on or mechanical joints in underground locations, unless indicated otherwise on the drawings.

2. Use flanged joints at other locations unless indicated otherwise on the Drawings.

3. All joints shall be watertight and free from leaks.

4. Repair each leak discovered within one year after final acceptance.

5. Block, anchor, or harness all mechanical couplings, and push-on or mechanical joints.

6. Do not deflect joints beyond the maximum values specified in AWWA C-600, Tables 5 and 6.

B. Push-On Joints.

1. Clean the inside of the bell and the outside of the spigot to remove dirt, oil, excess coating and other foreign matter.

2. Insert the gasket.

3. Apply a thin film of lubricant to either the inside surface of the gasket, the spigot end of the pipe or both.

4. Do not permit the joint surfaces to come in contact with the ground.

5. Assure that pipe is marked with a depth mark before assembly to assure the spigot end is inserted the full depth of the joint.

6. Complete the joint making certain the spigot is inserted to the depth mark.

C. Mechanical Joints.

1. Remove all dirt, oil, grit, excess coating and other foreign matter from the inside of the bell and the outside of the spigot.

2. Apply a thin film of lubricant to the inside of the bell, the outside of the spigot and the gasket.

3. Tighten nuts alternately on opposite sides of the pipe of produce equal pressure on all parts of the gland.

4. Use a torque limiting wrench and do not exceed the maximum torque valued listed in AWWA C600 Table 4.
5. Holes in mechanical joint bells shall straddle the top (or side for vertical piping) centerline.

D. Flanged Joints.
1. Extend pipe completely through screwed-on flanges.
2. Machine finish the pipe end and flange face in a single operation.
3. Eliminate any restraints on the pipe which would prevent uniform gasket compression or cause unnecessary stress in the flanges.
4. Do not assemble mechanical connections until all flanged joints affected thereby have been tightened.
5. Alternately tighten bolts spaced on opposite sides of the pipe to assure uniform gasket compression.
6. Holes in flanges shall straddle the top (or side for vertical piping) centerline.

E. Mechanical Couplings.
1. Clean and smooth pipe ends.
2. Allow one-quarter (3) inch minimum to one inch maximum space between pipe ends.

F. Additional requirements for PVC Pipe.
1. Service tap: Single band, full saddle.
2. Test ports for tracer wire, looped to rear of hydrant.

END OF SECTION
SECTION 10
VALVES

PART 1 - GENERAL

1.1 Description.

A. This section covers valves, valve operators, valve boxes, and appurtenances used for waterline and services.

B. Related Work specified elsewhere:
   1. Section 8 - Water Transmission and Distribution System.
   2. Section 9 - Ductile Iron Pipe.
   3. Section 11 - Hydrants
   4. Section 12 - Testing Piping System.

1.2 Product Delivery, Storage and Handling.

A. Take precautions so as not to damage materials during delivery or storage.

B. Store valves off the ground and away from materials that could contaminate potable water systems.

C. Take precautions to keep joints and internal parts clean.

PART 2 - PRODUCTS

2.1 Gate Valves.

A. Conformance: AWWA C509.
   1. Type: solid wedge, resilient seat.
   2. Stem seal: O-ring.
   4. Valve ends: conform to the type of pipe material used.
   6. Bubble tight at two hundred (200) psi working pressure.

2.2 Valve Boxes.

A. Materials and Construction - Water Main Lines.
   1. Type: Cast iron or ductile iron, extension sleeve type.
   2. Shaft size: six (6) inch minimum.
3. Thickness: three-sixteenths (3/16) inch minimum at any point.
4. Furnish with suitable cast iron bases and covers.
5. Cast word "WATER" in cover.
7. Manufacturer: Tyler Series 6860.

B. Materials and Construction - Curb Stop Boxes.
1. Type: Cast iron or ductile iron, Buffalo type.
2. Shaft size: Two and one-half (2 ½) inch minimum.
4. Manufacturer: Tyler Series 6500, Size 95E.

2.3  Air Relief/Vacuum Valves.

A. Materials and Construction.
1. Type: Integral type assembly which functions both as an air release and vacuum valve.
2. Rating: working pressure of two hundred (200) psi and a minimum hydrostatic test pressure of three hundred (300) psi.
3. Connections:
   a. Inlet: two (2) inches, threaded.
   b. Outlet: Protect to minimize entry of debris and dirt.
4. Body: cast iron or ductile iron.
5. Working parts and seats: brass, stainless steel, or non-corroding material.
6. Float: Stainless Steel.
7. Watertight at two hundred (200) psi.
8. Manufacturer: Apco, by Valve and Primer Corporation or equal.

B. Connection.
1. Connecting fittings and pipe shall be bronze, brass, or copper rated for two hundred (200) psi service.
2. Isolation valves shall be bronze gate valves, Crane No. 424 or approved equal.
3. Couplings and unions indicated between pipeline and air valve piping shall be insulated style.
2.4 **Corporation Stops.**
A. Materials and Construction.
   1. Material: Brass.
   3. In accordance with AWWA C-800.

2.5 **Tapping Saddles.**
A. Materials and Construction.
   1. Material: Bronze.
   2. In accordance with AWWA C-800.

2.6 **Curb Stops.**
A. Materials and Construction.
   1. Material: Brass.
   2. In accordance with AWWA C-800.

2.7 **Angle Valves.**
A. Materials and Construction.
   1. Material: Brass.
   2. In accordance with AWWA C-800.

2.8 **Insulating Couplings.**
A. Materials and Construction.
   1. Material: Non-conductive boot to eliminate metal-to-metal contact.

2.9 **Mastic Corrosion Protection.**
A. Use a minimum of twelve (12) mil dry coating of mastic with a viscosity of 700,000 cps.

**PART 3 - EXECUTION**

3.1 **Installation.**
A. Comply with the provisions of AWWA C600 and as specified.
B. Thoroughly clean and remove all shipping materials prior to setting. Confirm operation of all valves from fully opened to completely closed.

C. Equip with anchorage where required or indicated.

D. Valves handling a liquid waste or discharge during operation shall be permanently piped to an approved drain.

E. Tapping saddles are required on all corporation stop sizes above one (1) inch.

D. Valve Boxes
   1. Install valve boxes on all buried valves.
   2. Install so that no stress is transmitted to valve.
   3. Set plumb and directly over the valve with the top between one quarter (\( \frac{3}{4} \)) inch and three-eights (\( \frac{3}{8} \)) inch below finished grade.
   4. Install extended stems on valves where operating nut is more than four (4) feet below finished grade.

3.2 Air Relief/Vacuum Valves.
   A. Install at high points where indicated on the Drawings.

3.3 Corrosion Protection.
   A. Apply mastic to clean and dry exposed surfaces of valves. Allow one (1) hour drying time prior to backfilling.

3.4 Field Testing.
   A. Testing shall be in accordance with Section 11 - Testing Piping system and shall be witnessed by the ENGINEER's representative. Results will be submitted to the City.

END OF SECTION
SECTION 11
HYDRANTS

PART 1 - GENERAL

1.1 Description.
A. This section covers dry-barrel fire hydrants intended for use in public water supply systems where freezing temperatures occur. Refer to Section 7 for placement and flow requirements.

1.2 Product Delivery, Storage and Handling.
A. Handle, store and protect in a manner to prevent damage to materials, coatings, and finishes.
B. Do not drop or dump materials into trench.
C. Keep fittings and joints free from dirt.

PART 2 - PRODUCTS

2.1 General.
A. Conformance: AWWA C502-73.
B. Type: Dry barrel with compression shutoff opening against the pressure.
C. Dimensions:
   1. Size: 5-1/4".
   2. Inlet size: Six (6) inch nominal, mechanical joint w/retainer gland.
   3. Outlet nozzle size: Pumper nozzle (1) 4-1/2-inch, hose nozzles (2) 2-1/2-inch.
   5. Operating nut: One (1) inch Pentagonal.
   6. Minimum bury: Six (6) feet minimum, but not less than required to provide five (5) feet cover on 6" Inlet.
D. Operation: Open left (counter-clockwise).
E. Color: Safety Yellow.
F. Provide flange connection near ground designed to break on impact.
G. Acceptable manufacturers: no substitutes.
   2. Waterous, Pacer 250-67
PART 3 - EXECUTION

3.1 Inspection.
   A. Inspect all hydrants for:
      1. Direction of opening.
      2. Nozzle threading.
      3. Operating nut and cap dimensions.
      4. Tightness of pressure-containing bolting.
      5. Cleanliness of inlet elbow.
      6. Handling damage and cracks.
   B. Remove non-conforming or defective hydrants from the site.

3.2 Installation.
   A. Set hydrants plumb with the pumper outlet facing the street or curb. Prefer pumper to point to shutoff valve. Set hydrants to the established grade with the traffic flange three (3) to six (6) inches above finished grade.
   B. Connect each hydrant to the main with a six (6) inch branch line with an independent gate valve located as indicated on the approved plans. The hydrant, branch line, gate valve, and main tee form the "Fire Hydrant Assembly".
   C. Provide concrete thrust blocks or restrained joints as specified in Section 8.
   D. Carefully backfill and compact the soil around the hydrant to provide adequate soil support to avoid transmitting shock movement of the lower barrel and inlet connection.

3.3 Hydrant Drainage.
   A. When the hydrant is set in pervious soil, place coarse gravel or crushed stone mixed with coarse sand from the bottom of the trench to a minimum level of six (6) inches above the drain port, and to a distance of one (1) foot around the elbow.
   B. When the hydrant is set in clay or other impervious soil, excavate a two (2) foot by two (2) foot by two (2) foot drainage pit below the hydrant and fill with coarse gravel or crushed stone mixed with coarse sand under and around the elbow of the hydrant to a minimum level of six (6) inches above the drain port.
   C. Where the groundwater rises above the drain port, plug the drain port and note this condition on the as-built drawings. Water shall be pumped from the hydrant after each use.
   D. Repaint damaged areas with paint as specified in 2.1.E.

3.4 Operation.
   A. Hydrants shall be closed or fully open.
   B. Do not operate hydrants partially open.

END OF SECTION

SECTION 11 - 2
SECTION 12
TESTING PIPING SYSTEMS

PART 1 - GENERAL

1.1 General.

A. Description: This section covers the hydrostatic testing of water distribution and transmission lines.

B. Conduct pressure test and leakage test concurrently.

C. Do not test until at least seven (7) days have elapsed after the last concrete thrust restraint has been cast.
   1. Thirty-six (36) hours minimum shall elapse if high-early-strength cement is used.

D. Conduct tests in increments not to exceed two (2) miles of pipe as construction progresses.

E. No allowance shall be made for pressure reductions accomplished by means of pressure reducing valves or other mechanical means.

F. Prior to tests Contractor and Engineer shall inspect valves within the test section to make sure they are fully open.
   1. Hydrants: Test with the hydrant main valve closed and the auxiliary line valve open.

1.2 Pressure Test.

A. Preparation.
   1. Slowly fill pipe with water.
   2. Remove all air.
      a. Install corporation cocks at high points to evacuate the air if permanent air vents are not located there.
   3. Leave pipe filled with water at working pressure for a minimum of seventy-two (72) hours prior to the hydrostatic pressure test.

B. Test Pressure.
   1. For steel pipe, ductile iron pipe, and cast iron pipe, use a test pressure of one and one-half (1.5) times the working pressure measured at the lowest elevation of the test section or the working pressure plus fifty (50) psi, whichever is greater.
2. Maintain the test pressure within "five (5) psig of the test pressure for at least two (2) hours.

1.3 Leakage Test.

A. Definition: Leakage is the quantity of water that must be added to the pipeline to maintain pressure within five (5) psi of the specified test pressure after the air has been expelled and the pipe is filled with water.

B. Maximum allowable leakage.

1. For ductile iron pipe and steel pipe, pre-stressed concrete cylinder pipe:

\[
L = \frac{ND(P^2)H}{7400}
\]

Where:
- \(L\) = maximum allowable leakage in gallons
- \(N\) = Number of joints in the length of pipeline tested.
- \(D\) = Nominal pipe diameter in inches.
- \(P\) = Average test pressure during the leakage test in psig.
- \(H\) = Number of hours tested.

2. When testing against closed metal-sealed valves, an additional leakage per closed valve of 0.0078 gal/hour/inch of nominal valve size will be allowed.

1.4 Acceptance.

A. Acceptance shall be on the basis of maximum allowable leakage.

B. Locate and repair defective materials and joints if the tests discloses leakage greater than that specified.

C. Repeat tests until the leakage is within the permitted allowance.

D. All visible leaks shall be repaired, regardless of the amount of leakage.

PART 2 - PRODUCTS (not used)

PART 3 - EXECUTION (not used)
SECTION 13

DISINFECTION OF DOMESTIC WATER LINES

PART 1 - GENERAL

1.1 Description
A. This section covers disinfection of all potable water distribution and transmission lines.

1.2 Quality Assurance
A. Hypochlorites shall conform to AWWA B300 - "Hypochlorites".
B. Disinfection procedures shall conform to AWWA C651.

1.3 Delivery, Storage and Handling
A. Exercise extreme care in handling of hypochlorites and their solutions as these chemicals possess a health hazard.

PART 2- PRODUCTS

2.1 Materials
A. Hypochlorites: Calcium hypochlorite containing seventy (70) percent chlorine.

PART 3 - EXECUTION

3.1 General
A. Flush and satisfactorily disinfect new water lines prior to placing in service in accordance with AWWA C651.
B. Clean and swab the interior of the pipe, fittings, valves, or appurtenances with a five (5) percent (50,000 ppm) hypochlorite disinfecting solution if dirt, trench water; or other contaminants enter the pipe; or will not be removed by flushing operations.
C. Manipulate valves to prevent the disinfection solution from flowing back into the line supplying the water or into adjacent parts of the in-service distribution system.
D. Operate valves and other appurtenances while lines are filled with heavily chlorinated water.

3.2 Flushing
A. Preliminary flushing: Flush pipelines at a minimum velocity of two and one-half (2.5) ft/sec to remove foreign material prior to disinfection.
   1. Do not use preliminary flushing if the tablet method of disinfection is approved by Engineer.

SECTION 13 - 1
B. Final flushing: Flush chlorinated water from the lines after chlorination until the chlorine concentration is no higher than that prevailing in the system, or less than one (1) mg/l, whichever is higher.

3.3 Methods

A. In general, apply chlorine using the continuous feed method.

1. Slug method may be used on large diameter pipe where continuous feed is not practical.

2. Tablet method may be used on short extensions up to two thousand five hundred (2500) feet of water lines twelve (12) inches and smaller.

B. Continuous Feed Method

1. Introduce chlorinated water into the lines at a constant rate so that the chlorine concentration in the water lines is maintained at a minimum of fifty (50) mg/l available chlorine.

2. Fill the entire main with the chlorine solution.

3. Retain the chlorinated water in the main for at least twenty four (24) hours at which time the treated water shall contain no less than twenty five (25) mg/l chlorine throughout the length of the main.

C. Slug Method

1. Introduce chlorinated water into the lines at a constant rate so that the chlorine concentration in the water lines is maintained at a minimum of three hundred (300) mg/l available chlorine.

2. Apply for a sufficient period of time to develop a solid column of chlorinated water that will expose all interior surfaces for a period of at least three (3) hours.

3. The measured chlorine residual shall contain no less than twenty-five (25) mg/l throughout the length of the main.

D. Tablet Method

1. Do not use if trench water or foreign material has entered the line or if the water temperature is below 5°C (41°F).

2. Use only when scrupulous cleanliness has been exercised due to the fact that preliminary flushing is not possible with this method.

3. Place tablets in each section of pipe, hydrants, hydrant leads, and other appurtenances in sufficient number to produce a minimum chlorine concentration of 50 mg/l. Reference Table 3, AWWA C651.
4. Attach tablets, except in hydrants and joints, with an adhesive on the tablet except on the broad side next to the pipe surface.

5. Introduce water into the lines at a velocity less than one (1) foot/second.

6. Retain the water in the lines a minimum of twenty-four (24) hours.

3.4 Bacteriologic Tests

A. After final flushing and prior to Contractor placing water lines in service, the City will collect samples from the end of the pipeline after final flushing and prior to placing water lines in service and test for bacteriologic quality to show the presence of coliform organism.

B. The number and frequency of samples shall conform to the requirements of the City of Golden Environmental Services.

1. In no case shall the number be less than one (1) sample for lines with chlorinated supplies and two (2) samples collected 24 hours apart for unchlorinated supplies.

3.5 Disposal of Chlorinated Water

A. After successful testing and prior to placing water lines in service, the Contractor will be required to dispose of the chlorinated water in the new piping.

B. Super-chlorinated water, defined as greater than four (4) mg/l, regardless of volume, may not be discharged to surface waters or storm sewers. Non-discharge alternatives must be used, including:

1. Sanitary sewer disposal, either by connecting to an active manhole or hauling to a sewage treatment facility.

2. Land application, in the form of dust control or irrigation.

3. Measures must be used to maximize erosion and sediment control to reduce any pollutants from entering a drainage system.

C. Chlorinated water, defined as containing up to four (4) mg/l, must be disposed of using one of the following “Best Management Practices”:

1. Wherever practicable, chlorinated water should be disposed so it does not enter surface waters or storm sewers. Non-discharge alternatives such as sanitary sewer disposal, either by connecting to an active manhole or hauling to a sewage treatment facility, or land application, in the form of dust control or irrigation should be evaluated before considering a direct discharge to surface waters or a storm sewer.

2. When non-discharge options are not feasible, chlorinated water may be discharged to a storm sewer if the travel time and/or dilution in the storm sewer system is sufficient to allow the dissipation of chlorine. Typically, a total piping distance of one thousand (1000) feet or more should be adequate for the

SECTION 13 - 3
chlorine dissipation. Shorter distances may also be adequate if there is dilution available in the storm sewer system.

3. When non-discharge options are not feasible and the travel time/dilution in the storm sewer system is either insufficient or unknown, the chlorinated water should be de-chlorinated before discharging to a stream. De-chlorination should be sufficiently effective to reduce the total residual chlorine concentration to 0.1 mg/l or less and all water should be tested before discharge.

4. When non-discharge options are not available, the chlorinated water may be collected in a closed vessel or an open-air detention facility and held for sufficient time to allow the chlorine to dissipate. Detention time should be sufficient to reduce the total residual chlorine concentration to 0.1 mg/l or less and all water should be tested before discharge.

5. De-chlorination shall be conducted to minimize any pollutants from entering a drainage system. Erosion and sediment control measures shall be used at all existing storm sewer inlets that are to accept these flows.

3.6 Repetition of Procedure

A. Repeat disinfection until satisfactory samples have been obtained if the initial disinfection or subsequent disinfections fail to produce the specified results. The City reserves the right to impose a fee for each subsequent test.

END OF SECTION
SECTION 14

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 Description.

A. This Section covers all cast-in-place concrete, including forms, reinforcing steel, finishing, curing and other appurtenant Work.

1.2 Quality Assurance.

A. Reference Standards:

1. Except as modified or supplemented in these Specifications, all structural concrete shall meet the requirements of the following standards. Refer to the standards for detailed requirements.

   a. American Concrete Institute Standards (ACI).
      1. ACI 301 Specification for Structural Concrete for Buildings.
      2. ACI 347 Recommended Practice for Concrete Formwork (Chapters 1 through 5).

      1. As referred to in this section.

B. Mix Design:

1. Compressive Strength: Three thousand (3000) psi at twenty-eight (28) days.
   a. Minimum number of cylinders passing above requirement shall be 90%.
   b. Minimum strength of cylinder acceptable, two thousand eight hundred (2800) psi.

2. Cement Content: 52 bags per cubic yard, minimum.

3. Maximum permissible Water - absolute cement ratio by weight:
   a. Non air-entrained: 0.58.
   b. Air-entrained: 0.46.

4. Slump: Four (4) inch maximum.

5. Air Content: Six (6) percent " One (1) percent for concrete with exposed surfaces or subject to freezing and thawing; not required for other concrete.

SECTION 14 - 1
1.3 **Product Delivery, Storage and Handling.**

A. **Cement:** Store in weather-tight enclosures and protect against dampness, contamination and warehouse set. Do not use cement that has become caked or lumpy.

B. **Aggregates:**
   1. Stock pile to prevent excessive segregation or contamination with other materials or other sizes of aggregates.
   2. Use only one supply source for each aggregate stock pile.
   3. Do not use the bottom six (6) inches of aggregate piles in contact with the ground.

C. **Admixtures:**
   1. Store to prevent contamination, evaporation, or damage.
   2. Protect liquid admixtures from freezing or harmful temperature ranges.
   3. Agitate emulsions prior to use.

D. **Mixing and Transporting Ready-mixed Concrete:**
   1. The maximum elapsed time from the time water is added to the mix until the concrete is in place shall not exceed 12 hours when concrete is transported in revolving-drum truck bodies.

E. **Reinforcing Steel:**
   1. Deliver to site in bundles marked with metal tags indicating bar size and length.
   2. Carefully handle and store on supports which will keep the steel from coming in contact with the ground.
   3. Remove all mud, oil, loose rust or mill scale and other foreign materials prior to placing concrete.
   4. Rust or mill scale which is "tight" will be permissible without cleaning or brushing, provided weights, dimensions, cross sectional area, and tensile properties meet the requirements of ASTM A615.

1.4 **Job Conditions.**

A. **Environmental Requirements:**
   1. Do not place concrete during rain, sleet or snow unless adequate protection is provided.
2. Do not allow rain-water to increase the mixing water or damage the surface finish.

B. Cold Weather Concreting:
2. Temperature of concrete when placed shall not be less than the following:

<table>
<thead>
<tr>
<th>Minimum Air Temperature (EF)</th>
<th>Minimum Concrete Temperature Sections under 12&quot;</th>
<th>Minimum Concrete Temperature Sections 12&quot; and Over</th>
</tr>
</thead>
<tbody>
<tr>
<td>30 to 45</td>
<td>60</td>
<td>50</td>
</tr>
<tr>
<td>0 to 30</td>
<td>65</td>
<td>55</td>
</tr>
<tr>
<td>Below 0</td>
<td>70</td>
<td>60</td>
</tr>
</tbody>
</table>

3. When placed, heated concrete shall not be warmer than 80EF.
4. Prior to placing concrete, all ice, snow, surface and subsurface frost shall be removed, and the temperature of the surfaces to be in contact with the new concrete shall be raised above 35EF.
5. Protect concrete during specified curing period.
6. Heated enclosures shall be strong and windproof to insure adequate protection of corners, edges and thin sections.
7. Do not permit heating units to locally heat or dry the concrete.
8. Do not use combustion heaters during the first 24 hours unless the concrete is protected from exposure to exhaust gases which contain carbon dioxide.

C. Hot Weather Concreting:
1. Conformance: ACI 305 "Recommended Practice for Hot Weather Concreting."
2. Take precautions when the ambient air temperature is 90EF or above.
3. Temperature of concrete when placed shall not exceed 85EF.
4. Cool forms and reinforcing to a maximum of 90EF by spraying with water prior to placing concrete.
5. Do not use cement that has reached a temperature of 170EF or more.
6. Prevent plastic shrinkage cracking due to rapid evaporation of moisture.
7. Do not place concrete when the evaporation rate (actual or anticipated) equals or exceeds 0.20 pounds per square foot per hour, as determined by Figure 2.1.4 of ACI 305.

8. Approved set-retarding and water reducing admixtures may be used when ambient air temperature is 90°F or above to offset the accelerating effects of high temperature.

PART 2 - PRODUCTS

2.1 Concrete Materials.

A. Cement: ASTM C150, Type II or I/II.

B. Aggregates:
   1. Fine aggregate - ASTM C33, except that manufactured sands shall not be considered acceptable.
   2. Coarse aggregate - ASTM C33 except air-cooled blast furnace slag is acceptable. Nominal maximum size - as permitted by ACI 318.

C. Water: Clean and fresh.


E. Ready-mixed Concrete: Mixed and delivered, ASTM C94.

F. Batching and Mixing Equipment: ACI 304, "Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete."

2.2 Form Materials.

A. Forms:
   1. Plywood - Waterproof, resin-bonded, exterior type, Douglas fir.
   2. Lumber - straight, uniform width and thickness, free from knots, off-sets, holes, dents and other surface defects.
   3. Designed to produce hardened concrete having the shape, lines and dimensions shown on the Drawings.

B. Form Oil:
   1. Light colored paraffin oil, or other non-staining material. For exposed surfaces not in contact with earth backfill, acceptable chemical release agents are Protex Industries, "Pro-Cote," Symons Corp., "Magic Kote," L&M, "Debond," or equal.
C. Form Ties:
   1. Commercially manufactured permanently embedded type with removable ends for all exposed surfaces.
   2. Permanently embedded portion shall terminate not less than one inch from the face of the concrete.

2.3 Reinforcing Materials
   A. Bars: ASTM A615, Grade 60 unless specified otherwise.
   B. Welded Wire Fabric: ASTM A185 or A497.
   C. Fabrication ACI 315 and 318 unless shown otherwise on Drawings.

2.4 Non-Shrink Grout

2.5 Curing and Sealing Compounds
   A. Sheet materials: ASTM C171.
      1. 6 mil polyethylene film.
   B. Spray applied membrane forming curing compounds.
      1. For use on paving, curb and gutter, sidewalks, and other open areas exposed to direct sunlight: ASTM C-309, Type 2, Class B.
      2. For use on other surfaces not exposed to direct sunlight: ASTM C-309, Type 1-D, Class B.

2.6 Expansion Joint Filler
   A. Bituminous type: ASTM D994.
   B. Cork type: ASTM D1752, Type 2 or 3.
   C. Fiber type: ASTM D1751.

PART 3 - EXECUTION

3.1 Erection of Forms
   A. Brace or tie to maintain desired position, shape and alignment before, during and after concrete placement.
B. Construct forms for beams and slabs supported by concrete columns so the column forms can be removed without disturbing the beam or slab supports.

C. Provide temporary openings at the bottom of columns and wall forms and at other locations where necessary to facilitate cleaning and inspection.

D. Where concrete is placed against rock, remove loose pieces of rock and clean the exposed surface with a high pressure air hose.

E. Place Chamfer strips in forms to bevel salient edges and concrete corners of exposed surfaces except the top edges of walls and slabs which are to be tooled. Unless otherwise noted on the Drawings, bevels shall be 3/4 inch wide.

F. Remove mortar or grout from previous concrete and other foreign material from the surfaces. Coat form surfaces with approved coating material before either the reinforcing steel or concrete is placed.

G. Do not allow form coating to:
   1. Stand in puddles in the forms.
   2. Come in contact with the reinforcing steel.
   3. Come in contact with adjacent hardened concrete against which fresh concrete is to be placed.

3.2 Removal of Forms.

A. Do not remove or disturb forms until the concrete has attained sufficient strength to safely support all dead and live loads.

B. Remove forms with care to avoid surface gouging, corner or edge breakage, and other damage to the concrete.

3.3 Reinforcing.

A. Installation:
   1. Accurately place reinforcing bars and maintain in proper position while concrete is being placed and compacted.

B. Bar Supports:
   1. Provide minimum number of supports as required by ACI 315.
   2. Do not use pebbles, pieces of broken stone, common or face brick, metal pipe or wood blocks to support reinforcement.
   3. On ground, where necessary, supporting solid concrete bricks may be used. Use one half concrete bricks whenever possible.
4. Use metal, plastic or other approved bar chairs, bolsters and spacers over flat form surfaces.

5. Where the concrete surface will be exposed to the weather in the finished structure the portions of all accessories within 2 inch of the concrete surface shall be non-corrosive or protected against corrosion.

C. Splices.
   1. Do not splice bars, except at locations shown on the Drawings, without Engineer's approval.
   2. Minimum lap distance shall be as shown on the Drawings. If not shown, splices shall be as specified in ACI 318.
   3. Tie splices securely to prevent displacement during placement of concrete.

D. Welded Wire Fabric.
   1. Install in longest practicable length.
   2. Lap adjoining pieces one full mesh plus two (2) inches minimum.

3.4 Embedded Items.
   A. Anchor bolts, castings, steel shapes, conduits, sleeves, masonry anchorage, and other materials that are to be embedded in the concrete shall be accurately positioned in the forms and securely anchored.
   B. Install conduits in walls or slabs with reinforcement in both faces between the two faces of reinforcing steel.
   C. In slabs which have only a single face of reinforcing steel, place conduits near the center of the slab.

3.5 Inspection.
   A. General.
      1. Assure that excavations and form work are completed.
      2. Assure that dirt, mud, encrusted concrete, debris, and excess water has been removed.
      3. Check that reinforcement is properly positioned and secured in place.
      4. Verify that expansion joint material, anchors, waterstops, and other embedded items are secured in proper position.
      5. Verify that all required tests for pipes under slabs have been completed.
3.6 **Concrete Placement.**

A. **Conveying:**

1. Convey to the point of final deposit by methods which will prevent the separation or loss of ingredients.

2. During and immediately after placement, concrete shall be thoroughly compacted, worked around reinforcements and embedments, and worked into all corners of the forms.

3. Carefully deposit concrete for drilled piers excavated piers caissons to avoid contact with forms, reinforcing, and earth sides until completion of drop.
   a. Prevent earth or other material from falling into excavations.
   b. Prevent dislocation of reinforcing during concrete placement.
   c. Place concrete continuously to top of each pier caisson at a rate of vertical rise of not less than 2 feet per hour.
   d. Use cylindrical steel or fiber forms acceptable to ENGINEER above grade line.

3.7 **Expansion and Contraction Joints.**

A. **Installation:**

1. Formed where shown on the Drawings, but in no case more than fifty (50) feet in any direction.

2. Install expansion joints, fillers and water stops as detailed on the Drawings or in accordance with manufacturer's instructions.

3. Do not extend reinforcement through expansion joints, except where specifically noted or detailed on the Drawings.

3.8 **Construction Joints.**

A. **Location:**

1. Formed where shown on the Drawings.

2. Construct in one continuous concrete placing operation all concrete included between construction joints.

3. Obtain ENGINEER'S approval for location of additional construction joints desired.
3.9 **Finishing Formed Surfaces.**

A. **Rough Form Finish:**
   1. Rough form finish is acceptable for surfaces not exposed to view such as surfaces in contact with earth backfill.
   2. Patch tie holes with mortar.
   3. Repair defects.
   4. Smooth form finish is acceptable alternative.

B. **Smooth Form Finish:**
   1. Provide smooth form finish for surfaces not specified to have grout leaned finish.
   2. Use form facing to produce a smooth, hard, uniform surface.
   3. Keep number of seams to a minimum.
   4. Patch all tie holes with mortar.
   5. Remove all fins.
   6. Repair all defects.

C. **Grout Cleaned Finish.**
   1. Provide grout cleaned finish for surfaces so designated on the Drawings and the following surfaces:
   2. Complete operations for smooth form finish.
   3. Wet surface and apply grout mix of one (1) part Portland Cement and one and one half (1 1/2) parts of fine sand.
   4. Substitute white Portland cement for gray as required to match surrounding concrete.
   5. Rub surface with cork float or stone to fill air bubbles and holes.
   6. Remove excess grout by rubbing with a rubber float, sack or other means.
   7. Do not begin cleaning until all contiguous surfaces are completed and accessible.
3.10 **Finishing Unformed Surfaces.**

A. **Slabs, Pavements, Sidewalks, Driveways, Curb and Gutters and Similar Structures:**
   1. Screed and give an initial float finish as soon as concrete has stiffened sufficiently for proper working.
   2. Remove course aggregates disturbed by the initial floating or which cause a surface irregularity and replace with mortar.
   3. Initial floating shall produce a surface of uniform texture and appearance.
   4. Follow with a second floating at the time of initial set. This floating shall produce a finish of uniform texture and color.
   5. In areas where concrete is to remain exposed, follow the second floating with a broomed treatment to the surface to provide a uniform abrasive texture of constant color, except where steel trowel surface is indicated.

3.11 **Defective Concrete.**

A. Repair in accordance with ACI 301, Chapter 9.

3.12 **Curing.**

A. Keep concrete continuously moist for at least seven (7) days (two (2) days for high early strength concrete) after placement by use of:
   1. Ponding or continuous sprinkling.
   2. Wet burlap, wet absorptive mats, or wet sand.
   3. Waterproof sheets.
   4. Polyethylene film.
   5. Membrane curing compound.

   a. Do not use membrane curing compounds when the surface is to be painted or other material is to be bonded to the surface.

B. Maintain concrete within 50°F to 70°F range during curing.

C. Apply curing and sealing compounds in accordance with manufacturer’s instructions.

3.13 **Field Quality Control.**

A. **Test Cylinders:**
   1. Make a set of test cylinders (three (3) 6" x 12") for each fifty (50) cubic yards placed or portion thereof.
2. Deliver test cylinders to testing laboratory.


B. Failure of test cylinder results.

1. Upon failure of any set of test cylinder, the Engineer or City may, at Contractor's expense, require a test of at least three (3) two (2) inch diameter cored samples from area in question.

2. Concrete will be considered adequate if average of three cores is at least 85% of, and if no single core is less than 75% of, specified 28-day strength.

3. Upon failure of core test results, the Engineer or City may require Contractor, at Contractor's expense, to perform all work necessary to remove and replace all concrete which, in Engineer's opinion, is represented by the failed tests. All work necessary to expose the concrete to be removed, and to restore all other effected work to satisfactory status shall be at Contractor's expense.

4. Fill all core holes as specified for repairing defective concrete.

END OF SECTION
## SECTION 15

### STANDARD DETAILS

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<tr>
<td>UT-2</td>
<td>Approval Block</td>
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### SANITARY SEWER

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<th>Precast Manhole</th>
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<td>Precast Manhole (Plan View)</td>
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<td>S-2</td>
<td>Stub-out Manhole</td>
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<td>S-3</td>
<td>Manhole Base Deflector</td>
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<td>Outside Drop Manhole, 15 Inch &amp; Smaller</td>
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<tr>
<td>S-5</td>
<td>Outside Drop Manhole, 18 Inch &amp; Larger</td>
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<td>S-6</td>
<td>Intermediate Platform</td>
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<td>S-7</td>
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<td>S-15</td>
<td>Pipe Casing and Sled</td>
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<td>S-16</td>
<td>Concrete Easement</td>
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### WATER

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<td>W-2</td>
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<td>W-3</td>
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<td>W-4</td>
<td>Water Marker</td>
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<td>W-5</td>
<td>Blow-off Assembly</td>
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<td>Concrete Kickblocks Bearing Surface</td>
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<td>Vent Pipe Assembly</td>
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<td>W-15</td>
<td>Outside Meter Setting, 1-½” &amp; 2” w/Check Valve</td>
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<td>W-16</td>
<td>Outside Meter Setting, 1-½” &amp; 2” Brass Alternative</td>
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<td>Remote Reading ¾” &amp; 1” Meter, Typical Inside Setting</td>
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<td>W-18</td>
<td>Inside Meter Setting for 1-½” &amp; 2” w/Check Valve</td>
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<td></td>
<td>&amp; Bypass in Manhole</td>
</tr>
</tbody>
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NOTES:

1. STREET SECTION IS TYPICAL.
2. SECTION IS EAST OR NORTH TO THE RIGHT.
3. MINIMUM DEPTH OF COVER PER STANDARDS.
4. STORM SEWER AT CENTERLINE OR UNDER SIDEWALK.
5. FRONT LOT EASEMENT MAY VARY.
6. DRY UTILITIES ARE WITHIN FRON LOT EASEMENT.
7. FOR DRY UTILITIES, REFERENCE ALL APPLICABLE PROVISIONS IN CHAPTERS 11 AND 17 OF THE GOLDEN MUNICIPAL CODE AND CHAPTER, LATEST EDITION.
CITY OF GOLDEN APPROVALS

These plans have been approved by the City of Golden to be in general conformance with the City of Golden’s "Water and Sanitary Sewer Specifications" and/or other City-approved applicable standards.

Approved by:

Public Works ___________________________ Date ____________

Approved by:

FIRE DEPARTMENT ___________________________ Date ____________

CITY OF GOLDEN

APPROVAL BLOCK

Scale: NTS

Date: Dec 2003

Detail No. UT-2
Standard Operating Procedure

TITLE: Abandonment of Water & Sewer Service Lines

GENERAL PROCEDURE:

1. When abandoning a water service line, the owner of the service line, or the owner's agent or contractor, must shut off the corporation stop at the public water main, and must disconnect the service line from the corporation stop. A minimum of two feet of service line must be removed, as measured from the public water main. The remainder of the abandoned water service line may either be removed or left in place. The threads must be cut off of the corporation stop.

2. When abandoning a sanitary sewer service line, the owner of the service line, or the owner's agent or contractor, must cut off the service line as close to the sanitary sewer main as possible without cutting into a City street or alley (for example, behind the curb or sidewalk.) A minimum of two feet of sanitary sewer service line, as measured from this cut location toward the property being served, must then be removed. The portion of the service line remaining which is still connected to the main shall be filled with concrete for a minimum distance of two feet from the cut location, and then capped. The remainder of the abandoned sanitary sewer service line from the cut location toward the property being served may either be left in place or removed.

MISCELLANEOUS NOTES and COMMENTS:

The City Engineer or designee is authorized to carry out the provisions of this policy, and to use his/her discretion to waive any requirements in this policy, or to require methods or improvements not specified in this policy, if in his/her opinion and best professional judgment, it would be in the best interests of the City to do so.

S.O.P. prepared by: Vince Auriemma  Date: 3/30/2005

Approved by  Date: 3·30·05
WATER SERVICE REQUIREMENTS
1. SHUT OFF CORPORATION STOP.
2. REMOVE SERVICE LINE FROM CORPORATION STOP.
3. REMOVE A MINIMUM OF TWO FEET OF SERVICE LINE WITHOUT DAMAGING CURB, CUTTER, OR SIDEWALK.
4. REMAINDER OF SERVICE LINE MAY BE REMOVED OR LEFT IN PLACE.
5. REMOVE CURB STOP BOX AND METER BOX (IF APPLICABLE).
6. PATCH ASPHALT (MATCH EXISTING DEPTH OF ASPHALT).
7. DEMO WORK MUST BE INSPECTED BY CITY PRIOR TO BACKFILL.

SEWER SERVICE REQUIREMENTS
1. CUT AS CLOSE TO MAIN WITHOUT DAMAGING STREET OR SIDEWALK.
2. REMOVE A MINIMUM OF TWO FEET OF LINE.
3. CAP REMAINING SERVICE LINE.
4. DEMO WORK MUST BE INSPECTED PRIOR TO BACKFILL.
NOTES:
1. MANHOLE BARREL MINIMUM DIAMETER SHALL CONFORM TO TABLE BELOW
2. SHAPING FOR SMOOTH MANHOLE invertS MUST BE DONE BY FORMING OR SHAPING BASE CONCRETE. SEE DETAIL S-3
3. MANHOLE STEPS SHALL BE PLASTIC ACCORDING TO DETAIL S-9
4. PRECAST CONCRETE SECTIONS SHALL CONFORM TO ASTM C-478
5. BLOCK-OUTS WHEN APPROVED SHALL EXTEND A MAX. OF 6" PAST MANHOLE O.D. AND BE SATISFACTORY PLUGGED AND SEALED.
6. CONCRETE MANHOLES MAY BE Poured IN PLACE ONLY WITH PRIOR APPROVAL.
7. ALL MORTAR CROUT SHALL BE MIXED WITH TYPE II CEMENT.
8. BENCH MUST HAVE A BRUSHED, NON-SKID SURFACE.
9. OUTFALL OR DROP MANHOLES SHALL BE LINED WITH SIKARD NO. 62 OR APPROVED EQUAL, COATED WITH MIN. 20 MIL APPLIED IN 4-7 MIL LAYER, PER MANUFACTURERS SPECIFICATIONS

**NOTE:**
WHENEVER MORE THAN A TWO WAY MANHOLE OF MAX. PIPE I.D. IS REQUIRED THE MANHOLE SHOULD BE INCREASED TO LARGER Dia., E.G. 18"X18"X18", REQUIRES 5'-0" I.D.

<table>
<thead>
<tr>
<th>PIPE I.D.</th>
<th>MANHOLE I.D.</th>
<th>R. &amp; C.</th>
</tr>
</thead>
<tbody>
<tr>
<td>18&quot; &amp; SMALLER</td>
<td>4'-0&quot;</td>
<td>24&quot;</td>
</tr>
<tr>
<td>21&quot; TO 30&quot;</td>
<td>5'-0&quot;</td>
<td>30&quot;</td>
</tr>
<tr>
<td>33&quot; TO 42&quot;</td>
<td>6'-0&quot;</td>
<td>30&quot; / 36&quot; W/</td>
</tr>
<tr>
<td>60&quot; &amp; LARGER</td>
<td>SPECIAL DESIGN</td>
<td>24&quot; INNER-COVER</td>
</tr>
</tbody>
</table>

CITY OF GOLDEN

PRECAST MANHOLE

SCALE: NTS
DETAIL NO. S-1

DATE: DEC 2003
NOTES:

RING & COVER ELEVATION SHALL BE IN ACCORDANCE WITH THE CITY OF GOLDEN REQUIREMENTS. SEE DETAILS S-7 & S-8 FOR RING AND COVER.

SET ACCESS INTO MANHOLE ON BENCH SIDE OF MAIN AS SHOWN.
"STUB-OUT" OPENING FORMED BY A SHORT PIECE OF SPLIT PIPE

NOTE:
"STUB-OUT" OPENING IN BASE SHALL BE FORMED WITH A SHORT PIECE OF "SPLIT PIPE" AND BENCH FORMED ACCORDINGLY. THE PIPE SHALL BE A MINIMUM OF 12" DIAMETER OR 3" LARGER THAN THE DISCHARGE LINE SIZE. AN "O" RING GASKET SHALL BE USED ON THE LINE TO FORM A GASKET "KEY" FOR USE WHEN THE FUTURE PIPE IS CONSTRUCTED. AFTER THE CONCRETE HAS SET THE "SPLIT PIPE" SHALL BE BROKEN OUT AND THE HOLE CLOSED WITH BRICK AND MORTAR.

SHORT SPLIT PIPE FORM MIN. 12" DIA. OR 3" LARGER THAN DISCHARGE LINE DIA.

SECTION A-A
NOTES:
1. P.V.C. (ASTM D-3034 SDR-35) FITTINGS SHOWN; DETAILS SIMILAR FOR ALL OTHER TYPES OF PIPE.

2. CONCRETE ENCASEMENT SHALL BE CLASS II TYPE III-VIBRATED AND Poured MONOLITHIC WITH MANHOLE BASE MIN. 8" THICK ALL AROUND DROP.

3. ALL DROP MANHOLES SHALL BE LINED WITH SIKA GRIC 62 (20 MIL. MIN. APPLIED IN 4-7 MIL. LAYERS). PRIOR TO LINING, THE MANHOLE SHALL HAVE A PURGE COAT (SAND CEMENT RUB) TO FILL SURFACE POCKETS.

4. DIAMETER OF DROP PIPE SHALL NOT BE LESS THAN THE LINE DIAMETER.

5. ANY DROP OVER 4'-0" REQUIRES VERTICAL AND HORIZONTAL REINFORCEMENT (#6 @ 18" O.C. - 3" CLEAR) IN ADDITION TO THE REINFORCEMENT SHOWN.

6. MAXIMUM ALLOWABLE DROP SHALL NOT EXCEED 10'-0".

APPROVED
DIRECTOR OF PUBLIC WORKS

APPROVED
CITY ENGINEER

OUTSIDE DROP MANHOLE
15 INCH & SMALLER

SCALE: NTS
DATE: DEC 2003
DETAIL NO. S-4
NOTES:

1. DIAMETER OF DROP SHALL NOT BE LESS THAN THE LINE PIPE DIAMETER.

2. CONCRETE ENCASTEMENT SHALL BE CLASS II TYPE III VIBRATED AND POURED MONOLITHIC WITH MANHOLE BASE – MIN. 8” THICK ALL AROUND DROP.

3. ALL DROP MANHOLE OUTSIDE PIPING SHALL BE P.V.C. MATERIAL (SDR 35 MIN. OR SAME AS MAIN LINE REQUIRED).

4. ANY DROP OVER 4’-0” REQUIRES VERTICAL & HORIZONTAL REINFORCEMENT #4 @ 18” O.C. PLACED 3” CLEAR OF DROP ENCASTEMENT IN ADDITION TO THE REINFORCEMENT SHOWN.
24"x18" grate on hinges placed so that it adequately clears the step above.

Align steps above and below platform opening as shown.

Fiberglass or aluminum grating 3/16"x1 1/4" bearing bars. Serrated grating optional.

Set in full bed of bituminous mastic (Ramneck) or plastic sealing compound.

Standard precast flat top with 4x4 4/4 mesh w/24" opening. Thickness sized by MFG.

Note: Required in manholes where depth measured from ring to invert exceeds 20 feet. Center platform between the ring and invert.
TOP OF COVER

BOTTOM OF COVER

PIECE SLOT DETAIL

SECTION OF COVER

NOTES:

1. CASTING SPECIFICATIONS: ASTM A-48 CLASS 35.

2. ALL CASINGS TO BE DIPPED IN ASPHALT BASE PAINT (OR APPROVED EQUAL).

3. CASTINGS SHALL BE AS SPECIFIED BELOW.

   MANUFACTURERS:
   EAST JORDAN IRON WORKS 2405A
   DEETER FOUNDRY, INC. 1258

4. MACHINED SURFACE
NOTES:

1. CASTING SPECIFICATIONS: ASTM A-48 CLASS 35B
2. ALL CASTINGS TO BE DIPPED IN ASPHALT BASE PAINT (OR APPROVED EQUAL).
3. CASTINGS SHALL BE AS SPECIFIED BELOW MANUFACTURED BY: EAST JORDAN IRON WORKS or DEETER FOUNDRY, INC.
COPOLYMER POLYPROPYLENE PLASTIC

1/2" GRADE 60 STEEL REINFORCEMENT

SECTION A–A
NOTE: ALL LETTERS TO BE 2 INCHES HIGH IN BLACK CAPITAL LETTER, FACING THE OBJECT

CODE OBJECT
MH MANHOLE
NOTES:

1. TRENCH TO BE BRACED OR SHEETED AS NECESSARY FOR THE SAFETY OF THE WORKERS AND PROTECTION OF OTHER UTILITIES IN ACCORDANCE WITH APPLICABLE LOCAL, STATE, AND FEDERAL SAFETY REGULATIONS.

2. PIPE SHALL BE BEDDED FROM 6" BELOW THE BOTTOM OF THE PIPE TO 12" ABOVE THE TOP OF THE PIPE.

3. TRENCH WIDTH SHALL NOT BE MORE THAN 16" NOR LESS THAN 12" WIDER THAN THE LARGEST OUTSIDE DIAMETER OF THE PIPE.

4. COMPACTION FOR THE TOP 2.5 FEET OF TRENCH ZONE SHALL BE 95% S.P.D. IN STREET R.O.W., 90% S.P.D. OUTSIDE R.O.W. THE REMAINDER OF THE TRENCH SHALL BE 90% S.P.D.
MACHINE COMPACTED TRENCH BACKFILL.
LIMIT OF SLOPING OR BENCHING OF TRENCH WALLS.

1/4" MIN. TO 3/4" MAX. GRAVEL HAND TAMPED IN 6" LIFTS.

PIPE BEDDING IN ROCK

MIN. COVER PER SPECIFICATIONS OR PER CONSTRUCTION DRAWINGS

1/4" MIN. TO 3/4" MAX. GRAVEL HAND TAMPED IN 6" LIFTS

SINGLE LAYER OF 6 MIL. POLYETHYLENE PLASTIC OR EQUAL FOR UNDER-DRAIN ONLY.
3/4", 1" OR 1 1/2" CRUSHED ROCK

NOTES:
1. MIN. COVER TO BE BELOW FINAL STREET GRADE WHEN AVAILABLE
2. TRENCH TO BE BRACED OR SHEETED AS NECESSARY FOR THE PROTECTION OF OTHER UTILITIES AND TO MEET LOCAL, STATE, AND FEDERAL REQUIREMENTS.
3. TRENCH WIDTH SHALL NOT BE MORE THAN 16" OR LESS THAN 12" WIDER THAN THE LARGEST OUTSIDE DIAMETER OF THE PIPE LAID THEREIN. (BELL OR COUPLING O.D., IF APPLICABLE.)

CITY OF GOLDEN
DEPARTMENT OF PUBLIC WORKS
SPECIAL BEDDING DETAIL
SCALE: NTS
DETAIL NO. S-12
DATE: DEC 2003

APPROVED
DIRECTOR OF PUBLIC WORKS

APPROVED
CITY ENGINEER
NOTES:
1. THE MINIMUM DISTANCE FROM THE BELL OR SPIGOT END OF A PIPE SHALL BE 3 FEET.
2. THE MINIMUM DISTANCE BETWEEN SERVICES SHALL BE 3 FEET.
3. WHEN TAPPING INTO AN EXISTING MAIN, A SADDLE CONNECTION AND APPROVED CORING METHOD SHALL BE USED.
4. MAINTAIN 10 FEET MINIMUM SEPARATION FROM WATER SERVICE LINES, INSTALL DOWNHILL FROM WATER SERVICE.
NOTES:

1. CLEANOUT SHALL BE CONSTRUCTED SO THAT SURFACE LOAD WILL NOT BE TRANSFERRED TO MAIN.

2. SERVICE LINE CLEANOUTS SHALL BE INSTALLED APPROXIMATELY 5 FEET OUTSIDE THE BUILDING FOUNDATION.

3. AN OUTSIDE CLEANOUT IS REQUIRED ON ALL NEW SERVICE LINE INSTALLATIONS.
WRAP AROUND NEOPRENE END SEAL W/ SS WORM GEAR BANDS

PIPE BELL AT BOTH ENDS OF THE CASING FOR DIFFERENTIAL SETTLING (CARRIER PIPE)

NOTE: SPACERS TO BE PLACED THREE PER PIPE, AT ENDS AND MIDDLE.

SEALING - INSTALL RUBBER O-RINGS OR GASKETS AROUND EACH PIPE (CASING CARRIER) TO PROVIDE CONTINUOUS SEAL, TO PREVENT EXPANSION & CONTRACTION.

USE TWO SPACER RINGS AT EACH END OF CASING

STEEL CASING PIPE (SEE SPECIFICATIONS FOR SIZE AND WALL THICKNESS)

OVERALL BELL OR JOINT DIMENSION

CARRIER PIPE

DRY, WASHED SAND BLOWN INTO VOIDS

PLASTIC CASING SPACERS RACI OR EQUAL

PIPE CASING DETAIL

PIPE CASING THICKNESS

<table>
<thead>
<tr>
<th>PIPE DIAMETER</th>
<th>HIGHWAY (in)</th>
<th>RAILROAD (in)</th>
</tr>
</thead>
<tbody>
<tr>
<td>24” - LESS</td>
<td>0.250</td>
<td>0.250</td>
</tr>
<tr>
<td>30”</td>
<td>0.250</td>
<td>0.312</td>
</tr>
<tr>
<td>36”</td>
<td>0.312</td>
<td>0.375</td>
</tr>
<tr>
<td>42”</td>
<td>0.312</td>
<td>0.437</td>
</tr>
<tr>
<td>48”</td>
<td>0.375</td>
<td>0.500</td>
</tr>
</tbody>
</table>
2500 P.S.I. TYPE V CONCRETE VIBRATED IN PLACE

<table>
<thead>
<tr>
<th>PIPE I.D.</th>
<th>LONGITUDINAL BARS - LOCATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 IN.</td>
<td>4-#4 BARS</td>
</tr>
<tr>
<td>8 IN.</td>
<td>4-#4 BARS</td>
</tr>
<tr>
<td>10 IN.</td>
<td>8-#4 BARS</td>
</tr>
<tr>
<td>12 IN.</td>
<td>8-#4 BARS</td>
</tr>
<tr>
<td>15 IN.</td>
<td>8-#4 BARS</td>
</tr>
<tr>
<td>18 IN.</td>
<td>8-#4 BARS</td>
</tr>
<tr>
<td>21 IN.</td>
<td>12-#4 BARS</td>
</tr>
<tr>
<td>24 IN.</td>
<td>12-#4 BARS</td>
</tr>
<tr>
<td>27 IN.</td>
<td>12-#4 BARS</td>
</tr>
<tr>
<td>30 IN.</td>
<td>12-#4 BARS</td>
</tr>
<tr>
<td>33 IN.</td>
<td>12-#4 BARS</td>
</tr>
<tr>
<td>36 IN.</td>
<td>16-#4 BARS</td>
</tr>
</tbody>
</table>

1 EACH CORNER
3 EACH SIDE
4 EACH SIDE
5 EACH SIDE
NOTE:

AT THE ENGINEER’S DIRECTION, WOOD BLOCKS OR 3/4” WASHED ROCK TO BE INSTALLED UNDER THE VALVE TO PROVIDE PROPER SUPPORT WHERE REQUIRED.
NOTES:

1. VALVES WITH A BLACK OPERATION NUT INDICATE A STANDARD GOLDEN VALVE.

2. VALVES SHALL BE OPERATED BY CITY WATER PERSONNEL ONLY.

VALVE OPENING & CLOSING PROCEDURE
THREADED SIZE FOR CONNECTIONS

<table>
<thead>
<tr>
<th>PUMPER CONNECTION</th>
<th>HOSE CONNECTION</th>
<th>OUTLET THREADS</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 1/2&quot; NAT. STD.</td>
<td>2 1/2&quot; NAT. STD.</td>
<td>NFPA NP. 194</td>
</tr>
</tbody>
</table>

PROPERTY LINE

VARIATES

FLANGE ELEVATION
2-6 INCHES ABOVE
FINISHED GRADE

24" MIN.

6" FIRE HYDRANT

GROUND LINE

CURB & GUTTER

SWIVEL TEE

6" M.J. CATE VALVE &
6" VALVE BOX, WIDE
OVAL BASE

1/2 CU. YD 1-1/2"
CRUSHED ROCK
ONLY. HYDRANT
BASE AND DRAINAGE
ROCK TO BE
COVERED WITH
LOOSE SHEET OF
POLYETHYLENE TO
EXCLUDE BACKFILL
MATERIAL FROM
VOIDS IN ROCK.

6" D.I.P. PIPE

2-3/4" SS RODS AND
CLAMPS

POLYETHYLENE WRAPPED

4"X4" HARDWOOD
KICKBLOCK

NOTES:

1. ONLY THE FOLLOWING FIRE HYDRANTS AND VALVE BOXES LISTED BELOW
   SHALL BE ACCEPTED FOR CONSTRUCTION.

FIRE HYDRANTS
A. MUELLER CENTURION MODEL A-423
B. WATEROUS PACER 250-67

VALVE BOXES
A. TYLER SCREW – TYPE "C" CAST IRON VALVE BOX ASSEMBLY SERIES
   6860 WITH NO. 160 OVAL BASE.
B. CLAY AND BAILEY SCREW – TYPE 6 INCH CAST IRON VALVE BOX
   ASSEMBLY NO. P-108 WITH NO. 160 LARGE OVAL BASE

APPROVED
DIRECTOR OF PUBLIC WORKS

APPROVED
DEPARTMENT OF PUBLIC WORKS

CITY ENGINEER

CITY OF GOLDEN

FIRE HYDRANT ASSEMBLY

SCALE: NTS

DATE: DEC 2003

DETAIL NO. W-3
NOTE: ALL LETTERS TO BE 2 INCHES HIGH IN BLACK CAPITAL LETTERS, FACING THE OBJECT

<table>
<thead>
<tr>
<th>CODE</th>
<th>OBJECT</th>
</tr>
</thead>
<tbody>
<tr>
<td>BFV</td>
<td>BUTTERFLY VALVE</td>
</tr>
<tr>
<td>GV</td>
<td>GATE VALVE</td>
</tr>
<tr>
<td>AV</td>
<td>AIR VAC &amp; VAULT</td>
</tr>
</tbody>
</table>
NOTE: PLUG SHALL BE MECHANICALLY RESTRAINED:
- FOR SLEEVE TYPE MACHINED COUPLING PIPE, TIE BACK TO NEXT COUPLING.
- FOR BELL AND SPIGOT PIPE, TIE TO BELL.

PLAN

ELEVATION

POUR KICKBLOCK BELOW ASSEMBLY TO UNDISTRIBUTED

3” GALVANIZED PIPE CAP IN A 6” VALVE BOX.

3” GALVANIZED CAP

GROUND LINE

2” TYPE K SOFT COPPER PIPE

2” DRAIN & WASTE VALVE, OPERATING NUT & DRAIN.

2” BRASS, MALE I.P. THREAD X SOLDER ADAPTER, COVERED W/3” CAP.

6” VALVE BOX (3 SECTIONS, TOP, CENTER & BASE).

6” FULL VALVE BOX (2 SECTIONS, TOP & CENTER FOR ADJUSTMENTS).

2” BRASS

2” TYPE K SOFT COPPER PIPE

2” BRASS

6” DRAIN & WASTE VALVE, OPERATING NUT AND DRAIN.

PLUG - RESTRAINED BY ALLTHREAD OR MEGALUG

CITY OF GOLDEN
12” MAIN AND SMALLER

BLOW-OFF ASSEMBLY

DEPARTMENT OF PUBLIC WORKS

SCALE: NTS

DATE: DEC 2003

DETAIL NO. W-5
11-1/4°, 22-1/2°, 45°, AND 90° BENDS

MINIMUM BEARING SURFACE AREA
(IN SQUARE FEET)

<table>
<thead>
<tr>
<th>SIZE OF PIPE</th>
<th>111/4°</th>
<th>221/2°</th>
<th>45°</th>
<th>90°</th>
<th>TEE OR DEAD END</th>
</tr>
</thead>
<tbody>
<tr>
<td>4”</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>N.A.</td>
<td>1.50</td>
</tr>
<tr>
<td>6”</td>
<td>1.00</td>
<td>1.25</td>
<td>2.25</td>
<td>N.A.</td>
<td>3.00</td>
</tr>
<tr>
<td>8”</td>
<td>1.00</td>
<td>2.00</td>
<td>4.00</td>
<td>N.A.</td>
<td>5.25</td>
</tr>
<tr>
<td>12”</td>
<td>2.00</td>
<td>4.25</td>
<td>8.25</td>
<td>N.A.</td>
<td>11.00</td>
</tr>
<tr>
<td>16”</td>
<td>3.50</td>
<td>6.50</td>
<td>12.50</td>
<td>23.00</td>
<td>16.50</td>
</tr>
<tr>
<td>20”</td>
<td>5.00</td>
<td>10.00</td>
<td>19.50</td>
<td>35.50</td>
<td>25.00</td>
</tr>
<tr>
<td>24”</td>
<td>6.50</td>
<td>13.00</td>
<td>26.00</td>
<td>47.00</td>
<td>33.00</td>
</tr>
</tbody>
</table>

*BASED ON 3,000 PSF BEARING CAPACITY

NOTES:
1. ON 16” AND 20” TRANSMISSION MAINS ALL BENDS SHALL BE BOTH RODDED AND KICKBLOCKED.
2. BEARING SURFACES SHOWN IN CHART ARE MINIMUM.
3. BASED ON 150 PSI INTERNAL PIPE PRESSURE PLUS WATER HAMMER.
   4", 6” AND 8” WATER HAMMER = 120 PSI
   12” WATER HAMMER = 110 PSI
   16", 20” AND 24” WATER HAMMER = 70 PSI
4. ALL 90° BENDS SHALL BE RODDED.
5. N.A. = NOT APPLICABLE
CONCRETE THRUST BLOCKS

WATER MAIN AND TAP SIZE COMBINATIONS WHICH REQUIRE A CONCRETE THRUST REACTION BLOCK BEHIND THE MAIN AT THE TAPPING SLEEVE OR SADDLE.

ALL WATER MAINS

☒ INDICATES CONCRETE THRUST BLOCK REQUIRED

MAIN SIZE (INCHES)

4 6 8 10 12 14 16 18 20 22 24 26 28 30 36 42

TAP SIZE (INCHES)

4 6 8 10 12 14 16 18 20 22 24

ANY THRUST REACTION BLOCK REQUIREMENTS FOR WATER MAIN AND TAP SIZE COMBINATIONS OTHER THAN THOSE SHOWN ABOVE WILL REQUIRE SPECIAL DESIGN APPROVAL BY THE ENGINEERING DIVISION.
### ROD DIAMETER, GRADE & LENGTH OF RESTRAINED PIPE

<table>
<thead>
<tr>
<th>PIPE SIZE</th>
<th>Fitting</th>
<th>TEE OR VALVE</th>
<th>PLUG OR BEND</th>
<th>45° BEND</th>
<th>22½° BEND</th>
<th>11½° BEND</th>
</tr>
</thead>
<tbody>
<tr>
<td>4&quot;</td>
<td>D L G D L G</td>
<td>D L G D L G</td>
<td>D L G D L G</td>
<td>D L G D L G</td>
<td>D L G D L G</td>
<td>D L G D L G</td>
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<tr>
<td>6&quot;</td>
<td>D L G D L G</td>
<td>D L G D L G</td>
<td>D L G D L G</td>
<td>D L G D L G</td>
<td>D L G D L G</td>
<td>D L G D L G</td>
</tr>
<tr>
<td>8&quot;</td>
<td>D L G D L G</td>
<td>D L G D L G</td>
<td>D L G D L G</td>
<td>D L G D L G</td>
<td>D L G D L G</td>
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</tr>
<tr>
<td>12&quot;</td>
<td>D L G D L G</td>
<td>D L G D L G</td>
<td>D L G D L G</td>
<td>D L G D L G</td>
<td>D L G D L G</td>
<td>D L G D L G</td>
</tr>
<tr>
<td>16&quot;</td>
<td>D L G D L G</td>
<td>D L G D L G</td>
<td>D L G D L G</td>
<td>D L G D L G</td>
<td>D L G D L G</td>
<td>D L G D L G</td>
</tr>
</tbody>
</table>

### NOTES:

1. LENGTH OF TIED PIPE MEASURED EACH WAY FROM VALVES AND BENDS.
2. CLAMPS AND RODS NOT ALLOWED FOR 24" AND LARGER PIPES.
3. DIAMETER, D = 4.5" GRADE OF STEEL A = MILD STEEL, H.S. = HIGH STRENGTH.
4. M.S. = MILD STEEL, H.S. = HIGH STRENGTH RODS.
5. MINIMUM 4.5" GROUND COVER REQUIRED.
8. NUTS SHALL BE A.S.T.M. STANDARD DESIGNATION A-307 GRADE A OR B HEXAGON HEAVY SERIES.
9. LENGTH REFER TO AMOUNT OF PIPE WHICH MUST BE TIED TOGETHER AND IS NOT NECESSARILY THE LENGTH OF RODS.

---

**CITY OF GOLDEN**

**DEPARTMENT OF PUBLIC WORKS**

**LENGTH OF TIED PIPE**

**SCALE:** NTS

**DATE:** DEC 2003

**DETAIL NO.:** W-8

**APPROVED**

**DIRECTOR OF PUBLIC WORKS**

**APPROVED**

**CITY ENGINEER**

**W-8**
**RESIDENTIAL ASSEMBLY**

- MODIFIED HUBBLE LIGHTING BOLLARD, OR APPROVED EQUAL
- 8" O.D. SEAMLESS ALUMINUM PIPE
- POP RIVET
- SEE NOTE 2

**STEEL ANGLE DETAIL**

- 6 5/8" O.D. GALVANIZED STEEL PIPE, SCHEDULE 40 WITH THREADED JOINTS.
- FABRICATED VENT SCREEN
- GROUND LINE
- CENTER OF ADAPTER AT GROUND LEVEL.

**BREAKAWAY ASSEMBLY**

- 6" PVC PIPE SCHEDULE 40 WITH GLUED JOINTS
- 90° BEND

**NOTES:**

1. VENT PIPES TO BE LOCATED IN FIELD AT THE NEAREST INTERSECTION OF THE STREET PROPERTY LINE & THE SIDE LOT LINE
2. COLOR SHALL BE OLIVE GREEN OR FLAT BLACK TO MATCH SURROUNDINGS

**VENT PIPE ASSEMBLY**

- SCALE: NTS
- DETAIL NO: W-10
- DATE: DEC 2003
NOTE:
ANY SUB-DRAIN UNDER THE SEWER SHALL BE REPLACED SUCH THAT NO FLOW SHALL ENTER THE WATER LINE TRENCH.

SEWER CROSSING UNDER
WITH "D" LESS THAN 2'-0"
WATER SERVICE REQUIREMENTS

1. ALL SERVICE LINES SHALL HAVE A MINIMUM OF 4.5' OF COVER.

2. ALL SERVICE LINES SHALL BE A MINIMUM OF 3/4" DIAMETER "K" COPPER.

3. ALL JOINTS UNDERGROUND SHALL BE FLARE JOINTS ONLY.

4. NEW CONSTRUCTION REQUIREMENTS
   A. INSIDE METER INSTALLATIONS ONLY.
   B. METER HEIGHT ABOVE FINISHED FLOOR SHALL BE 4 FEET.
   C. ALL SERVICE LINES SHALL HAVE A CURB STOP INSTALLED AS SHOWN ABOVE.
   D. CURB STOP RISERS SHALL BE 4" DIAMETER.
   E. NO METER SHALL BE INSTALLED INSIDE A CRAWL SPACE.
   F. ALL METERS SHALL HAVE AN INSIDE SHUT-OFF.

5. ALL METERS 3/4" OR LARGER, SUPPLIED BY CITY, BUT SET BY CONTRACTOR.

6. CONTRACTOR MUST PURCHASE FROM CITY: (2) PACKING JOINTS; (2) VALVES FOR 5/8" & 3/4"; AND (1) YOKE.
GENERAL METER NOTES

1. LOCATION OF THE METER TO BE ESTABLISHED BY THE DEVELOPMENTAL ENGINEER.

2. ALL SETTINGS MUST BE INSPECTED BY THE WATER DEPARTMENT REPRESENTATIVE.

3. IF THE STREET OR GROUND IS NOT TO FINAL GRADE AT THE TIME OF INSTALLATION OF THE METER, THE OWNER MUST RAISE OR LOWER THE METER VAULT WHEN THE FINAL GRADE IS ESTABLISHED.

4. LEADED JOINTS AND GALVANIZED PIPING SHALL NOT BE ALLOWED INSIDE THE METER VAULTS.

5. A BYPASS IS TO BE INSTALLED ON 1 1/2” AND LARGER METERS UNLESS OTHERWISE SPECIFIED.

6. THE SERVICE LINE THROUGH AND ON BOTH SIDES OF THE METER PIT MUST BE OF THE SAME MATERIAL.

7. NO CONNECTIONS SHALL BE MADE IN THE METER PIT. SPRINKLER CONNECTIONS MUST BE MADE MORE THAN FIVE (5) FEET FROM THE METER PIT ON THE DOWNSTREAM SIDE.

8. GATE VALVES:
   A. ALL GATE VALVES UNDER 3” FOR USE w/ COPPER PIPE SHALL BE ALL BRONZE, w/ NON-RISING STEMS AND SOLID WEDGE DISC, MANUFACTURED IN ACCORDANCE WITH A.S.T.M. SPEC. B62 AND FEDERAL SPEC. W.W.–V–54 CLASS A, 125 PSI W.S.P., 200 PSI W.O.G. OR CURB STOPS IN ACCORDANCE WITH AWWA C800 AND MS–23 OF THE MATERIAL SPECIFICATIONS.
   B. ALL GATE VALVES 3” AND LARGER SHALL CONFORM WITH GOLDEN’S STANDARD SPECIFICATIONS.

9. ALL DRESSER (OR APPROVED EQUAL) COUPLINGS SHALL HAVE THE PIPE STOP REMOVED.
GENERAL METER NOTES

10. ALL VALVES 4” DIAMETER AND LARGER SHALL BE SUPPORTED BY ADJUSTABLE STEEL SUPPORTS. METERS 1 1/2” AND LARGER SHALL BE SUPPORTED BY CONCRETE BLOCKS WITH STEEL SHIMS, IF NEEDED.

11. MANHOLE RINGS AND COVERS:
   A. MANHOLE RINGS AND COVERS SHALL BE NEENAH R-1706 OR APPROVED EQUAL.
   B. 38” X 22” DOUBLE MANHOLE RING AND COVER SHALL BE NEENAH 1741D OR APPROVED EQUAL. THE 38” COVER SHALL HAVE AN AUXILIARY 22” OPENING AND COVER.

12. OTHER METER SETTINGS:
   SETTINGS OF METERS OTHER THAN SHOWN AND DETAILED HEREIN SHALL BE CONSIDERED AS NON-STANDARD AND SHALL REQUIRE PRIOR APPROVAL OF PROPOSED PIPING LAYOUT, METER SETTING AND STRUCTURAL DESIGN OF VAULT FOR EACH SEPARATE INSTALLATION.

13. BACKFLOW PREVENTION DEVICES MAY BE REQUIRED.

14. A FLOOR DRAIN SHALL BE PLACED NEAR THE METER INSTALLATION AND BE OPERABLE.

15. ALL PIPE OUTLETS THROUGH WALLS MUST HAVE A WATER TIGHT SEAL.

16. FACTORY-INSTALLED TEST PORTS ARE REQUIRED ON ALL 1 1/2” AND LARGER METERS.

CITY OF GOLDEN

DEPARTMENT OF PUBLIC WORKS

METER NOTES

SCALE: NTS
DATE: DEC 2003
DETAIL NO. W-14B
1. MANHOLE BASE BEAMS
   REQUIRED FOR DRIVEWAYS, OR PARKING
   AREA WHEN APPROVED

2. A 48" DIA. MANHOLE PIT
   WILL ACCOMMODATE
   1 1/2" & 2" METERS
   w/ CUSTOM SETTER.

3. JOINTS INSIDE METER
   VAULT SHALL BE EITHER
   THREADED OR SOLDERED
   w/ 95-5 TINANTIMONY
   SOLDER.

4. NO CONCRETE TO BE
   LAID IN FLOOR OR
   METER MANHOLE.

5. METER SHALL BE
   FLANGED w/ BRASS
   COMPANION FLANGES.

6. NO CONNECTIONS OR
   CHANGES IN PIPE
   DIAMETER SHALL BE
   MADE IN THE METER
   PIT OR IN THE DIS-
   TANCE OF FIVE FEET
   BEYOND THE METER
   PIT ON THE OUTLET
   SIDE.

7. LADDER RUNGS SHALL
   BE ON THE OPPOSITE
   SIDE OF THE BYPASS.
1. 90° ELL.
2. TEE
3. CURB STOP VALVE
4. METER UNIT
5. CHECK VALVE
6. TYPE K COPPER TUBING
7. 48" DIAMETER CONCRETE MANHOLE
8. FORD FLARED COPPER COUPLING
   OR APPROVED EQUAL
9. FORD PACK JOINT COUPLING (1-1/2" METER CATALOG NO. C-55-66) OR (2" METER CATALOG NO. C-55-77)
   OR APPROVED EQUAL
10. BRASS TUBING
11. CONCRETE MANHOLE BASE BEAMS
12. CURB STOP VALVE AND SERVICE BOX
REMOTE READING UNIT MOUNTED ON EXTERIOR OF HOUSE. EXACT LOCATION TO BE DETERMINED BY THE UTILITY DEPARTMENT.

ELECTRICAL LINE TO REMOTE READING UNIT MUST BE INSTALLED IN CONDUIT.

BRONZE GATE VALVE

METER UNIT

STOP & WASTE VALVE

WATER SERVICE LINE

BASEMENT WALL

18” MAX.

4’-0”

BASEMENT FLOOR

REMOTE READING 3/4” & 1” METER TYPICAL INSIDE SETTING

SCALE: NTS
DETAIL NO. W-17
DATE: DEC 2003
NOTES
1. PIPE JOINTS SHALL BE THREADED OR SOLDERED WITH 95-5 TINANTIMONY SOLDER.
2. INSTALLATION MUST ALLOW ACCESS FOR MAINTENANCE AND BE PROTECTED FROM FREEZING.
3. A FLOOR DRAIN SHALL BE PLACED NEAR THE METER INSTALLATION.
4. METER SUPPORT SHALL BE EITHER CONCRETE OR ADJUSTABLE STEEL PIPE.

DETAILS:
1. CURB STOP
2. TYPE K COPPER TUBING
3. 12” COPPERSETTER/METER YOKE
4. METER UNIT
5. 3” NIPPLE BETWEEN COPPERSETTER AND CHECK VALVE
6. CHECK VALVE
7. MECH. IRON PIPE TO FLARE COUPLING FROM INLET SIDE OF COPPERSETTER AND OUTLET SIDE OF CHECK VALVE
8. BY-PASS WILL BE 1” FOR 1-1/2” COPPERSETTERS AND 1-1/2” OR 1-1/4” FOR 2” COPPERSETTERS
9. CONCRETE BLOCK SUPPORTS 4”X4”X12”
10. 1” (DIA) X 18” (LENGTH) PIPE
11. 90° ELBOW
12. ELECTRICAL LINE TO REMOTE READING UNIT MUST BE IN CONDUIT
13. ISOLATION VALVE ON BY-PASS LINE

COPPERSETTER/METER WITH BY-PASS

<table>
<thead>
<tr>
<th>SIZE</th>
<th>FORD CUSTOM SETTER</th>
<th>MUeller</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>TYPE</td>
<td>CAT. No.</td>
</tr>
<tr>
<td>1-1/2”</td>
<td>FLANGED KEY VALVE</td>
<td>V V76-12B-11-66</td>
</tr>
<tr>
<td>1-1/2”</td>
<td>FLANGED ANGLE BALL VALVE</td>
<td>VVB76-12B-11-66</td>
</tr>
<tr>
<td>2”</td>
<td>FLANGED KEY VALVE</td>
<td>V V77-12B-11-77</td>
</tr>
<tr>
<td>2”</td>
<td>FLANGED ANGLE BALL VALVE</td>
<td>VVB77-12B-11-77</td>
</tr>
</tbody>
</table>
CITY OF GOLDEN
WATER AND SANITARY SEWER
SPECIFICATIONS

PART II – ENGINEERING
PLAN/REPORT SUBMITTALS
ENGINEERING PLAN/REPORT SUBMITTALS

A. GENERAL INFORMATION

The City of Golden has responsibility for the health, safety, and welfare of the public within City right-of-way. Therefore, the Engineering Division has established and the City Council has adopted construction standards and engineering reviews for proposed developments.

With the establishment of engineering reviews for proposed developments, developers are required to submit plans/reports for review. The developer is encouraged to have his engineer meet with the Engineering Division so that the project’s technical aspects can be discussed prior to submitting plans. The submittals which may be required and their intent are as follows:

GRADING PLANS – This submittal details the overlot grading proposed for the site and should include significant features such as retaining walls and grades matching to adjacent properties. These are typically done with the drainage plans unless a separate overlot grading permit is desired.

DRAINAGE REPORTS – The Jefferson County Storm Drainage Manual refers to a Phase I, Phase II, and Phase III Drainage report and PLAN SUBMITTAL. The developer is encouraged to closely follow these requirements.

UTILITY REPORTS – May be required at the discretion of the City Engineer.

PRELIMINARY CONSTRUCTIONS PLANS – These plans address the preliminary (functional) design of streets and improvements within easements and the public right-of-way.

FINAL CONSTRUCTION PLANS – These are construction documents for the public improvements on the project. They include public and private street plans and drainage elements within easements for the public right-of-way. They also may include signing, pavement marking and traffic signal plans.

SOILS/PAVEMENT DESIGN REPORT – This documents the soil conditions and proposed pavement installation with the structural cross sections for both parking lots and streets.

GEOLOGIC REPORT – This report documents the geologic conditions anticipated at the site and their compatibility with the proposed development.

RETAINING WALL DESIGN REPORT – This report provides construction documents with all supporting engineering calculations necessary for retaining wall installations that are forty-eight (4) inches or more above finished grade.

These submittals are reviewed by the Engineering Division in conjunction with other City departments to insure conformance with City Standards. All submittals are to be prepared by a professional geologist.
B. NUMBER OF SUBMITTALS

Three sets of plans/reports are required on each submittal. If additional sets are needed for agency referral reviews, the applicant will be contacted by the Engineering Division. Upon approval, a mylar original will be required. A transmittal letter should accompany each submittal giving pertinent information such as review desired and contact person.

C. APPROVED PLANS/REPORTS

Plans and/or reports must be approved prior to initiation of any construction activities. Approved plans and/or reports will be valid for two years from the date of approval. The approved reports and construction drawing mylars will become the property of the City. Prior to the issuance of a permit, the developer (or its engineer or contractor) shall check out the mylars from the City, create their own master print set, and return the mylars with two (2) full size and two (2) half size copies to the City.

Review is for general compliance with City of Golden Engineering standards and requirements. The City of Golden is not responsible for the correctness of design, dimensions, details, quantities, and design safety during construction.

All constructions plans that deal with the extension of the water system, or have on-site fire requirements must include a signature block for the Golden Fire Department.

D. DRAFTING/REPORT STANDARDS

All reports submitted for review must be typewritten and bound, and all pages must be legible. All drawings submitted for review shall meet the Colorado Department of Transportation Drafting Standards, and be on 24” x 36” plan sheets.

Final drawings submitted for approvals shall be three mil mylar originals, with the engineer’s wet stamp on each sheet.

E. STATE HIGHWAYS

Whenever a project is proposed on or adjacent to a state highway, the City of Golden coordinates the review of the project with the Colorado Department of Transportation. The City also is responsible for submitting all access permits to the Department once final construction plans have been approved by the City Engineer.

Construction activities on state highways will be governed by the Colorado Department of Transportation regulations and inspection will be undertaken by the Department’s forces.

State highways within the City of Golden currently include; 6th Avenue, Colfax Avenue, Highway 93, and Highway 58.

F. OTHER AGENCIES

Depending on the project’s location, the City may also refer the plans for review an comments to other agencies. Those agencies include: Urban Drainage and Flood Control District, Jefferson County, Army Corps of Engineers, State Engineer’s Office, and all Public Utility Companies. The City will determine, based on the proposed project’s location and improvement plans, which agencies which will receive referrals.
# PLAN REVIEW CHECK LIST

## GENERAL REQUIREMENTS

<table>
<thead>
<tr>
<th></th>
<th>IN COMPLIANCE</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Correct Sheet Size (24&quot;x36&quot;).</td>
<td></td>
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<tr>
<td>2. Vicinity Map.</td>
<td></td>
<td></td>
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<tr>
<td>3. Location Map.</td>
<td></td>
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<tr>
<td>4. Index to Drawings</td>
<td></td>
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<tr>
<td>5. List of Quantities</td>
<td></td>
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<tr>
<td>6. List of Agencies, Including; Surveyor, Soils Engineer and All involved Agencies for the Project.</td>
<td></td>
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<tr>
<td>7. General Notes</td>
<td></td>
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<tr>
<td>8. Erosion Control Notes</td>
<td></td>
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</tr>
<tr>
<td>9. City Approval Block on Each Sheet</td>
<td></td>
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</tr>
<tr>
<td>10. P.E. Seal and Signature on Title Sheet and Each Electrical and Structural Sheet (if included).</td>
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<tr>
<td>11. North Arrow on Vicinity Map, Location Map and each Plan View.</td>
<td></td>
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</tr>
<tr>
<td>12. Title Block on Each Sheet. Datum, Location, Elevation and Monument Type.</td>
<td></td>
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</tr>
<tr>
<td>13. Street Alignment, Existing and Proposed, Shown on Overall Plan.</td>
<td></td>
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<tr>
<td>14. Street Names</td>
<td></td>
<td></td>
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<tr>
<td>15. Horizontal Curve Data for Street Centerline and all Curbs Shown on Plan, or Recorded Plat Included in Plan Set.</td>
<td></td>
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</tr>
<tr>
<td>16. Street Grades, Existing and Proposed Shown on Profile.</td>
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<tr>
<td>17. Typical Street Cross-Section(s).</td>
<td></td>
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<tr>
<td>18. Street Addresses for all Lots and/or Buildings Indicated on Plan, or Address Plat Included in Plan Set.</td>
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<tr>
<td>19. Lot and Block Numbers.</td>
<td></td>
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<tr>
<td>20. Front Lot Dimensions.</td>
<td></td>
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<tr>
<td>22. Private Improvements Identified.</td>
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</tr>
<tr>
<td>23. Existing Improvements Identified.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>24. Match Lines and Sheet References Called Out in Plan and Profile.</td>
<td></td>
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<tr>
<td>25. Street Cross-Pans Shown.</td>
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<tr>
<td>26. Center Line of Drainage Channel(s) Shown.</td>
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<td>IN COMPLIANCE</td>
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<tr>
<td>27.</td>
<td>100-Year Flood Plain Limits Shown.</td>
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<tr>
<td>29.</td>
<td>Recorded Plat and Address Plat Submitted.</td>
<td></td>
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<tr>
<td>30.</td>
<td>Project in Conformance With Overall Master Plan.</td>
<td></td>
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</tbody>
</table>
SANITARY SEWER REQUIREMENTS

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Compliance</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Sewer Line Horizontal Alignment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Generally 10’ South and West of Street Centerline; 3' Min. From Flow Line; 5' Min. From R.O.W. Line.</td>
<td></td>
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</tr>
<tr>
<td>2. All Sewer Lines Shown in Both Plan and Profile.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Manning Formula Hydraulic Data</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Including Q,V,D, d/D, S and n, Indicated at Connection(s) to Existing System. Number and Type of Units and Per Unit Average and Peak Flows.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Sewer Easement Drawings and Legal Descriptions Submitted With PLS Seal and Signature Affixed.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Sanitary Sewer System Notes Included.</td>
<td></td>
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<tr>
<td>6. Sanitary Sewer System Details Included.</td>
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<td></td>
</tr>
<tr>
<td>7. Service Wye Locations, Including Size, Manhole Reach, Lot or Building Number, Stationing From Nearest Downstream Manhole, Right or Left Side Connection Looking Upstream and The Invert of the Main at Wyes and Plugs Shown in Tabular Form on the Plans.</td>
<td></td>
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</tr>
<tr>
<td>8. Note on Plans: “No Connections to Existing System Shall be Made Until the New Lines Have Been Tested and Accepted by the District”.</td>
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</tbody>
</table>

B. Sewer Plan View

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Compliance</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Maximum Scale: 1” = 50’.</td>
<td></td>
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</tr>
<tr>
<td>3. Bearings and Linear Footage Between Manholes Called Out Along Sewer Reach.</td>
<td></td>
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<tr>
<td>4. Outside Angles Between Sewer Reaches Called Out at Manholes.</td>
<td></td>
<td></td>
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<tr>
<td>5. Sewer Lines Dimensioned From Street Centerline or Property Line, and From Other Utilities, Curb and Gutter and Other Obstructions.</td>
<td></td>
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</tbody>
</table>
### PART II - 6

#### IN COMPLIANCE

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
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<tbody>
<tr>
<td>6.</td>
<td></td>
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<tr>
<td>Connection(s) to Existing System Shown on Plan and Tied to Property Corner or Section Corner.</td>
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<td>7.</td>
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<tr>
<td>Manholes Properly Numbered on Plan.</td>
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<td>8.</td>
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<tr>
<td>Directional Flow Arrows Shown.</td>
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<td>9.</td>
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<tr>
<td>Service Line Connections Shown (Service Lines Within Easements Not Allowed).</td>
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<td>10.</td>
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<tr>
<td>At Least a 10' Workable Easement Margin on Each Side of the Sewer Line.</td>
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<td>11.</td>
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<tr>
<td>Manhole Markers Included For Sewer Line Outside of Paved R.O.W.</td>
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<tr>
<td>12.</td>
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<tr>
<td>Match Lines and Sheet References</td>
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<tr>
<td>13.</td>
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<tr>
<td>All Utility Improvements, Including Water Lines and Storm Sewer, Shown on Plans.</td>
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</table>

#### C. Sewer Profile View

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
<th>N/A</th>
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<tbody>
<tr>
<td>1.</td>
<td></td>
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<tr>
<td>Max. Scales: 1&quot; = 50' (horizontal)</td>
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<tr>
<td>1&quot; = 5' (vertical)</td>
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<td>2.</td>
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<tr>
<td>Manholes Properly Numbered and Stationed.</td>
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<tr>
<td>3.</td>
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<tr>
<td>Pipe Size, Linear Footage and Grade Called Out Between Manholes.</td>
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<td>4.</td>
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<tr>
<td>Sewer Line Grades Checked.</td>
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<tr>
<td>5.</td>
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<tr>
<td>Invert Elevations for All Entering and Exiting Pipes, Rim Elevations, Cuts and Drops Inverts Called Out at The Manholes.</td>
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<tr>
<td>6.</td>
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<tr>
<td>Inside Manhole Drop Between Inverts of Highest Entering Pipe and Lowest Existing Pipe Not to Exceed 18”.</td>
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<td>7.</td>
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<tr>
<td>Connections to Existing System Shown on Profile.</td>
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<td>8.</td>
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<tr>
<td>Crossings With Other Utilities Shown on Profile (18&quot; Minimum Separation From Outside of Pipe to Outside of Pipe).</td>
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<tr>
<td>9.</td>
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<tr>
<td>Match Lines and Sheet References.</td>
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## WATER LINE REQUIREMENTS

### A. General

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Yes</th>
<th>No</th>
<th>N/A</th>
<th>Comments</th>
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</thead>
<tbody>
<tr>
<td>1. Water Line Horizontal Alignment</td>
<td></td>
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<tr>
<td>Generally 10’ North and East of Street Centerline; 3’ Min. From Flowline; 5’ Min. From R.O.W. Line.</td>
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</tr>
<tr>
<td>2. All Water Lines Outside of Street R.O.W. and Water Lines 12” in Diameter and Larger Within Street R.O.W. Shown in Both Plan and Profile.</td>
<td></td>
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</tr>
<tr>
<td>3. Water Demands, Including Peak Fire Flow and Max. Hour Use, Shown at Connection(s) to Existing System. Number and Type of Units.</td>
<td></td>
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<tr>
<td>4. Water Easement Drawings and Legal Descriptions Submitted With PLS Seal and Signature Affixed.</td>
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<tr>
<td>5. Water System Notes Included and completed.</td>
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<tr>
<td>6. Water System Details Included.</td>
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<tr>
<td>7. Service Trees Not Allowed.</td>
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<tr>
<td>8. Signature of Fire Marshall on Cover Sheet.</td>
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<tr>
<td>9. Chlorination and Flushing Note.</td>
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<tr>
<td>11. Service Lines and Meters, Including Size to Buildings, Shown on “as-builts”.</td>
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</tbody>
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### B. Water Plan View

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Yes</th>
<th>No</th>
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<th>Comments</th>
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<tbody>
<tr>
<td>1. Maximum Scale: 1” = 50’.</td>
<td></td>
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<tr>
<td>3. All Valves, Fittings, Fire Hydrants, Wet Taps, Thrust Blocks, Rodding, Blow-Offs and Other Appurtenances Called Out.</td>
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<td>5. Radius of Deflected Water Line Called Out. 3 Degrees Maximum Deflection Per Joint.</td>
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<td>Yes</td>
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<td>6. Water Lines Dimensioned From Street Centerline or Property Line, and From Other Utilities, Curb and Gutter and Other Appurtenances.</td>
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<tr>
<td>7. Connections to Existing System Shown on Plan and Tied to Property Corner or Section Corner.</td>
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<td>8. At Least a 10' Workable Easement Margin on Each Side of the Water Line.</td>
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<td>9. Valves Located at Property Line Extensions. Valves Required to Isolate all Fire Hydrants, Both Ends Of a Water Line Through an Easement Or Creek Crossing and Spaced to Minimize the Number of Units Put Out Of Service During Water Line Maintenance and Repair Work.</td>
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<td>10. Valve and Fitting Markers Included for Water Line Outside of Paved R.O.W.</td>
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<td>11. Fire Lanes Called Out.</td>
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<td>12. PRV Size and Inlet and Outlet Pressures Shown.</td>
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<td>14. All Utility Improvements, Including Sanitary Sewer and Storm Sewer, Shown on Plans.</td>
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<td>15. All Gate Valves Numbered.</td>
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<td>C. Water Profile View.</td>
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<tr>
<td>1. Max. Scale: 1&quot; = 50' (horizontal) 1&quot; = 5' (vertical)</td>
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<td>2. Water Line Stationed.</td>
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<td>3. Pipe Size, Linear Footage and Grade Called Out Between Grade Breaks.</td>
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<tr>
<td>5. Top of Pipe Elevations Called Out at all Grade Breaks Fire Hydrants Blowoffs, Air and Vacuum Valves, Plug, Connections to Existing Water System and Match Lines.</td>
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<tr>
<td>6. 4.5 foot Minimum Cover From Finished Grade to Top of Pipe.</td>
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<td>7. 6.5 foot Minimum Cover For Air and Vacuum Valve Vaults.</td>
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<td>8. Blow-offs at all Low Points.</td>
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<td>9. Air Relief Valves at all High Points.</td>
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<td>10. Restrained Pipe Length Shaded on Profile.</td>
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<td>11. Connections to Existing System Shown on Profile.</td>
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<tr>
<td>12. Crossings With Other Utilities Shown on Profile (18” Minimum Separation From Outside of Pipe to Outside of Pipe).</td>
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GENERAL NOTES

1. All materials, workmanship, and construction of public improvements shall meet or exceed the standards and specifications set forth in the City of Golden Standards and Specifications, and applicable state and federal regulations. Where there is conflict between these plans and the specifications, or any applicable standards, the higher quality standard shall apply. All work shall be inspected and approved by the City.

2. All references to any published standards shall refer to the latest revision of said standard, unless specifically stated otherwise.

3. The Consultant Engineer shall provide, on the cover of the plan set, the location and description of the nearest survey benchmark for the project as well as the basis of bearings.

4. The Contractor shall have one (1) signed copy of the approved plans, one (1) copy of the appropriate standards and specifications, and a copy of any permits and/or agreements needed for the job, onsite at all times.

5. The Contractor is specifically cautioned that the location and/or elevation of existing utilities, as shown on these plans, is based on records of the various utility companies and, where possible, measurements taken in the field. The information is not to be relied upon as being exact or complete. The Contractor must call the local utility location center at least forty-eight (48) hours before any excavation or request to exact field locations of the utilities. Prior to construction, the Contractor shall verify pertinent locations and elevations, especially at connection points and at potential utility conflicts. It shall be the responsibility of the Contractor to relocate all existing utilities that conflict with the proposed improvements shown on these plans.

6. The Contractor shall be responsible for obtaining all necessary permits for applicable agencies. Any earth disturbing activity or construction on any and all public improvements will not be permitted until the recordation of plat(s) and/or easements, and a preconstruction meeting. The Developer, Engineer or Contractor, shall schedule a preconstruction meeting with the City at least forty-eight (48) hours prior to the start of construction. Approved plans shall be distributed at the preconstruction meeting.

7. The Contractor is responsible for the timely notification of and shall coordinate work in all work areas with the appropriate State, County, City, or local agencies.

8. The Contractor shall coordinate and cooperate with the City, and all utility companies involved, with regard to relocations or adjustments of existing utilities during construction, and to assure that the work is accomplished in a timely fashion and with a minimum disruption of service. The Contractor shall be responsible for contacting all parties affected by any disruption of utility service.

9. The Contractor shall be responsible for all aspects of safety including but not limited to, excavation, trenching, shoring, traffic control, and security.

10. The Contractor shall submit a Traffic Control Plan, in accordance with MUTCD, to the appropriate right-of-way authority (City, County or State), for approval, prior to any construction activities within, or affecting, the right-of-way. The Contractor shall be responsible for providing any and all traffic control devices as may be required by the construction activities.
11. The contractor is responsible for providing all labor and materials necessary for the completion of the intended improvements, shown on these drawings, or designated to be provided, installed, or constructed, unless specifically noted otherwise.

12. If, during the construction process, conditions are encountered which could indicate a situation that is not identified in the plans or specifications, the Contractor shall contact the City immediately.

13. The Contractor shall be responsible for keeping roadways free and clear of all construction debris and dirt tracked from the site.

14. Dimensions for layout and construction are not to be scaled from any drawing. If pertinent dimensions are not shown, contact the Consultant Engineer for clarification, and annotate the dimension on the as-built record drawings.

15. The Contractor shall comply with all terms and conditions of the project’s Colorado Permit for Storm Water Discharge, the Storm Water Management Plan and the Erosion Control Plan, where applicable.

16. All structural erosion control measures shall be installed, at the limits of construction, prior to any other ground-disturbing activity. All erosion control measures shall be maintained in good repair by the Contractor, until such time as the entire disturbed areas is stabilized with hard surface landscaping. The City maintains the right to require additional erosion control measures if necessary during construction.

17. The contractor shall sequence installation of utilities in such a manner as to minimize potential utility conflicts. In general, storm sewer and sanitary sewer should be constructed prior to installation of water lines, dry utilities, curb and gutter, and paving.

18. All existing structures, fences, signs, and improvements destroyed, damaged, or removed due to the construction of this project shall be replaced or restored in like and kind at the Contractor’s expense, unless otherwise indicated on the drawings.

19. The Contractor shall be responsible for obtaining a disposal site for all unusable material removed from the project.

20. All pavement marking required from the construction shall be the responsibility of the Contractor.

21. There shall be no site construction activities on Saturdays, unless specifically approved by the City, and no site construction activities on Sundays or Holidays, unless there is prior written approval by the Public Works Director.

22. The Contractor shall be responsible for recording as-built information on a set of record drawings kept on the construction site, and available to the City at all times.
WATER SYSTEM NOTES

1. All water lines and system plans and construction, shall conform to the City of Golden’s Standards and Specifications are subject to construction observation by City representatives. Copies of the City Standards and Specifications may be obtained from the City. Construction will not be permitted until the recordation of plat(s) and/or easements, and a preconstruction meeting. The Developer, Engineer or Contractor, shall schedule a preconstruction meeting with the City at least forty-eight (48) hours prior to the start of construction. Approved plans shall be distributed at the preconstruction meeting.

2. Theoretical static water pressures are estimated to range from ________ psi at USGS Elevation ____ to ____ psi at USGS elevation ______ based upon a hydraulic gradient of USGS Elevation______. The City has provided only the hydraulic gradient elevation. This hydraulic gradient, which was provided at the time of plan review, may change in the future as overall water system operations warrant.

3. The pipe specified by the Developer or Engineer for the water lines in the project is Class ____, ________ pipe. All water lines shall have a minimum of four and one-half (4-1/2) feet of cover and be located a minimum of ten (10) feet from the sanitary sewer, and three (3) feet from the edge of concrete curb and gutter pan.

4. All water line valves shall be set at the intersection of the extended property line and water line except where that point falls in the flow line of a concrete cross pan. In that case, the valve shall be located so that surface drainage does not infiltrate the valve box. Valve boxes shall be set at an elevation in accordance with City paving requirements.

5. Polyethylene wrapping shall be installed around all ductile iron pipe fittings, valves, fire hydrant barrels, and rods and clamps. The polyethylene shall have a minimum thickness of eight (8) mils.

6. Concrete for all structures shall have a minimum of three thousand (3000) psi strength at twenty-eight (28) days.

7. The Contractor shall coordinate all utility tie-ins and shut downs with the City and affected residences and businesses, including timely posting of adequate notification to all affected parties.

8. The Contractor shall not operate any existing utility valves.

9. Support all existing utility lines during the performance of the work with adequate structural members to avoid any movement or settlement of the lines being protected.

10. Initial acceptance of the new water lines is contingent upon receiving copies of:
   a. Water line trench compaction test results,
   b. Record drawings, and
   c. Golden Environmental Services’ tests. (Chlorine and clear water).

11. The new water system will be tested in accordance with Section 12 of the City specifications.

12. The City is not a guarantor of the construction Contractors’ obligations and performance of contract.
13. Observations of work in progress and on-site visits are not to be construed as a guarantee by the City of the Contractors’ performance.

14. The City is not responsible for safety in, on, or about the Project site, nor for compliance by the appropriate party of any regulations relating thereto.

15. The City exercises no control of the safety or adequacy of any equipment, building components, scaffolding forms, or any other work aids used in or about the project, or in the superintending of the same.
SANITARY SEWER SYSTEM NOTES

1. All sanitary sewer system plans and construction shall conform with the City of Golden Specifications and Standards, and are subject to construction observation by City representatives. Copies of the City’s Specifications may be obtained from the City. Construction will not be permitted until the recordation of plat(s) and/or easements, and a preconstruction meeting. The Developer, Engineer or Contractor, shall schedule a preconstruction meeting with the City at least forty-eight (48) hours prior to the start of construction. Approved plans shall be distributed at the preconstruction meeting.

2. The pipe for sanitary sewer mains shall be in accordance with ASTM D-3034 SDR 35 PVC pipe in paved rights-of-way and easements, and AWWA C 900, Class 150 in unpaved easements.

3. Initial acceptance of the new sanitary sewer mains will not be considered until all requirements for acceptance have been met, including
   1. Sanitary sewer trench compaction test results, and,
   2. Record Drawings.
   3. Video Record after paving is completed.

4. The sanitary sewer system will be tested in accordance with the City specifications:
   1. Lamp 100% of the new system,
   2. Low pressure air test 100% of the new system
   3. Deflection test 100% of the new system.

5. Manhole rims shall be set at an elevation relative to the payment, in accordance with the appropriate City, County, or State Highway Department Standards. Whether or not the manhole is in a paved or unpaved area, a minimum of four (4) inches of concrete riser rings shall be used to adjust rim elevations to final grade. The maximum acceptable vertical adjustment utilizing riser rings is twelve (12) inches.

6. Existing pipe at the point of connection shall not be “broken out” and no service connections will be made until the new system is accepted.

7. The Contractor shall verify existing manhole inverts at proposed points of connection, prior to construction staking.

8. The Contractor shall take care to properly shape all manhole inverts and benches in accordance with City Specifications. Manhole inverts shall be constructed with a smooth trowel or stone finish, and benches finished with a light broom, non-skid finish.

9. The Contractor shall coordinate all utility tie-ins and shut downs with the City and affected residences and businesses, including timely posting of adequate notification to all affected parties.

10. Support all existing utility lines during the performance of the work with adequate structural members to avoid any movement or settlement of the lines being protected.

PART II - 14
11. The City is not a guarantor of the construction Contractors' obligations and performance of contract.

12. Observations of work in progress and on-site visits are not to be construed as a guarantee by the City of the Contractors' performance.

13. The City is not responsible for safety in, on, or about the Project site, nor for compliance by the appropriate party of any regulations relating thereto.

14. The City exercises no control of the safety or adequacy of any equipment, building components, scaffolding forms, or any other work aids used in or about the project, or in the superintending of the same.

15. All new mains must be jetted prior to initial acceptance and may be required again prior to final conveyance and acceptance by the City. Costs of jetting will be the responsibility of the Contractor. The Contractor will be responsible for all pumping associated with the line jetting.
EROSION CONTROL NOTES

1. The Contractor shall ensure storm water quality best management practices shall be implemented to minimize soil erosion, sedimentation, increased pollutant loads and changed water flow characteristics resulting from land disturbing activity, to the maximum extent practicable, so as to minimize pollution of receiving waters.

2. The Contractor is responsible for implementing and maintaining erosion and sediment control measures at all times before, during and after construction to prevent damaging flows on the site and adjacent property.

3. To the extent practicable, erosion and sediment control measures shall be installed prior to grading activities. Following initial grading activities, erosion and sediment control devices shall be placed as construction sequencing and access dictates.

4. At a minimum, all best management practices (BMPs) outlined on the drainage and storm water management plan must be correctly installed and functioning, in accordance with the City of Golden Storm Water Quality Control Design Guidance Manual. At all times during the project construction, all temporary and permanent erosion and sediment control measures shall be maintained and repaired as needed to prevent accelerated erosion and sedimentation, or as requested by the City, until a time when the City determines they are no longer needed.

5. Natural vegetation shall be retained and protected wherever possible. Exposure of soil to water and wind by removal or disturbance of vegetation shall be limited to the area required for immediate construction operations and for the shortest practicable period of time.

6. All topsoil, where physically practicable, shall be salvaged and on topsoil shall be removed from the site except as set forth in the approved plans. Topsoil and overburden shall be segregated and stockpiled separately as designated by the Developer. Topsoil and overburden shall be redistributed within the graded area after a rough grading to provide a suitable base for the areas that will be seeded and planted.

7. Any construction debris or mud tracking in the public right-of-way resulting from the construction shall be removed immediately by the Contractor.

8. Fugitive dust emissions resulting from grading activities and/or wind shall be controlled using the best available technology. A water truck shall be used within twenty-four (24) hours of the City's request for dust control on site.

9. Runoff from stockpiles shall be controlled to prevent erosion and resultant sedimentation of receiving waters or adjacent property. Soils stockpiled for more than thirty (30) days shall be seeded with a temporary or permanent grass cover within fourteen (14) days after completion of the stockpile construction.

10. If stockpiles are located within close proximity to a drainageway, additional sediment control measures, such as temporary diversion dike or silt fence, shall be provided.

11. Permanent soil stabilization measures shall be applied within fourteen (14) days to disturbed areas in which final grade is completed.
12. Temporary soil stabilization measures shall be applied within fourteen (14) days, to areas that are not at final grade but will remain dormant (undisturbed) for longer than thirty (30) days, per the Urban Drainage and Flood Control District Volume 3.

13. Hydraulic seeding may be substituted for drilling only where slopes steeper than three to one (3:1) or where access limitations exist. When hydraulic mulching should be done as a separate operation immediately following seeding, to prevent seeds from being encapsulated in the mulch. Hydraulic mulch must contain a tackifying agent at a rate of fifteen hundred (1500) pounds per acre (City of Golden Storm Water Quality Control Design Guidance Manual, Appendix c 3.2).

14. For slopes greater than three to one (3:1) and other special situations, erosion control blankets, anchored with staples, may be required in stead of mulch.

15. Seeding rates for broadcast application should be increased at least twice that of drilled rates.

16. Straw mulch rates should be a minimum of two (2) tons/acre and should be crimped, or anchored with the aid of tackifiers.

17. Inspection and Maintenance Procedures. Inspections shall be performed every fourteen (14) days, or following a storm water event. An inspection form (provided by the city) shall be completed for each inspection performed. The completed inspection form shall be provided to the city. Inspection Reports must be kept on site. Maintenance and repairs shall be performed as soon as possible on items or areas identified in the inspection report. Maintenance should be performed as indicated in the City of Golden Stormwater Quality Control Design Guidance Manual, per manufacturer’s specifications, or other sources determined to be acceptable.

18. All erosion control measures must remain in a functional condition until a viable vegetative cover has been established.

19. A viable vegetative cover should be established within one (1) year on all disturbed areas and soil stockpiles not otherwise permanently stabilized. Vegetation is not considered established until a ground cover is achieved which, in the opinion of the City, is sufficiently mature to control soil erosion and can survive severe weather conditions. "Established" is defined as a minimum of seventy (70) percent cover of desired species.

20. The City of Golden may modify the erosion and sediment control plan as field conditions warrant.
A. GENERAL INFORMATION

Any excavations affecting or involving any part of the City’s water and/or sanitary sewer systems, including all main extensions, domestic service(s) or City facilities shall be performed in conformity with and are subject to the requirements and conditions set forth herein.

COMPLIANCE - Contractor shall comply with all applicable City, State, and Federal agencies’ rules, regulations, standards, and specifications.

PERMITS - The Contractor shall be solely responsible for determining and obtaining any and all permits required for the work from other governmental entities or agencies having jurisdiction, and shall perform the work in accordance with any and all applicable ordinances, regulations, laws and orders of, or permits issued by such entities or agencies.

SUBSURFACE STRUCTURES - The Contractor shall have access to any record drawings showing the location of existing City facilities, but the Contractor shall be finally and solely responsible for notifying all owners or operators thereof of his intent to excavate in the area, and determining the existence and location of all subsurface structures in such area. If a Contractor damages any City facilities during the construction, he shall be immediately notify the City and take such measures as may be reasonably necessary or appropriate to minimize damage to the City System, prevent the escape of water from the City System, and prevent and mitigate damage from fugitive water. Any Contractor who damages City facilities shall indemnify and hold the City harmless against any and all claims for damage resulting therefrom, and shall indemnify and hold the City harmless against any and all claims for damage to any such structures.

WARRANTY - All materials and workmanship furnished by the Contractor shall conform to the City standards, these specifications, and to all plans approved by the City, and shall be free from all defects due to faulty or non-conforming materials or workmanship.

INDEMNIFICATION - By undertaking any work subject to this section, Contractor agrees to indemnify and hold harmless the City from any and all liability, claims and demands, on account of injury, loss or damage, including without limitation claims arising from bodily injury, personal injury, sickness, disease, death, property loss or damage, or any other loss of any kind whatsoever, which arise out of or are in any manner connected with any work subject to this section if such injury, loss or damage is caused in whole or in part by, or is claimed to be caused in whole or in part by, the act, the omission, professional error, mistake, negligence, or other fault of Contractor, or which arise out of any Workmen’s Compensation Claim of any employee of the Contractor. Contractor agrees to investigate, handle, respond to, and to provide defense for and defend against such liability, claims or demands at the sole expense of Contractor. The Contractor also agrees to bear all other costs and expenses related thereto, including court costs and attorney fees, whether or not any such liability, claims, or demands alleged are groundless, false, or fraudulent. Nothing in this subsection shall be deemed to impose upon Contractor any obligation to defend or hold the City harmless against claims for damages legally caused by any unlawful act or omission of the City.
B. REQUIRED APPROVALS

Contractor shall not begin work on any main extensions, domestic service(s), or City facilities until all approvals from the City have been obtained.

C. CONSTRUCTION PLANS

The construction plans have been reviewed, approved, and signed by the City. A copy of these signed plans shall be kept on the project site by the Contractor at all times.

D. FEES

Contractor will pay the City all fees imposed and assessed by the City for reviews, observation, tests, approvals, and any other undertakings performed by the City or its professional consultants in connection with the administration and enforcement of these specifications.

E. PRE-CONSTRUCTION

A Pre-construction Meeting shall be arranged by the Contractor and held prior to the start of any work. A representative of the City, Contractor, Soils Engineer, Surveyor, Developer, and Engineer must be represented at this meeting. Once the pre-construction meeting has been held, the Contractor shall, at least forty-eight (48) hours prior to the start of construction, notify the City of its construction schedule and start date.

F. DESIGN REVISIONS DURING CONSTRUCTION

Should the Contractor encounter field conditions that prevent construction to occur in conformance with the approved plans, a meeting shall be scheduled by the Contractor with the developer’s Engineer and City to discuss an alternative design. The Contractor’s construction shall not deviate from the signed plans without the prior review and approval of the City and Engineer.

G. CONSTRUCTION OBSERVATION

The City shall decide on any and all questions that may arise during construction as to the quality and acceptability of the materials furnished, the work performed, or the manner of the performance of the work.

No observation or testing will be performed by the City on weekends or holidays without the express agreement of the City secured in advance. Whenever any observation or testing is required by any specific provision of the specifications, or by the terms of any permit or plan approval, the Contractor shall give the City such notice as is required and shall not cover or otherwise obscure the work until the observation or testing has been made. The Contractor shall at his cost uncover or otherwise make such work accessible for observation or testing when ordered to do so by the City if he violates this requirement.

The observations, testing and reviews performed by the City are for the sole and exclusive benefit of the City. No liability shall attach to the City by reason of any
observations, testing or reviews required or authorized by these, or by reason of the issuance of any approval or permit for any work in this subject to this section.

The City is not a guarantor of the construction Contractor’s obligations and performance of contract.

Observations of work in progress and on-site visits are not to be construed as a guarantee by the City of the Contractor’s performance.

The City is not responsible for safety in, on, or about the Project site, or for compliance by the appropriate party of any regulations relating thereto.

The City exercises no control of the safety or adequacy of any equipment, building components, scaffolding, forms, or any other work aids used in or about the project, or in the superintending of the same.

H. GEOTECHNICAL OBSERVATION

Geotechnical observation and backfill density tests will be performed by the Developer’s Soils Engineer to provide acceptable fill control, bedding compaction, and foundation suitability. All supervision necessary to control fill and compaction tests will be at the expense of the Developer. If the first compaction test does not meet with the specifications, the sub-standard areas shall be reworked and additional compaction tests will be performed until the specification is met. Any deviation from the plans, specifications or soils report must be corrected by the Contractor to the satisfaction of the City. Copies of all compaction tests shall be provided to the City on the working day of the following test.

I. CONSTRUCTION WATER

The Contractor shall be responsible for obtaining any water required for various phases of construction. Arrangement and coordination of permits shall be made through the appropriate City agency.

J. REPLACEMENT OF EXISTING IMPROVEMENTS

In areas where existing pavement, concrete improvements, storm or drainage improvements are removed during construction, they shall be replaced in kind to the limits disturbed by water line construction. All replacement shall be in accordance with the appropriate City, County, or State Highway Department.

K. SAFETY AND TRAFFIC CONTROL

The Contractor shall determine, initiate, maintain, and supervise all measures necessary to protect the public during construction.

Traffic shall be controlled at those locations throughout the project area in order to maintain an efficient and orderly vehicular and pedestrian flow. All traffic control, construction signing, vehicular traffic and residential access, etc., shall be handled in conformance with the Uniform Traffic Control Manual and the appropriate City, County, or State Highway Department Standards.
The Contractor shall furnish, construct, maintain, and finally remove detours, road closures, lights, signs, fences, barricades, flares, miscellaneous traffic devices, flagmen, drainage facilities, reconstruct paving and such other items and services as are necessary to adequately safeguard the public, both traveling and otherwise, from hazard and inconvenience. He shall erect and maintain such warnings and directional signs as may be requested by the City, County, or State Highway Department.

Should the progress of construction require closure of residential access, the Contractor shall notify the residents which may be affected at least twenty-four (24) hours in advance and provide temporary access. Prior to the start of construction, the Contractor shall notify affected residents as well as the appropriate police and fire departments, giving the approximate starting date expected, completion date, and the name and telephone number of a responsible person representing the contractor who may be contacted at any hour.

L. DEFECTIVE MATERIALS

All materials not conforming to the specifications of the City shall be considered defective. Whether in place or not, such material shall be removed immediately from the site of the work, unless by written permission by City. The City will not consider conveyance and acceptance of a project if the contractor fails to comply promptly with any order of the City made under provisions of this section.

M. STOP WORK ORDERS

The City may revoke any approval for work and issue a Stop Work Order upon a determination that the Contractor has violated or is about to violate any condition of any plan approval, any provision of the City’s specifications or rules and regulations, or any other standard, specification or rule imposed by the City. A Stop Work Order shall take effect immediately upon the entry thereof by the City and notice to the Contractor, and shall remain in full force and effect until rescinded in writing by the City. It is unlawful for any person to do any work in violation of the terms of any Stop Work Order issued pursuant to this section except such as may be permitted by the City order to render the construction site safe and secure. Any work performed after the Stop Work Order will be considered defective and must be remedied prior to acceptance.

N. CURE OF DEFECTS

If the City determines that any part of the work was not performed in conformity with these specifications or approved plans, or is defective, of poor or unworkmanlike quality, or is otherwise not in conformity, with any applicable warranty, it may give written notice thereof to the Contractor. Such notice shall specify the nonconformity, direct the Contractor at this cost to perform specified remedial work, and specify the period of time determined by City reasonably necessary for completion of the remedial work.

If the Contractor fails within the time stated following such notice to cure the nonconformity specified therein, the City, in addition to and without waiving any of its other remedies, may perform the work and charge the Contractor for its actual costs incurred in connection therewith.
O. RECORD DRAWINGS

The Contractor shall maintain on the job site, a separate set of full-scale Drawings marked up to fully indicate field installed conditions, including all service locations and any deviation to the approved design. These Drawings shall be maintained current at the end of each day until completion of the work and shall be available for review by the City at all times. All reviewed variations from the signed Drawings, for whatever reason, including those occasioned by optional materials, and those required by coordination between trades, shall be indicated. These variations shall be shown in the same general detail utilized in the original design. Upon completion of the work, the marked up set of Drawings (red-lines) shall be furnished to the City for review. After the City has reviewed the marked up Drawings, the Drawings shall be returned to the Engineer with the original mylars. The Engineer shall use the marked up Drawings to prepare as-builts on the original mylars.

These as-built mylars must be identified as “As-Built” and dated. A computer disk containing the planimetric drawings in the City’s current version of AutoCAD must be presented to the City prior to probationary acceptance of the project.

P. CONVEYANCE AND ACCEPTANCE

Initial acceptance by the City of facilities intended to be owned and operated by the City shall be accomplished by compliance with the above requirements and the following:

1. Successful testing as specified in Sections 4, 11, and 13.

2. A video record (in a City-approved format) of all sewer line after the first lift of asphalt has been placed. Street acceptance will not be given until this video has been submitted, reviewed, and approved.

Final acceptance by the City of facilities intended to be owned and operated by the City shall be accomplished by the successful inspection of all work one (1) year after initial acceptance and any agreements with the City.