CITY OF GOLDEN

WATER AND SANITARY SEWER SPECIFICATIONS

CITY OF GOLDEN, COLORADO
DEPARTMENT OF PUBLIC WORKS
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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 sewer line 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.

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, December 2003***". Any previous specifications addressing sanitary sewer construction or water meter installation are also replaced by this publication.

END OF SECTION

SECTION 2

ABBREVIATION, DEFINITION, AND CONTRACTORS REQUIREMENTS

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
BFP	Backflow Prevention
CM	Centimeter
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	Professional 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

SF	Square Foot (feet)
SPD	Standard Procter Density
SS	Stainless Steel
THD'D	Threaded
TYP	Typical
USGS	United States Geological Survey

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 - CONTRACTORS 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. Copy of any recorded easements shall be provided to City at their request

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 by City Engineer.

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 their own 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 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 public safety will be performed by City personnel at the Contractors 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. The City of Golden's Stormwater Manual should be reviewed prior to beginning any work.

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 seventy-two (72) hours prior to the commencement of work, which might affect utility installations, and to secure from such representative's information as to accurate location, size and type of such installations.

B. Utility locates must be obtained prior to any excavation, potholing, or other sub-surface work. Contractors are to call the Utility Notification Center of Colorado (Colorado 811) to request locates at least seventy-two (72) hours prior to excavation.

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 work conducted within the City ROW will require a ROW permit.

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

C. 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.

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

E. The Contractor shall coordinate their 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.

F. 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.

G. 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 City 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.

7. Obtain all necessary dewatering permits to discharge groundwater or groundwater mixed with stormwater to the City's storm drainage system, surface water, or groundwater (if discharging to sanitary sewer, a permit isn't needed, but permission of the owner of the system is required).

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. All sheeting and shoring must meet OSHA standards 29 CFR 1926.6250, 29 CFR 1926.651, and 29 CFR 1926.652.

E. Sequence of Operation.

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

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

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

4. All excavated material shall be stockpiled within the City ROW and 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 travel ways, 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 seventy-two (72) 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 and City in case of conflict.

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

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

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

a. If the Contractor should choose to remove any underground obstructions (i.e. irrigation lines/sprinklers, drainage culverts, catch basins, etc.), all removed underground obstructions shall be replaced with new materials.

5. 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.

C. Materials handled per manufacturer specifications

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 settlement or defective work 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 Contractors expense.

C. If an emergency situation arises during the one-year correction period, as a result of backfill settlement or defective work, and the Contractor cannot respond as needed by the City, 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

2.2 Bedding Materials.

A. Class A Bedding (Squeegee):

Class A Bedding (Squeegee)	
Sieve Size	Total % Passing by Weight
3/8”	100%
No. 8	65-100%
No. 50	10-30%
No. 100	0-10%
No.200	0-5%

B. Class B Bedding (Granular Material): Or well graded crushed, stone or gravel meeting requirements of ASTM D448, gradation 67.

Class B Bedding (Granular Material)	
Sieve Size	Total % Passing by Weight
1”	100%
3/4”	90-100%
3/8”	20-55%
No. 4	0-10%
No.8	0-5%

2.3 Trench Backfill Material.

A. Any street cut shall be backfilled with Class 6 roadbase.

B. Imported Backfill Material: Class 6 Aggregate Base Course with the CDOT standard gradation:

Class 6 Aggregate Base Course	
Sieve Size	% Passing
1”	100%
3/4"	95-100%
No. 4	30-65%
No. 8	22-55%
No. 200	3-12%

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-90, respectively.

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

D. 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-cultivated 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, 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. Full stone removed

3.2 Trenching.

A. Excavate trenches by open cut methods, except where approved by the City to bore or tunnel where indicated on the Drawings, required by jurisdictional agencies, or desired by Contractor to avoid removal of obstruction.

1. Excavate only 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 or City 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, or 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 A 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 and City.

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.

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 un-compacted 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 Trench Backfill Material for backfill of utility alignments within a street section, or outside of a street section if compaction cannot be obtained with job excavated material. Class B material shall be used for trench backfill if compaction cannot 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. Grading permit, SWMP, outside of City.

G. All excess excavated materials and material not suitable for backfilling shall be disposed of off-site by the Contractor. Contractor shall be responsible for obtaining appropriate Grading Permit and Stormwater Management Plans for any stockpile or permanent disposal sites outside of the City, or within the City if the total disturbed area exceeds one-half (1/2) acre and/or if the total amount of material placed within the City exceeds 50 cubic yards.

3.5 Field Quality Control.

A. A Geotechnical Technician 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 a 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. Under paved roads, sidewalks, and other paved areas: 98%

    c. All other locations: 95%.

2. Barrier material: 95%.

3. Pipe bedding.

    a. Barrier Material: 95%.

    b. All other locations: 90%.

4. Trench backfill.

    a. State Highway Rights-of-way.

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%.

5. Right-Of-Way

a. Concrete and asphalt in City Right-Of-Way: 98%

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 - 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 without approval from the City.

D. All contractors performing work within the City of Golden must be properly registered 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 five (5) feet west of the centerline of the street.

2. On streets running east and west, the sewer line shall generally be placed five (5) feet south of the centerline of the street.

3. On streets shaped as a U 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 their 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.

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 4.1

Size of Sewer Inches	Minimum Slope Feet Per Hundred	Maximum Slope Feet Per Hundred
4	2.0	25
6	0.6	20
8	0.4	15
10	0.28	12
12	0.20	11
15	0.15	8.5
18	0.12	6.5

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 Manning's n = 0.013. Larger sizes require approval of the City.

B. 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.

C. 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 Manning's 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.

D. 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. See concrete encasement detail S-16 and W-10.

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.

B. Type: High-Density Polyethylene Pipe (HDPE), 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 inches (15”) or smaller.

a. Strongback

b. Mission Rubber Company

c. Or equal.

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

a. Lap joint downward at springline of pipe.

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

B. Encase flexible coupling in a concrete collar with a minimum of six inches (6”) thick and extending a minimum of six inches (6”) on 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. City and Engineer will examine pipe or appurtenance and specify any necessary adjustments in line or grade of the proposed pipe to accomplish the connection.

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

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

2. Mark rejected pipe and remove from site.

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: Plus or minus one inch (±1”) per one hundred feet (100’) in open cut or tunnel.

2) Grade: Plus or minus one inch (±1”) per one hundred feet (100’).

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

B. Pipe Laying.

1. Cutting the pipe – prior to cutting, score the pipe. Cut pipe square with saw or pipe cutters designed specifically for the material. Bevel the end in accordance with manufacturer’s recommendations. Remove burrs and wipe off all dust and dirt from jointing surfaces.

2. 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.

3. 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 percent (1%) of the inside diameter, or three-eighths inch (3/8”), whichever is smaller.

4. 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.

5. 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.

6. 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.

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

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

9. 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 eighteen inches (18”) clear distance vertically below the watermain, construct the crossing by one of the following methods:

   a. Using one length of pipe, PVC at least eighteen feet (18’) 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 inches (6”) thick at all locations within ten feet (10’) on 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. <u>General</u>

   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 degrees (45°) 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 feet (12') below finished grade. Riser connections shall reach a grade of nine feet (9') below finished grade within a horizontal distance of two feet (2') 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 or equal to six inches (6") must be connected by a manhole.

a. On all new main, install forty-five degree (45°) "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.

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

c. 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.

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

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

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

g. 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 (exact distance) of each marker on the Drawings. See Section XX on locating pipe.

2. Clay Pipe

a. Tap Preparation

1) The pipe shall be cleaned with high pressure water to remove all debris.

2) Core drill a hole in the existing main pipe for the new tap.

b. Installation

1) Connect the saddle riser to the new section of PVC service pipe utilizing a push gasket joint.

2) Apply a smooth layer of epoxy adhesive/sealant to the underside of the saddle.

3) Snap the saddle directly onto the clay main pipe.

4) The saddle shall encompass more than fifty percent (50%) of the main pipe diameter.

5) Two (2) bands shall be attached to each end of the saddle - four (4) bands in total - to ensure no slippage occurs during the curing process.

6) Once secure, smooth out the exposed epoxy around the service opening and main pipe.

3. Clay Pipe with Liner

a. Tap Preparation

1) The pipe shall be cleaned with high pressure water to remove all debris.

2) Break away the outer clay wall of the main pipe to expose the lining. The liner shall be exposed beyond the length of the saddle by two (2) inches on each side. Take care to not damage the liner.

3) Mark the location and cut a hole in the existing main liner for the new tap.

b. Installation

1) Connect the saddle riser to the new section of PVC service pipe utilizing a push gasket joint.

2) Apply a smooth layer of epoxy adhesive/sealant to the underside of the saddle.

3) Snap the saddle directly onto the exposed main liner.

4) The saddle shall encompass more than fifty percent (50%) of the main pipe diameter.

5) Two (2) bands shall be attached to each end of the saddle - four (4) bands in total - to ensure no slippage occurs during the curing process.

6) Once secure, smooth out the exposed epoxy around the service opening and main pipe.

4. Video Inspection of Sanitary Services Repaired by Bursting or Lining

Video inspection shall be provided by the contractor to the City and approved by the City before a lined or burst sanitary service will be approved.

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. 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 inches (6”) into the manhole. No service line shall connect to the main line closer than five feet (5’) 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 feet (100’) between cleanouts.

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 require mandrel tests for 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. Air testing shall comply with ASTM C1244M-11. Comply with the requirements of latest edition 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.

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.

TABLE 4.2
SPECIFIED TIME REQUIRED FOR 0.5 PSIG PRESSURE DROP FOR SIZE AND LENGTH OF PIPE

Pipe Diameter (Inches)	Minimum Time (min:sec)	Length For Minimum Time (feet)	Time For Additional Length (sec)	100 ft	150 ft	200 ft	250 ft	300 ft	350 ft	400 ft	450 ft
8	3:47	298	0.760 L	3:47	3:47	3:47	3:47	3:48	4:26	5:04	5:42
10	4:43	239	1.187 L	4:43	4:43	4:43	4:57	5:56	6:55	7:54	8:54
12	5:40	199	1.709 L	5:40	5:40	5:42	7:08	8:33	9:58	11:24	12:50
15	7:05	159	2.671 L	7:05	7:05	8:54	11:08	13:21	15:35	17:48	20:02
18	8:30	133	3.846 L	8:30	9:37	12:49	16:01	19:14	22:26	25:38	28:51
21	9:55	114	5.235 L	9:55	13:05	17:27	21:49	26:11	30:32	34:54	39:16
24	11:20	99	6.837 L	11:24	17:57	22:48	28:30	34:11	39:53	45:35	51:17
27	12:45	88	8.653 L	14:25	21:38	28:51	36:04	43:16	50:30	57:42	64:54
30	14:10	80	10.683 L	17:48	26:43	35:37	44:31	53:25	62:19	71:13	80:07
33	15:35	72	12.926 L	21:33	32:19	43:56	53:52	64:38	75:24	86:10	96:57
36	17:00	66	15.384 L	25:39	38:28	51:17	64:06	76:55	89:44	102:34	115:23

E. Exfiltration Tests.

1. Conduct exfiltration tests on section of sewer where the groundwater table is less than five feet (5') 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 feet (5') above the groundwater level at the upper manhole for a period of seventy-two (72) hours prior to testing.

4. Duration of Test: Two (2) 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 feet (100') 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. Final Completion. After the Final completion of sanitary sewer improvements including associated paving or other site restoration, all sewer mains constructed will be considered initially accepted by the City for a one (1) year correction period upon:

1. Successful inspection of all "initial punch list" item remedies.

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

3. Successful flushing of all mains while observed by the City.

4. Successful infiltration/exfiltration testing if deemed necessary by the City.

5. Successful Air Testing conducted by Contractor, per ASTM F1417-11A, and

observed by the City.

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

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

   a. Latest version of NASCO.

   b. Copy of the camera operator's NASCO certificate.

   c. Manhole and pipe naming must match the City's designations on the plans in accordance with GIS designations.

   d. Cameras must be wheeled or tracked, push cameras are not acceptable.

   e. Quality of the video shall be sufficient enough to allow for clear measure and inspection as judged by the City of Golden.

   f. Video format compatible with WinCan

B. Final Acceptance. At the end of the one (1) year initial acceptance period, all public mains will be 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
RESIDENTIAL SANITARY SEWER DESIGN FLOW RATES

Use	Average Daily Sewage Flow
1-Bedroom or less than 900 SF	100 GPD/Unit
2-Bedroom or less than 1400 SF	155 GPD/Unit
3-Bedroom or less than 1800 SF	220 GPD/Unit
1800 SF or greater	255 GPD/Unit

TABLE 4.4 COMMERCIAL/INDUSTRIAL SANITARY SEWER DESIGN FLOW RATES	
Use	Average Daily Sewage Flow
Office Building	0.1 GPD/SF
Restaurants	25 GPD/Seat
Bar & Lounges	15 GPD/Seat
Hotels & Motels	140 GPD/Room
Neighborhood Stores	0.15 GPD/SF
Department Stores	0.15 GPD/SF
Laundries & Dry Cleaning	400 GPD/Machine
Banks & Financial Buildings	0.1 GPD/SF
Medical Buildings & Clinics	0.3 GPD/SF
Warehouses	0.05 GPD/SF
Meat & Food Processing Plants	2.8 GPD/SF
Car Washes	540 GPD/Bay
Service/Gas Stations	100 GPD/Plumbing Fixture
Auto Dealer, Repair & Service	0.15 GPD/SF
Super Market	0.2 GPD/SF
Trade Businesses (Plumbers, Exterminators, etc.)	0.2 GPD/SF
Places of Assembly (Churches, Libraries, Theaters, etc.)	5.0 GPD/Seat
Schools	15 GPD/Student
Factories (Manufacturing raw products into finished products)	0.8 GPD/SF
Hospitals	450 GPD/Bed
Other, non-identified commercial uses	Determined by City

Peaking Factor = PF*

Peaking Factor shall be determined using the following equation from the Denver Regional Council of Governments (DRCOG). In no cases shall the peaking Factor be less than 2.0 or greater than 4.0.

$$PF = 2.6 \times Q_{avg}^{-0.16}$$

Where:

$Q_{peak} = 2.6 \times Q_{avg}^{0.84}$

Q_{avg} = Average Sewer Flow in cfs

Q_{peak} = Peak Sewer Flow in cfs

The relationship of peak flow to average flow is given below. Both peak flow and maximum infiltration shall be used to determine the hydraulic capacity of sewer pipe.

Peak Flow = (Average Flow x Peaking Factor) + Infiltration/Inflow (flow units are in cfs)

Infiltration/Inflow = 10% of the Average Flow

END OF SECTION

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.

B. This section also covers the rehabilitation of existing manholes.

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 percent (80%) 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. CDOT Class D

3. Strength: Four thousand five hundred (4500) psi at twenty-eight (28) days

4. Cement: Type II or Type I/II

5. Slump: Two inches (2").

6. Air Entrapment: Five to Eight percent (5%-8%).

B. Mortar.

1. One (1) part Portland Cement, ASTM C150, Type II.

2. Three (3) parts sand, ASTM C144.

3. One-half (1/2) part hydrated lime, ASTM C207, Type S.

C. Grout (non-shrink).

1. Pre-mixed: Quickrete “Non-Shrink Precision Grout”, or equal.

2. Job Mixed:

a. One)1) part Portland Cement, ASTM C150, Type II.

b. One (1) part sand, ASTM C144.

c. One (1) part Quickrete Non-Shrink Precision grout, or equal.

2.2 Precast Concrete.

A. Bases, barrels, cones and flat tops.

1. Cast base at first barrel section monolithic.

2. Meet Requirements of: ASTM C478.

3. Cement: Type II or Type I/II

4. Invert: Cast-in-place concrete as specified in paragraph 2.1.A above.

5. Provide horseshoe shaped openings for manholes to be installed in existing lines.

2.3 Manhole Gaskets.

A. Meet Requirements of: SS-S-210 A, AASHTO M-198 75 1, and ASTM C990-91

B. Diameter:

1. 48-inch manholes: One and one-half inch (1½”).

2. 60-inch manholes: One and three-quarters inch (1 ¾”).

3. 72-inch manholes: Two inch (2”).

C. Approved Manufacturers.

1. K.T. Snyder Co., "Ram-Nek" or "Rubr'-Nek."

2. Hamilton-Kent Mfg. Co., "Kent Seal."

3. ConSeal, “CS-231 Controlled Expansion Waterstop Sealant.”

4. Or equal.

2.4 Pipe Penetration Gaskets.

A. Approved Manufacturers.

1. Dukor Co., “Ko-N-Seal”.

2. A-lok Corp., “A-lok”.

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 inch (24”) 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: One-half inch (1/2”) diameter, Grade 60 steel.

2. Length: Nine and three-quarter inches (9¾”), designed for six and three-eighths inch (6 3/8”) protrusion from manhole wall.

3. Width: Fourteen inches (14”) clear.

4. Tread: notched ridge with retainer lugs on each end.

C. Spacing.

1. Eight inches (8”) above bench.

2. Twenty inches (20”) maximum below rim.

3. Twelve inches (12”) 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.

2.8 Renovating Manholes

A. The materials to be utilized in the lining of manholes shall be designed and manufactured to withstand the severe effects of hydrogen sulfide in a wastewater environment.

B. Equipment for installation of lining materials shall be high quality grade and be as recommended by the manufacturer.

C. The lining system to be utilized for manhole structures shall be multi-component stress skin panel liner system as described below:

1. Liner

Installation	Liner
Moisture Barrier	Modified Polymer
Surfacer	Polyurethan/Polymeric blend foam
Final corrosion barrier	Modified polymer

2. Modified polymer shall be sprayable, solvent free, two-component polymeric, moisture/chemical barrier specifically developed for the corrosive wastewater environment.

D. Approved Manufacturers.

a. SpectraShield

b. Poly-Triplex Technologies

c. Or equal.

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.

B. Reference: ASHTO R-73

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

C. Manholes installed at depths greater than twenty feet (20’) 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 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.

D. Install ring and covers on one or a maximum of two (2) pre-cast adjusting rings of varying heights, not to exceed six (6) 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 (1/4) 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 forty-eight (48) hours before continuing construction. Twenty-four (24) hour set time allowable with high early as approved by the City.

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 inches (2") 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 sewer line as shown on Detail S-4 for sewer line up to fifteen inches (15") and twelve inches (12") above the pipe as shown on Detail S-5 for sewer line eighteen inches (18") and larger.

B. Drop Distance. All drop manholes must be constructed with an outside drop. The maximum vertical drop shall be ten feet (10').

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

D. Lining. All drop manholes must be completely lined as shown in 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 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.

3.8 Vacuum Testing.

A. All manholes must pass vacuum testing per ASTM C1244-11. Vacuum testing shall be performed after backfilling. Vacuum testing must be observed by the City.

B. Typical Field Test Procedure:

1. Plug and brace all penetrations.
2. Install 5 psig rated plugs beyond boot seals on influent and effluent pipes.
3. Secure vacuum apparatus.
4. Start vacuum.
5. Attain a vacuum of 10-inches Hg.
6. Time pressure drop to 9-inches Hg.
7. Release vacuum.
8. Compare time of pressure drop to Table 5.1.
9. If leaks are evident excavate, seal, re-backfill, and re-test.

TABLE 5.1
MINIMUM TEST TIMES FOR VARIOUS MANHOLE DIAMETERS (ASTM C1244-93)

	Diameter (inches)								
Depth (feet)	30	33	36	42	48	54	60	66	72
	Time (seconds)								
5	11	12	14	17	20	23	26	29	33
10	14	15	18	21	25	29	33	36	41
12	17	18	21	25	30	35	39	43	49
14	20	21	25	30	35	41	46	51	57
16	25	27	32	38	45	52	59	65	73
18	25	27	32	38	45	52	59	65	73
20	28	30	35	42	50	53	65	72	81
22	31	33	39	46	55	64	72	79	89
24	33	36	42	51	59	64	78	87	97
26	36	39	46	55	64	75	85	94	15
28	39	42	49	59	69	81	91	101	113
30	42	45	53	65	74	87	98	108	121

END OF SECTION

SECTION 6

PLASTIC PIPE

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) Gravity 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.

3. Joints: ASTM D3212, Push On.

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 C900-16 or AWWA C909-16DR18, Pressure Class 235.

3. Pipe 14" to 48": AWWA C905-10, Pressure Class 200 DR 21.

4. Joints: Gasket bell end or gasket couplings.

2.3 High-Density Polyethylene (HDPE) Pipe

A. Conform to the following standards:

1. All Pipe: ASTM D2239, ASTM D2683, ASTM D2737, ASTM D3035, ASTM D3261, ASTM D3350, ASTM F714, ASTM F905, ASTM F1055, ASTM F1533, ASTM F2164, and AWWA C901/C906.

2.4 Joints to Other Pipe Materials.

A. Approved Manufacturers:

1. Mission "Bushing Adapters."

2. Fernco "PVC Donuts" or "Flexible Couplings."

3. Strong Backs

4. 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. Score pipe at desired location of cut.

C. 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.

D. 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 backfilling 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.

END OF SECTION

SECTION 7

WATER DISTRIBUTION SYSTEM DESIGN AND CONSTRUCTION

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 (4½) 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

Density	3.5 unit/acre
Occupancy	3.2 residents/unit
Usage	70 gallons/capita/day
Lawn Area	0.1 acre/lot
Irrigation Application	2.5 acre feet/year/acre*

Usage - 1560 gal/day/acre

Multi-Family

Density	6.0 units/acre
Occupancy	2.4 residents/unit
Usage	70 gal/capita/day
Lawn Area	0.25 acre/gross acre
Irrigation Application	2.5 acre feet/year/acre*

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 - 1300 gal/day/acre

Parks and Open Space

Irrigation	2.5 acre feet/acre/year*

Total Usage - 3900 gal/day/acre

Fire Flows

Land Use	Flow (gpm)	Duration Hours
Residential	1500	2
Light Industrial/Office/Commercial	4000	4
Downtown	5000	5
Industrial/Large Commercial	6000	6

*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 ensure 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.

Land Use	System Classification	Location	Minimum Pipe Size
Residential SF	Major Distribution Line Distribution Lines Local Lines	Arterial Streets Collector Streets Local Streets	12@ 10@ 6@
Residential MF	Major Distribution Line Distribution Lines Local	Arterial Streets Collector Streets Local	12@ 10@ 8@
Commercial/ Industrial	Major Distribution Lines Distribution Lines Local	Arterial Streets Collector Streets Local	12@ 12@ 10@

These are guidelines and are recommended for developments that are typical in a Golden P.U.D. 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 (½) 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 blowoff 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.

D. A minimum separation of five (5) feet is required between water lines and any other type of utilities except for sanitary sewer, which requires a minimum of ten (10) feet of separation. If ten (10) feet of separation between the water and sanitary sewer is not possible, refer to the City adopted International Plumbing Code (IPC) guidelines.

1.5 Developments.

In 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.

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 six hundred (600) foot dictum. Line valves shall also be placed:

A. Such that no more than one (1) fire hydrant or one (1) commercial fire service 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.

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 downhill 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-4.

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 the required fire-flow, spacing shall meet the requirements shown below (per International Fire Code Section C102.1):

Fire-Flow Requirement (gpm)	**Minimum Number of Hydrants**	**Average Spacing Between Hydrants (feet)[a, b, c, f, g]**	**Maximum Distance From Any Point on Street or Road Frontage to a Hydrant (feet)[d, f, g]**
1,750 or less	1	500	250
2,000 - 2,250	2	450	225
2,500	3	450	225
3,000	3	400	225
3,500 – 4,000	4	350	210
4,500 – 5,00	5	300	180
5,500	6	300	180
6,000	6	250	150
6,500 – 7,000	7	250	150
7,500 or more	8 or more	200	120

Notes:

a) Reduce by 100 feet for dead-end street or roads.
b) Where streets are provided with median dividers that cannot be crossed by fire fighters pulling hose lines, or where arterial streets are provided with four or more traffic lanes and have a traffic count of more than 30,000 vehicles per day, hydrant spacing shall average 500 feet on each side of the street and be arranged on an alternating basis.
c) Where new water mains are extended along streets where hydrants are not needed for protection of structures or similar fire problems, fire hydrants shall be provided at spacing not exceeded by 1,000 feet to provide for transportation hazards. Reduce by 50 feet for dead-end streets or roads.
d) One hydrant for every 1,000 gallons per minute or fraction thereof.
e) A 50-percent spacing increase shall be permitted where the building is equipped throughout with an approved automatic sprinkler system in accordance with Section 903.3.1.1 of the International Fire Code.
f) A 25-percent spacing increase shall be permitted where the building is equipped throughout with an approved automatic sprinkler system in accordance with Section 903.3.1.2 or 903.3.1.3 of the International Fire Code or Section P20904 of the International Residential Code.
g) The governing fire protection authority will have ultimate discretion.

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 bends, off-sets or taps are to be installed in these lines, unless otherwise approved. All fire service lines shall comply with NFPA 24. 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 K 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. For inside meter sets, the residential domestic service line is teed off the fire line, one (1) foot downstream of the meter.

D. For outside meter sets, the residential domestic service line is teed off the fire line, upon entering the structure.

E. A meter and pit are 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.

F. The fire protection service line shall be equipped with rubber faced check valve or backflow prevention devices.

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.

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 (¾) 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 manufacturers 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 total peak flow. Peak domestic water requirements shall be as calculated per the latest edition of the International 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 (½) 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 fifty (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.

4.1 Sub-Meter.
Sub-meters will not be allowed/approved by the City.

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. Does not include residential fire systems.

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

No common trench shall be used for water pipes with any other type of utilities. Common trench between multiple water pipes is acceptable.

PART 7 - BACKFLOW PREVENTION DEVICES:

7.1 General.
The City of Golden has adopted the Colorado Cross-Connection Manual (latest edition) as the standard reference for Backflow Prevention compliance within the city limits of Golden. Technicians are encouraged to also utilize resources form the Colorado Department of Public Health & Environments Cross-Connection Control Program website, manufacturer's information, trade organizations, and trade magazines for addition information. Newly installed Backflow Prevention Assemblies shall be inspected and approved by the City of Golden.

Backflow Prevention assemblies shall be installed on all 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 by the City of Golden that a hazardous or aesthetically objectionable condition does or could potentially exist.

Building plans must be submitted, approved and permitted through the City of Golden Building Department. Building Plans must show at a minimum:

A. Water service type, size and location.

B. Backflow prevention assembly manufacturer, size, type and location.

C. Adequate drainage as needed if installed inside.

D. Fire sprinkling system(s) service line, size and type of backflow prevention assembly if applicable.

E. Irrigation system(s) service line, size and type of backflow prevention assembly.

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 or a pressure vacuum breaker or air gap.

7.3 Approved Models.

Only those models that are testable and have met completely the latest laboratory and field performance specifications of the University of Southern California, Foundation for Cross-Connection Control and Hydraulic Research (USC FCCC&HR) 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, unless approved for vertical installation by either the University of Southern California's Foundation for Cross Connection Control and Hydraulic Research approved assemblies list or the American Society of Sanitary Engineering.

1. Exterior installations of Backflow prevention assemblies are permitted when enclosures meeting the ASSE 1060 Standard are utilized.

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. Installations elevated more than five (5) feet above the floor must have a permanent platform adequate to test and repair the assembly.

D. Horizontal clearance between any wall and the device must be adequate around the assembly so that testing and repairs can be made.

E. Continuous service systems shall be provided with parallel back flow prevention assemblies providing an equivalent degree of protection. 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.

1. A. Air-Gaps and Reduced Pressure Assemblies

a) Irrigation and lawn sprinkling systems which permit the mixing, pumping, dissolution, injection, or siphoning of any foreign substance into the water, or any such system which incorporates the use of any booster pump(s), or which is subject to backpressure, shall be separated from the public potable water system by an approved air-gap separation or an approved reduced pressure principle assembly. In any irrigation or lawn sprinkling system where the terrain makes the installation height of a pressure or atmospheric vacuum breaker assembly impractical, the public potable water system shall be protected by an approved reduced pressure principle assembly. A reduced pressure principle assembly may also be installed to serve multiple irrigation circuits in lieu of pressure vacuum breakers.

2. B. Pressure Vacuum Breakers

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

3. Atmospheric Vacuum Breakers

a) An atmospheric vacuum breaker assembly may be used when the irrigation or lawn sprinkling system does not incorporate an injection system or booster pump(s), and is not subjected to backpressure, continuous pressure or continuous flow. Atmospheric vacuum breakers shall only be installed on irrigation circuits with sprinkler heads which shall not return any pressure to, or retain any pressure in the circuit when the circuit control valve is closed. Atmospheric Vacuum Breakers shall be installed with the air inlet in a level position and a minimum of six (6) inches above the highest piping or outlet it is protecting. Shutoff valves may not be installed downstream of the assembly. AVB’s may not be used as a containment device.

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

I. A single check valve is not considered an approved backflow prevention assembly.

J. Only Sanitary Yard Hydrants approved by the City will be permitted. Yard hydrants containing a 'stop & waste' style valves are not acceptable.

7.4 Fire Suppression Systems.

A. Requirements

All fire lines supporting a fire sprinkler system, including those attached to residential service lines, shall require an approved reduced pressure backflow prevention assembly or an approved double check backflow prevention assembly as required by the City of Golden Public Works Department. Installation of a backflow prevention device can reduce the required operating pressure of the overall fire sprinkler system flow requirements.

An evaluation of this potential effect must be evaluated by a qualified sprinkler contractor and submitted to a City of Golden Life Safety representative 303-384-8093 for review and approval prior to installation.

Backflow prevention assemblies used on fire protection systems must be 'classified' by Underwriters laboratories (UL) for fire system use.

All glycol (ethylene or propylene), or antifreeze systems shall have an approved Reduced Pressure Zone assembly for containment upstream of the point of use.

Dry fire systems shall have an approved Double Check Valve installed upstream of the air pressure valve.

Single family residences with a combined domestic water and fire sprinkler system shall have a double check valve when no chemicals are used unless an approved passive purge system or pump and tank configuration is being used

7.5 Installation.

A. Location and Design

Backflow prevention assemblies shall be installed downstream of the water meter before any other tee or branch. In no case shall it be permissible to have any connections or tees between the meter and service line backflow prevention assembly.

Test cocks are not to be used as supply connections.

Proper drainage should be provided for the relief valve and may be piped away from the location provided it is readily visible from above grade and provided the relief valve is separated from the drain line by a minimum of double the diameter of the supply line.

In situations where a facility has high level of security or restricted commercial properties do not allow the City to gain access to conduct a cross-connection control audit of a facility and approved a USC FCCCHR approved assembly shall be installed 5-feet

downstream from the existing meter pit in an above ground, heated enclosure.

B. Basement Installations

Basement installations are allowed providing there is drainage equal to two times the supply pipe diameter and/or high water alarm is installed near the assembly. Sump pumps may be acceptable if approved by the Utilities Department. Electrical systems and/or components shall not be installed in the same general area.

The relief valve opening shall never have a water level under the assembly reach within a vertical distance of 12 inches of the relief valve discharge port. The relief valve discharge port shall be directed down.

The relief valve discharge port on a reduced pressure principle assembly shall not be directly connected to any sump or sanitary sewer.

Only factory supplied funnels shall be used to remove the periodic discharge from the assembly and the piping system must have an approved air-gap at the termination of the run.

C. Double Check Valve Assemblies

Double Check Valve Assemblies may NOT be installed;

1. In health hazard systems
2. Areas where the assembly may become submerged.
3. Manholes, vaults or other confined spaces.
4. Any area where water spillage during normal testing and repairs could cause a problem.

D. Reduced Pressure Backflow Preventers

Reduced pressure backflow preventers shall be installed above ground. The unit should be placed with the discharge outlet at least twelve inches (12) above the finish grade to allow clearance for assembly discharge and repair work. A concrete slab at finish grade is recommended.

Reduced pressure principle assemblies shall not be installed in any below-grade pit or vault unless there is a drain sized twice the nominal pipe diameter of the assembly which gravity discharges to daylight.

E. Waterline Flushing

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

7.6 Testing and Reporting.

A. Testing requirements

Backflow prevention assemblies are required to be tested by a certified cross-connection control technician at the time of installation, repair or replacement, and on an annual basis thereafter. Where the director of public works deems necessary, the director may require operational tests at more frequent intervals.

All testing gauges shall be tested and calibrated for accuracy yearly, or more often in the event of questionable readings.

The cost for any tests shall be at the property owner's expense.

The assembly shall be repaired or replaced at the expense of the property owner whenever the assembly is found to be defective.

Records of all tests, repairs or replacement shall be kept by the certified cross-connection control technician and the property owner, and a copy of all such records shall be sent to the City's public works department within five working days of performance of such work, in the manner as prescribed in this chapter.

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 one-half (½) foot.

B. Do not deviate from grade more than zero point three (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

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 ten (10) percent or more:

a. Hold the last pipe laid in place by some means, such as a winch, 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 filling 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. Install air vents at any high points.

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. Dewatering permit may be required. Contractors are responsible for obtaining any necessary dewatering permits.

2. Make each connection at a time authorized by Engineer which will least interfere with service.

3. Use suitable fittings for the conditions encountered.

4. Dewater and dispose of water from dewatered lines.

5. Use effective measures to prevent contamination to existing potable water lines. Do not permit trench water, mud or other contaminating substances to enter pipelines.

6. Swab the interior of new pipe, fittings, and valves installed in existing pipelines with a solution of one (1) percent (10,000 ppm) chlorine solution, minimum, prior to installation.

7. 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 or required by specifications.

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. 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.

b. 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 11¼ degrees or more, reducers, and valves according to Details W-5, W-6, and W-7.

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 epoxy paint to ferrous metal rods, rebars, clamps, Blue Core 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.

1. Standard: AWWA C105-10/A21.5.

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.

e. Taps on ductile iron

3.6 Trenchless Installation by Boring or Jacking.

A. Trenchless installation by boring or jacking may be used as a method of installing mains using a casing pipe and carrier pipe. Prior to any work, the Contractor shall submit a pilot bore plan drawing and Geotechnical Baseline Report to the City of Golden. The pilot bore plan shall include the bore entry point and angle, bore exit point and angle, ground line, deflection and radiuses of the pilot bore, and existing utilities with minimum vertical and horizontal clearances. The Contractor shall confirm that alignment and elevation of critical utilities by potholing, vacuum excavation, or other suitable excavation methods.

1. Approved Casing Spacers:
   a. 4810 Casing Chock from PowerSeal
   b. Plastic Casing Spacer
   c. Raci Casing Spacer

3.7 Horizontal Directional Drilling.

A. With the approval of the City, HDD may be used as a method of installing mains.

B. Prior to any work, the Contractor shall submit a pilot bore plan drawing and Geotechnical Baseline Report to the City of Golden. The pilot bore plan shall include the bore entry point and angle, bore exit point and angle, ground line, deflection and radiuses of the pilot bore, and existing utilities with minimum vertical and horizontal clearances. The Contractor shall confirm that alignment and elevation of critical utilities by potholing, vacuum excavation, or other suitable excavation methods.

C. The Contractor is to submit a Quality Control Plan to the City for approval. The Quality Control Plan shall include the following:

1. Submit a complete written description and drawing identifying details of the proposed method of construction, equipment, procedures, and sequence of operations to perform during construction.

2. Submit the type and capacity of the drilling rig to be used on the project, including pullback and push torque. The Contractor is to verify that the allowable pipe stresses of the pipe will not be exceeded by the drilling rig. Submit information on the type of locating and tracking system. Submit type and capacity of mud mixing system, and composition of drilling fluid, viscosity, and density.

3. Submit a drawing showing proposed crossing configuration, including entry and exit angles, radius of curvature, entry and exit points. Drawing shall include location and applicable dimensions of any excavations. Include information on the diameter of the pilot hole and size and number of pre-reamers used for development of the borehole.

4. Submit information on the method to address and mitigate obstruction problems during drilling, reaming, and potential problems of product becoming stuck during pipe pull back, emergency procedures when drilling through existing underground utilities, or other events that lead to work stoppage. Procedures must comply with all regulations.

5. Submit information on the method of slurry containment, method of recycling drilling fluids and spoils, or method of containing drilling fluids or spills and

transporting drilling fluids and spoils. All material must be disposed of in accordance with local, state, and federal regulations.

6. Submit information on the method to address and mitigate collapse or subsidence of surface roadways, adjacent utilities during drilling, reaming, and installation of the pipe.

7. The Contractor shall maintain a logbook that includes driller notes and records for bores using steering and tracking system. Data will include pipe number, depth, pitch, and other notes. Log must also contain rig performance parameters, ground conditions, obstruction encountered, etc. Logbook must be submitted to the City at the completion of the project.

D. The Contractor shall utilize a self-contained, closed, drilling fluid mixing system of sufficient size to mix and deliver drilling fluid. The drilling fluid shall be composed of bentonite clay, potable water, and appropriate additives. The drilling fluid will lubricate the cutting head during the drilling operations as well as stabilize the reamed bore path prior to and during pull-back.

E. An electronic walkover tracking system is required to continuously and accurately monitor the location of the drill head during the drilling operation. This tracking system shall enable the driller to guide the drill head by providing real-time feedback of the horizontal direction (azimuth) and vertical direction (inclination) of the tool face. The location of the pilot hole shall be approved by the City of Golden prior to the reaming of the hold.

F. The bore hole diameter shall be increased to 1.2-1.5 times the outer diameter of the largest part of the carrier pipe to accommodate the pull-back operation. The Contractor shall choose the type of hold opener or back reamer based on the type of subsurface condition that was identified during the pilot hole drilling operation. The open bore hole shall be stabilized using bentonite drilling slurry that is pumped through the inner diameter of the drill pipe and through the openings in the reamer.

G. The carrier pipe shall be assembled according to the Manufacturer's specifications and installed using the cartridge or assembled-line methods. For both methods, a pulling eye shall be attached to the pulling head on the lead stick of pipe, which in turn shall be attached to a swivel on the end of the drill pipe. The end of the pipe shall be sealed to prevent contamination during the pull-back operation.

H. Tracer wire is required for PVC carrier pipe. The tracer wire shall be adequately secured to the pipe prior to the pull-back operation.

I. The carrier pipe shall be adequately supported as it enters the bore hole to minimize forces on the pipe during pull-back. Pull-back operations shall be carried out in a continuous manner until the pipe reached the original entry side of the bore. The manufacturer's recommendations regarding bend radius and tensile strength shall be followed. After pull-back is complete, the Contractor shall allow the pipe to achieve mechanical and thermal equilibrium with its surrounding prior to cutting it at either end.

J. The Contactor may be required to submit a Geotechnical Instrumentation Monitoring Plan in areas with critical infrastructure. The City of Golden will determine this on a case-by-case basis.

K. The Contractor is responsible for drilling fluid disposal and other restoration, which shall comply with proper disposal of drilling fluid regulations. Cleaning, flushing, and hydrostatic testing of the pipe shall be conducted.

L. The Contractor shall provide an as-built plan and profile drawing to the City of Golden. This submittal shall be based on the reading from the electronic walkover system showing the actual location, horizontally and vertically, of the final installation.

END OF SECTION

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.

5. Section 15 – Identification and Signage for Utilities.

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 C600-17.

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.

1. Standard: AWWA C151-17/ANSI 21.51, AWWA C150-14.

2. Pressure Class 350 for all diameters.

3. Thickness Class 52 for fire services and fire hydrants.

B. Joints

1. General: Ductile Iron Pipe and fittings shall be furnished with push-on joints, push-on restrained joints, mechanical joints, flanged joints as required.

2. Push on Joints:

a. Shall conform to AWWA C111-17/ANSI A21.11

b. Synthetic Rubber Gasket.

c. Pressure Rating: Three hundred fifty (350) psi.

3. Restrained Joints

a. Furnish joint restraint where required to offset internal pipeline forces.

b. 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-7 by the following: Restrained mechanical joint, wedge type retainer gland or by Restrained push-on joint, as recommended by pipe manufacturer.

c. Pressure Rating: Three hundred fifty (350) psi

4. Flanged Joints

a. Shall conform to AWWA C115-11.

b. Bolt hole drilling to match those of ANSI B16.1 class 125

d. Class 150 (Two hundred fifty (250) psi Working Pressure)

5. Mechanical Joints

a. Shall conform to AWWA C111-17/ANSI A21.11

b. Bolts:
i. Tee-head bolts made with high-strength, low-alloy steel.
ii. Blue Core bolts
iii. Or Approved Equal

c. Pressure Rating: Three hundred fifty (350) psi

C. Lining

1. Cement Mortar.

2. Standard: ANSI A21.4. AWWA C104-16/ ANSI A21.4

3. Thickness: Standard.

D. Pipe Coatings.

1. Underground or Submerged Locations.

Type: Epoxy or Polymeric.

Standard: AWWA C116-09 and AWWA C620-19

2. Exposed Locations. Pipe Primer:

a. Tnemec "77 Chem-Prime,

b, Mobil "13-R-50 Chromox Q.D.

c. Wasser MC-Ferroclad Primer

d. Or equal as recommended by Pipe Manufacturer

C. Flanged Pipe.

1. Standard: AWWA C115-11, flat faced.

2.2 Polyvinyl Chloride (PVC) Pressure Pipe:

A. Potable Water Pipe

1. Pipe 4” and larger: AWWA C900-16, DR 14, Pressure Class 305

2. Joints: Gasket, push-on type. Meeting ASTM D3139, Gaskets shall be part of a complete pipe section, shall meet ASTM F477

3. Shall be certified to NSF 61.

B. Non-Potable shall conform to the same standards but shall be colored purple.

2.3 Fittings.

A. General

1. Fittings shall be ductile iron in accordance with AWWA C110-12, or AWWA C153-11 (Compact Fittings)

B. Cement Lining: Fittings shall be internally lined with cement mortar in accordance with AWWA C104-16/ANSI A 21.4. Lining thickness equal to or greater than comparable size of pipe.

C. Buried Service Fittings

1. Push-On, Restrained Push-On, or Mechanical Joints shall be rated for 350 psi working pressure.

D. Aboveground Service Fittings

1. Flanged Joints shall be rated for two hundred fifty (250) psi working pressure.

E. Fittings shall be internally lined with fusion bonded epoxy or ceramic epoxy and shall be in accordance with AWWA C110-12 or AWWA C153-11 (Compact Fittings).

2.4 Joints.

A. Mechanical and Push-on.

1. Standard: AWWA C111-17/ANSI A21.11.

2. Gaskets: Synthetic Rubber.

3. Lubricant: Furnished by pipe manufacturer.

B. Flanged.

1. Standard: AWWA C111-17/ANSI A21.11.

2. Flanges: ANSI A21.15.

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 addition to thrust blocks, joints may be restrained at the appropriate distances indicated on Detail W-7 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.

3. Gaskets: Synthetic Rubber.

4. Manufacturers: Dresser Style 138, Smith-Blair Type 411, Romac Industries ALPHA or equal.

B. Flanged Adaptors

1. Unit consisting of steel or carbon steel body sleeve, flange, followers, and ASTM A307 bolts and nuts.

2. Supply flanges meeting standards of adjoining flanges.

3. Manufacturers: Dresser - Style 128, EBAA Iron Inc. – Series 2100 Megaflange, Ford Meter Box – Style FFCA, Or Equal

2.6 Pipe Lining.

A. Cement Mortar.

1. Standard: AWWA C104-16/ANSI A21.4.

2. Thickness: Standard.

2.7 Pipe Coatings.

A. Underground or Submerged Locations.

1. Type: Epoxy or Polymeric (NSF/ANSI 61 certified).

2. Standard: AWWA C116-09 and AWWA C620-19

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. Polyethylene Tubing.

1. Standard: AWWA C105-10/ANSI 21.5.

2. Method: A.

B. Nuts and Bolts

1. Tee-head, Blue Core, or approved equal bolts per AWWAC111/ANSI21.11

2. Heads and dimensions per ANSI B1.1

3. Threaded per ANSI B1.1

4. For mechanical couplings furnish ASTM A183 or A194 bolts and nuts.

5. Provide two nuts for one-inch diameter bolt applications and larger.

C. Tracer Wire (To be Installed on all Water Lines):

1. Refer to Section 15 – Identification and Signage for Utilities.

F. Copper piping

1. Service Connections to be Type “K”. ATM B 88 – Domestic Water Application

G. Residential Meter Accessories

1. 80 Series Coppersetter Ford Meter Box Company.

2. Copperhorn w/ Mail Iron Pipe Thread Swivel Both Ends. Ford Meter Box CH88-2xx-NL Style or CH88-444-NL Style)

3. Grip Joint Coupling (CH84-xx-G-NL Style) Ford Meter Box.

4. Smith Cooper International – Lead Free Brass Ball Valve Threaded (Series01728155L)

5. Meter Pit Lid – Cast iron Cap Type w/ 7” Diameter Recess & 2” Hole for AMR Device or Approved composite top lid.

PART 3 - EXECUTION

3.1 Inspection/Preparation.

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. 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.

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

E. Prevent foreign material from entering the pipe.

F. Do not place debris, tools, clothing, or other material in the pipe.

G. 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.

H. Use effective measures to prevent uplifting or floating of the pipeline prior to completion of backfilling operations.

I. Do not lay pipe under the following conditions:

1. In water.

2. Unsuitable weather conditions.

3. Unsuitable trench conditions.

3.2 Pipe Installation

A. Installation shall be in general accordance with AWWA C600-17 for Ductile Iron Pipe and appurtenances, or AWWA C605-13 for Pressure PVC Pipe and Fittings.

B. Pipe Laying

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

2. On down slopes of ten percent (10%) or more:

   a. Hold the last pipe laid in place by some means, such as a winch, 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 ½) feet.

7. Install Tracer Wire on all Pipe Lines. Refer to Section 15 – Identification and Signage for Utilities.

C. Connections to existing pipelines.

1. Use wedges for tracing. Make each connection at a time authorized by City 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 percent (5% or 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.

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 for ductile iron pipe.

5. Do not use an oxyacetylene torch for cutting holes for saddles.

6. Grind cut ends and rough edges smooth.

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 feet (2') longer than that of the pipe section.

3. Slip the tube around the pipe, centering it to provide a one foot (1') 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.

H. Encasements.

1. Provide concrete encasement where indicated on the Drawings or as warranted by utility crossings as identified in the field.

2. Sewer line crossings. Where water mains cross sewer lines, and the sewer is above the water main or less than eighteen inches (18") clear distance vertically below the water main, construct the crossing by one of the following methods:
   a. Install one length of PVC pipe in the sewer line centered on the intersection with the water main. PVC pipe shall be the same size as sewer line, or nearest size larger, then sewer line. Use approved adapters for joints between the PVC pipe and the sewer line or encase the joints in a concrete collar as noted.

b. Encase the sewer pipe with reinforced concrete at least six inches (6") thick at all locations within ten feet (10') either side of the water main.

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 initial 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 C600-17.

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 values listed in AWWA C600-17.

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 inch (¼") minimum to one-inch (1") 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.

3.4 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 eleven and one quarter degrees (11 1/4°) degrees or more, reducers, and valves according to Details.

B. Extend concrete from the fitting or valve to solid undisturbed earth. Construct so joints and drain holes are clear and accessible. Thrust blocks should bear against undisturbed soil at least three feet (3') below the surface.

C. Reducers and valves shall be restrained with the use of wedge-type retainer glands.

D. Provide a concrete thrust block under flanged valves that have valve boxes. Wrap plastic around the pipe and fittings to eliminate contact with concrete.

E. Resultant Thrust – See table on following page.

F. For Thrust Blocks - Soil Bearing Pressure – one thousand (1000) psf – equivalent fluid density two hundred ten (210) pcf is assumed value based on geotechnical investigation.

3.5 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 to accommodate field conditions.

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

2. Install Water Marker posts on all sectionalizing valves (or clusters) and Air Release and Vacuum Valve Vaults. Place Marker such that it is perpendicular to the appurtenance location and out of traffic areas.

3.6 Hydrostatic Testing of Water Distribution and Transmission Lines

A. See Section 13 for specifications, testing shall be in general accordance with AWWA C600-17 for Ductile Iron, and C605-13 for PVC Pipe.

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 & PVC.

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 C509-15.

1. Type: solid wedge, resilient seat.

2. Stem seal: O-ring.

3. Direction of opening: open left (counter-clockwise).

4. Valve ends: conform to the type of pipe material used.

5. Operator: Underground – two-inch (2”) nut; Vault - Handwheel.

6. Bubble tight at two hundred (200) psi working pressure.

7. Manufacturer: Mueller A-2361 (M.J.xM.J.), Ford, or approved alternative. All fittings shall be epoxy coated.

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-inch (6") minimum.

3. Thickness: three-sixteenths inch (3/16") minimum at any point.

4. Furnish with suitable cast iron bases and covers.

5. Cast word "WATER" in cover.

6. Coating: Dip in bituminous varnish.

7. Manufacturer: Tyler Union 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 inch (2 ½") minimum.

3. Coating: Dip in bituminous varnish.

4. Manufacturer: Tyler Union Series 6500, Size 95E.

2.3 Butterfly Valves

A. Conformance with AWWA C504-15

1. Type: Cast Iron or Ductile Iron

2. Direction of Opening: open left (counter-clockwise).

3. Connections: conform to the type of pipe material/joint used.

4. Operator: Underground – 2-inch (2") nut;
Vault – Handwheel or as indicated on plans.

5. Manufacturer: Mueller Lineseal III (Class 150B) or DeZurik AWWA Butterfly Valves (BAW), Ford, or approved equal.

6. Construction:

a. Ductile/Cast Iron Body
b. Self-Lubricating Bearings
c. Stainless Steel one-piece shaft
d. Cast Iron Disc body with Stainless Steel Disc Edge

2.4 Air Relief/Vacuum Valves.

A. Conformance with NSF/ANSI 61

1. Type: Integral type assembly which functions both as an air release and vacuum valve.

2. Rating: working pressure of 0.2-16 bar and a minimum hydrostatic test pressure of 25 bar.

3. Connections:

a. Inlet: two inches (2”), threaded.

b. Outlet: Protect to minimize entry of debris and dirt.

4. Body: Reinforced Nylon.

5. Working parts and seats: corrosion-resistant material.

6. Float: Foamed Polypropylene

7. Watertight at sixteen (16) bar.

8. Manufacturer: D-040 by A.R.I., or equal.

2.5 Pressure Reducing Valve

A. General: Pressure Reducing Valve with 2” Low Flow Bypass, hydraulically operated and controlled by a pilot control.

1. Cla-Val 90-99 or Equal

2. Type: Globe Valve

3. End Connections: conform to the type of pipe material/joint used.

4. Adjustment Range: thirty to three hundred (30-300) psi unless otherwise noted on the Plans.

5. Construction

a. Body: Ductile Iron
b. Disc: Buna-N
c. Trim: Bronze
d. Stem, Nut & Spring: Stainless Steel

2.6 Tap Valve

A. Conformance: AWWA C509-15.

1. Type: solid wedge, resilient seat.

3. Direction of opening: open left (counter-clockwise).

4. Valve ends: MJxFlange – Or as required

5. Operator: two-inch (2") nut;

6. (250) psi maximum working pressure.

7. Manufacturer: Mueller T-2362 or Ford, epoxy coated. Or Approved Equal.

8. Tap Sleeve: JCM 412 or Equal.

2.7 Service/Tapped Connections

A. Piping – Type "K" Copper

B. Corporation Stops.

1. Material: Brass.

2. In accordance with AWWA C800-14.

3. Connections: Inlet AWWA Taper/Outlet Copper Flare Straight Connection

4. Key Nut Operator

5. Manufacturer: Mueller Co, Ground Key Corporation Valve H-15000N. Or Approved Equal.

C. Tapping Saddles.

1. Material: Bronze.

2. In accordance with AWWA C800-14.

3. Service Size up to 1" - Mueller Co, #H-13000 Series. Or Approved Equal.
Service Size larger than 1" – Mueller BR2B Series – Double Strap Type. Or Approved Equal.

D. Curb Stops.

1. Material: Brass.

2. In accordance with AWWA C800-14.

3. Ball Curb Valve

4. Connections: Inlet/Outlet Copper Flare Nut

5. Key Nut Operator

6. Manufacturer: Mueller Co, Mark II Oriseal Curb Valve H-15204N. Or Approved Equal.

E. Couplings

1. Mueller – H15400N Couplings. Or Approved Equal.

F. Curb Stop Box

1. Tyler Union Adjustable Service Box. Or Approved Equal.

2. "Water" Lid

2.8 Angle Valves.

A. Materials and Construction.

1. Material: Brass.

3. In accordance with AWWA C800-14.

2.9 Insulating Couplings.

A. Materials and Construction.

1. Material: Non-conductive boot to eliminate metal-to-metal contact.

2. Manufacturers: Dresser Style 39, Smith-Blair 416, or Approved Equal.

2.10 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 applicable AWWA standards 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 inch (1”).

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 inch (1/4”) and three-eighths inch (3/8”) below finished grade.

4. Install extended stems on valves where operating nut is more than four feet (4’) 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.

B. Any chipped or damaged valves shall be replaced.

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 C502-18.

B. Type: Dry barrel with compression shutoff opening against the pressure.

C. Dimensions:

1. Size: 5 ¼".

2. Inlet size: Six-inch (6") nominal, mechanical joint w/retainer gland.

3. Outlet nozzle size: Pumper nozzle (1) 4 ½-inch, hose nozzles (2) 2 ½-inch.

4. Outlet threads: NFPA No. 1963.

5. Operating nut: One-inch (1") Pentagonal.

6. Minimum bury: Six feet (6') minimum, but not less than required to provide five feet (5') cover on six-inch (6") Inlet.

D. Operation: Open left (counter-clockwise).

E. Color: Safety Yellow.

1. Rust-Oleum Enamel, Paint Code: 202191T

F. Provide flange connection near ground designed to break on impact.

G. Acceptable manufacturers: no substitutes.

1. Mueller, No. A-423.

2. American Flow Control Waterous, Pacer WB-67-250

2.2 Water Quality Hydrant

A. Acceptable Manufactures:

1. Eclipse No. 88

B. Type: Freeze Proof Sampling Station with interior parts extractable for maintenance without digging.

C. Features:

1. ¾“ FIP Inlet

2. Aluminum cover with storage shelves.

3. All brass waterway.

4. O-Ring Valve design.

5. Unthreaded nozzle.

D. Include a two-foot (2’) wide by three-foot (3’) long by four-inch (4”) thick concrete pad in front of hydrant.

PART 3 - EXECUTION

3.2 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.

3.3 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 two to six inches (2”-6”) above finished grade.

B. Connect each hydrant to the main with a six inch (6”) 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.

3.4 Hydrant Drainage.

A. When setting a hydrant, excavate a two (2) foot by two (2) foot drainage pit below the hydrant and fill with gravel or crushed stone (3/4-inch or Class 67) under and around the elbow of the hydrant to a minimum of six (6) inches above the drain port. In addition, place filter fabric in excavation area (Mirafi 140N or Equal) and cover the installed drainage rock with a loose sheet of polyethylene plastic wrap to prevent backfill material from entering voids in the rock.

B. 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.

C. Repaint damaged areas with paint as specified in 2.1.E.

3.5 Operation.

A. Hydrants shall be closed or fully open.

B. Do not operate hydrants partially open.

END OF SECTION

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.

G. Hydrostatic Testing shall be in general accordance with AWWA C600-17 for ductile iron pipe and AWWA C605-13 for Polyvinyl Chloride (PVC) pressure pipe.

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. The pipeline shall be allowed to stabilize at test pressure before conducting final tests; this may require several cycles of pressurizing and bleeding trapped air. Leave pipe filled with water at working pressure for a minimum of seventy-two (72) hours prior to hydrostatic pressure test.

B. Test Pressure.

1. Use a test pressure of at least (1.25) times the maximum 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.

3. Test Pressure shall not exceed the thrust restraint design pressure or 1.5 times the pressure rating of the pipe or joint.

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:

$$L = \frac{SD\,(P^{0.5})}{148{,}000}$$

Where:

L = maximum allowable leakage in gallons/hour.
S = Length of Pipe Tested, in feet.
D = Nominal pipe diameter in inches.
P = Average test pressure during the leakage test, in psig.

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 disclose 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)

END OF SECTION

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. Disinfection procedures shall conform to AWWA C651-14.

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. Chlorine

1. Liquid Chlorine:

a. Conforming to AWWA B301-18 containing 100% available chlorine.

b. Shall only be used with appropriate gas-flow chlorinators etc., and under direct supervision of someone familiar and trained and equipped to handle said material.

2. Sodium Hypochlorite:

a. Conforming to AWWA B300-18 containing five to fifteen percent (5-15%) available chlorine as expressed as a percent of volume.

3. Calcium Hypochlorite:

a. Conforming to AWWA B300-18 available in granular form or in tablets, containing approximately sixty five percent (65%) available chlorine by weight.

b. Tablets dissolve in approximately seven (7) hours and must be given adequate contact time.

c. Do not use calcium hypochlorite intended for swimming pool disinfection, as this material is extremely difficult to remove from the pipe after desired contact time.

PART 3 - EXECUTION

3.1 General

A. Prevent contaminating materials from entering the water main during storage, construction, or repair.

B. Clean and swab the interior of the pipe, fittings, valves, or appurtenances with a five percent (5% or 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.

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. General

1. 3 Methods:

2. Continuous Feed Method: In general, apply chlorine using the continuous feed method.

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

4. Tablet method may be used on short extensions up to two thousand five hundred (2,500) feet of water lines twelve inches (12”) and smaller.

B. Continuous Feed Method

1. Place calcium hypochlorite granules in the main during construction.
Place quantities of granules in accordance with 4.4.2.1 of AWWA C651-14, at the beginning of each main and at each five hundred-foot (500’) interval. To provide a strong chlorine concentration in the first flow of flushing water going down the main.

Pipe Diameter (In)	Calcium Hypochlorite Granules (Oz.)
6	3.8
8	6.7
10	10.5
12	15.1
14 and Larger	D^2 x 15.1 (Where D is pipe Dia. In Feet)

2. Preliminary Flushing as specified. Main should undergo hydrostatic testing as specified in Section 13 prior to disinfection.

3. Chlorination:

   a. 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 twenty-five (25) 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 a residual of no less than ten (10) mg/ℓ of free chlorine throughout the length of the main.

C. Slug Method

1. Consists of placing calcium hypochlorite granules in the main during construction, slowly flowing a slug of chlorinated water into the lines at a constant ratee so that the chloring concentration in the water lines is maintained at a minimum of one-hundred (100) mg/ℓ available chlorine. Add granules as previously indicated.

2. Preliminary Flushing as previously specified.

3. 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.

4. The measured chlorine residual shall contain no less than fifty (50) 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 25 mg/. Reference AWWA C651-14. Provide a sufficient number to produce a minimum chlorine concentration of fifty (50) mg/ℓ.

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 twenty-four (24) hours apart for unchlorinated supplies.
2. For new mains, the purchaser has two options for the bacteriological testing for total coliform analysis

a. Before approving a main for release, take an initial set of samples and then resample again after a minimum of 16 hr using the sampling site procedures outlined. Both sets of samples must pass for the main to be approved for release.

b. Before approving a main for release, let it sit for a minimum of 16 hr without any water use. Then collect, using sampling site procedures outlined and without flushing the main, two sets of samples a minimum of 15 min apart while the sampling taps are left running. Both sets of samples must pass for the main to be approved for release. A set of samples collected along the length of the pipeline. For new mains, sets of samples shall be collected every 1,200 feet of the new water main, plus one set from the end of the line and at least one from each branch greater than one pipe length.

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.

1. Discharge without chlorination

a. Discharge to sanitary sewer, either by connecting to an active manhole or hauling to a sewage treatment facility, for super-chlorinated discharges.

b. Land application is allowed if done in accordance with CDPHE Low Risk Discharge Guidance for Discharges of Potable Water.

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

2. Dechlorination when discharging to a street, storm sewer, creek or gully (dry or flowing).

    a. Residual chlorine must not exceed 0.011 mg/ℓ where it discharged to state waters (Clear Creek and all tributaries).

    b. For each discharge, determine the chlorine limitation is met. This can be achieved either by testing, or by concluding that factors such as hold time, travel time and other variables will adequately reduce the chlorine concentration.

    c. Chemical dichlorination must be in accordance with manufacture's specifications, ensuring proper quantities and rates are used; that adequate mixing occurs; and that enough time is allowed for dechlorination chemicals to react with chlorine.

    d. Avoid directing water across bare soil or areas stained with petroleum products/waste.

    e. The discharge cannot cause erosion. Energy dissipation may be needed. Sediment control should be used.

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 latest version of the following 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).

3. ACI 306 Recommended Practice for Cold Weather Concreting.

4. ACI 305 Recommended Practice for Hot Weather Concreting.

5. ACI 304 Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete.

b. American Society for Testing and Materials (ASTM).

1. As referred to in this section.

B. Mix Design:

1. Compressive Strength: Four thousand five hundred (4500) psi at twenty-eight (28) days.

a. Minimum number of cylinders passing above requirement shall be ninety percent (90%).

b. Minimum strength of cylinder acceptable, four thousand two hundred (4200) psi.

2. Cement Content: 600-615 lbs. 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-inch (4") maximum.

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

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 inches (6") 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 thirty (30) minutes 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:

1. Conformance: ACI 306, "Recommended Practice for Cold Weather Concreting."

2. Temperature of concrete when placed shall not be less than the following:

Minimum Air Temperature (˚F)	Minimum Concrete Temperature Sections under 12"	Minimum Concrete Temperature Sections 12" and Over
30 to 45	60	50
0 to 30	65	55
Below 0	70	60

3. When placed, heated concrete shall not be warmer than 80˚F.

4. Prior to placing concrete, all ice, snow, surface a subsurface frost shall be removed, and the temperature of the surfaces to be in contact with the new concrete shall be raised above 35 ˚F.

5. Heated enclosures shall be strong and windproof to insure adequate protection of corners, edges and thin sections.

6. Do not permit heating units to locally heat or dry the concrete.

7. Do not use combustion heaters during the first twenty-four (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 90˚F or above.

3. Temperature of concrete when placed shall not exceed 85˚F.

4. Cool forms and reinforcing to a maximum of 90˚F by spraying with water prior to placing concrete.

5. Do not use cement that has reached a temperature of 170˚F 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 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.

D. Air-entraining Agent: ASTM C260.

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.

A. Quickrete “Non-Shrink Precision Grout”, or equal.

2.5 Curing and Sealing Compounds.

A. Sheet materials: ASTM C171.

1. Six (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 C309, Type 2, Class B.

2. For use on other surfaces not exposed to direct sunlight: ASTM C309, 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 ¾ 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- inches 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 inches (2") 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 two (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 l e a n e d 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 (1½) 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 (or 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˚ 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 three (3) test cylinders for each fifty (50) cubic yards placed or portion thereof.

2. Cylinders shall have a diameter of six inches (6”) and be twelve inches (12”) tall.

3. Deliver test cylinders to testing laboratory.

4. Comply with ASTM C912.

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-inch (2”) diameter cored samples from area in question.

2. Concrete will be considered adequate if average of three cores is at least eighty-five percent (85%) of, and if no single core is less than seventy-five percent (75%) of, specified twenty-eight (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.

5. Contractor shall have no right to claim additional costs as a result of any work required to comply with paragraph 3.13.B and its sub-paragraphs.

END OF SECTION

SECTION 15

IDENTIFICATION AND SIGNAGE FOR UTILITIES

PART 1 - GENERAL

1.1 Description

A. Section Includes:

1. Detectable Marking Tape

2. Non-Detectable Marking Tape.

3. Tracer Wire.

B. Related Work specified elsewhere:

1. Section 4 – Sanitary Sewer Design and Construction

2. Section 9 – Potable Water Pipe

1.2 Quality Assurance

A. Perform Work in accordance with City standards, specifications, and details.

B. Materials used for the construction of water and sewer components and appurtenances shall be new and free of defects. Materials and appurtenances shall be clearly, legibly, and appropriately marked for identification purposes.

C. The City/Engineer must inspect, review, and approve materials to be used for water and sewer components and appurtenances prior to installation.

1.3 Delivery, Storage, and Handling

A. Comply Manufacturer's Product Requirements, for transporting, handling, storing, and protecting products.

B. Inspect products thoroughly upon arrival for damage. Remove damaged or rejected materials from the site immediately.

PART 2– PRODUCTS

2.1 Tracer Wire

A. All trace wire shall have HDPE insulation intended for direct bury, color coated per APWA standard for the specific utility being marked.

1. Open-cut Excavation Installations: #12-gauge AWG Copper Clad Steel, High Strength with minimum four hundred fifty-pound (450 lb.) break load, with minimum thirty (30) mil HDPE insulation thickness.

2. Directional Drilling/Boring: #12-gauge AWG Copper Clad Steel, Extra High Strength with minimum one thousand one hundred fifty-pound (1150 lb.) break load, with minimum thirty (30) mil HDPE insulation thickness.

3, Pipe Bursting/Slip Lining: 7x7 Stranded Copper Clad Steel, Extreme High Strength with minimum four thousand seven hundred-pound (4700 lb.) break load, with minimum fifty (50) mil HDPE insulation thickness.

2.2 Connectors

A. Copperhead (Direct Bury Wire Connectors) or Equal, specifically manufactured for use in underground trace wire installation. Connectors shall be dielectric silicon filled to seal out moisture and corrosion. Non-locking friction fit, twist on or taped connectors are prohibited.

2.3 Test Stations

A. Termination points must utilize an approved trace wire access box, specifically manufactured for this purpose.

B. Copperhead Cobra (Above Grade Access Point) or SnakePit (At Grade Access Point) or Equal (Water or Sewer) cast in the cap.

C. A minimum of two (2) feet of excess/slack wire is required in all trace wire boxes after meeting final elevation

D. Locations:

1. Water Mains: Fire Hydrants and near curb stop on water services (new or reconnection to new mainline). In addition to splice into the main line tracer wire, ground rod should be installed near each service tap.

2. Sewer Mains: Sewer Services at limits of right-of-way (new or reconnection to a new mainline), and manholes installed or incorporated into the improvements.

3. If storm sewer includes service laterals for connection of private drains, underdrains, etc. it shall have same requirements as a sanitary sewer application.

PART 3– EXECUTION

3.1 Installation

A. Detectable Marking Tape:

1. Place nine (9) to twelve (12) inches below finished grade (for 3-inch wide tape) directly above installed utility pipe with printed side up during backfill procedure. Tape shall not be pulled, distorted, or otherwise misplaced during completion of the trench backfill.

B. Non-Detectable Marking Tape:

1. Place six (6) to twelve (12) inches below finished grade directly above installed utility pipe with printed side up during backfill procedure. Tape shall not be pulled, distorted, or otherwise misplaced during completion of the trench backfill.

C. Tracer Wire:

1. Trace wire installation shall be performed in such a manner that allows proper access for connection of line tracing equipment, proper locating of wire without loss or deterioration of low frequency signal for distances in excess of one thousand (1000) lineal feet, and without distortion of signal caused by multiple wires being installed in close proximity to one another.

2. Trace wire systems must be installed as a single continuous wire, except where using approved connectors.

3. Install continuously along the top of installed utility pipe (conductive & non-conductive) and attach securely every five (5) feet with electrical tape or zip ties. A mainline trace wire must be installed, with all no service lateral trace wires connected to the mainline trace wire. Alternatively, new construction, scrape, or full replacement require a grounding rod be installed near the service lateral connection to the mainline and tracer wire installed to the house, for water, or to the cleanout, for sanitary sewer.

4. Make splices in the wire only by use of an underground-rated, watertight, and approved splice connector. Do not twist wire ends. Do not wrap tracer wire around the pipe, flanges, bells, valves, or other appurtenances. All mainline trace wires must be interconnected in intersections, at mainline tees and mainline crosses. At tees, three wires shall be joined using a single 3-way lockable connector. At crosses the four wires shall be joined using a 4-way connector. When an existing trace wire is encountered when connecting to an existing utility, the new trace wire and existing trace wire shall be connected using approved splice connectors and shall be properly grounded as required.

5. Tracer wire shall be accessible above ground at least every five hundred (500) feet. **Valve boxes shall not be used for accessibility due to maintenance activities.**

6. Electrical conductivity along the pipe shall be continuous and uninterrupted between valve boxes.

7. At each access point, provide sufficient excess length of wire such that the wire can be extended at least two (2) feet above finished grade for connection to locating equipment.

8. Grounding: Trace wire must be properly grounded at all dead ends/stubs. Grounding of trace wire shall be achieved by use of a drive-in grounding rod with a minimum of twenty (20) feet of #12 red HDPE insulated copper clad steel wire connected to anode (minimum 1.5 lb.) specifically manufactured

for this purpose and buried at the same elevation as the utility.

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

b) When grounding the trace wire in areas where the trace wire is continuous and neither the mainline trace wire or the grounding anode wire will be terminated at/above grade, install grounding anode directly beneath and in-line with the trace wire. Do not coil excess wire from grounding anode. In this installation method, the grounding anode wire shall be trimmed to an appropriate length before connecting to trace wire with a mainline to lateral lug connector.

c) Where the anode wire will be connected to a trace wire access box, a minimum of two (2) feet of excess/slack wire is required after meeting final elevation.

10. Any damage occurring during installation of the trace wire must be immediately repaired by removing the damaged wire and installing a new section of wire with approved connectors. Taping and/or spray coating shall not be allowed.

3.2 Field Quality Control

A. Tracer Wire Testing

1. Contractor shall perform locate on new trace wire installations using typical low frequency line tracing equipment in the presence of the City/Engineer prior to acceptance.

END OF SECTION

SECTION 16

STANDARD DETAILS

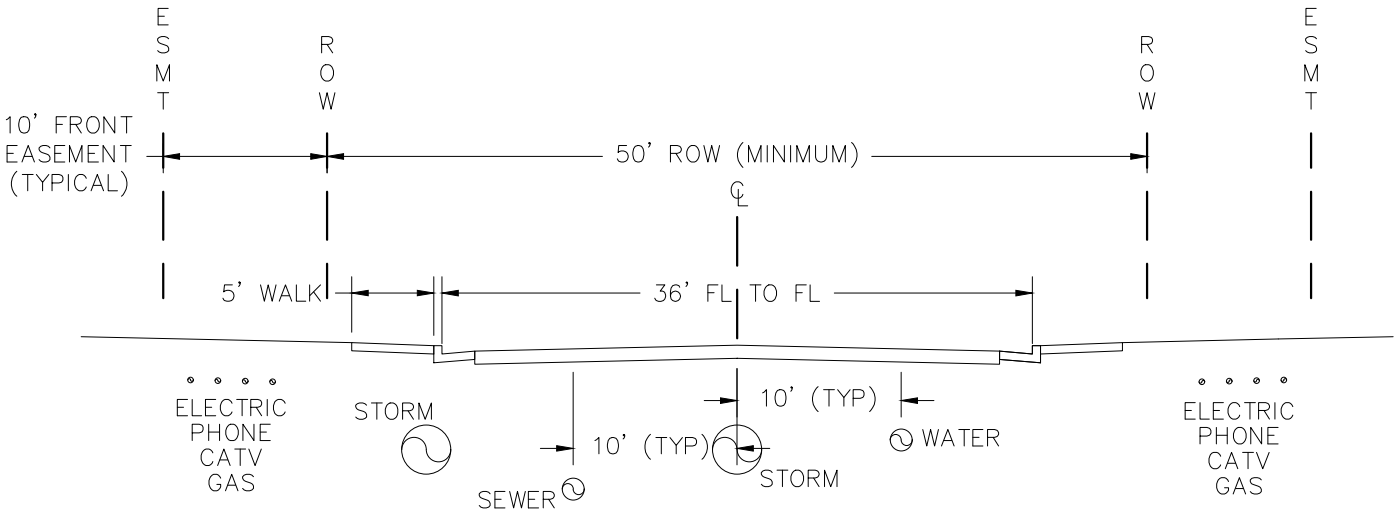
Number	Description	Number	Description
UT-1	Typical Utility Location	UT-3(A-G)	Tracer Wire
UT-2	Abandonment of Water & Sewer Service Lines		

SANITARY SEWER

S-1(A-C)	Precast Manhole	S-10	Manhole Marker
S-2	Stub-out Manhole	S-11	Standard Bedding
S-3	Manhole Base Deflector	S-12A	Special Bedding
S-4	Outside Drop Manhole 15” & Smaller	S-12B	Special Bedding for Expansive Soils
S-5	Outside Drop Manhole 18” & Larger	S-13	Sanitary Sewer Service
S-6	Intermediate Platform	S-14	Sewer Service Line Cleanout
S-7	24” Manhole Ring & Cover	S-15	Pipe Casing & Sled
S-8	24” Ring & Bolt Down Cover	S-16	Concrete Encasement
S-9	Plastic Manhole Step	S-17	Manhole Abandonment

WATER

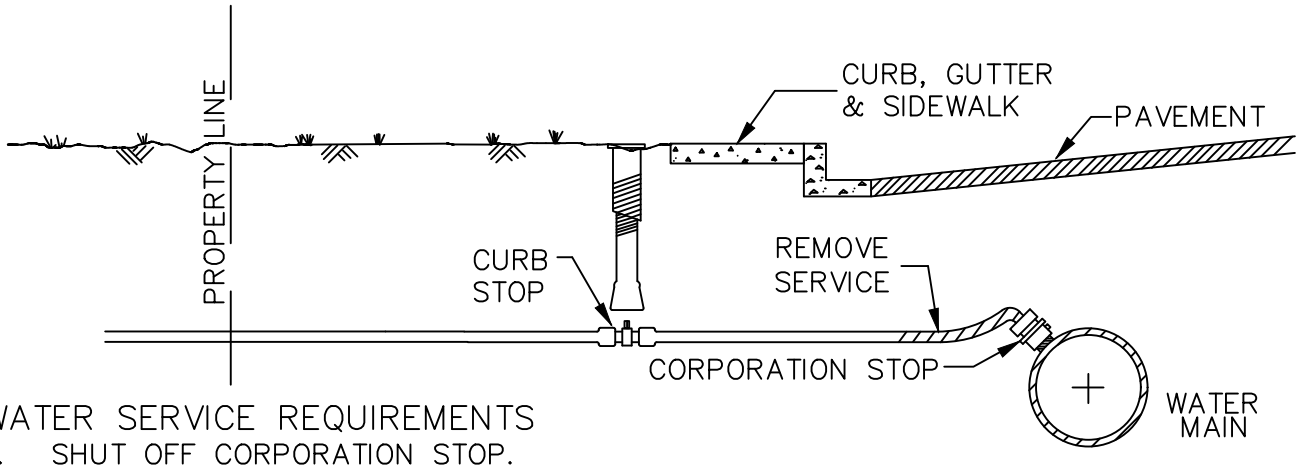
W-1(A-C)	Valves	W-12C	Outside Setting for ¾” & 1” Meter
W-2	Fire Hydrant Assembly	W-13	Polyethylene Wrap
W-3	Water Marker	W-14(A-B)	Meter Notes
W-4	Blow-off Assembly 12” Mains & Smaller	W-15	Outside Meter Setting, 1½” & 2” w/ Check Valve & Bypass in Manhole
W-5(A-B)	Concrete Kickblocks	W-16	Remote Reading ¾” & 1” Meter Inside Setting
W-6	Concrete Thrust Block	W-17	Inside Meter Setting for 1½” & 2” w/ Bypass & BFP
W-7	Length of Restrained Pipe	W-18(A-E)	Backflow Prevention
W-8	Air & Vacuum Valve	W-19	Irrigation Outside Setting for 2” & Smaller RPPA in Enclosure
W-9	Vent Pipe Assembly	W-20	Tapping Tee & Valve
W-10	Crossing: Storm & Sanitary Sewer	W-21	Domestic Water Tapping
W-11	Water Line Crossing	W-22	Pipe Abandonment
W-12A	Water Service Profile	W-23	Vault Abandonment
W-12B	¾” & 1” Service Line, Stop Box, & Outside Meter		



NOTES:

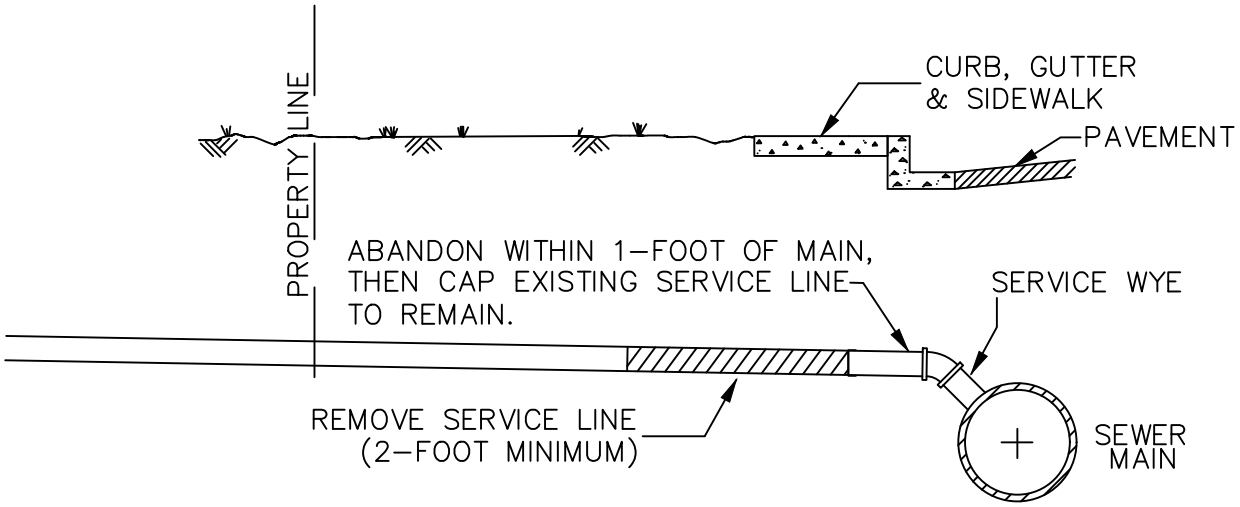
1. STREET SECTION IS TYPICAL.
2. SECTION IS EAST OR NORTH TO THE RIGHT.
3. MINIMUM DEPTH OF COVER PER STANDARDS.
4. STORM SEWER AT CENTERLINE OR UNDER SIDEWALK.
5. FRONT LOT EASEMENT MAY VARY.
6. DRY UTILITIES ARE WITHIN FRONT LOT EASEMENT.
7. FOR DRY UTILITIES, REFERENCE ALL APPLICABLE PROVISIONS IN CHAPTERS 11 AND 17 OF THE GOLDEN MUNICIPAL CODE AND CHAPTER, LATEST EDITION.
8. MINIMUM SEPARATION: 10-FT (TYP)

APPROVED DIRECTOR OF PUBLIC WORKS	CITY OF GOLDEN DEPARTMENT OF PUBLIC WORKS	TYPICAL UTILITY LOCATION
APPROVED CITY ENGINEER		SCALE: NTS DATE: JAN 2022 DETAIL NO. UT-1



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 AND DAMAGE THREAD TO POINT THAT IS NOT REUSABLE. REMOVE AND REPAIR/REPLACE DAMAGED CURB, GUTTER, AND SIDEWALK. CONTRACTOR MUST REMOVE FULL STONES AS NECESSARY.
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.
8. IF DIRECT TAP AND PIPE IS DAMAGED, A REPAIR CLAMP MUST BE INSTALLED.

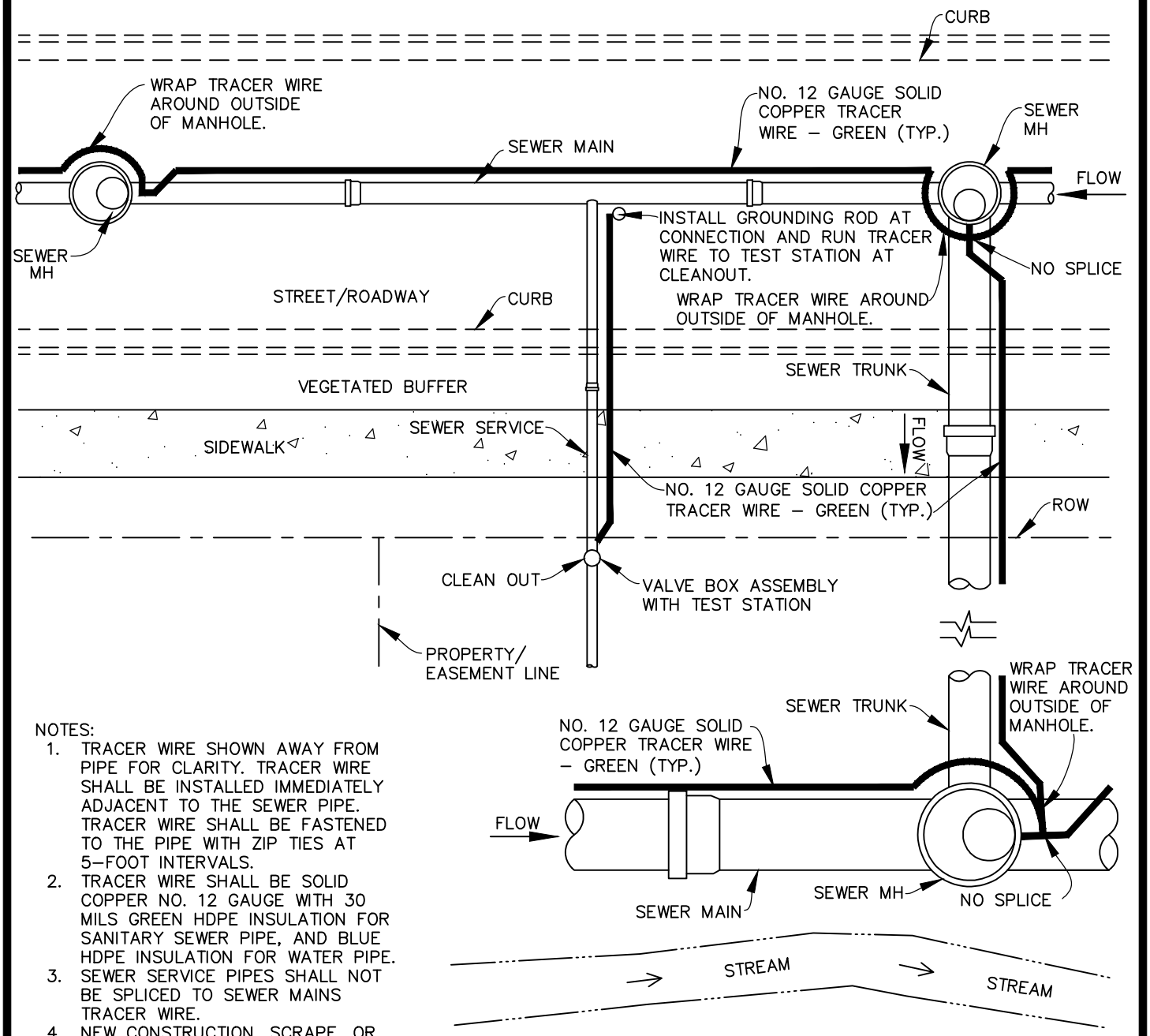


SEWER SERVICE REQUIREMENTS

1. CUT WITHIN 1–FOOT OF MAIN.
2. REMOVE A MINIMUM OF TWO FEET OF LINE.
3. CAP REMAINING SERVICE LINE.
4. DEMO WORK MUST BE INSPECTED PRIOR TO BACKFILL.
5. SANITARY TO BE ABANDONED AT MAIN. BREAK IN TAPS – REMOVE EXISTING CLAY TILE, INSTALL TAPPING SADDLE WITH CAP OR PLUG.

APPROVED DIRECTOR OF PUBLIC WORKS	**CITY OF GOLDEN**	ABANDONMENT OF WATER AND SEWER SERVICE LINES
APPROVED CITY ENGINEER	**DEPARTMENT OF PUBLIC WORKS**	SCALE: NTS DATE: JAN 2022 DETAIL NO. *UT-2*

STANDARD SEWER SYSTEM LAYOUT – STREET VIEW



NOTES:

1. TRACER WIRE SHOWN AWAY FROM PIPE FOR CLARITY. TRACER WIRE SHALL BE INSTALLED IMMEDIATELY ADJACENT TO THE SEWER PIPE. TRACER WIRE SHALL BE FASTENED TO THE PIPE WITH ZIP TIES AT 5–FOOT INTERVALS.
2. TRACER WIRE SHALL BE SOLID COPPER NO. 12 GAUGE WITH 30 MILS GREEN HDPE INSULATION FOR SANITARY SEWER PIPE, AND BLUE HDPE INSULATION FOR WATER PIPE.
3. SEWER SERVICE PIPES SHALL NOT BE SPLICED TO SEWER MAINS TRACER WIRE.
4. NEW CONSTRUCTION, SCRAPE, OR FULL REPLACEMENT REQUIRES TRACER WIRE TO BE INSTALLED FROM HOUSE TO CLEANOUT/TEST STATION FOR ALL WATER AND SANITARY SERVICES.

APPROVED
DIRECTOR OF PUBLIC WORKS

APPROVED
CITY ENGINEER

CITY OF GOLDEN

DEPARTMENT OF PUBLIC WORKS

TRACER WIRE
STANDARD SEWER SYSTEM LAYOUT

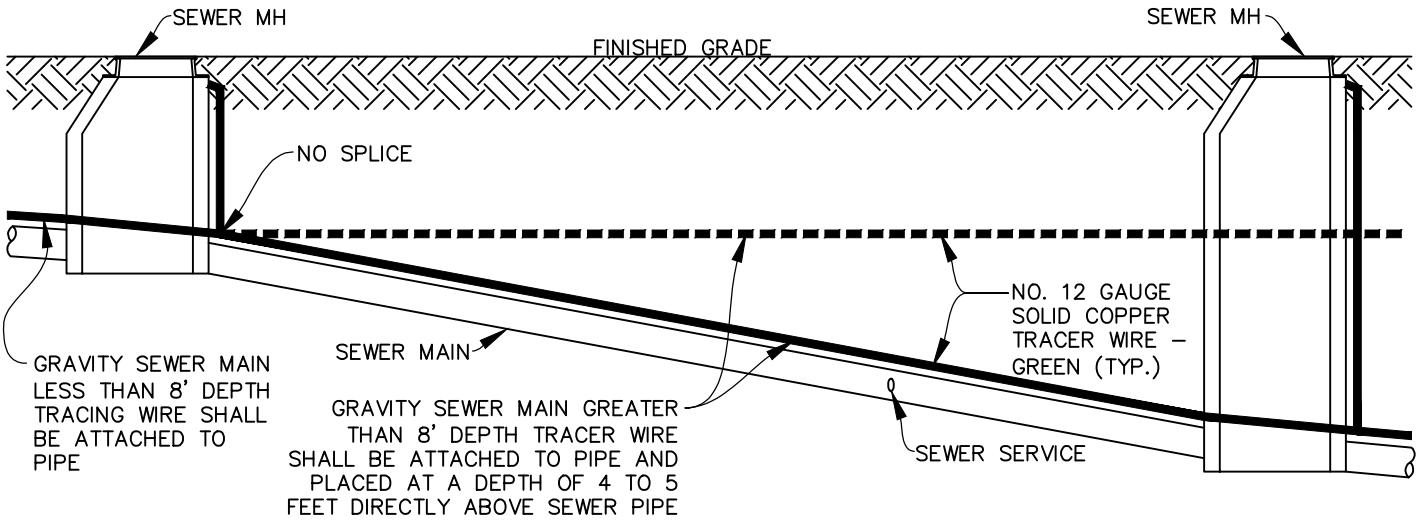
SCALE: NTS

DATE: JAN 2022

DETAIL NO. **UT-3A**

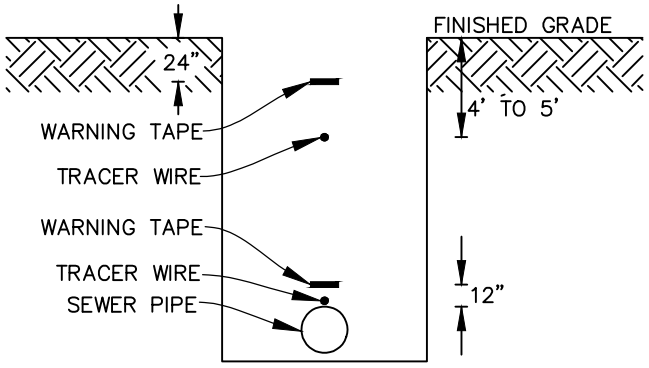
TRACER WIRE FOR GRAVITY SEWER DEEPER THAN 8 FT

SECTION VIEW



TRENCH DETAIL

PROFILE VIEW



APPROVED

DIRECTOR OF PUBLIC WORKS

APPROVED

CITY ENGINEER

CITY OF GOLDEN

DEPARTMENT OF PUBLIC WORKS

TRACER WIRE
FOR GRAVITY SEWER DEEPER THAN 8FT

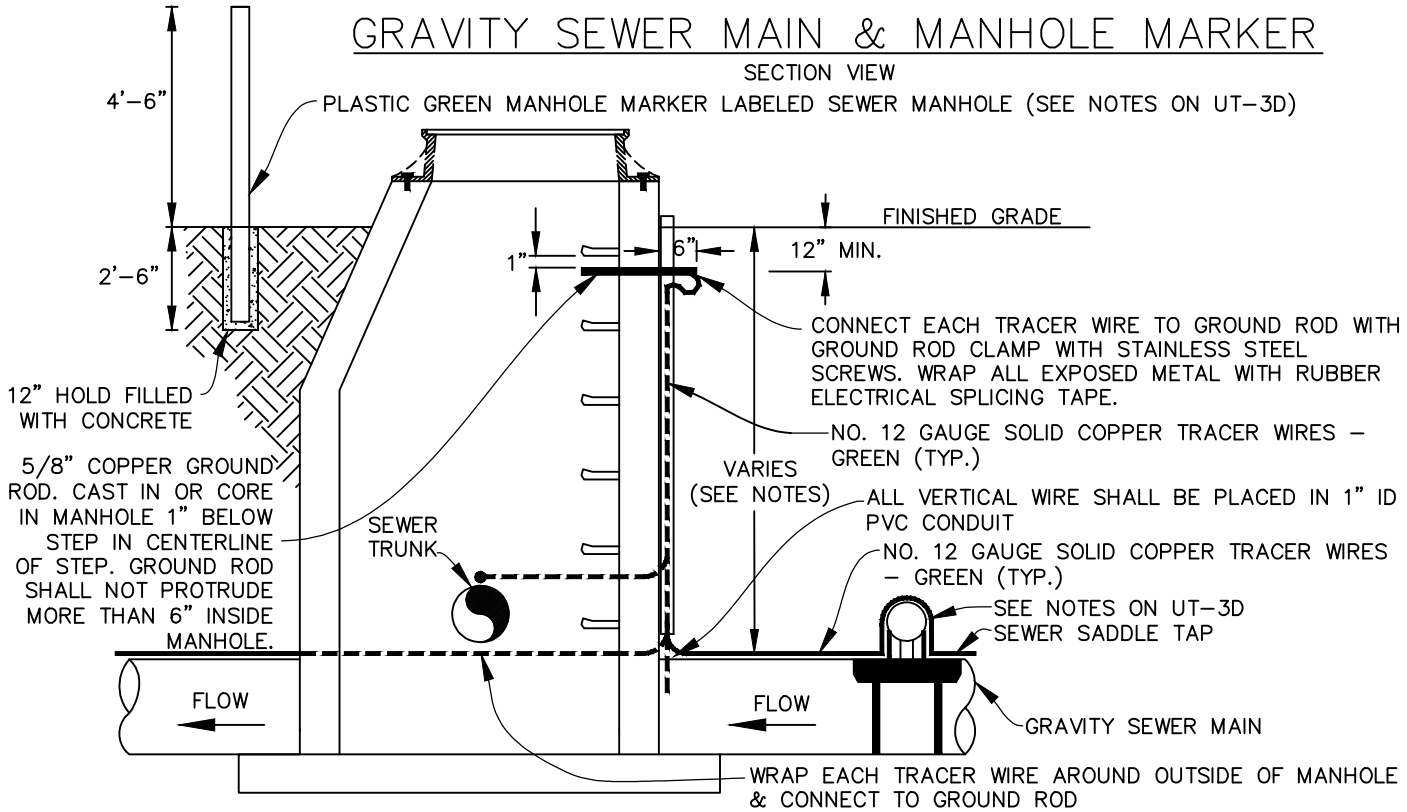
SCALE: NTS

DETAIL NO. UT-3B

DATE: JAN 2022

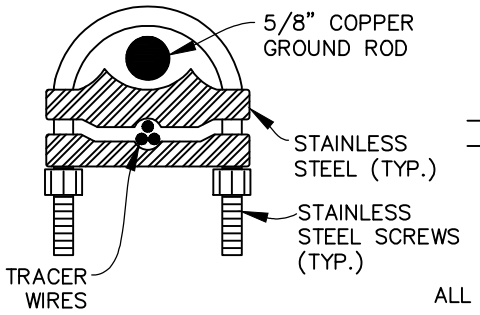
GRAVITY SEWER MAIN & MANHOLE MARKER

SECTION VIEW



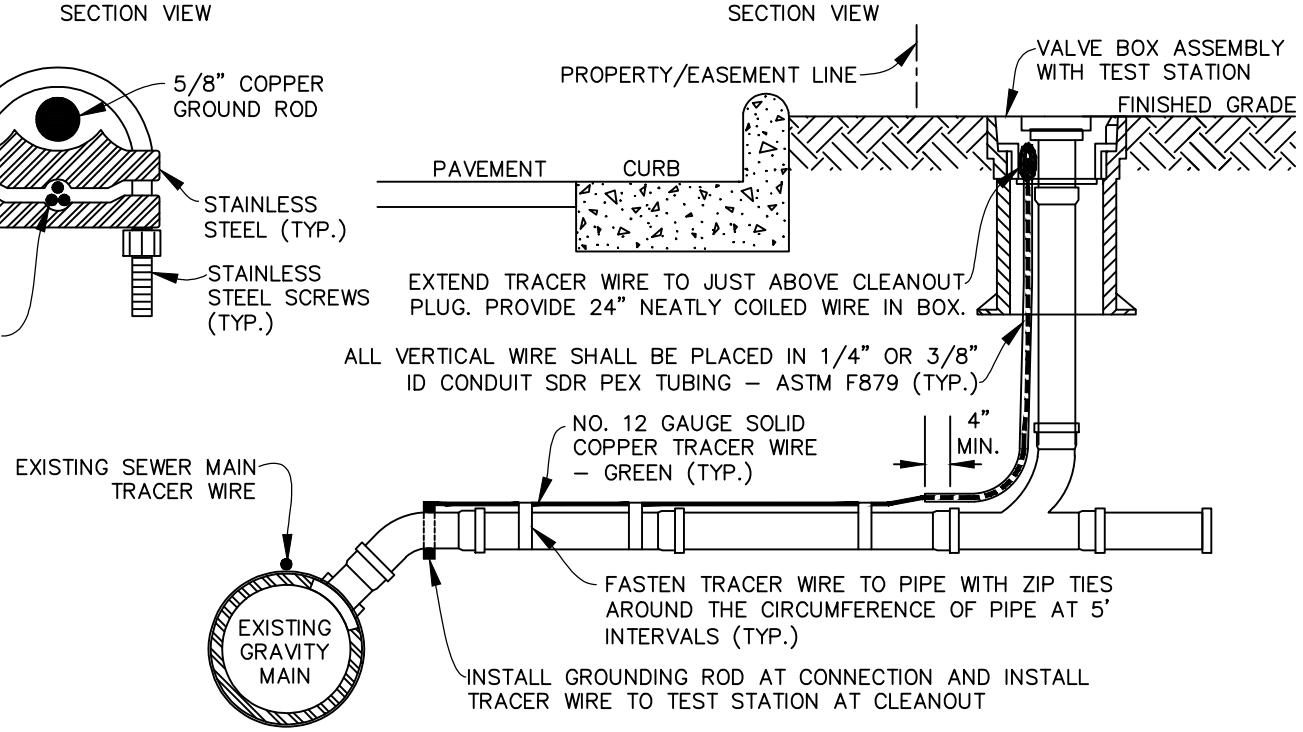
GROUND ROD CLAMP

SECTION VIEW



SERVICE CONNECTION

SECTION VIEW



APPROVED

DIRECTOR OF PUBLIC WORKS

APPROVED

CITY ENGINEER

CITY OF GOLDEN

DEPARTMENT OF PUBLIC WORKS

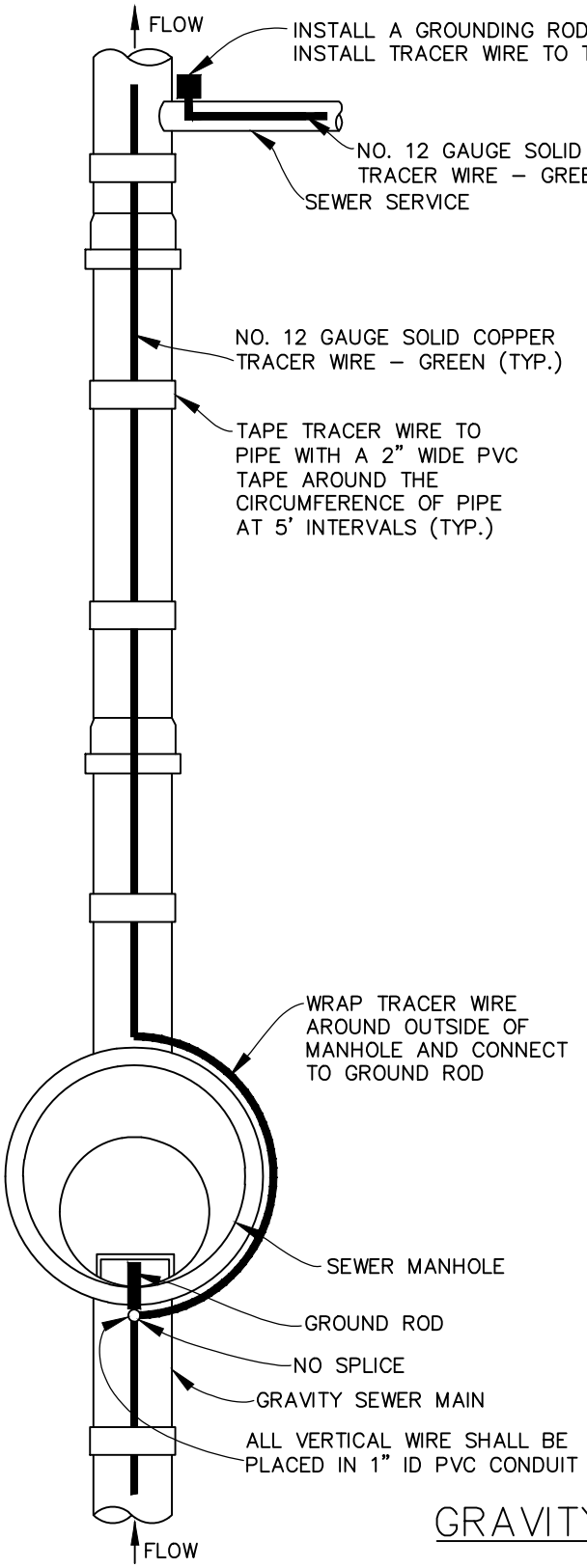
TRACER WIRE

GRAVITY SEWER MAIN & MH MARKER

SCALE: NTS

DATE: JAN 2022

DETAIL NO. **UT-3C**



NOTES:

1. TRACER WIRE SHALL BE AUG NO. 12 GAUGE SOLID COPPER WITH 30 MILS GREEN HDPE INSULATION.
2. FOR GRAVITY MAIN AND/OR LATERAL INSTALLATIONS LESS THAN 8 FEET, THE TRACING WIRE SHALL BE ATTACHED TO THE PIPE. TRACER WIRE SHALL BE LAID FLAT AND SECURELY AFFIXED TO THE PIPE AT 5 FOOT INTERVALS USING ZIP TIES. FOR GRAVITY MAIN AND/OR LATERAL INSTALLATION DEEPER THAN 8 FEET, THE TRACING WIRE SHALL BE ATTACHED TO THE PIPE AND PLACED AT A DEPTH OF 4 TO 5 FEET DIRECTLY ABOVE THE SEWER PIPE. THE WIRE SHALL BE PROTECTED FROM DAMAGE DURING THE EXECUTION OF THE WORK. NO BREAKS OR CUTS IN THE TRACER WIRE OR INSULATION SHALL BE PERMITTED.
3. WHERE LATERAL TAPS ARE MADE BY SERVICE SADDLES, THE TRACER WIRE SHALL NOT BE ALLOWED TO BE PLACED BETWEEN THE SADDLE AND MAIN.
4. SPLICES IN THE PRIMARY TRACER WIRE ALONG THE SEWER MAIN SHALL INCLUDE 3 FEET OF SLACK WIRE ON EACH SIDE OF THE SPLICE.
5. MANHOLE MARKERS SHALL BE PLACED ADJACENT TO MANHOLES AT THE DISCRETION OF THE CITY OF ENGINEER.

NOTES:

1. THE TRACER WIRE SHALL BE CONTINUOUS TO THE GREATEST EXTENT POSSIBLE. WHERE SPLICES ARE NECESSITATED IN THE WIRE, THE SPICES SHALL BE SECURELY BONDED TOGETHER WITH AN APPROVED INDUSTRIAL CONNECTOR TO PROVIDE ELECTRICAL CONTINUITY. CONNECTOR SHALL BE COPPER AND INSULATION SHALL BE REPAIRED TO SEAL OUT MOISTURE AND CORROSIONS AND SHALL BE INSTALLED IN A MANNER SO AS TO PREVENT ANY UNINSULATED WIRE EXPOSURE.
2. THE CLEANOUT AT THE RIGHT OF WAY AND/OR EASEMENT SHALL SERVE AS THE TEST PORT.
3. SPICED CONNECTIONS SHALL BE ALLOWED BETWEEN THE MAIN LINE TRACER WIRE AND THE LATERAL TRACER WIRE.
4. FOR NEW SEWER TAPS ON EXISTING MAINS VOID OF ANY TRACER WIRE, PROVIDE A GROUNDING ROD FOR THE TRACING WIRE TERMINATION AT THE POINT OF THE NEW TAP ON THE EXISTING SEWER MAIN. PLACE GROUNDING ROD AT BOTTOM EDGE OF TRENCH AWAY FROM MAIN & LATERAL.
5. PRIOR TO ACCEPTANCE EACH WIRE SEGMENT SHALL PASS A CONDUCTIVITY TEST, WITNESSED BY THE CITY.

GRAVITY SEWER MAIN

PLAN VIEW

APPROVED
DIRECTOR OF PUBLIC WORKS

APPROVED
CITY ENGINEER

CITY OF GOLDEN

DEPARTMENT OF PUBLIC WORKS

TRACER WIRE
GRAVITY SEWER MAIN

SCALE: NTS

DETAIL NO. UT-3D

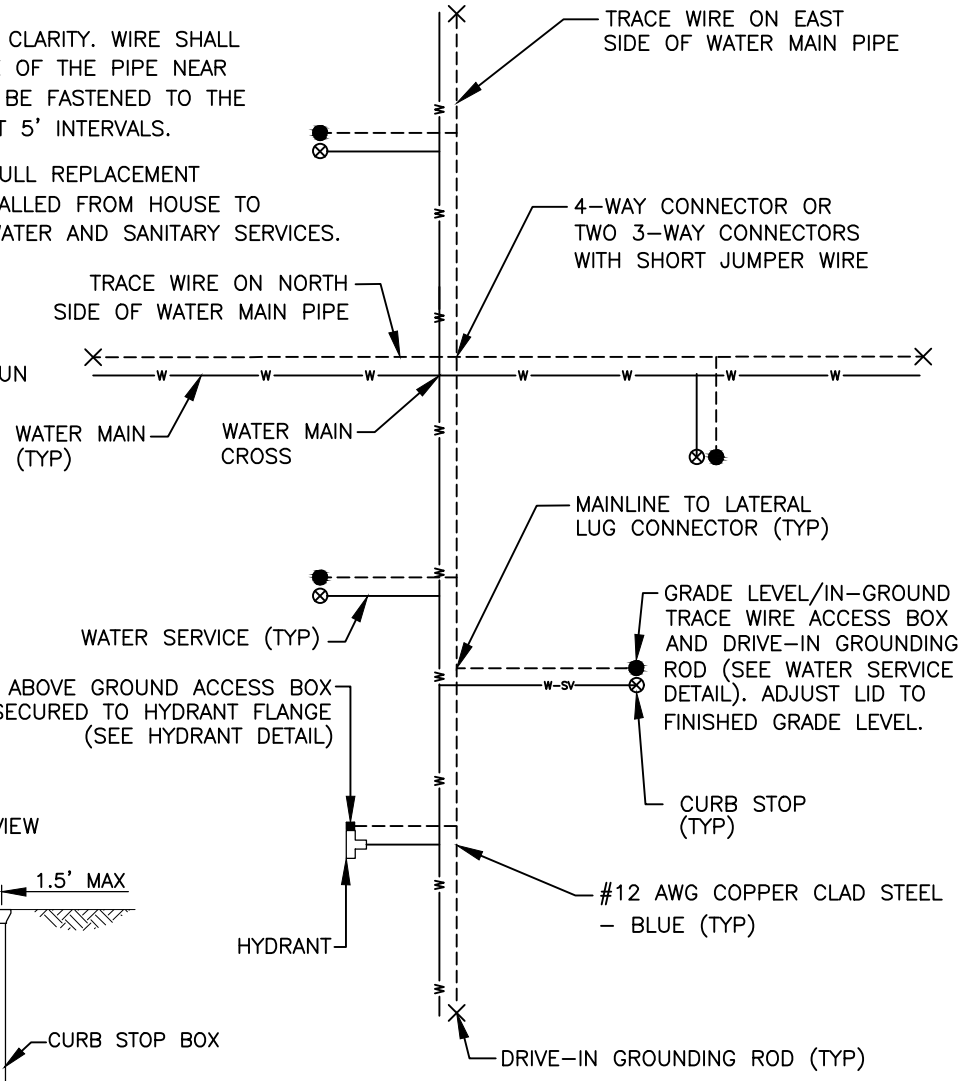
DATE: JAN 2022

STANDARD WATER SYSTEM LAYOUT

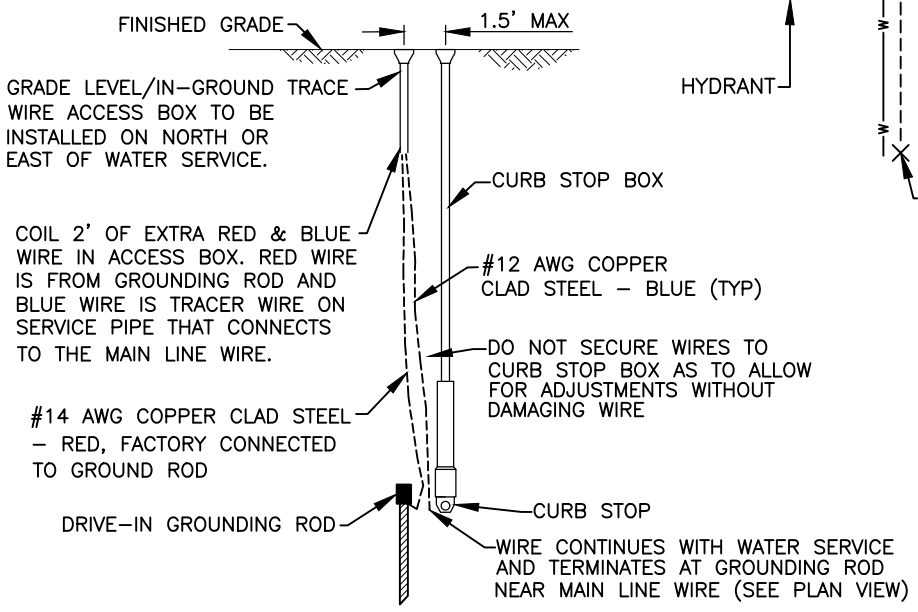
PLAN VIEW

NOTES:

1. WIRE SHOWN AWAY FROM PIPE FOR CLARITY. WIRE SHALL BE INSTALLED ON THE BOTTOM SIDE OF THE PIPE NEAR THE SPRING LINE. THE WIRE SHALL BE FASTENED TO THE PIPE WITH TAPE OR PLASTIC TIES AT 5' INTERVALS.
2. NEW CONSTRUCTION, SCRAPE, OR FULL REPLACEMENT REQUIRES TRACER WIRE TO BE INSTALLED FROM HOUSE TO CLEANOUT/TEST STATION FOR ALL WATER AND SANITARY SERVICES.
3. TRACER WIRE DESIGN SHALL INCORPORATE FIRE HYDRANT OR VALVE TRACER ACCESS TO MINIMIZE THE DISTANCE BETWEEN MAINLINE RUN ACCESS POINTS.

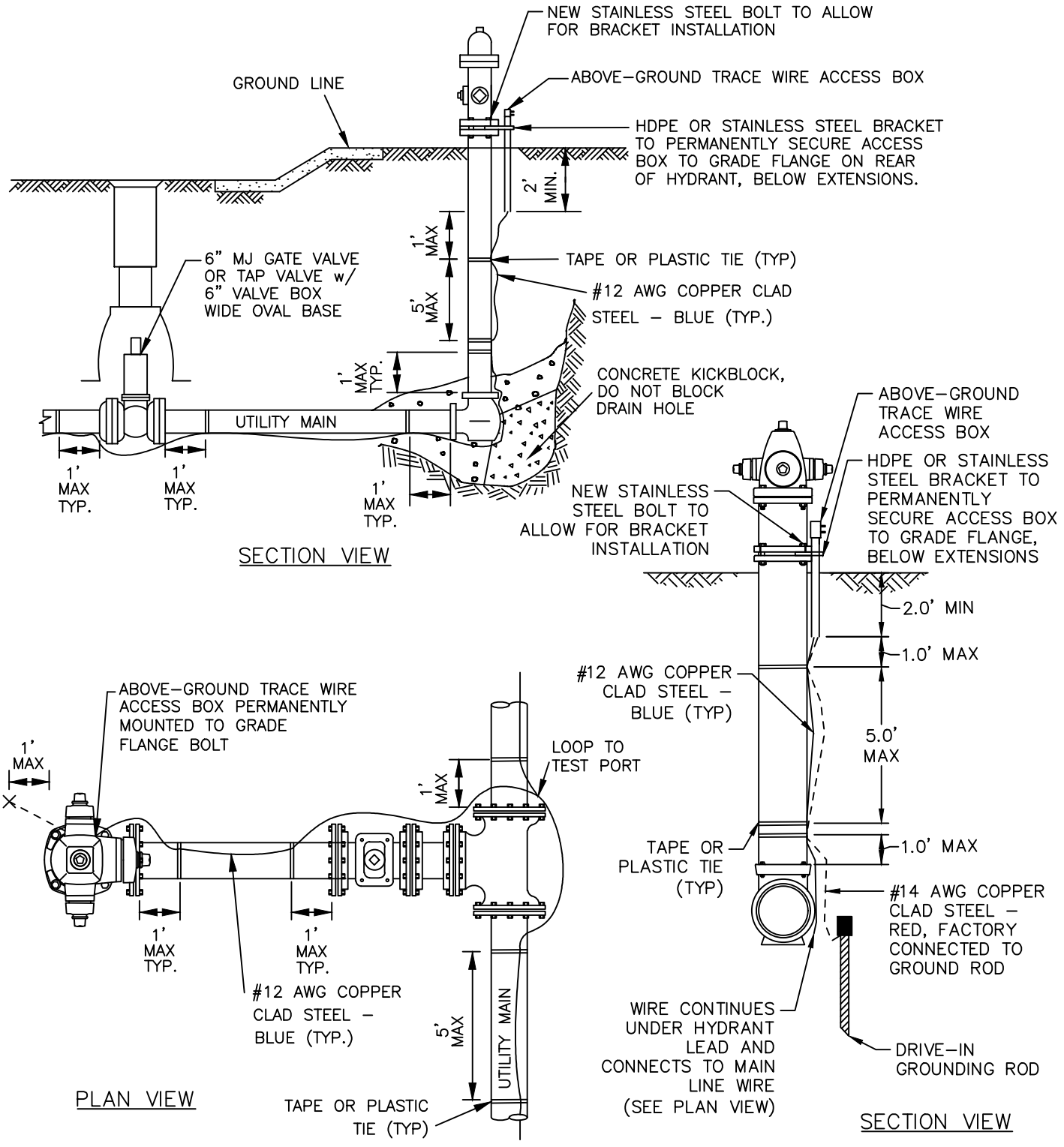


SECTION VIEW



APPROVED DIRECTOR OF PUBLIC WORKS	**CITY OF GOLDEN** **DEPARTMENT OF PUBLIC WORKS**	TRACER WIRE STANDARD WATER SYSTEM LAYOUT
APPROVED CITY ENGINEER		SCALE: NTS DATE: JAN 2022 DETAIL NO. UT-3E

FIRE HYDRANT CONNECTION & ACCESS BOX INSTALLATION



APPROVED
DIRECTOR OF PUBLIC WORKS

APPROVED
CITY ENGINEER

CITY OF GOLDEN

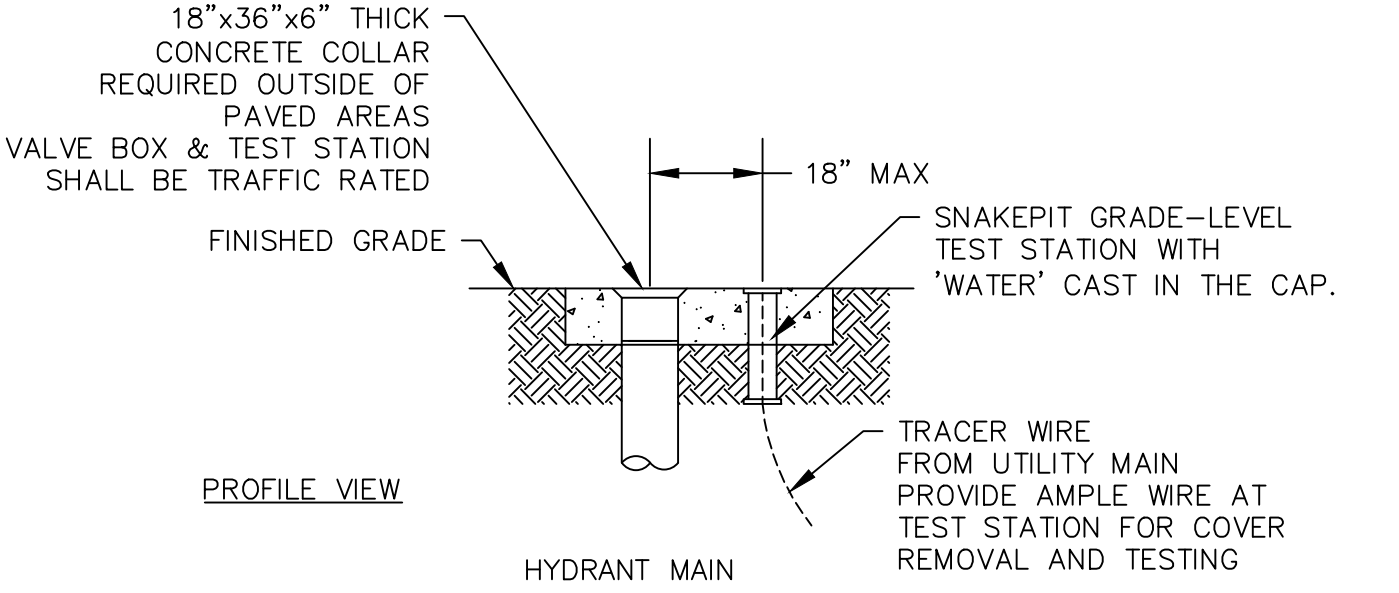
DEPARTMENT OF PUBLIC WORKS

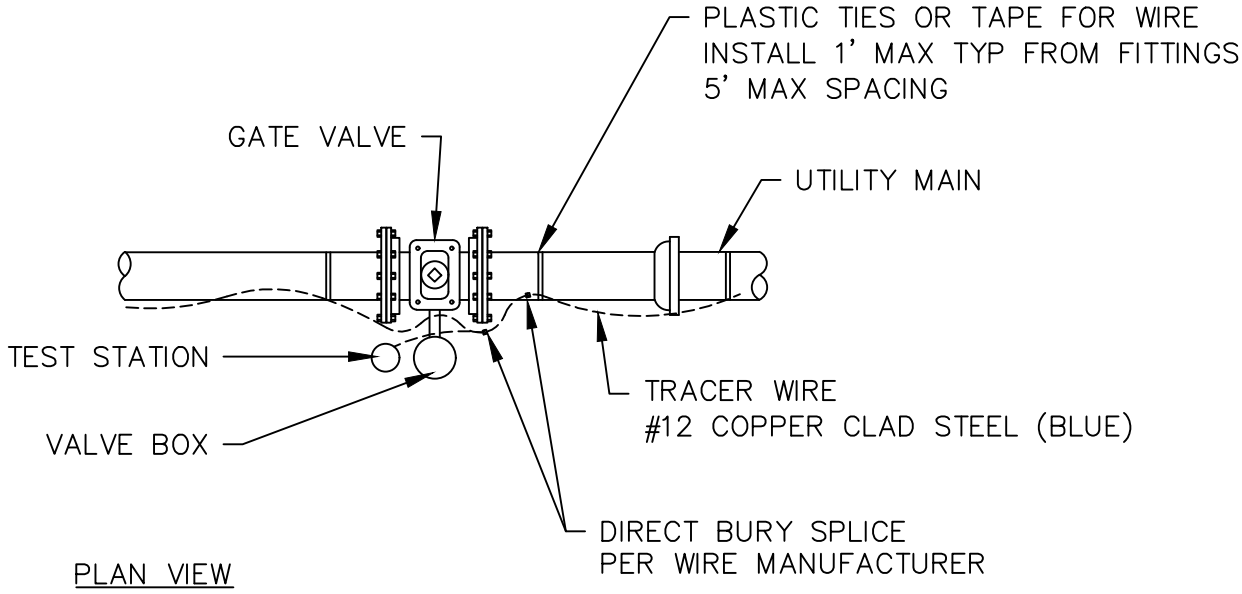
TRACER WIRE
FH CONNECTION & ACCESS BOX INSTALLATION

SCALE: NTS

DATE: JAN 2022

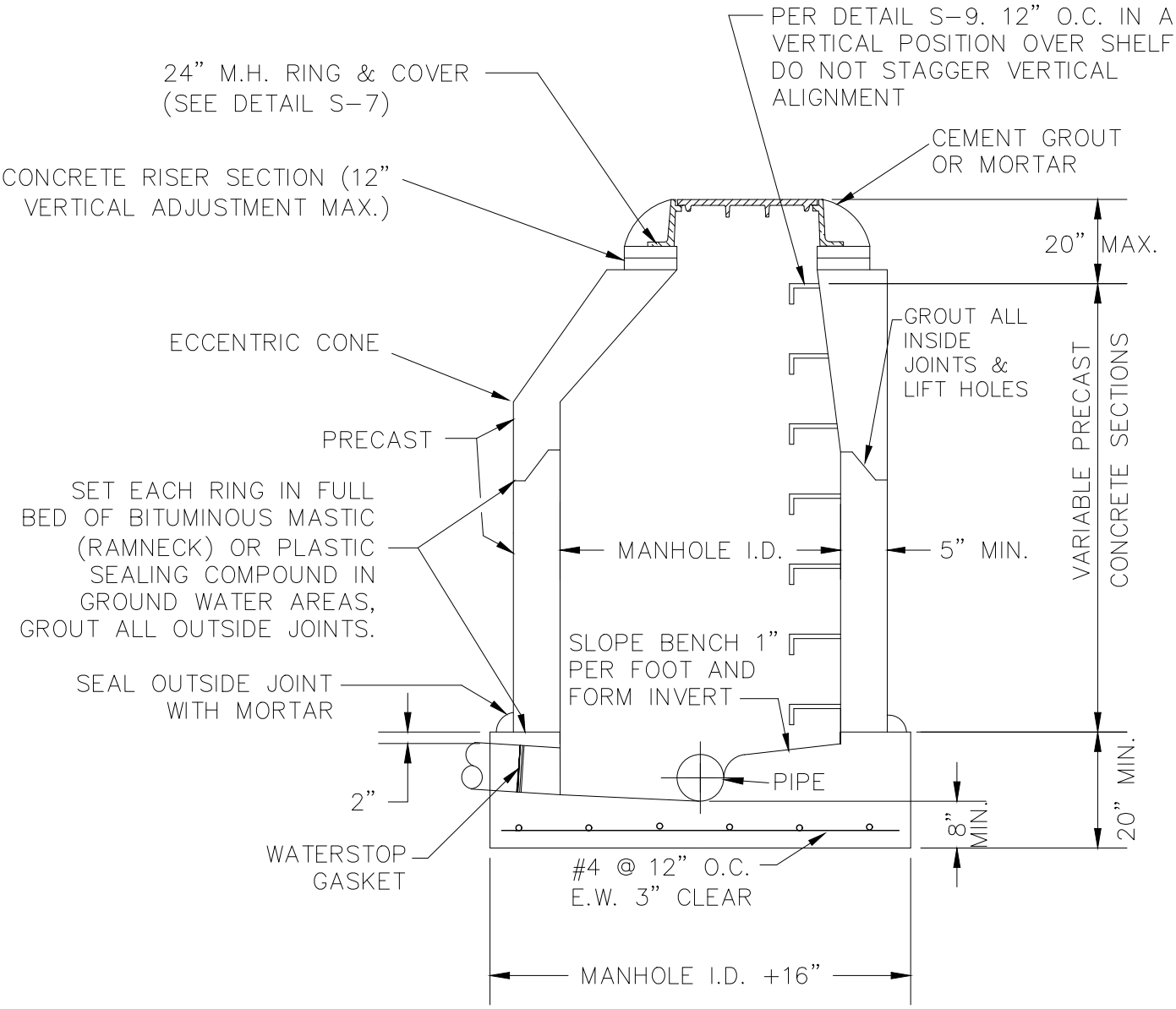
DETAIL NO.
UT-3F





NOTE: THIS DETAIL TYPICALLY APPLIES TO WATER MAINS WITH VERY FEW HYDRANTS, OR OTHER TRACER WIRE ACCESS POINTS/TEST STATIONS.

APPROVED DIRECTOR OF PUBLIC WORKS	**CITY OF GOLDEN**	TRACER WIRE TEST STATION
APPROVED CITY ENGINEER	**DEPARTMENT OF PUBLIC WORKS**	SCALE: NTS DATE: JAN 2022 DETAIL NO. *UT-3G*



MANHOLE BARREL MINIMUM DIAMETER SHALL CONFORM TO THE FOLLOWING TABLE:

PIPE I.D.	MANHOLE I.D.	R. & C.
18" & SMALLER	4'-0"*	24"
21" TO 30"	5'-0"	30"
33" TO 42"	6'-0"	30", 36" w/ 24" INNER-COVER
60" & LARGER	SPECIAL DESIGN	

*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.

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APPROVED
CITY ENGINEER

CITY OF GOLDEN
DEPARTMENT OF PUBLIC WORKS

PRECAST MANHOLE

SCALE: NTS

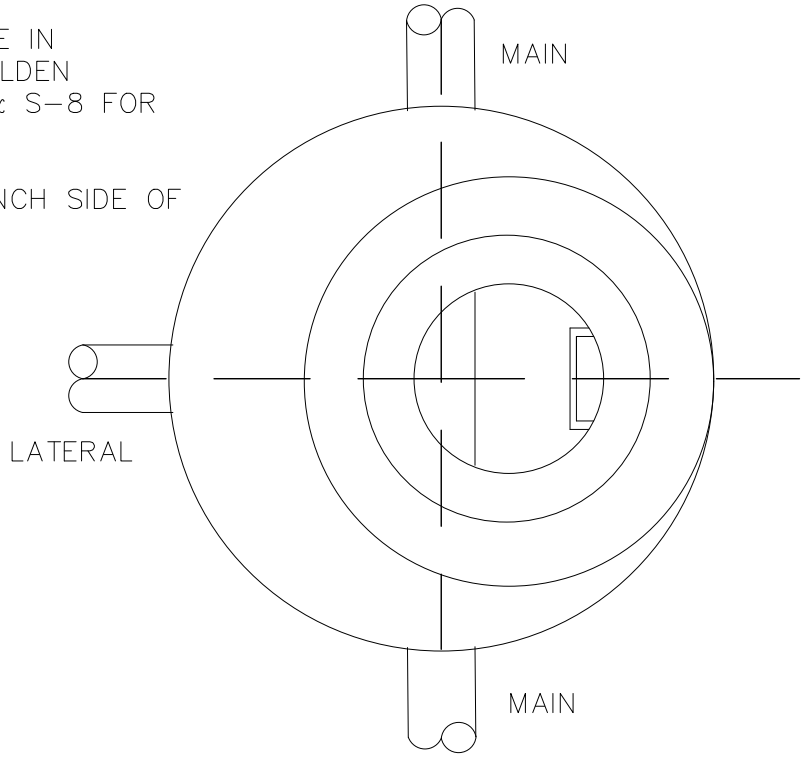
DATE: JAN 2022

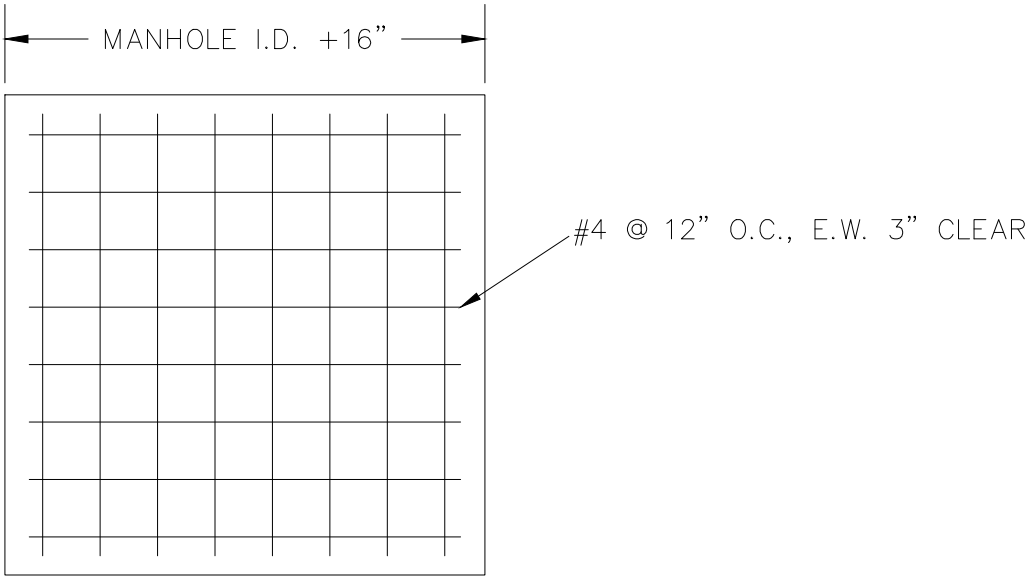
DETAIL NO. S-1A

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.





PRECAST MANHOLE BASE
PLAN VIEW

APPROVED
DIRECTOR OF PUBLIC WORKS

APPROVED
CITY ENGINEER

CITY OF GOLDEN

DEPARTMENT OF PUBLIC WORKS

PRECAST MANHOLE
(PLAN VIEW)

SCALE: NTS

DATE: JAN 2022

DETAIL NO.
S-1B

GENERAL PRECAST MANHOLE NOTES

1. MANHOLE BARREL MINIMUM DIAMETER SHALL CONFORM TO THE TABLE ON DETAIL S–1A.

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.

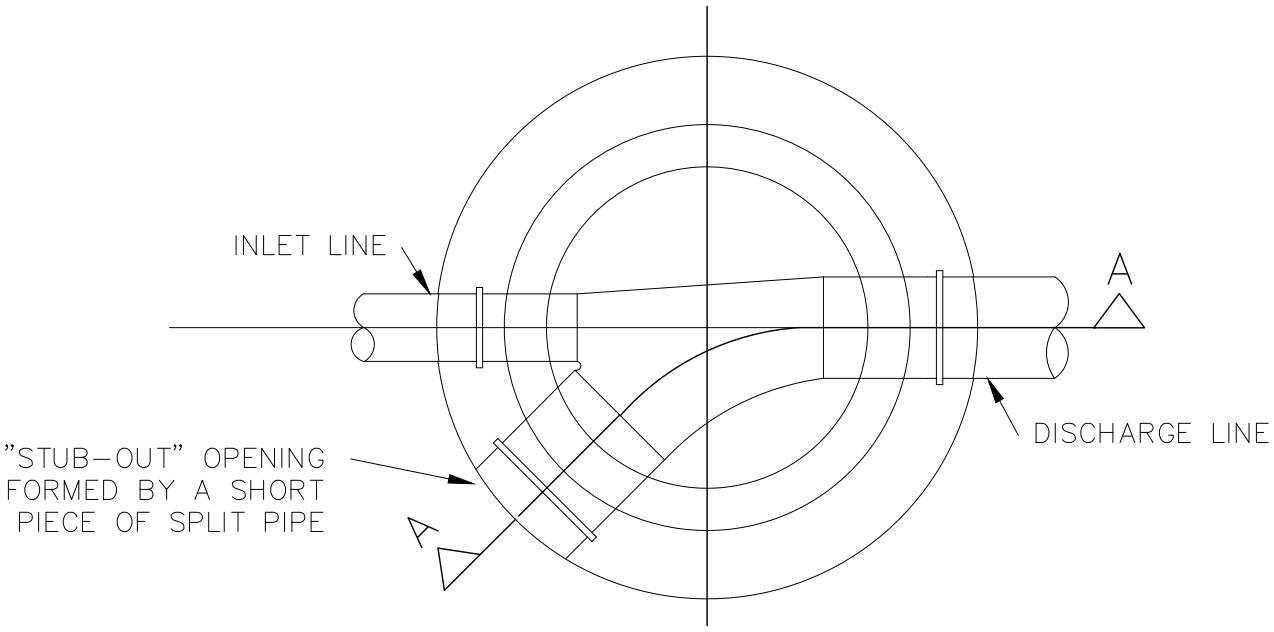
6. CONCRETE MANHOLES MAY BE POURED IN PLACE ONLY WITH PRIOR APPROVAL.

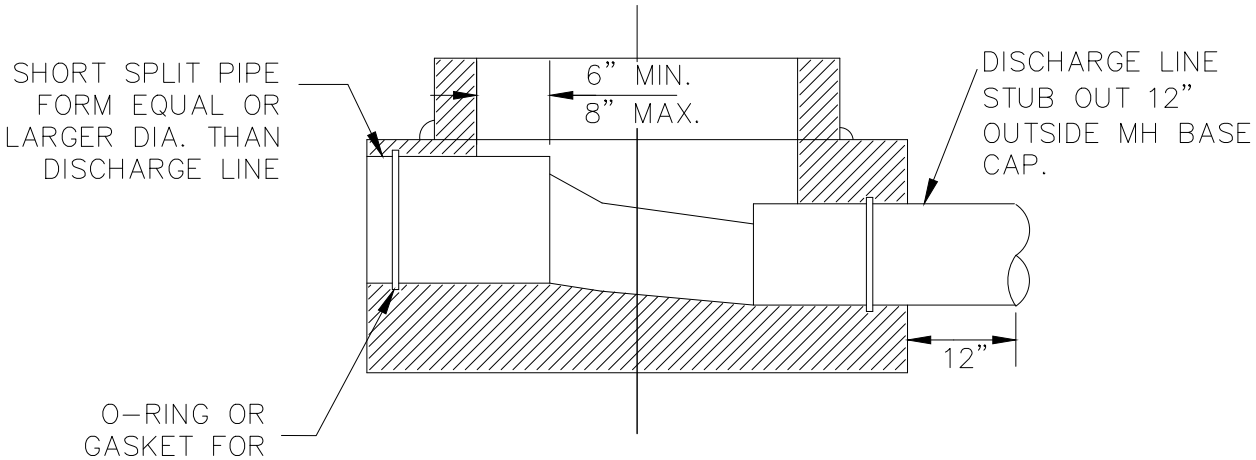
7. ALL MORTAR GROUT SHALL BE MIXED WITH TYPE II CEMENT.

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 4–7 MIL PER COAT WITH A MINIMUM OF 2 LAYERS APPLIED, PER MANUFACTURERS SPECIFICATIONS.

APPROVED DIRECTOR OF PUBLIC WORKS	CITY OF GOLDEN DEPARTMENT OF PUBLIC WORKS	PRECAST MANHOLE NOTES
APPROVED CITY ENGINEER		SCALE: NTS DATE: JAN 2022 DETAIL NO. S-1C





SECTION A-A

APPROVED
DIRECTOR OF PUBLIC WORKS

APPROVED
CITY ENGINEER

CITY OF GOLDEN

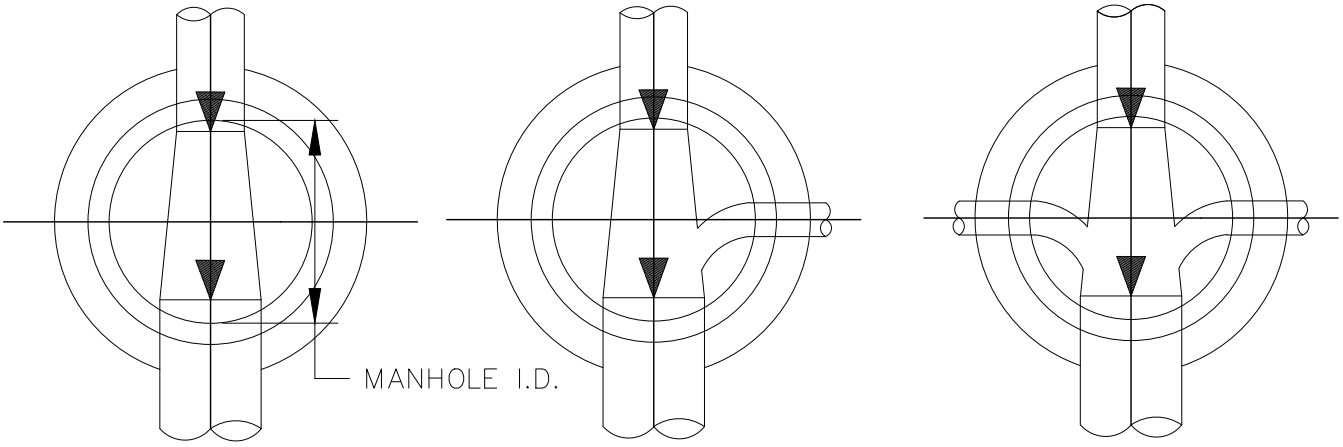
DEPARTMENT OF PUBLIC WORKS

STUB-OUT MANHOLE

SCALE: NTS

DATE: JAN 2022

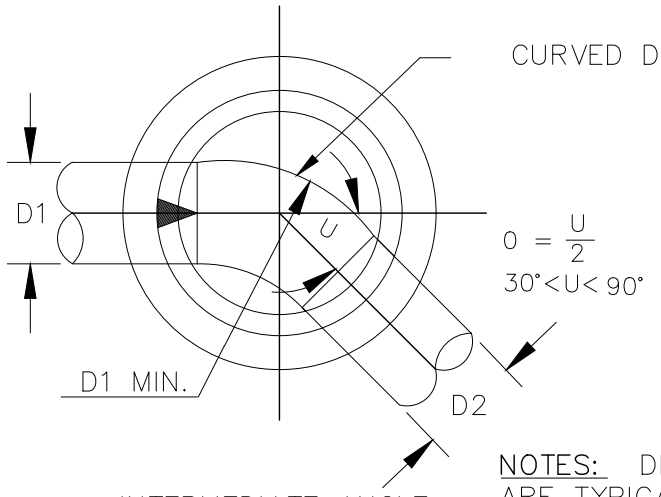
DETAIL NO. S-2



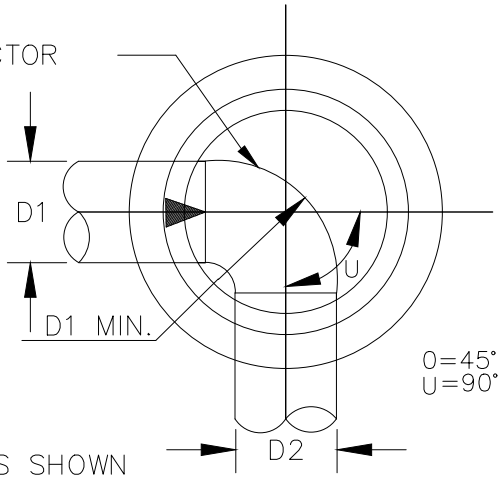
THROUGH PIPE

THROUGH PIPE
ONE COLLECTION LINE

THROUGH PIPE
TWO COLLECTION LINES

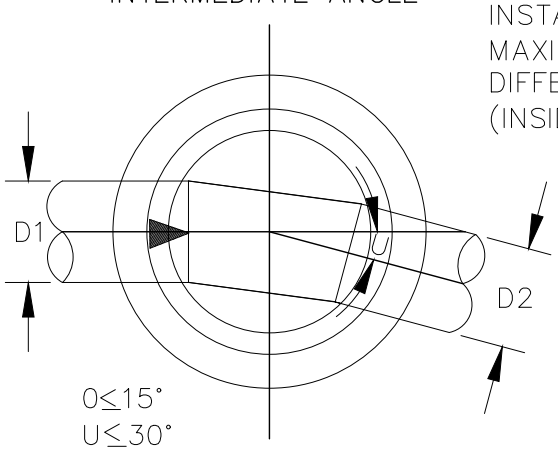


INTERMEDIATE ANGLE

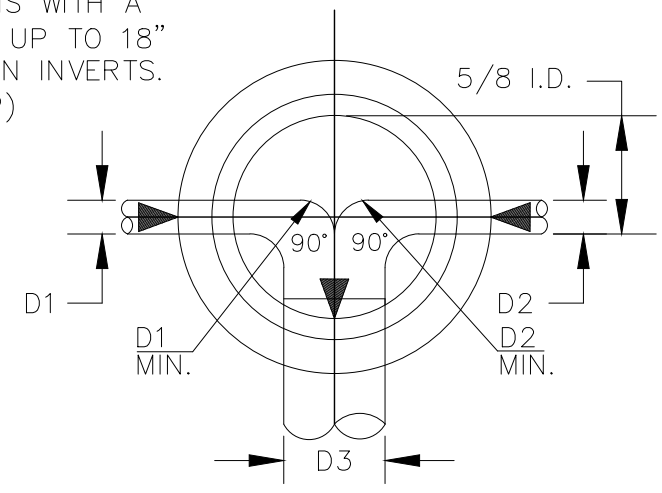


SHARP ANGLE

NOTES: DETAILS SHOWN ARE TYPICAL ONLY FOR INSTALLATIONS WITH A MAXIMUM OF UP TO 18" DIFFERENCE IN INVERTS. (INSIDE DROP)



INTERMEDIATE ANGLE



OPPOSED LATERALS

APPROVED
DIRECTOR OF PUBLIC WORKS

APPROVED
CITY ENGINEER

CITY OF GOLDEN

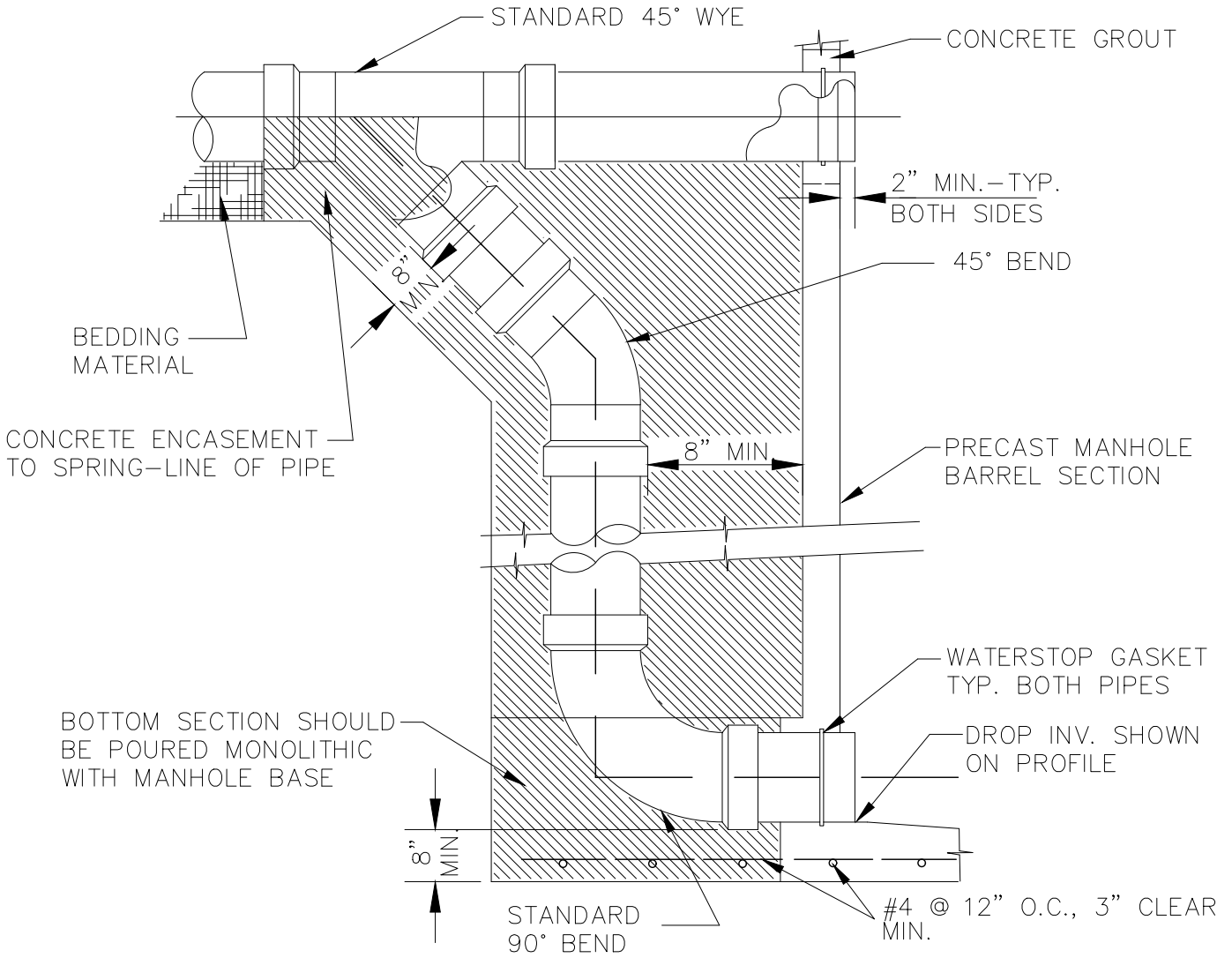
DEPARTMENT OF PUBLIC WORKS

MANHOLE BASE DEFLECTOR

SCALE: NTS

DATE: JAN 2022

DETAIL NO. S-3



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 SIKAGARD 62 (4–7 MIL PER COAT, MIN. 2 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 (#4 @ 18" O.C. – 3" CLEAR) IN ADDITION TO THE REINFORCEMENT SHOWN.

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

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DIRECTOR OF PUBLIC WORKS

APPROVED
CITY ENGINEER

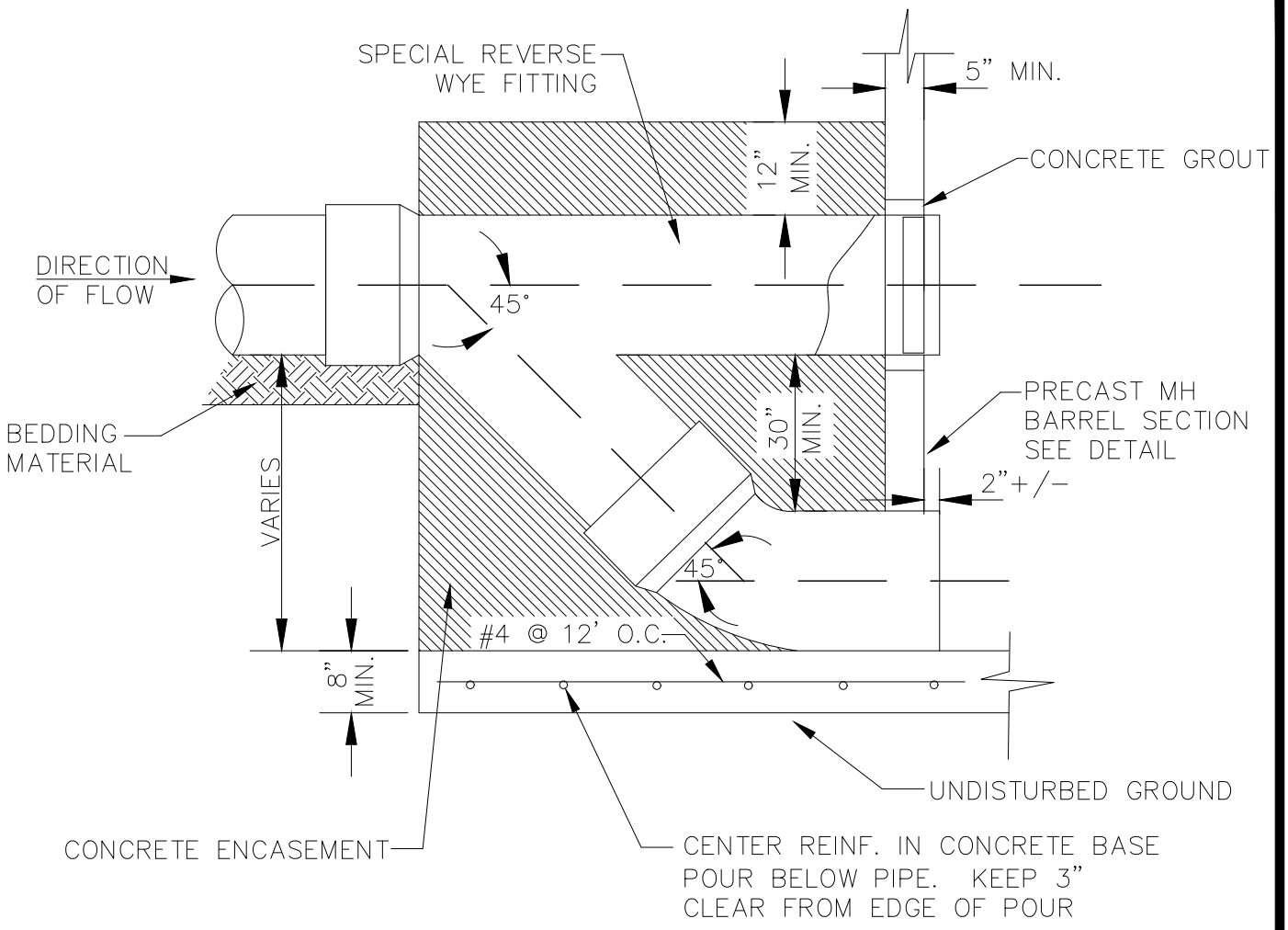
CITY OF GOLDEN
DEPARTMENT OF PUBLIC WORKS

OUTSIDE DROP MANHOLE
15 INCH & SMALLER

SCALE: NTS

DATE: JAN 2022

DETAIL NO. S-4



NOTES:

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

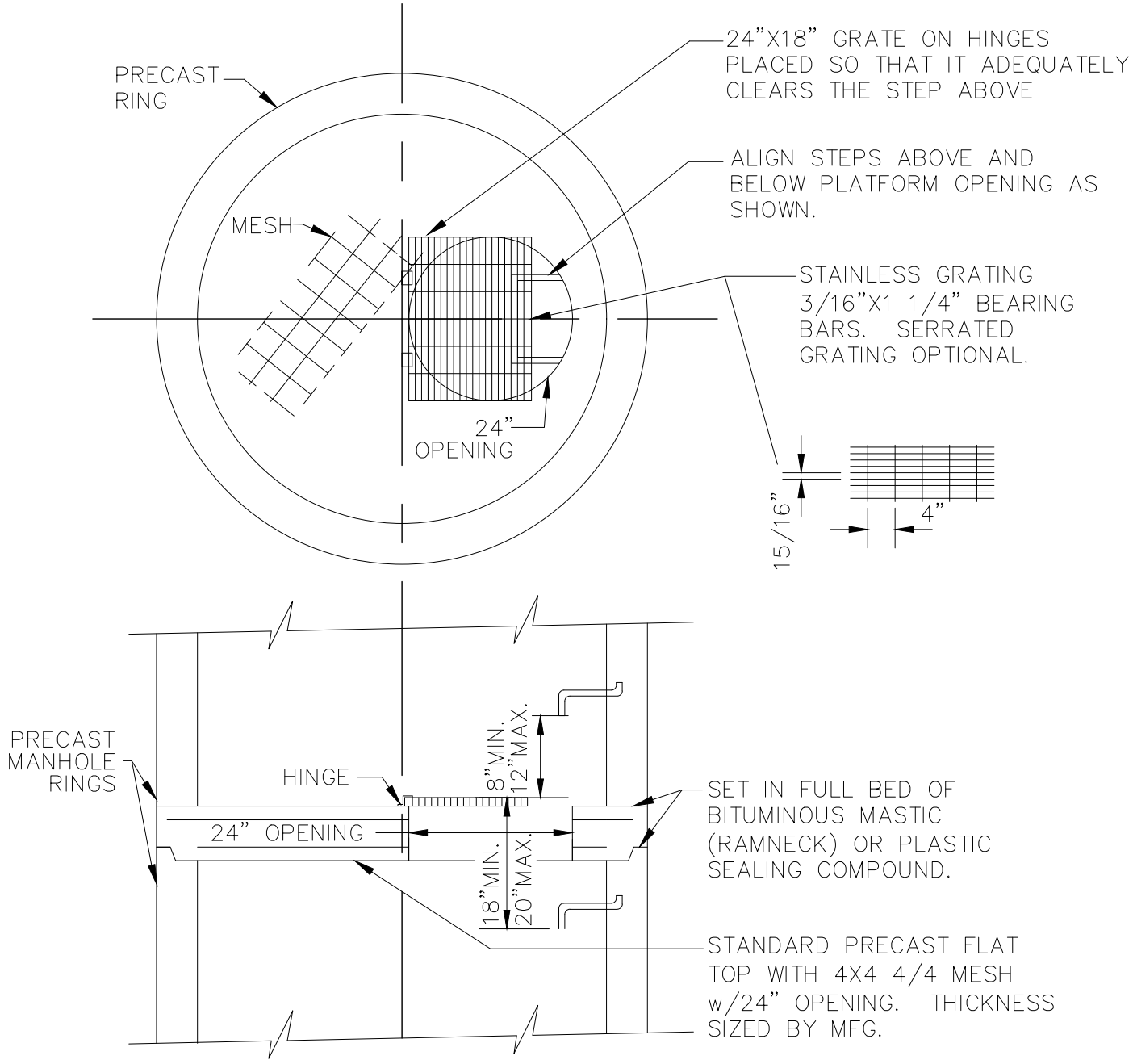
2. CONCRETE ENCASEMENT SHALL BE CLASS II TYPE III VIBRATED AND POURED MONOLITHIC WITH MANHOLE BASE – MIN. 8" THICK ALL AROUND DROP.

3. ALL DROP 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 ENCASEMENT IN ADDITION TO THE REINFORCEMENT SHOWN.

5. MAXIMUM ALLOWABLE DROP SHALL NOT EXCEED 5'–0".

APPROVED DIRECTOR OF PUBLIC WORKS	CITY OF GOLDEN DEPARTMENT OF PUBLIC WORKS	OUTSIDE DROP MANHOLE 18 INCH & LARGER
APPROVED CITY ENGINEER		SCALE: NTS DATE: JAN 2022 DETAIL NO. S-5



NOTE:
REQUIRED IN MANHOLES WHERE DEPTH MEASURED FROM RING TO INVERT EXCEEDS 20 FEET. CENTER PLATFORM BETWEEN THE RING AND INVERT. MINIMUM 5–FOOT DIAMETER MANHOLE.

APPROVED
DIRECTOR OF PUBLIC WORKS

APPROVED
CITY ENGINEER

CITY OF GOLDEN
DEPARTMENT OF PUBLIC WORKS

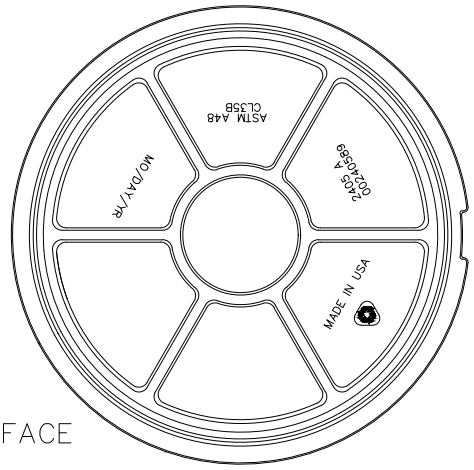
MANHOLE
INTERMEDIATE PLATFORM

SCALE: NTS

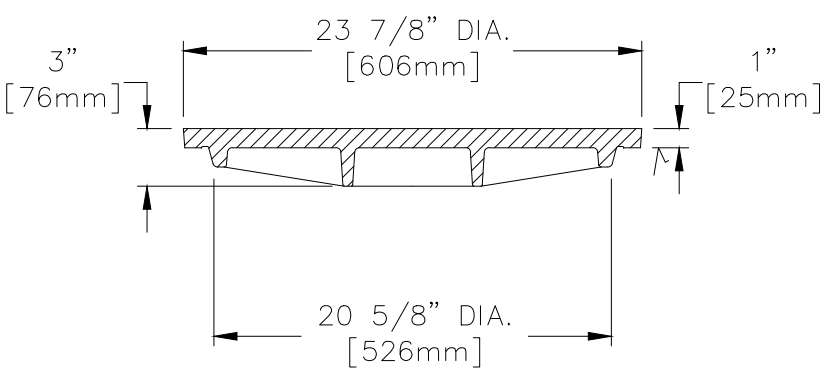
DATE: JAN 2022

DETAIL NO.
S-6

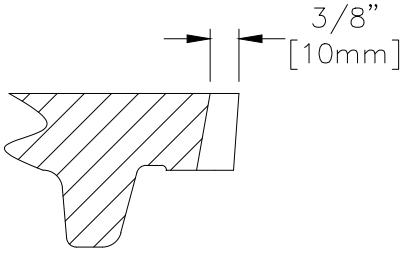
TOP OF COVER



BOTTOM OF COVER



SECTION OF COVER



PICKSLOT DETAIL

NOTES:

1. CASTING SPECIFICATIONS: ASTM A-48 CLASS 35.
2. CASTINGS SHALL BE AS SPECIFIED BELOW.

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

3. MACHINED SURFACE
4. CITY MAY REQUIRE LARGER RING & COVER SIZING (30"+) DEPENDING ON THE APPLICATION.

APPROVED
DIRECTOR OF PUBLIC WORKS

APPROVED
CITY ENGINEER

CITY OF GOLDEN
DEPARTMENT OF PUBLIC WORKS

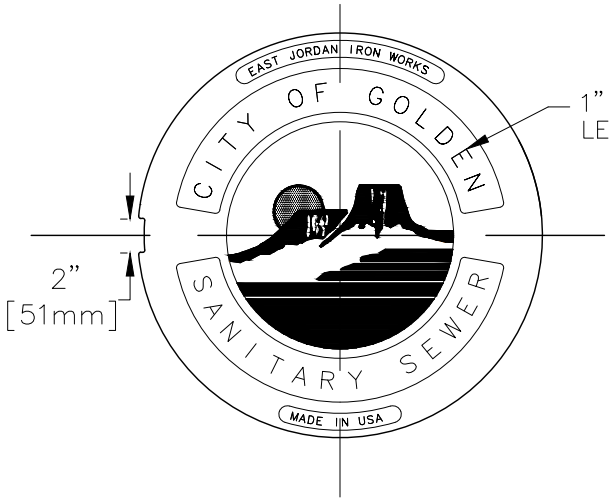
24" MANHOLE
RING AND COVER

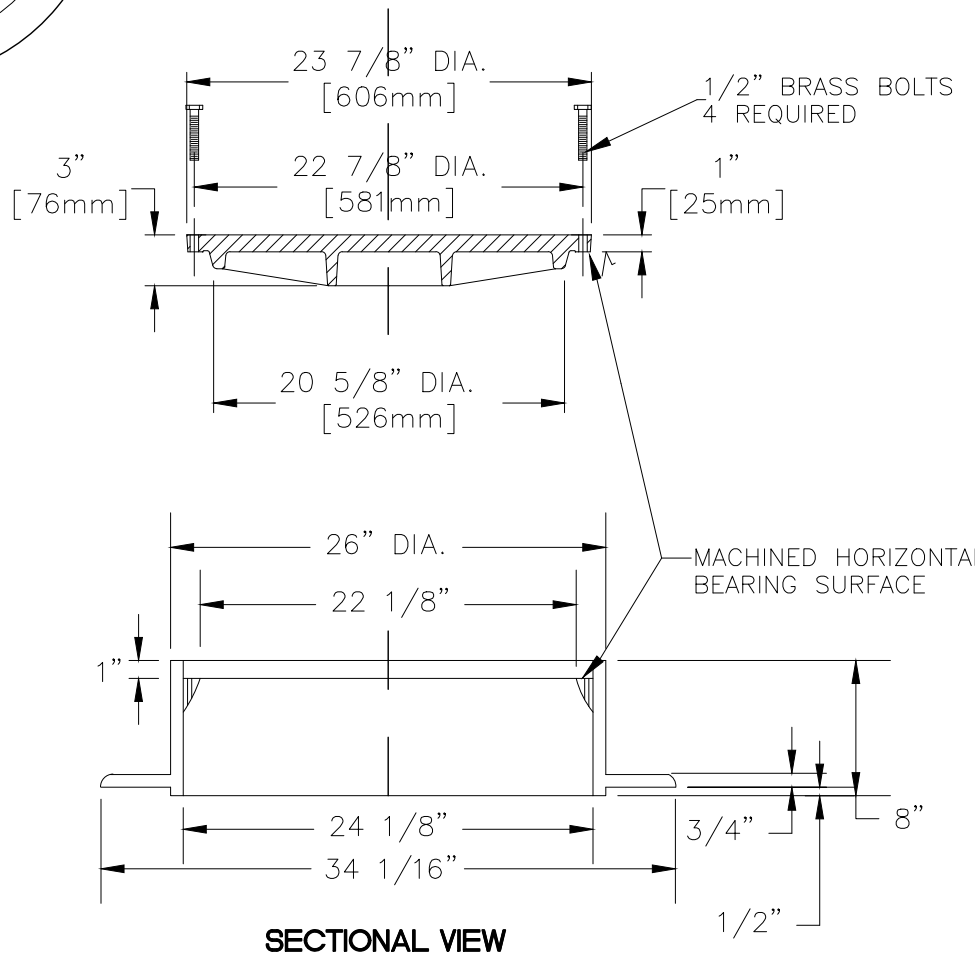
SCALE: NTS

DETAIL NO. S-7

DATE: JAN 2022

TOP OF COVER



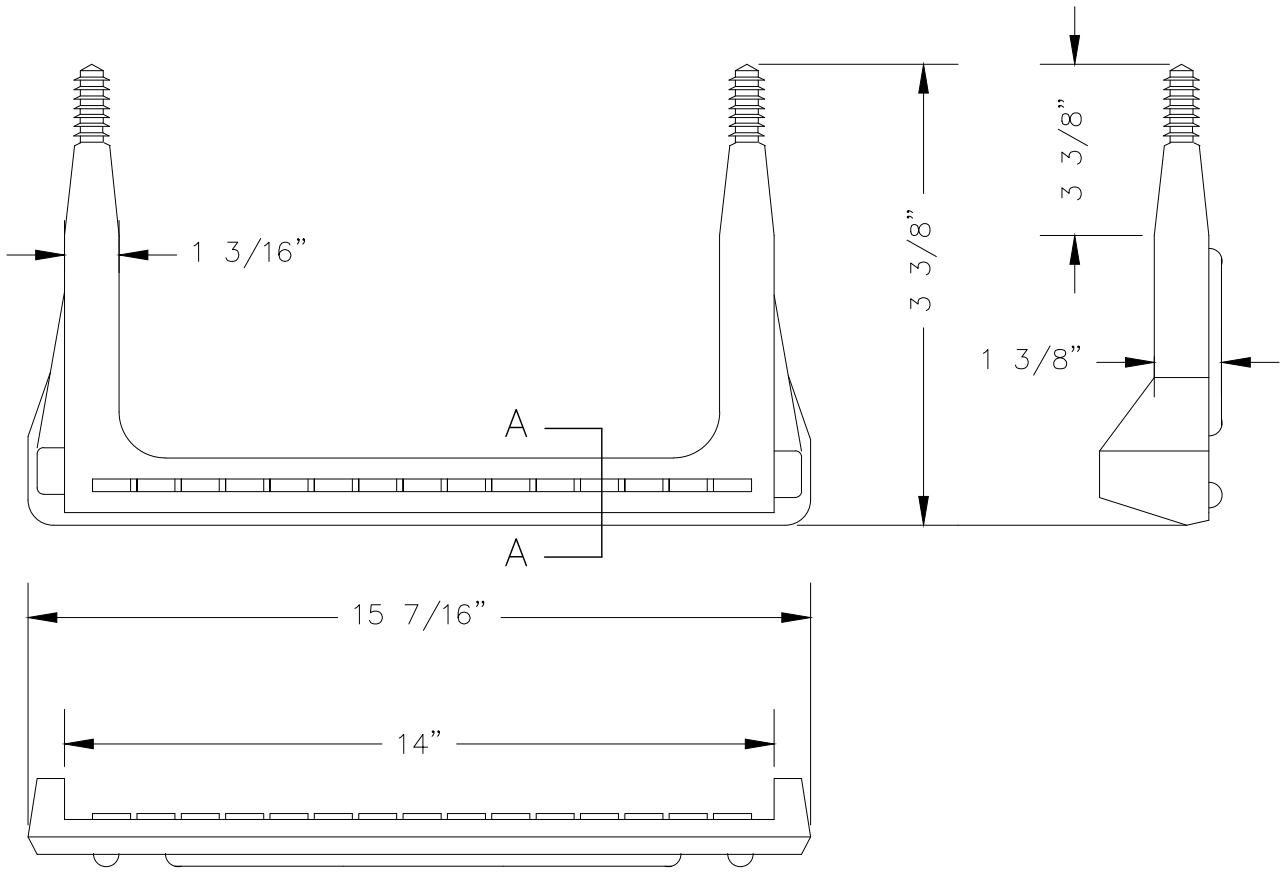


SECTIONAL VIEW

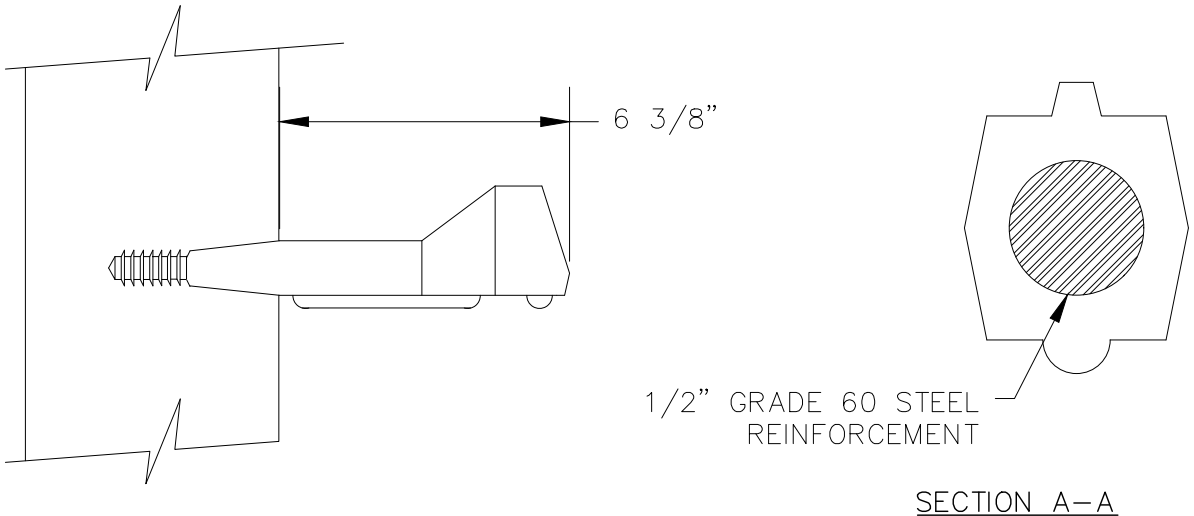
NOTES:

1. CASTING SPECIFICATIONS: ASTM A-48 CLASS 35B.
2. CASTINGS SHALL BE AS SPECIFIED BELOW MANUFACTURED BY:
   EAST JORDAN IRON WORKS or
   DEETER FOUNDRY, INC.
3. CITY MAY REQUIRE LARGER RING & COVER SIZING (30"+) DEPENDING ON THE APPLICATION.

APPROVED DIRECTOR OF PUBLIC WORKS	CITY OF GOLDEN DEPARTMENT OF PUBLIC WORKS	24" RING AND BOLT DOWN COVER
APPROVED CITY ENGINEER		SCALE: NTS DATE: JAN 2022 DETAIL NO. S-8

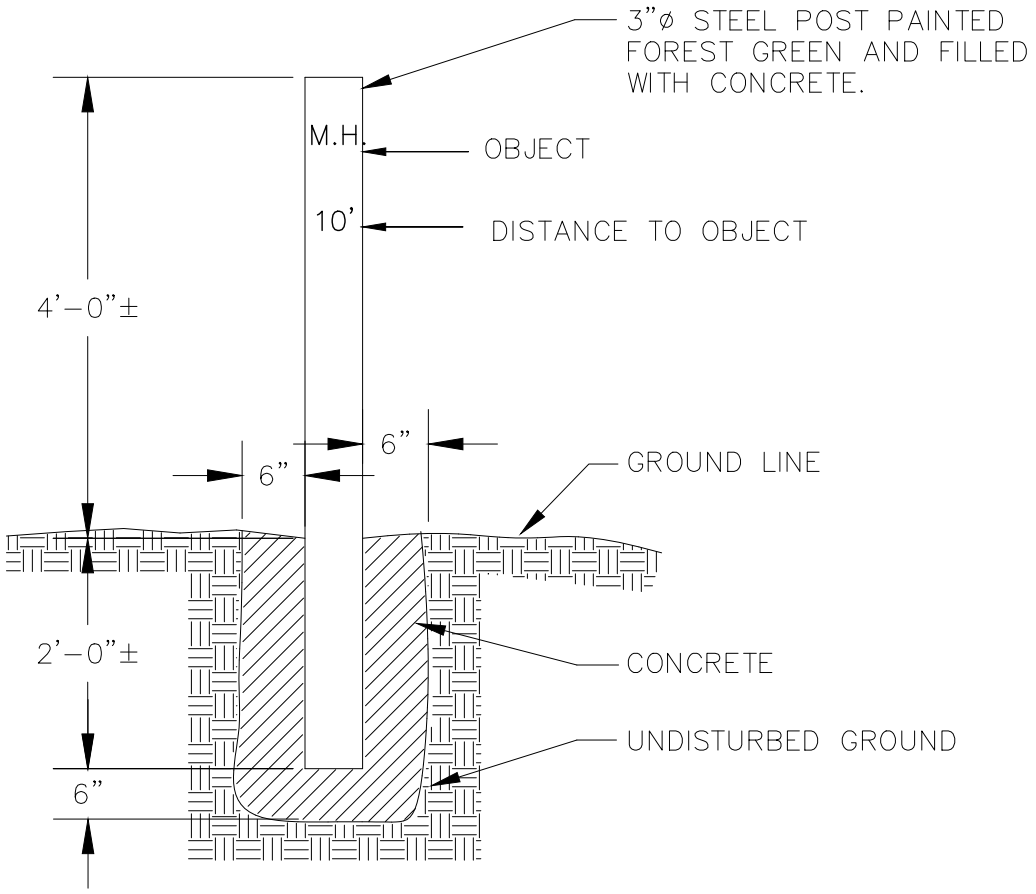


COPOLYMER POLYPROPYLENE PLASTIC



SECTION A–A

APPROVED DIRECTOR OF PUBLIC WORKS	CITY OF GOLDEN DEPARTMENT OF PUBLIC WORKS	PLASTIC MANHOLE STEP
APPROVED CITY ENGINEER		SCALE: NTS DATE: JAN 2022 DETAIL NO. S-9



NOTE; ALL LETTERS TO BE 2 INCHES HIGH IN BLACK CAPITAL LETTER, FACING THE OBJECT

CODE	OBJECT
MH	MANHOLE

APPROVED
DIRECTOR OF PUBLIC WORKS

APPROVED
CITY ENGINEER

CITY OF GOLDEN

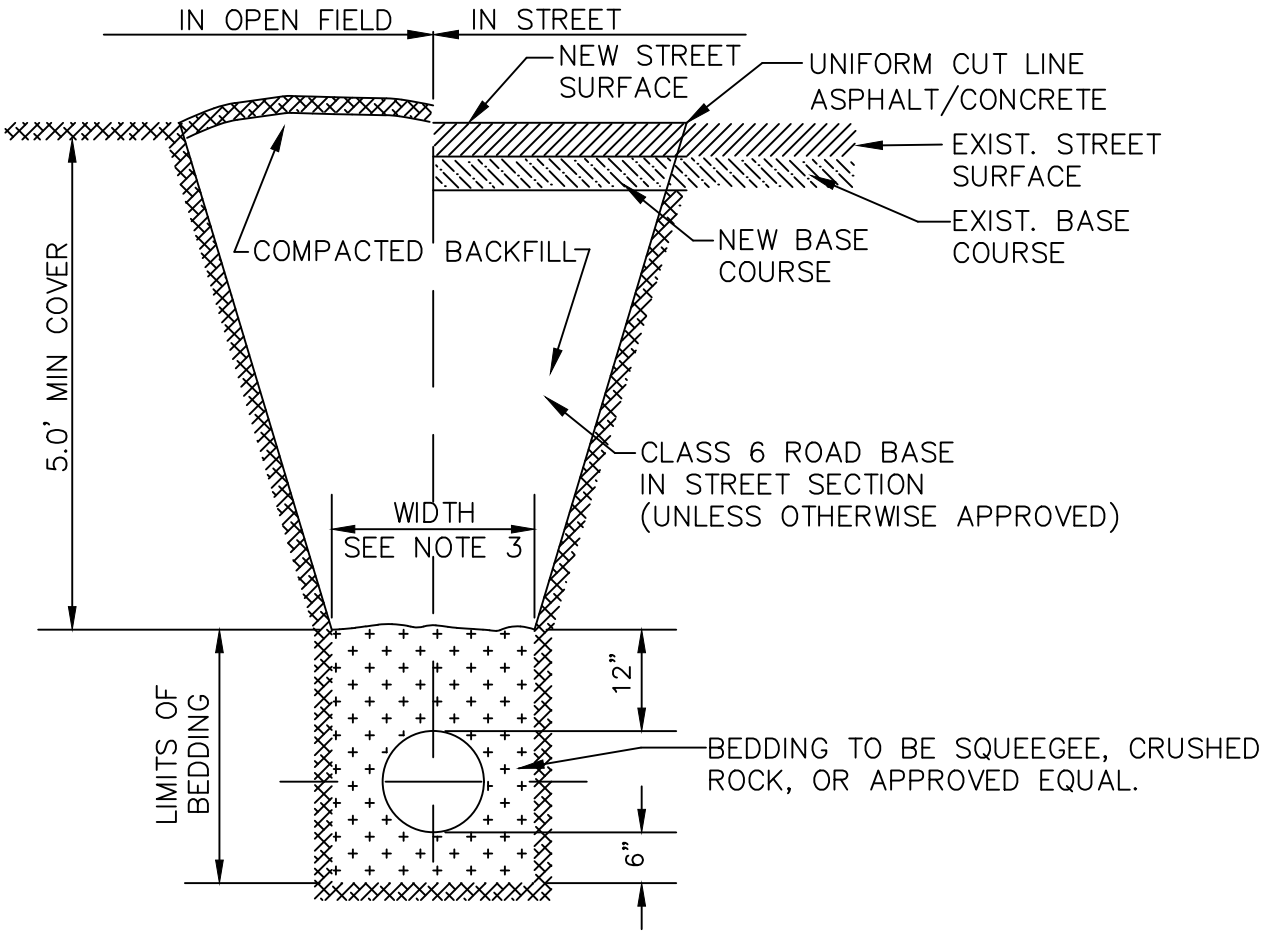
DEPARTMENT OF PUBLIC WORKS

MANHOLE MARKER DETAIL

SCALE: NTS

DATE: JAN 2022

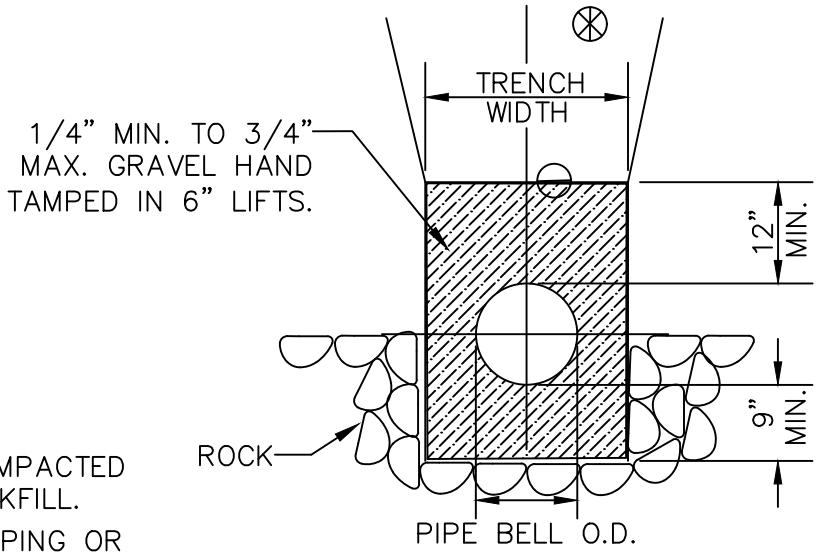
DETAIL NO. S-10



NOTES:

1. BACKFILL SHALL BE CLASS 6 ROAD BASE OR APPROVED EQUAL BY CITY ENGINEER.
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 TRENCH ZONE SHALL BE 95% S.P.D. IN STREET R.O.W., AND 90% S.P.D. OUTSIDE THE R.O.W.
5. MINIMUM COVER TO BE 5' BELOW FINAL GRADE.
6. TRENCH SHALL BE BRACED OR SHEETED FOR THE WORKMAN AND PROTECTION OF THE UTILITIES IN ACCORDANCE WITH APPLICABLE LOCAL, STATE, AND FEDERAL SAFETY REGULATIONS.

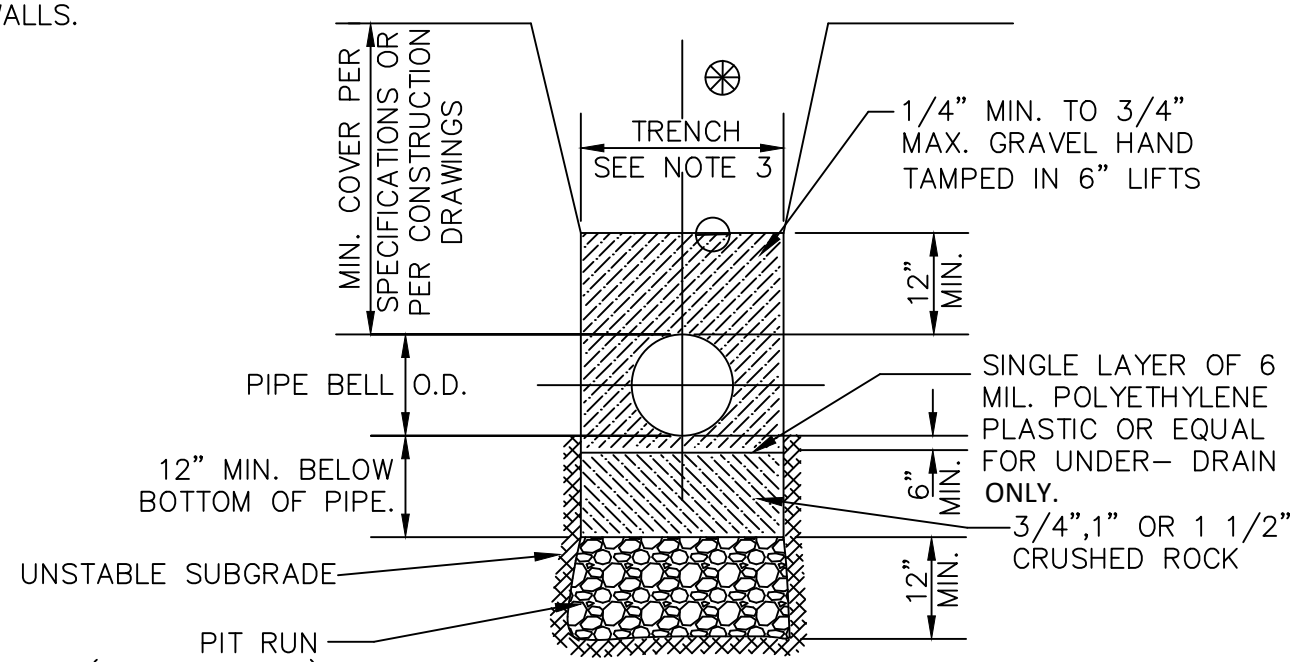
APPROVED DIRECTOR OF PUBLIC WORKS	**CITY OF GOLDEN** **DEPARTMENT OF PUBLIC WORKS**	STANDARD BEDDING DETAIL
APPROVED CITY ENGINEER		SCALE: NTS DATE: JAN 2022 DETAIL NO. **S-11**



PIPE BEDDING IN ROCK

⊛ MACHINE COMPACTED TRENCH BACKFILL.

⊖ LIMIT OF SLOPING OR BENCHING OF TRENCH WALLS.

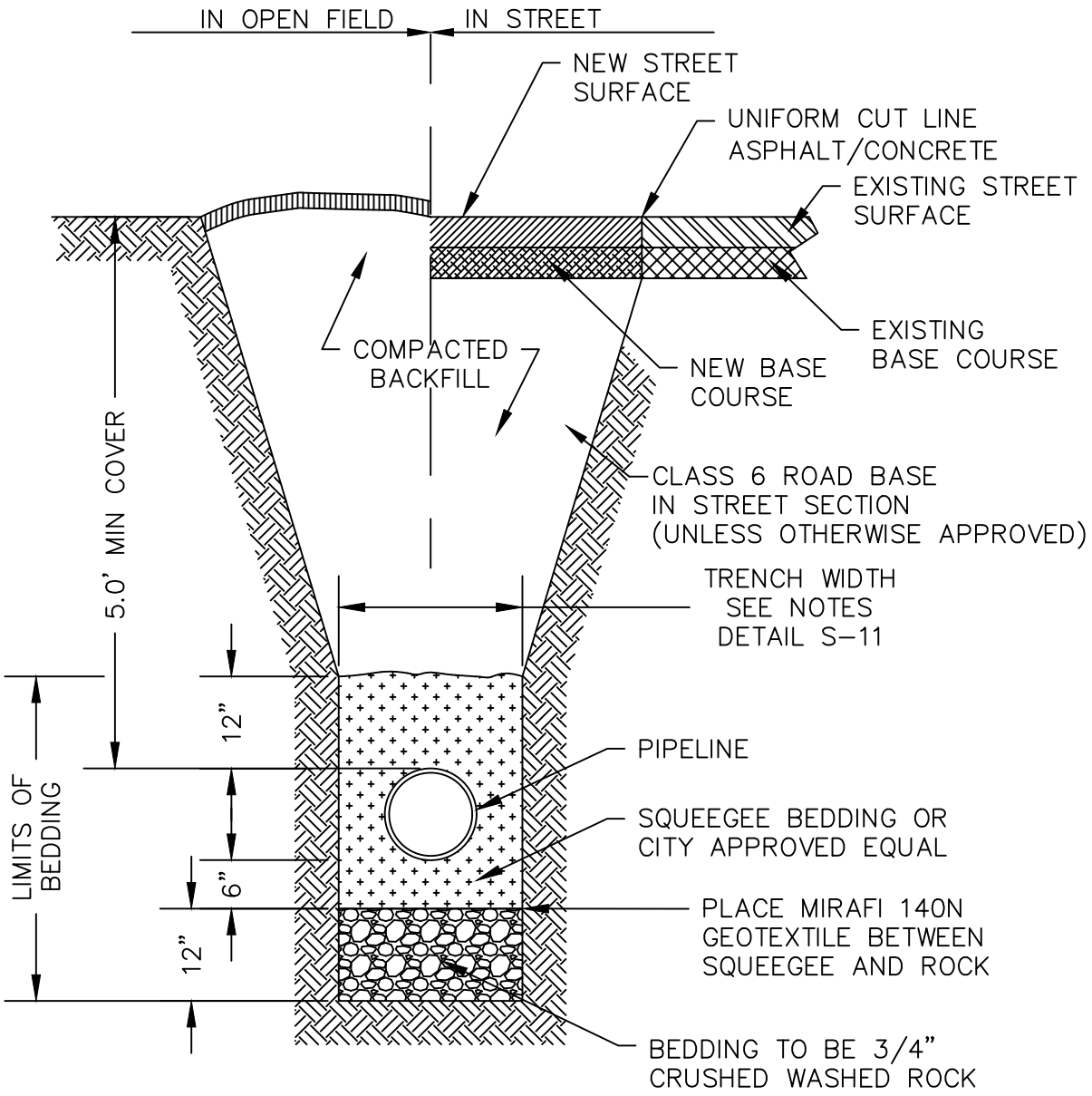


UNSTABLE SUBGRADE

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).
4. THESE DETAILS ARE A MIN. REQUIREMENT. IF GEOTECH INVESTIGATIONS DETERMINE ADDITIONAL OVER EXCAVATION, OR BEDDING MODIFICATIONS ARE NECESSARY, CONTRACTOR SHALL ADHERE TO THE SITE SPECIFIC DESIGN REQUIREMENTS.

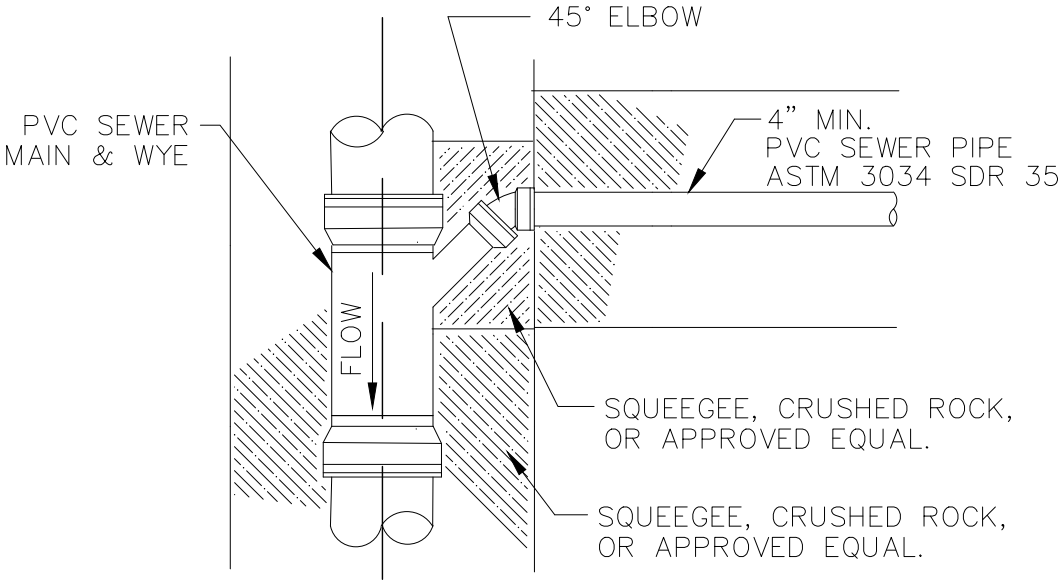
APPROVED DIRECTOR OF PUBLIC WORKS	**CITY OF GOLDEN**	SPECIAL BEDDING DETAIL
APPROVED CITY ENGINEER	**DEPARTMENT OF PUBLIC WORKS**	SCALE: NTS DATE: JAN 2022 DETAIL NO. S-12A



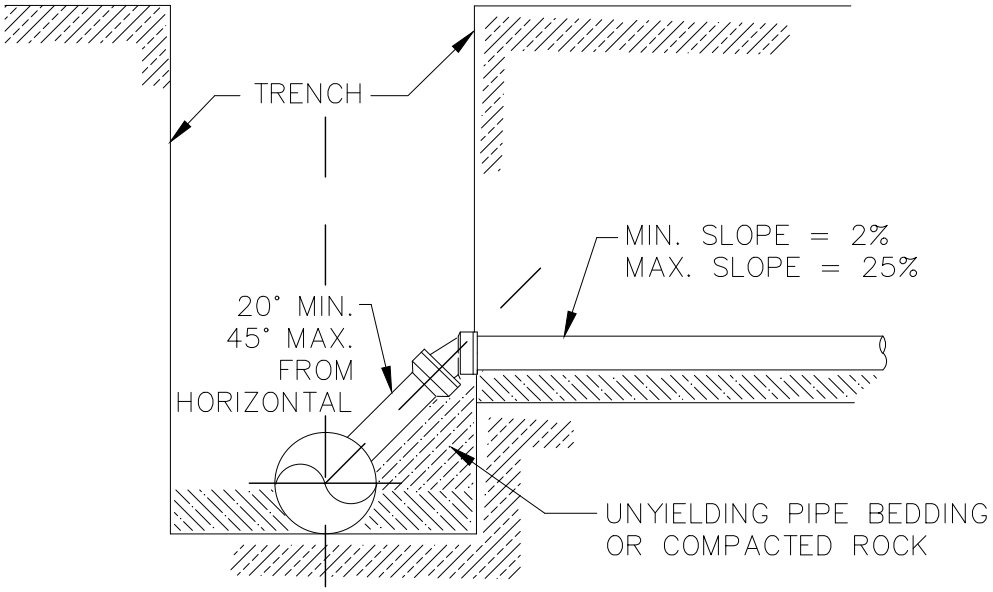
NOTES:

1. REFER TO DETAIL S-11 FOR MINIMUM DEPTH, TRENCH WIDTH, COMPACTION REQUIREMENTS ETC.
2. TRENCH SHALL BE BRACED OR SHEETED FOR THE WORKMAN AND PROTECTION OF OTHER UTILITIES IN ACCORDANCE WITH APPLICABLE LOCAL, STATE, AND FEDERAL SAFETY REGULATIONS.
3. PIPE SHALL BE BEDDED FROM 18" BELOW THE BOTTOM OF THE PIPE TO 12" ABOVE THE TOP OF THE PIPE. THIS DETAIL IS A MINIMUM REQUIREMENT. IF GEOTECHNICAL INVESTIGATIONS DETERMINE ADDITIONAL OVER EXCAVATION, OR BEDDING MODIFICATIONS ARE NECESSARY, CONTRACTOR SHALL ADHERE TO THE SITE SPECIFIC DESIGN REQUIREMENTS.

APPROVED DIRECTOR OF PUBLIC WORKS	**CITY OF GOLDEN** **DEPARTMENT OF PUBLIC WORKS**	SPECIAL BEDDING FOR EXPANSIVE SOILS
APPROVED CITY ENGINEER		SCALE: NTS DATE: JAN 2022 DETAIL NO. S-12B



PLAN

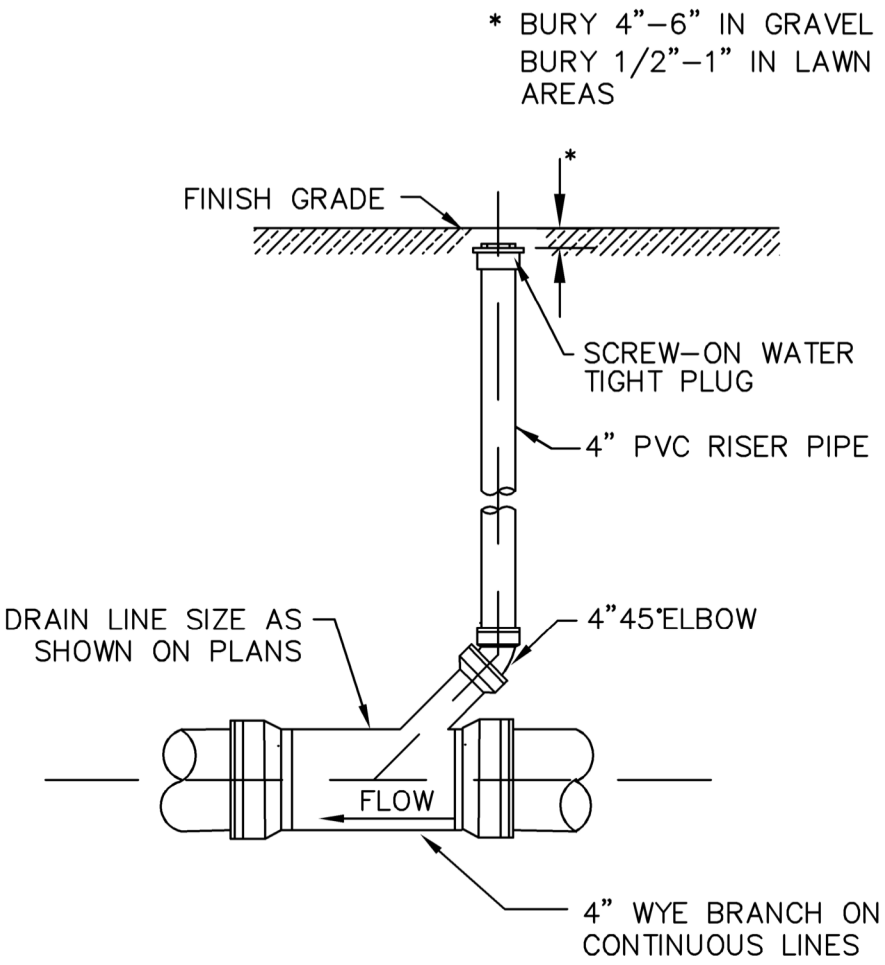


ELEVATION

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.

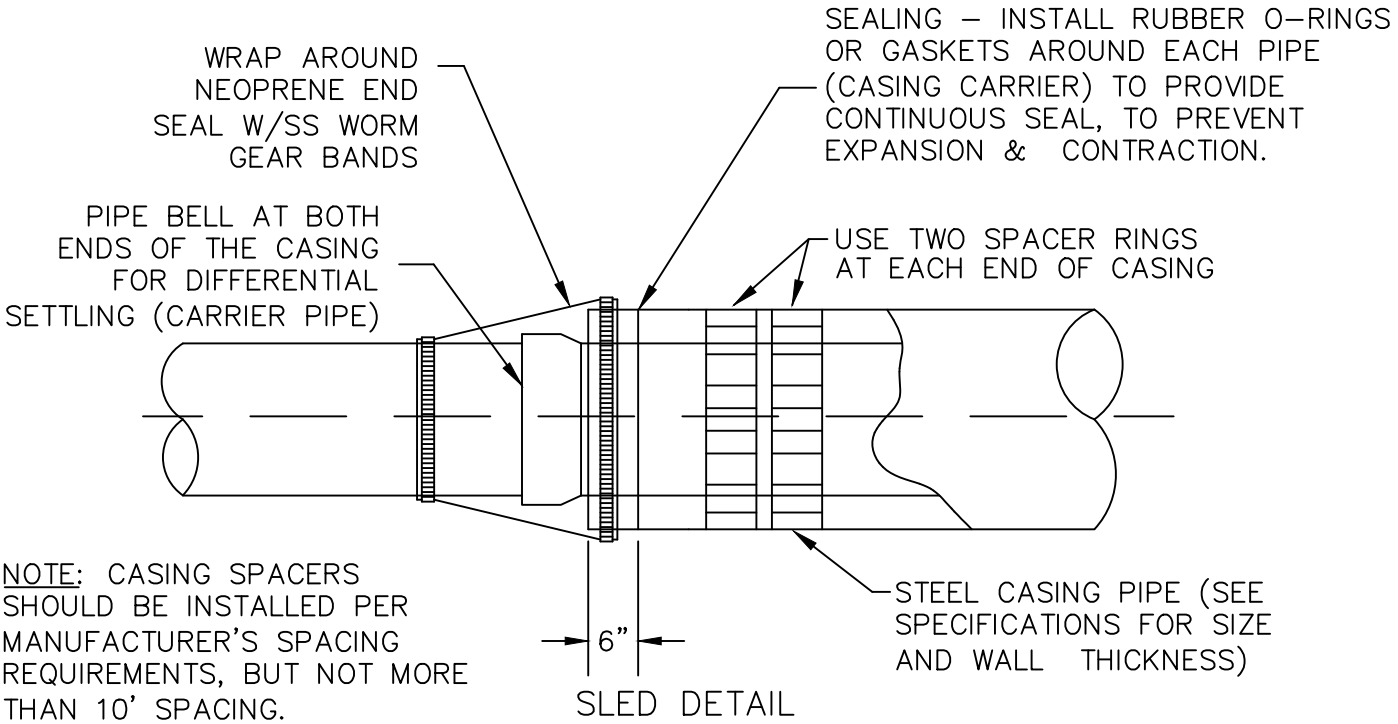
APPROVED DIRECTOR OF PUBLIC WORKS	**CITY OF GOLDEN**	SANITARY SEWER SERVICE DETAIL
APPROVED CITY ENGINEER	**DEPARTMENT OF PUBLIC WORKS**	SCALE: NTS DATE: JAN 2022 DETAIL NO. S-13



NOTES:

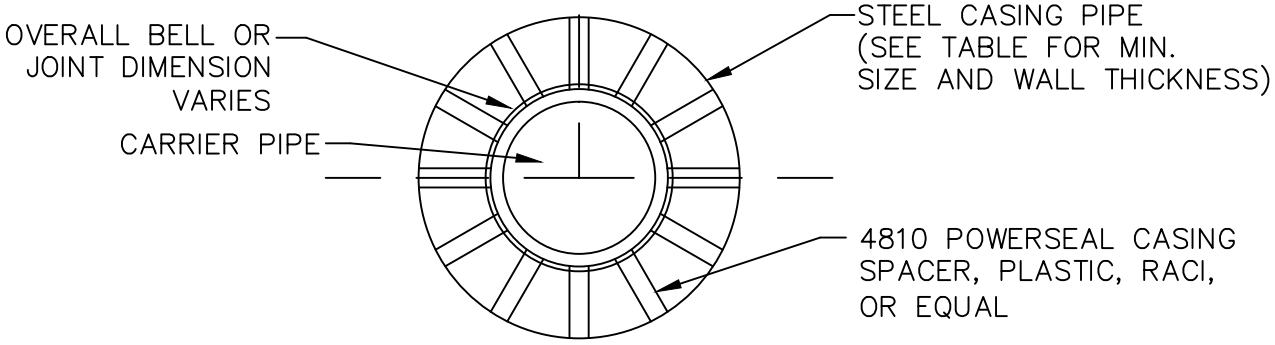
1. CLEANOUT SHALL BE CONSTRUCTED SO THAT SURFACE LOAD WILL NOT BE TRANSFERED TO MAIN.
2. SERVICE LINE CLEANOUTS SHALL BE INSTALLED APPROXIMATELY 5 FEET OUTSIDE THE BUILDING FOUNDATION.
3. AN OUTSIDE CLEANOUT IS REQUIRED ON ALL NEW SERVICE LINE INSTALLATIONS.

APPROVED DIRECTOR OF PUBLIC WORKS	**CITY OF GOLDEN**	SEWER SERVICE LINE CLEANOUT
APPROVED CITY ENGINEER	**DEPARTMENT OF PUBLIC WORKS**	SCALE: NTS DATE: JAN 2022 DETAIL NO. S-14



NOTE: CASING SPACERS SHOULD BE INSTALLED PER MANUFACTURER'S SPACING REQUIREMENTS, BUT NOT MORE THAN 10' SPACING.

SLED DETAIL



PIPE CASING DETAIL

CARRIER PIPE NOMINAL ø	CASING PIPE	
	MIN. OD	MIN. WALL THICKNESS
4"	12"	0.250"
6"	16"	0.3125"
8"	18"	0.3125"
12"	22"	0.375"
16"	28"	0.500"
20"	32"	0.500"

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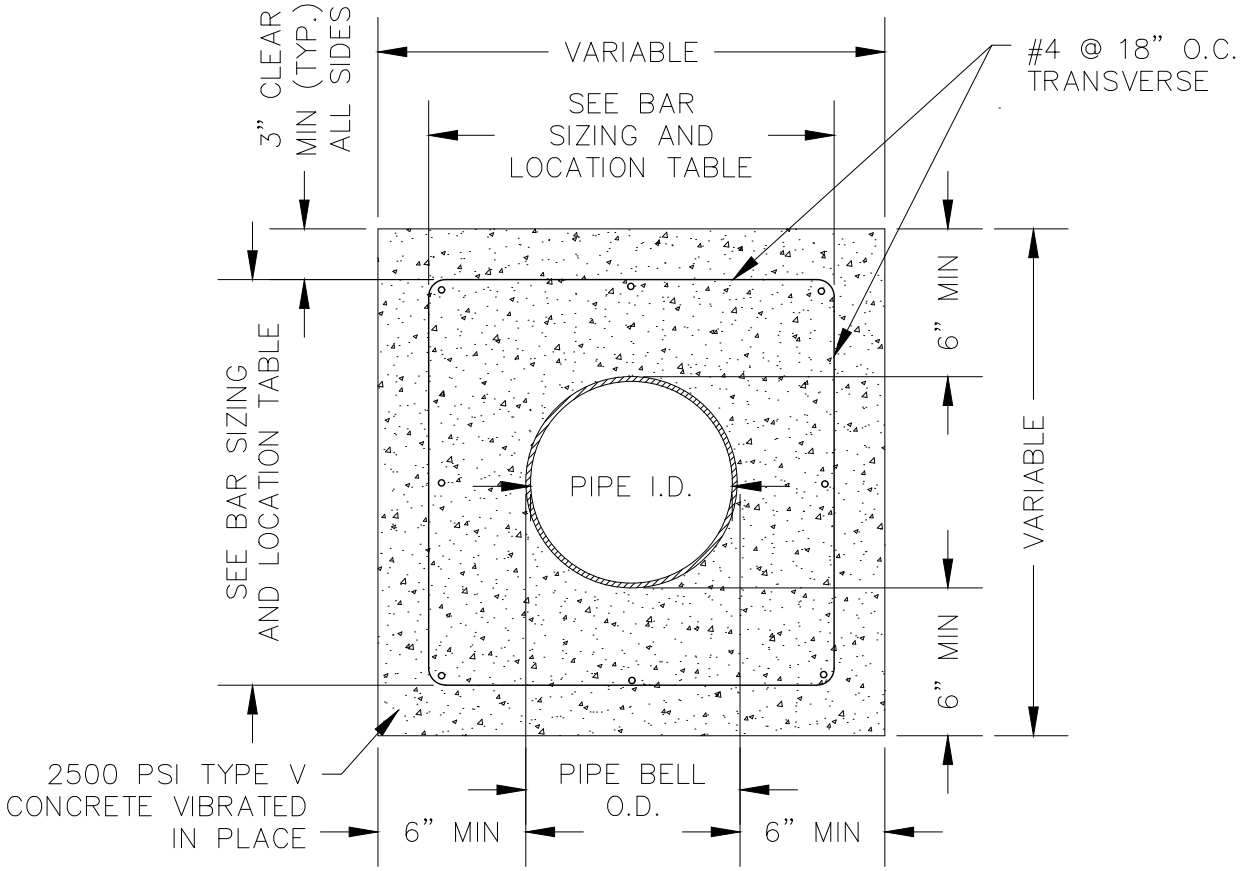
PIPE CASING & SLED DETAIL

SCALE: NTS

DATE: JAN 2022

DETAIL NO. S-15



PIPE I.D.	LONGITUDINAL BARS – LOCATION	
6 IN.	4–#4 BARS	1 EACH CORNER
8 IN.	4–#4 BARS	1 EACH CORNER
10 IN.	8–#4 BARS	3 EACH SIDE
12 IN.	8–#4 BARS	3 EACH SIDE
15 IN.	8–#4 BARS	3 EACH SIDE
18 IN.	8–#4 BARS	3 EACH SIDE
21 IN.	12–#4 BARS	4 EACH SIDE
24 IN.	12–#4 BARS	4 EACH SIDE
27 IN.	12–#4 BARS	4 EACH SIDE
30 IN.	12–#4 BARS	4 EACH SIDE
33 IN.	12–#4 BARS	4 EACH SIDE
36 IN.	16–#4 BARS	5 EACH SIDE

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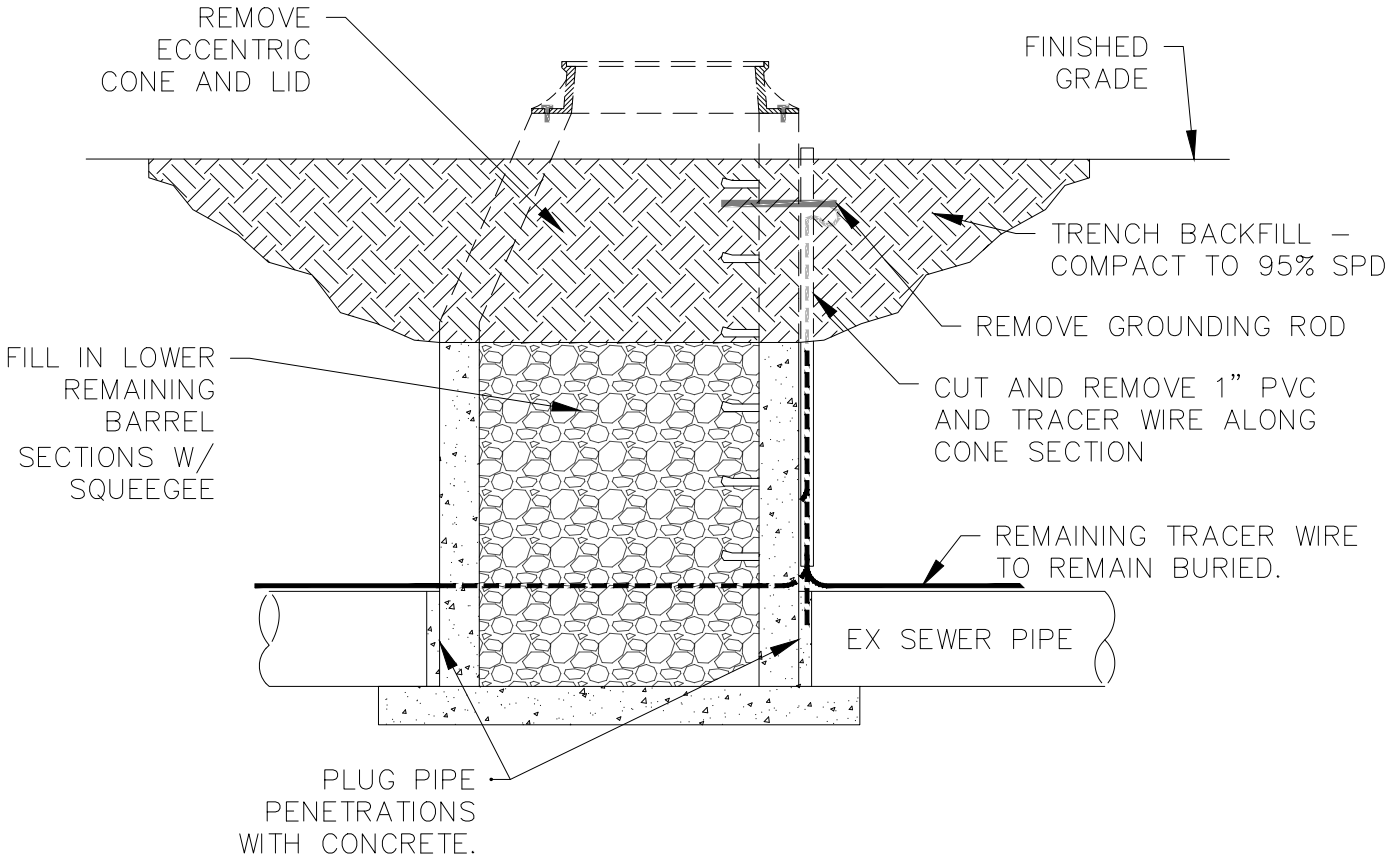
CONCRETE ENCASEMENT DETAIL

SCALE: NTS

DATE: JAN 2022

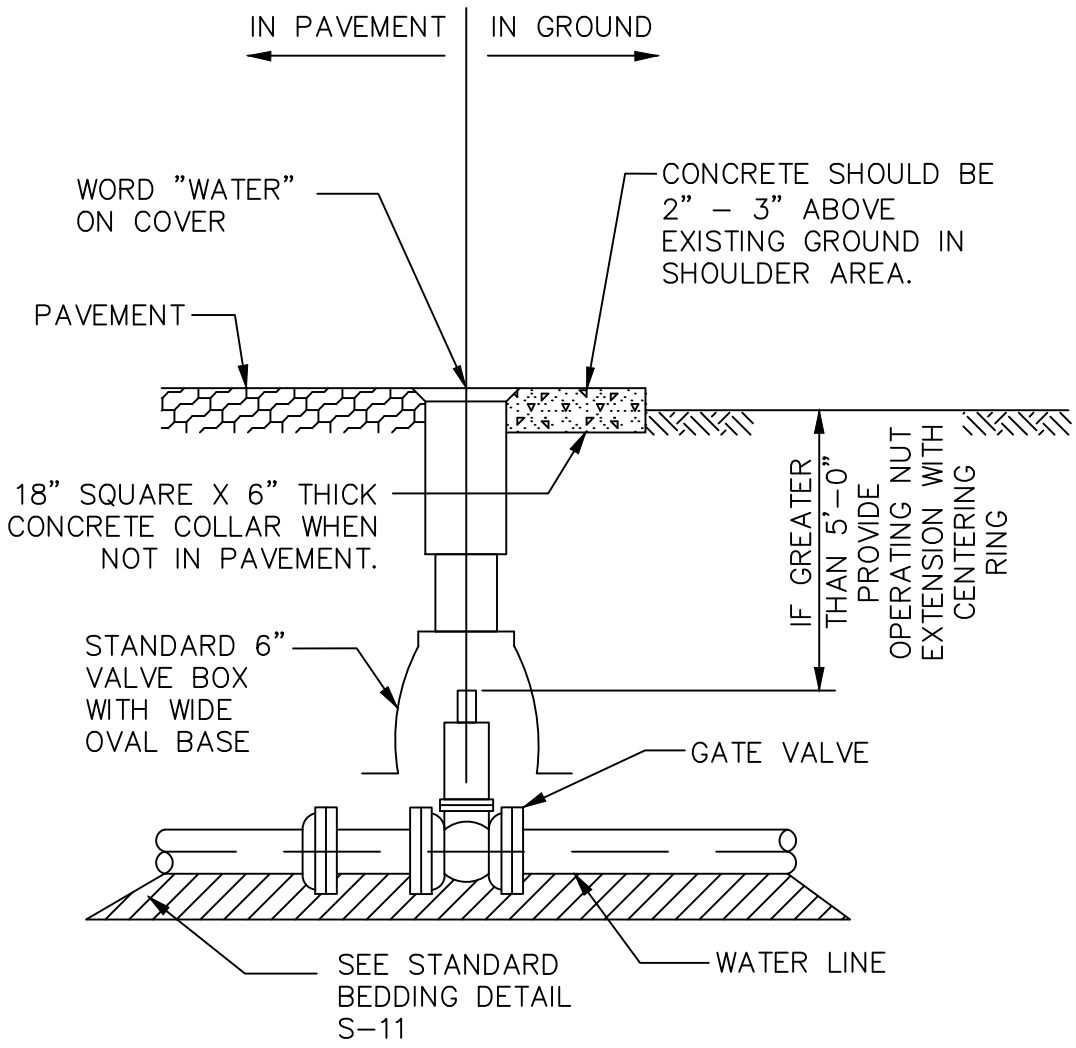
DETAIL NO. S-16



NOTES:

1. FOR MANHOLES ABANDONED IN STREET SECTIONS, DRIVES, OR PARKING AREAS, REMAINING BARREL SECTIONS SHALL BE FILLED IN WITH FLOW FILL.

APPROVED DIRECTOR OF PUBLIC WORKS	CITY OF GOLDEN DEPARTMENT OF PUBLIC WORKS	MANHOLE ABANDONMENT
APPROVED CITY ENGINEER		SCALE: NTS DATE: JAN 2022 DETAIL NO. S-17



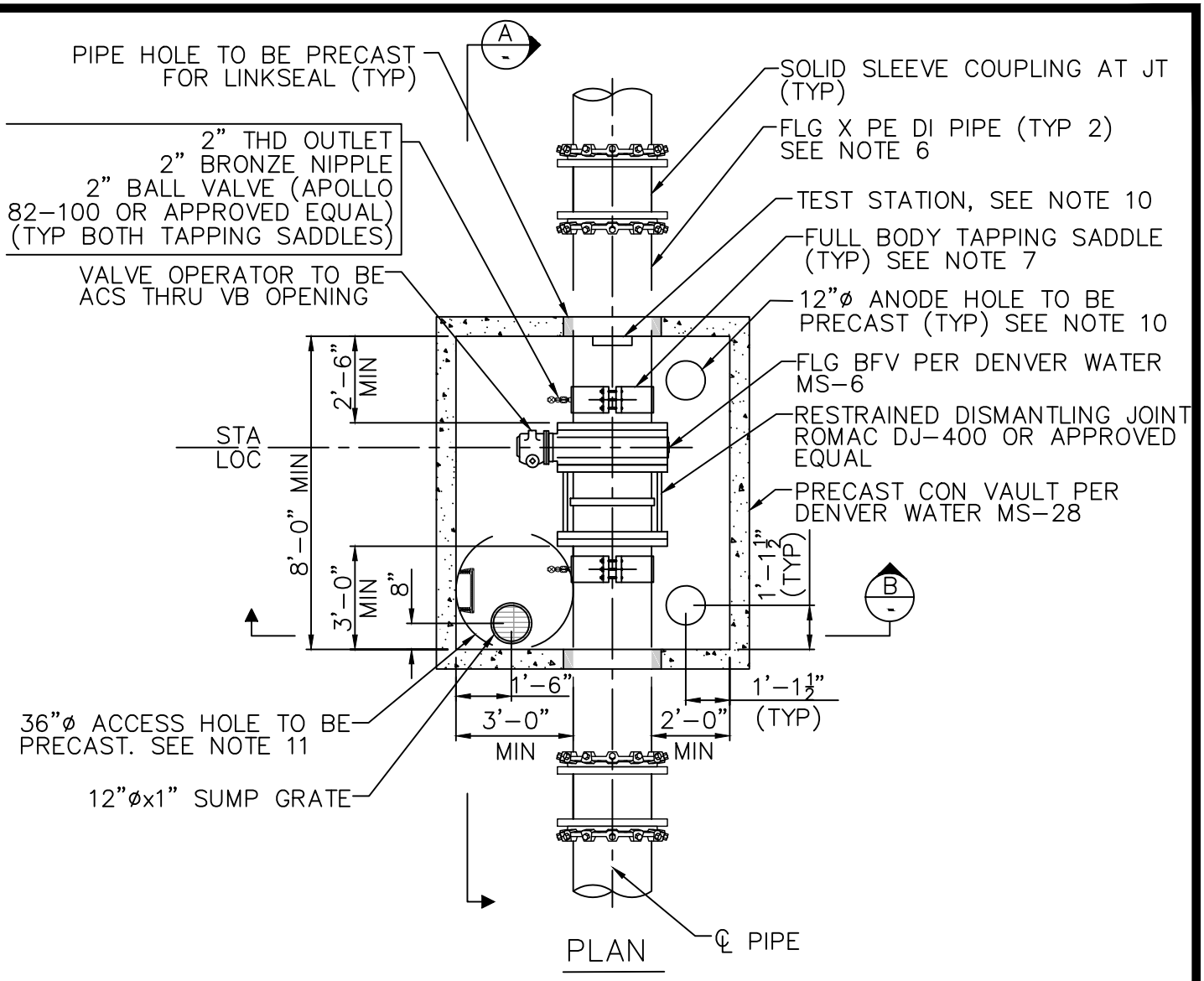
NOTES:

1. AT THE CITY'S DIRECTION, 3/4" WASHED ROCK TO BE INSTALLED UNDER THE VALVE TO PROVIDE PROPER SUPPORT.
2. AT THE CITY'S DIRECTION, TRACER WIRE SHALL BE LOOPED AND BROUGHT TO GRADE VIA A TEST PORT
3. FOR VALVE BOXES WHERE THE OPERATING NUT IS MORE THAN 5 FEET BELOW THE FINISHED GRADE, INSTALL EXTENDED STEMS ON VALVE.

VALVE OPERATING PROCEDURE NOTES:

1. VALVES WITH A BLACK OPERATING NUT INDICATES A STANDARD GOLDEN VALVE.
2. EXISTING VALVES SHALL BE OPERATED BY CITY WATER PERSONNEL ONLY.
3. ALL VALVES OPEN LEFT.

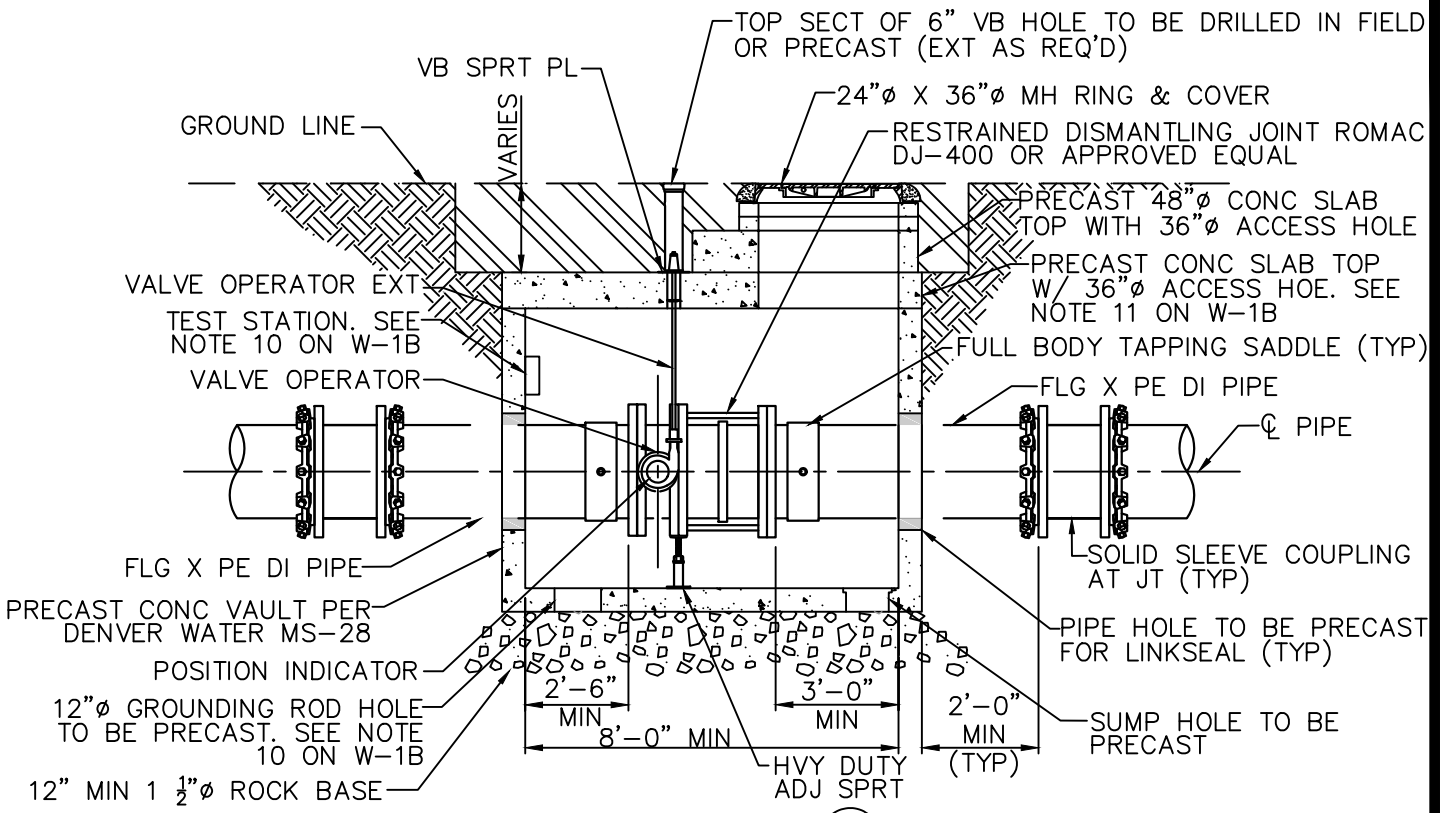
APPROVED DIRECTOR OF PUBLIC WORKS	CITY OF GOLDEN	GATE VALVE
APPROVED CITY ENGINEER	DEPARTMENT OF PUBLIC WORKS	SCALE: NTS DATE: JAN 2022 DETAIL NO. W-1A



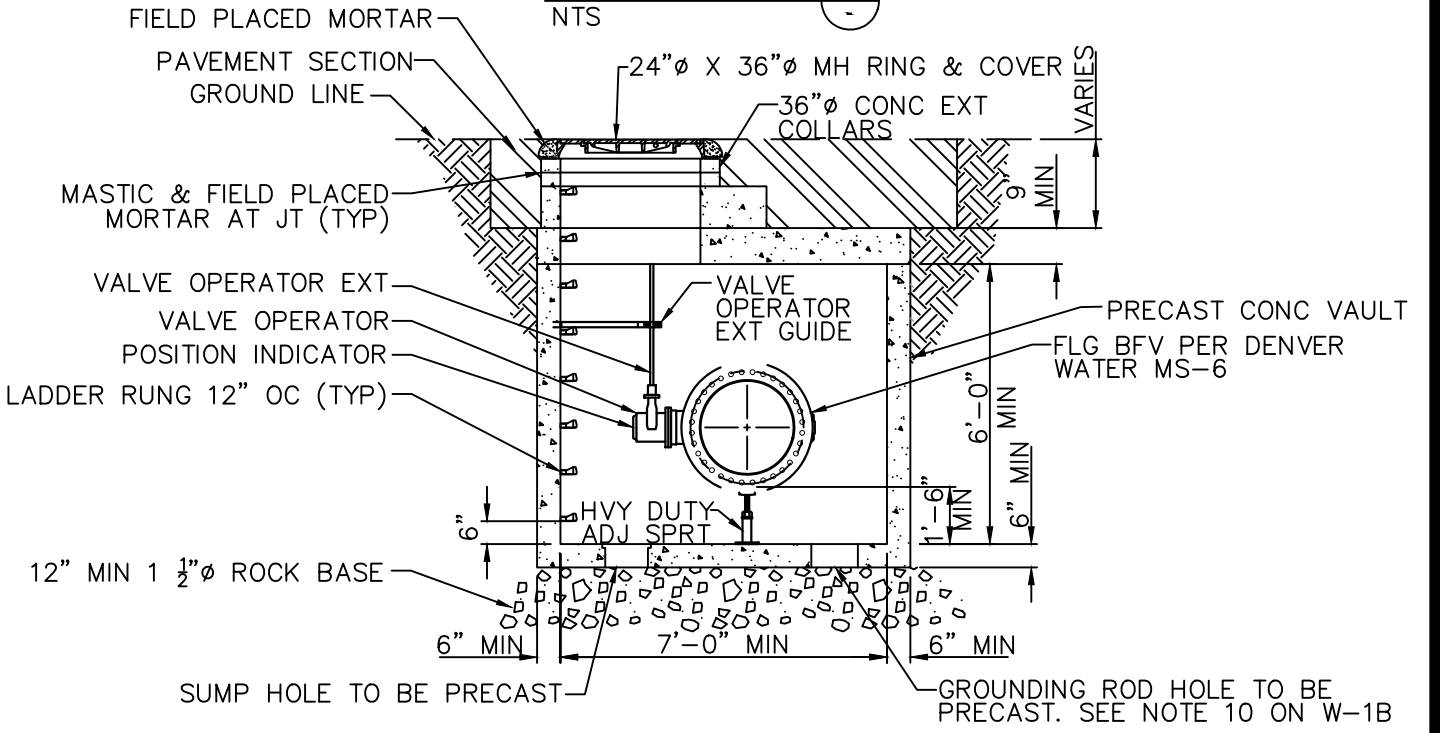
NOTES:

1. STRUCTURE SHALL BE RATED FOR H20 LOADING. PRECAST VAULT STRUCTURAL CALCULATIONS TO BE PROVIDED BY SUPPLIER.
2. MANHOLE COVER TO BE STAMPED "WATER".
3. CONCRETE EXTENSION COLLARS, MANHOLE RINGS, AND 6" VALVE BOXES TO BE FIELD MORTARED. MORTAR = 1 PART PORTLAND CEMENT TO 3 PARTS SAND CONFORMING TO ASTM C35.
4. ALL FLANGES ALONG THE MAIN SHALL MATCH. ALL FLANGES SHALL BE IN ACCORDANCE WITH AWWA C207.
5. ALL FASTENERS (BOLTS, NUTS, ETC.) SHALL BE STAINLESS STEEL SERIES 304 OR 316.
6. ALL FLANGED VAULT PIPING SHALL HAVE MINIMUM 10-MIL EPOXY COATING PER CITY SPECIFICATIONS.
7. TAPPING SADDLE SHALL BE ROMAC FTS420T WITH FUSION EPOXY COATING AND STAINLESS STEEL NUTS AND BOLTS OR APPROVED EQUAL.
8. VAULT INTERIOR TO BE COATED WITH EXTERIOR CONCRETE PAIN. MINIMUM 2 COATS.
9. VAULT EXTERIOR TO BE COATED WITH RUBBERIZED EXTERIOR COATING. MINIMUM 2 COATS.
10. INSTALLATION OF ANODES, CORE HOLES, AND TEST STATION IS NOT REQUIRED UNLESS SPECIFIED BY THE CITY. CATHODIC PROTECTION REQUIREMENTS TO BE DETERMINED BASED ON SOIL AND EXISTING PIPE CONDITIONS. FLANGE JOINTS SHALL BE INSULATED PER DENVER WATER SHEET 24 AND/OR BONDED PER DENVER WATER ENGINEERING STANDARDS SECTIONS 6.28 WHEN APPLICABLE.
11. FOR WATERLINE DIAMETERS GREATER THAN 24", ACCESS HOLE SHALL BE SIZED TO ALLOW FURTURE REMOVAL AND REPLACEMENT OF BUTTERFLY VALVE.

APPROVED DIRECTOR OF PUBLIC WORKS	**CITY OF GOLDEN** **DEPARTMENT OF PUBLIC WORKS**	FLANGED BUTTERFLY VALVE VAULT INSTALLATION FOR 16" & LARGER PIPE
APPROVED CITY ENGINEER		SCALE: NTS DATE: JAN 2022 DETAIL NO. **W-1B**



SECTION A
NTS



SECTION B
NTS

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DEPARTMENT OF PUBLIC WORKS

FLANGED BUTTERFLY VALVE VAULT INSTALLATION FOR 16" & LARGER PIPE CONT.

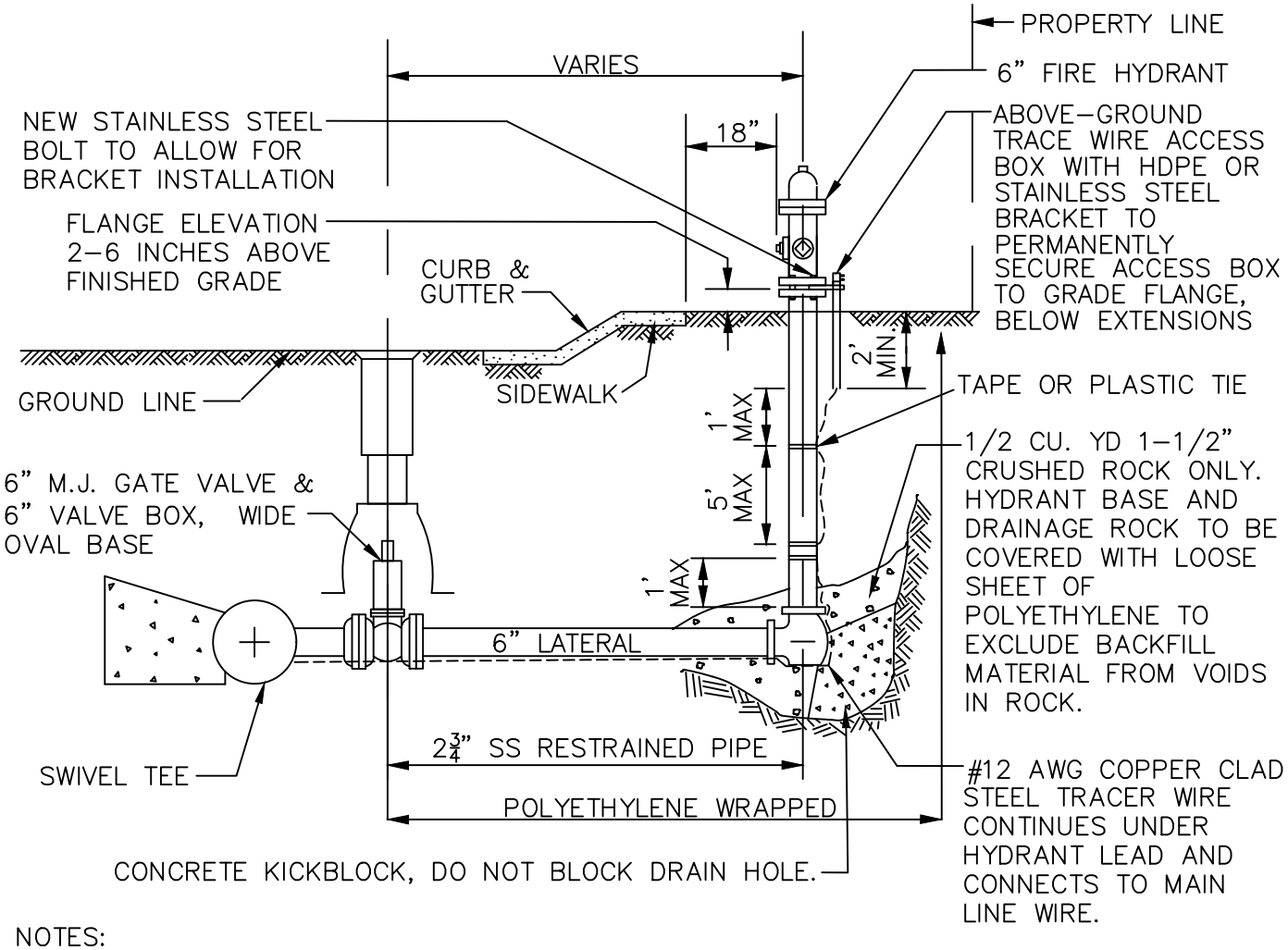
SCALE: NTS

DATE: JAN 2022

DETAIL NO. **W-1C**

THREAD SIZE FOR CONNECTIONS

PUMPER CONNECTION 4 1/2" NAT. STD.	HOSE CONNECTION 2 1/2" NAT. STD.	OUTLET THREADS NFPA NP. 194



NOTES:

1. MUST COMPLY WITH NFPA 24.
2. ONLY THE FOLLOWING FIRE HYDRANTS AND VALVE BOXES LISTED BELOW SHALL BE ACCEPTED FOR CONSTRUCTION.

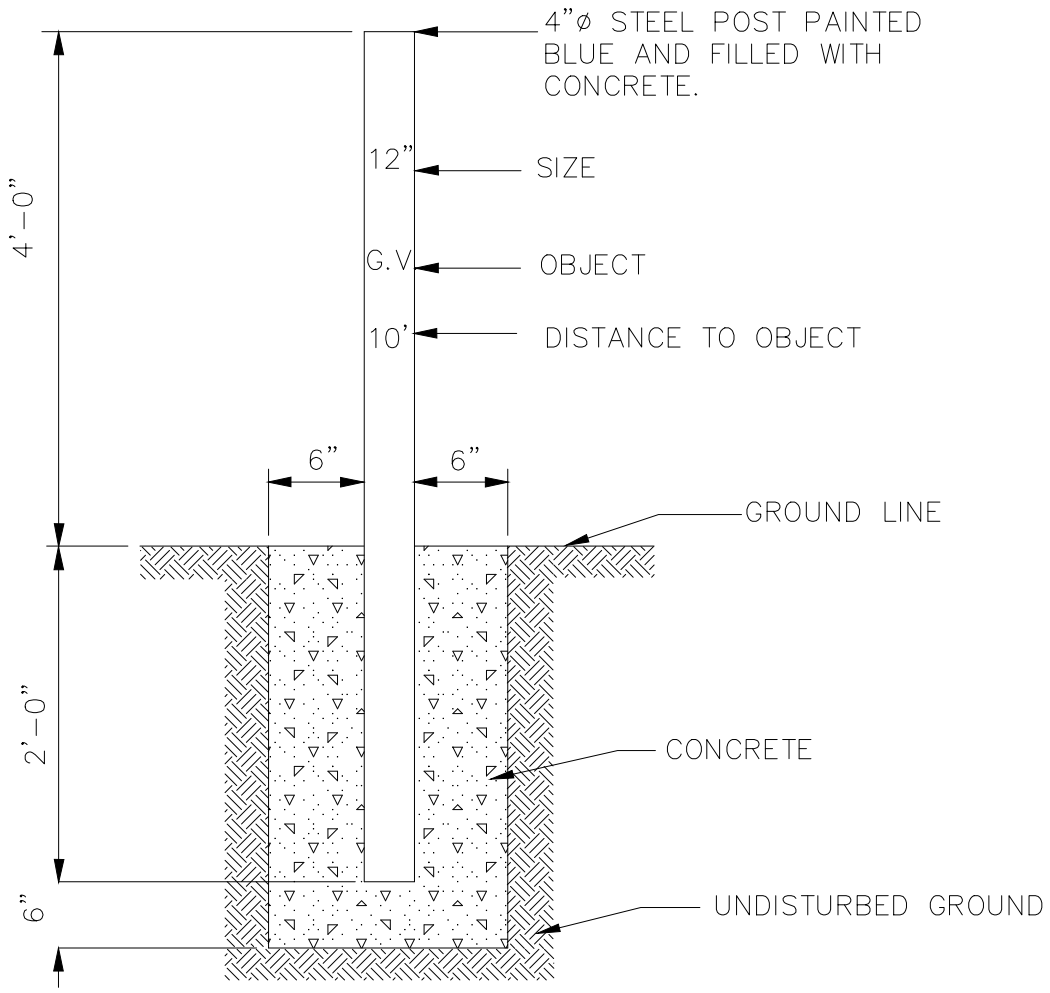
FIRE HYDRANTS

A. MUELLER SUPER CENTURION MODEL A-423
B. WATEROUS PACER WB-67-250

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	CITY OF GOLDEN DEPARTMENT OF PUBLIC WORKS	FIRE HYDRANT ASSEMBLY
APPROVED CITY ENGINEER		SCALE: NTS DATE: JAN 2022 DETAIL NO. W-2



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

CODE	OBJECT
BFV	BUTTERFLY VALVE
GV	GATE VALVE
AV	AIR VAC & VAULT

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WATER MARKER DETAIL

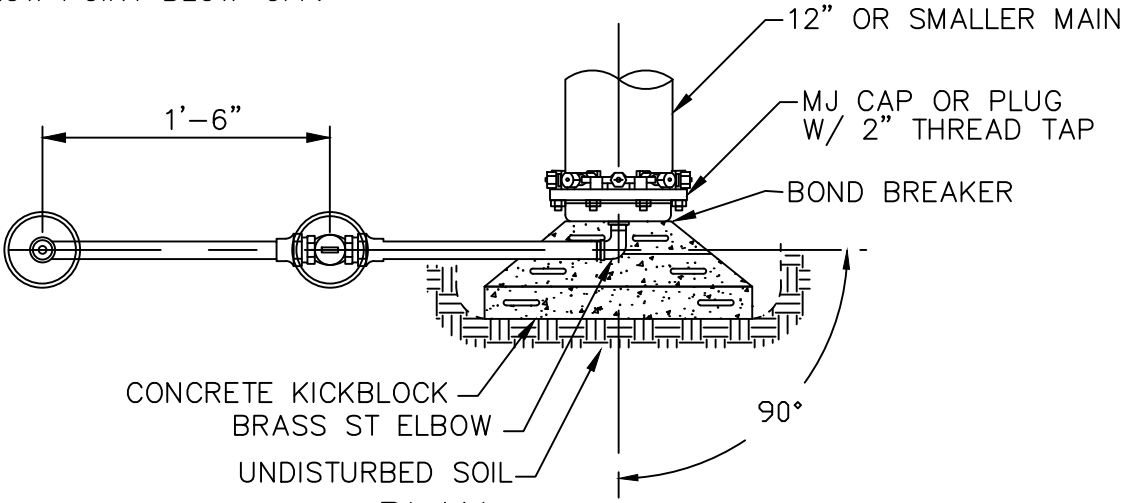
SCALE: NTS

DATE: JAN 2022

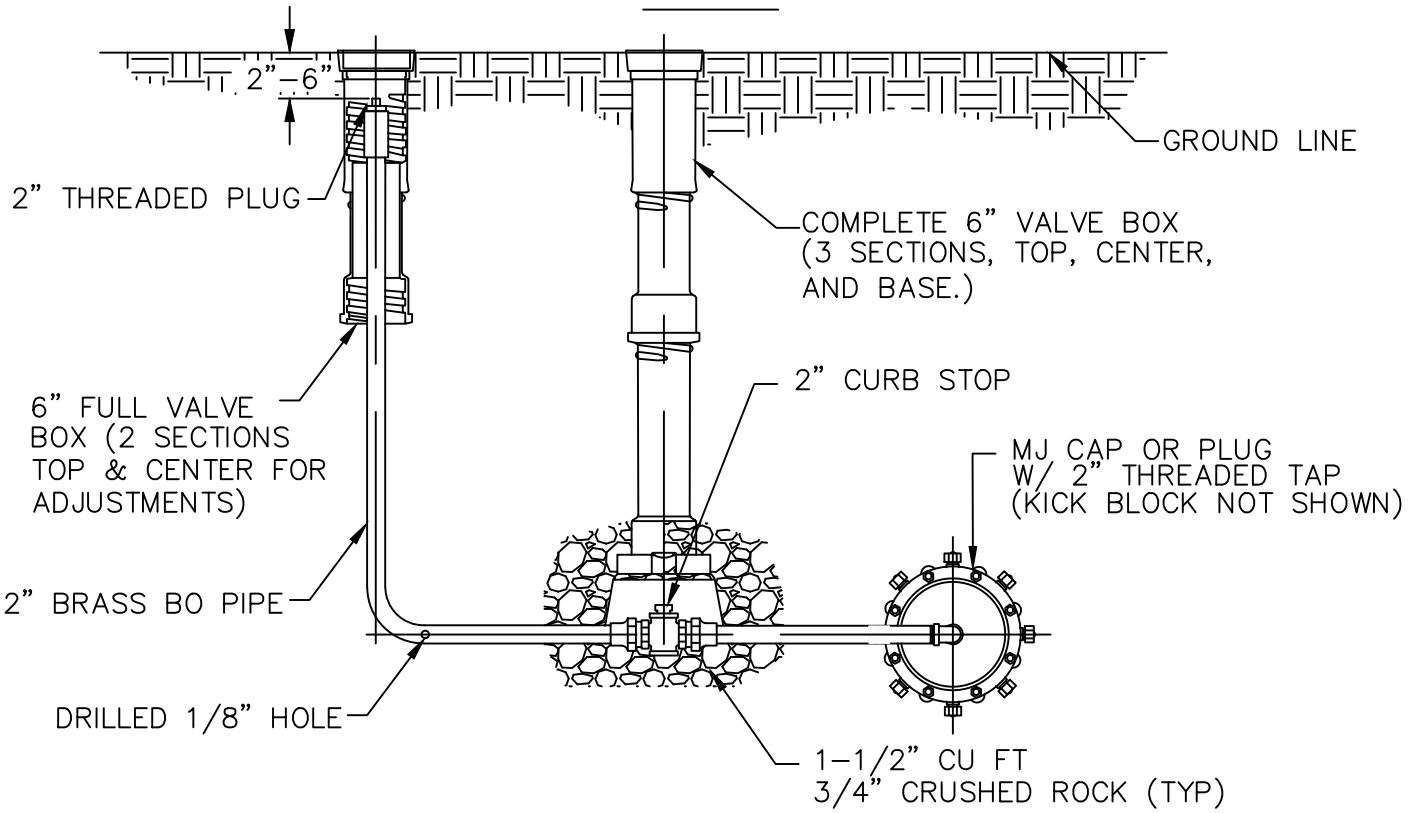
DETAIL NO. W-3

NOTES:

1. PLUG SHALL BE MECHANICALLY RESTRAINED (SHOWN AS A SPIGOT WITH A CAP):
   - FOR SLEEVE TYPE MACHINED COUPLING PIPE, TIE BACK TO NEXT COUPLING.
   - FOR BELL AND SPIGOT PIPE, TIE TO BELL.
2. ORIENTATION OF BLOW-OFF CAN BE ROTATED TO BE IN LINE WITH THE DEAD END MAIN. DETAIL CAN ALSO BE ADAPTED TO BE TAPPED INTO A MAINLINE TO PROVIDE PERMANENT LOW POINT BLOW-OFF.

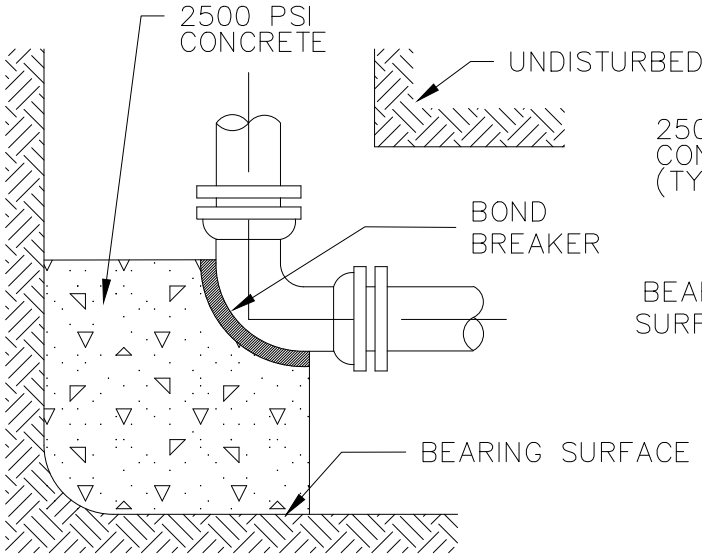


PLAN

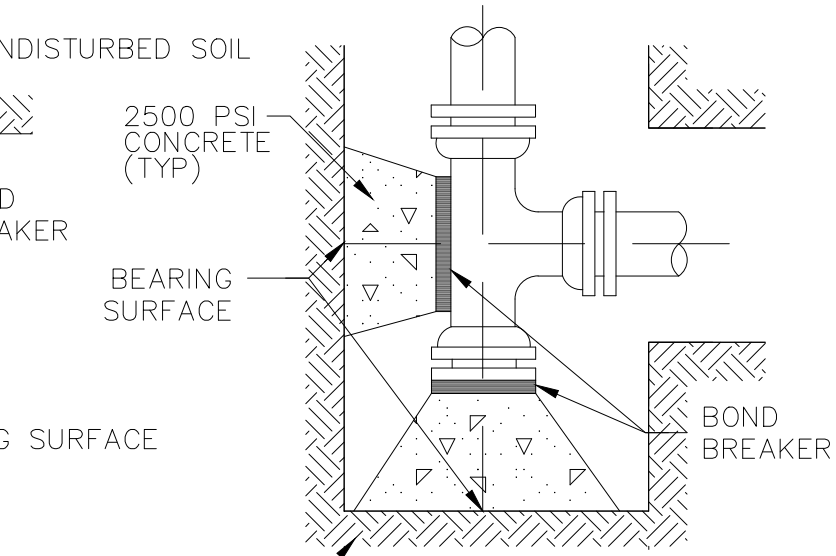


ELEVATION

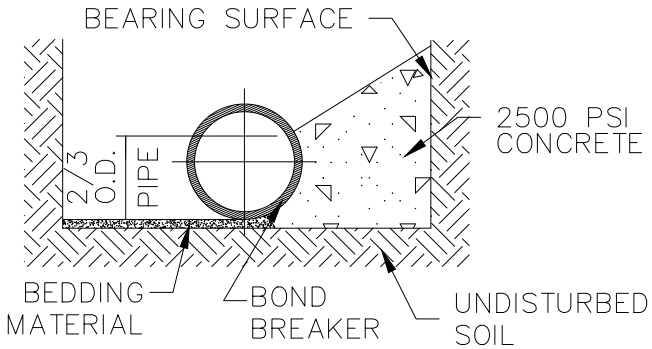
APPROVED DIRECTOR OF PUBLIC WORKS	CITY OF GOLDEN DEPARTMENT OF PUBLIC WORKS	BLOW-OFF ASSEMBLY 12" MAIN AND SMALLER
APPROVED CITY ENGINEER		SCALE: NTS DATE: JAN 2022 DETAIL NO. W-4



11–1/4°, 22–1/2°, 45°, AND 90° BENDS



TEE AND DEAD END



TYPICAL CROSS SECTION

MINIMUM BEARING SURFACE AREA

(IN SQUARE FEET)

SIZE OF PIPE	BENDS				TEE OR DEAD END
	11¼°	22½°	45°	90°	
4"	1.00	1.00	1.00	N.A.	1.50
6"	1.00	1.25	2.25	N.A.	3.00
8"	1.00	2.00	4.00	N.A.	5.25
12"	2.00	4.25	8.25	N.A.	11.00
16"	3.50	6.50	12.50	23.00	16.50
20"	5.00	10.00	19.50	35.50	25.00
24"	7.00	14.00	27.75	51.00	36.00

*BASED ON 3,000 PSF BEARING CAPACITY

NOTES:

1. BEARING SURFACES SHOWN IN CHART ARE MINIMUM.
2. 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
3. N.A. = NOT APPLICABLE
4. ALL BENDS, TEES, AND DEAD ENDS SHALL BE BOTH MECHANICALLY RESTRAINED AND KICKBLOCKED.

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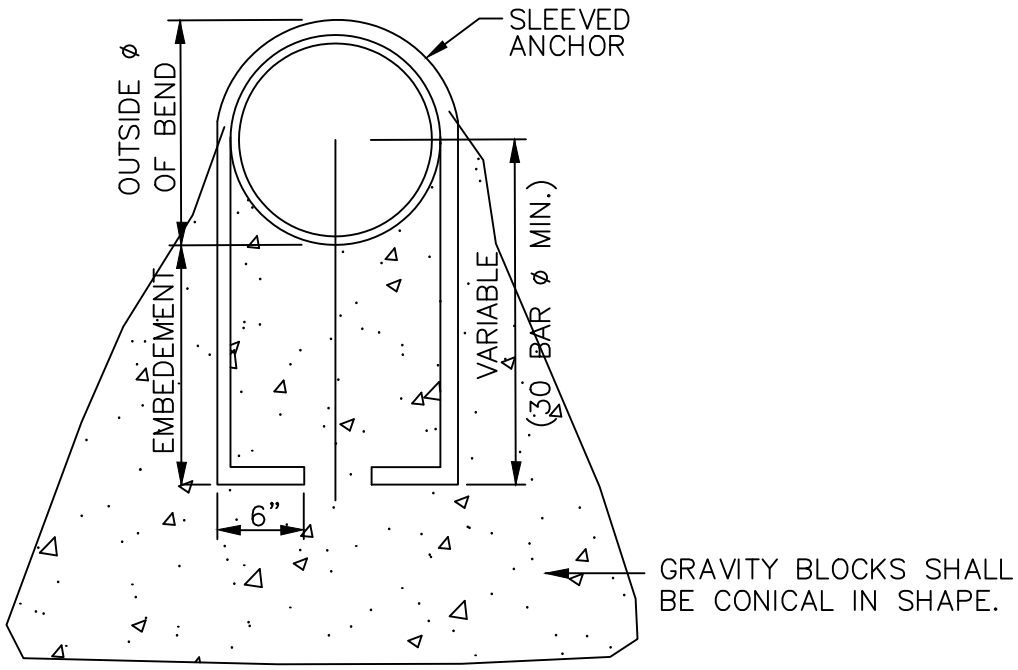
DEPARTMENT OF PUBLIC WORKS

HORIZONTAL CONCRETE KICKBLOCKS
(BEARING SURFACES AND INSTALLATION)

SCALE: NTS

DATE: JAN 2022

DETAIL NO. W-5A



GRAVITY BLOCKS MINIMUM VOLUME

(IN CUBIC FEET)

SIZE OF PIPE	BENDS		
	11¼°	22½°	45°
6"	10.5	20.5	33.0
8"	17.5	35.0	68.0
12"	37.0	74.0	145.0
16"	48.5	96.0	189.0

NOTES:

1. VERTICAL 90° BENDS ARE NOT ALLOWED.
2. ALL LINES 12" AND LARGER WILL REQUIRE BODY CLAMPS (NATIONAL PIPE HANGER HEAVY TWO–BOLT PIPE CLAMP OR APPROVED EQUAL) APPROPRIATELY SIZED ALL–THREAD AND DOUBLE NUT.
3. THERE SHALL BE A MINIMUM CLEARANCE OF 24" BETWEEN WATERLINE AND ANY NEW CONSTRUCTION.
4. ALL JOINTS SHALL BE RESTRAINED BETWEEN THE FITTINGS.
5. ANCHORS SHALL BE SLEEVED TO PREVENT CORROSION OF THE PIPE AND/OR BAR. THIS COULD INCLUDE, BUT NOT LIMITED TO, STAINLESS/EPOXY COATED TIES, CURVED FIBERGLASS BOARD, ETC.

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VERTICAL CONCRETE KICKBLOCKS

SCALE: NTS

DATE: JAN 2022

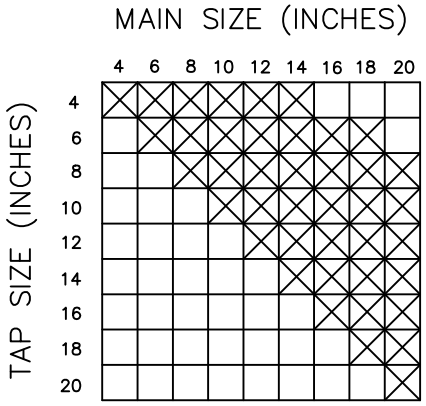
DETAIL NO. W-5B

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.

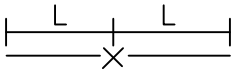
ALL WATER MAINS

☒ INDICATES CONCRETE THRUST BLOCK REQUIRED

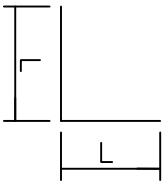


ANY THRUST REACTION BLOCK REQUIREMENTS FOR WATER MAIN AND TAP SIZE COMBINATIONS OTHER THAN THOSE SHOWN ABOVE WILL REQUIRE SPECIAL DESIGN APPROVAL BY THE ENGINEERING DIVISION.

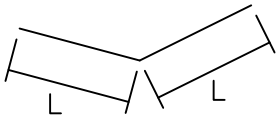
APPROVED DIRECTOR OF PUBLIC WORKS	CITY OF GOLDEN DEPARTMENT OF PUBLIC WORKS	CONCRETE TRUST BLOCKS
APPROVED CITY ENGINEER		SCALE: NTS DATE: JAN 2022 DETAIL NO. W-6



TEE OR VALVE



90° BEND



BENDS

LENGTH OF RESTRAINED PIPE

FITTING	PIPE SIZE					
	4"	6"	8"	12"	16"	20"
TEE OR VALVE	30'	46'	61'	90'	116'	141'
PLUG OR 90° BEND	30'	46'	61'	90'	116'	141'
45° BEND	9'	13'	18'	26'	34'	41'
22½° BEND	2'	3'	5'	7'	9'	11'
11¼° BEND	1'	1'	1'	2'	2'	3'

NOTES:

1. LENGTH OF RESTRAINED PIPE MEASURED EACH WAY FROM VALVES AND BENDS.
2. CLAMPS AND RODS NOT ALLOWED FOR 24" AND LARGER PIPES.
3. D=DIAMETER, L=LENGTH, G=GRADE OF STEEL, M.S.=MILD STEEL, H.S.=HIGH STRENGTH.
4. MINIMUM 4.5' GROUND COVER REQUIRED.
5. BASED ON 150 PSI INTERNAL PRESSURE.
6. M.S. MEANS MIL STEEL ROD A.S.T.M. STANDARD DESIGNATION A–36.
7. H.S. MEANS HIGH STRENGTH ROD A.S.T.M. STANDARD DESIGNATION A–193 GRADE B–7.
8. NUTS SHALL BE A.S.T.M. STANDARD DESIGNATION A–307 GRADE A OR B HEXAGON HEAVY SERIES.
9. LENGTH REFERS TO THE AMOUNT OF PIPE WHICH MUST BE TIED TOGETHER AND IS NOT NECESSARILY THE LENGTH OF RODS.

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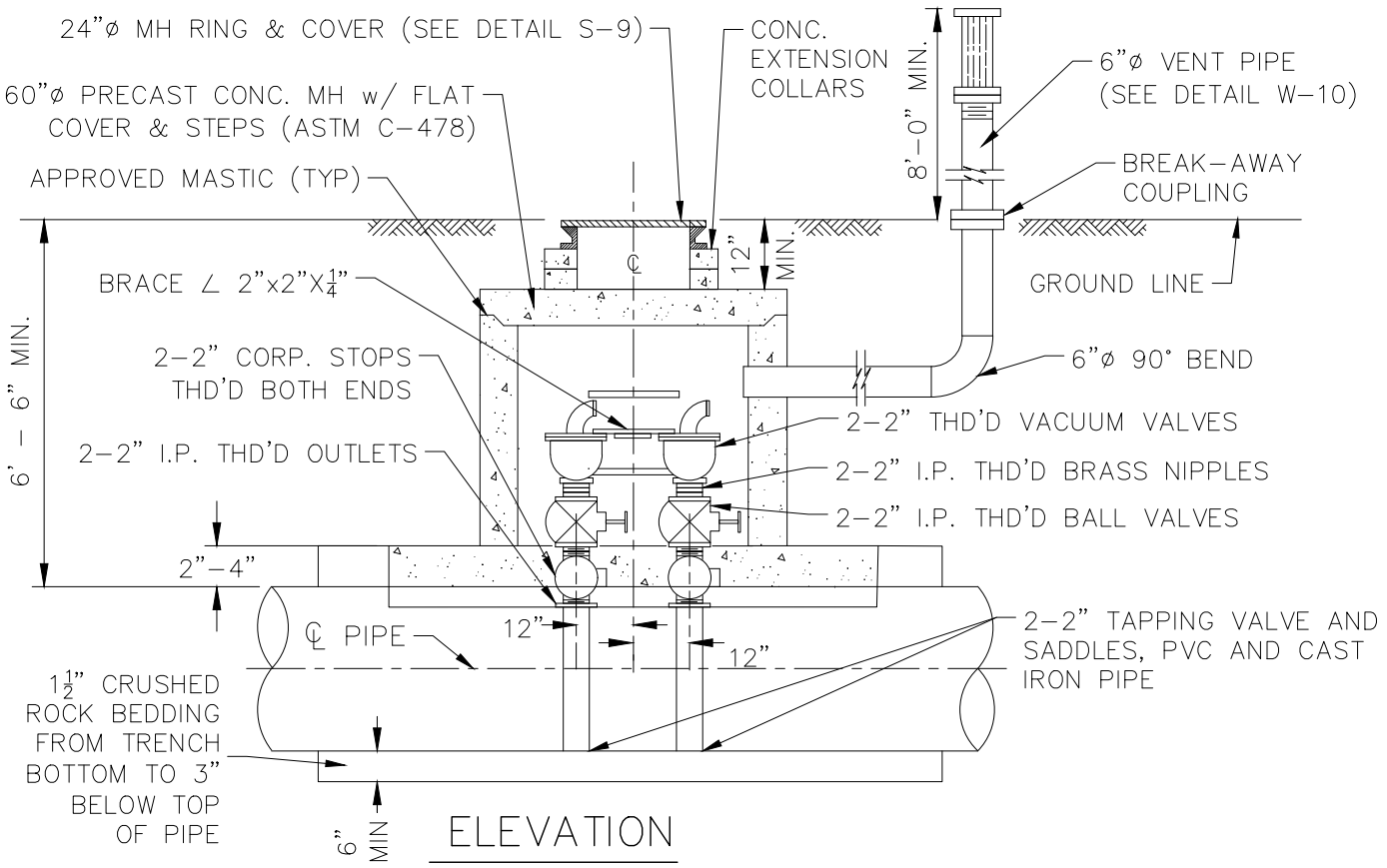
DEPARTMENT OF PUBLIC WORKS

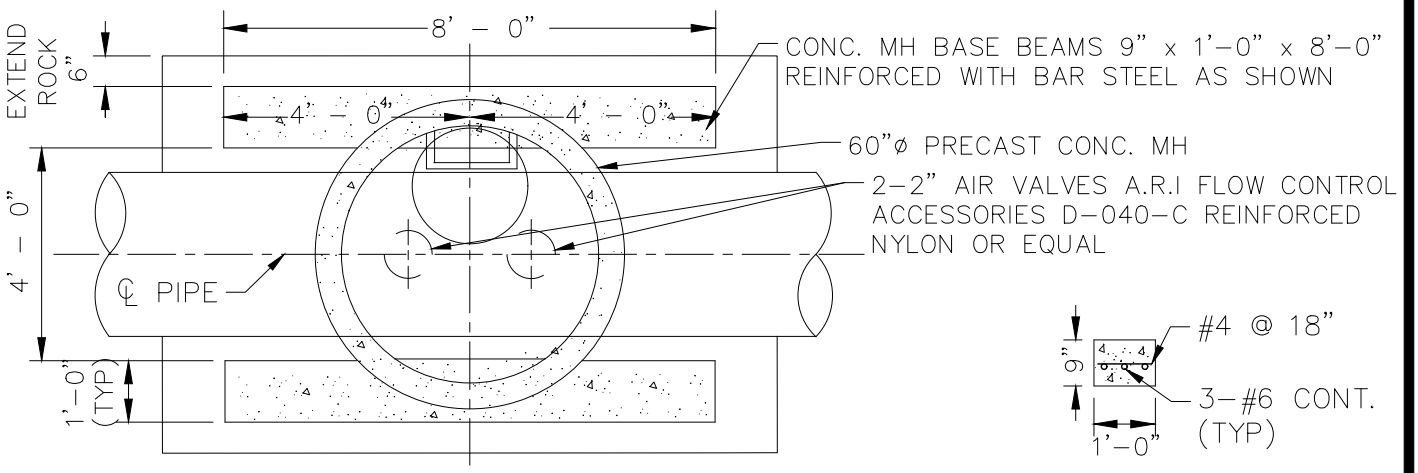
LENGTH OF RESTRAINED PIPE

SCALE: NTS

DATE: JAN 2022

DETAIL NO. **W-7**





NOTES:

1. CITY MAY REQUIRE LARGER RING & COVER SIZINGS (30"+) DEPENDING ON THE APPLICATION.
2. PIPE TO BE GRADED SO VALVES ARE AT HIGH POINT ON LINE ON A LEVEL SECTION OF PIPE WHILE MAINTAINING VAULT DEPTH AS NOTED. VALVES TO BE PLACED AT CENTER OF FULL PIPE SECTION.
3. FOR PIPE LARGER THAN 16"ø, VALVES, VAULT, AND FOOTING ETC. SHALL BE SPECIALLY DESIGNED AND APPROVED BY CITY.

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APPROVED
CITY ENGINEER

CITY OF GOLDEN

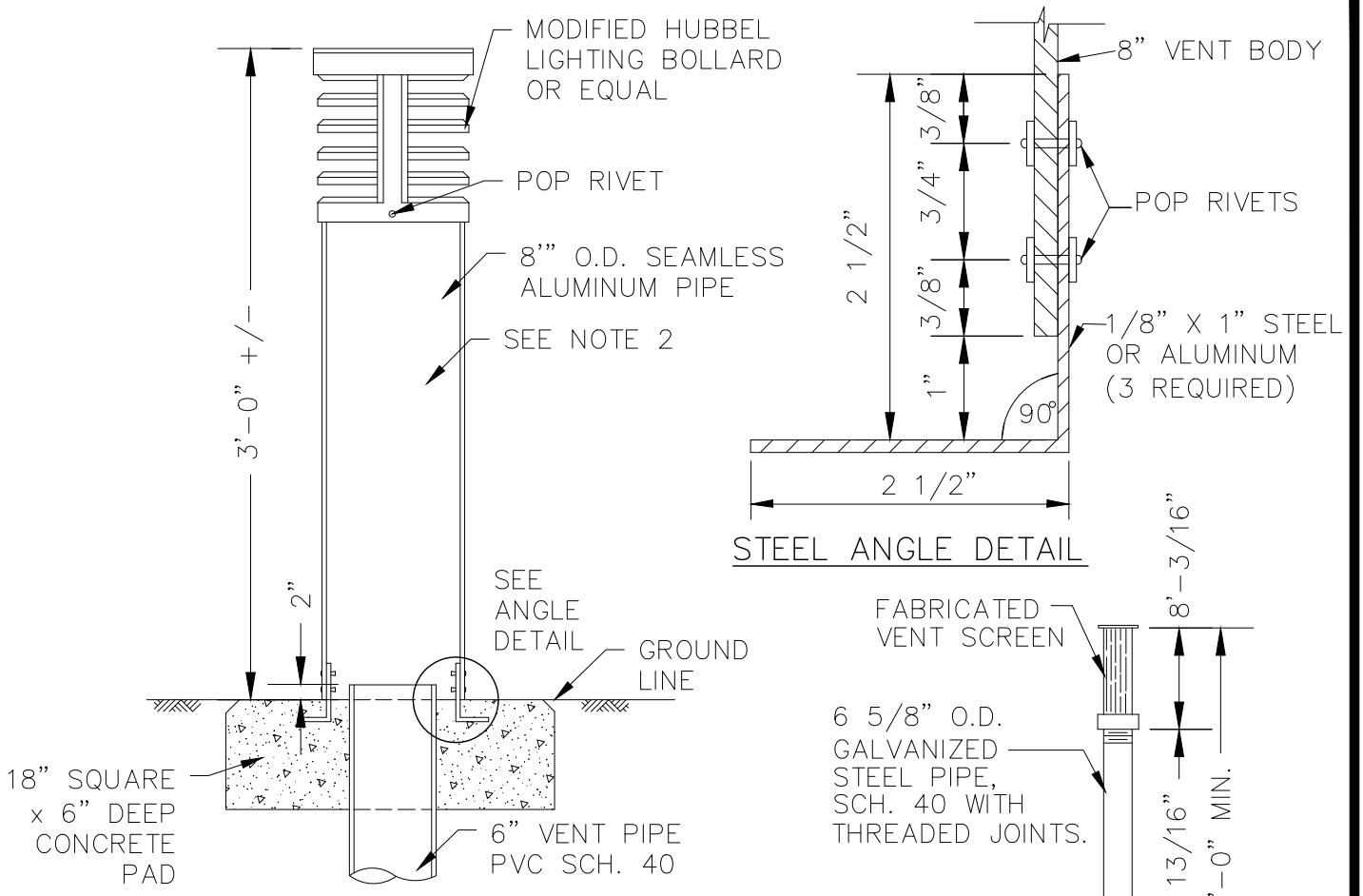
DEPARTMENT OF PUBLIC WORKS

AIR & VACUUM VALVE DETAIL

SCALE: NTS

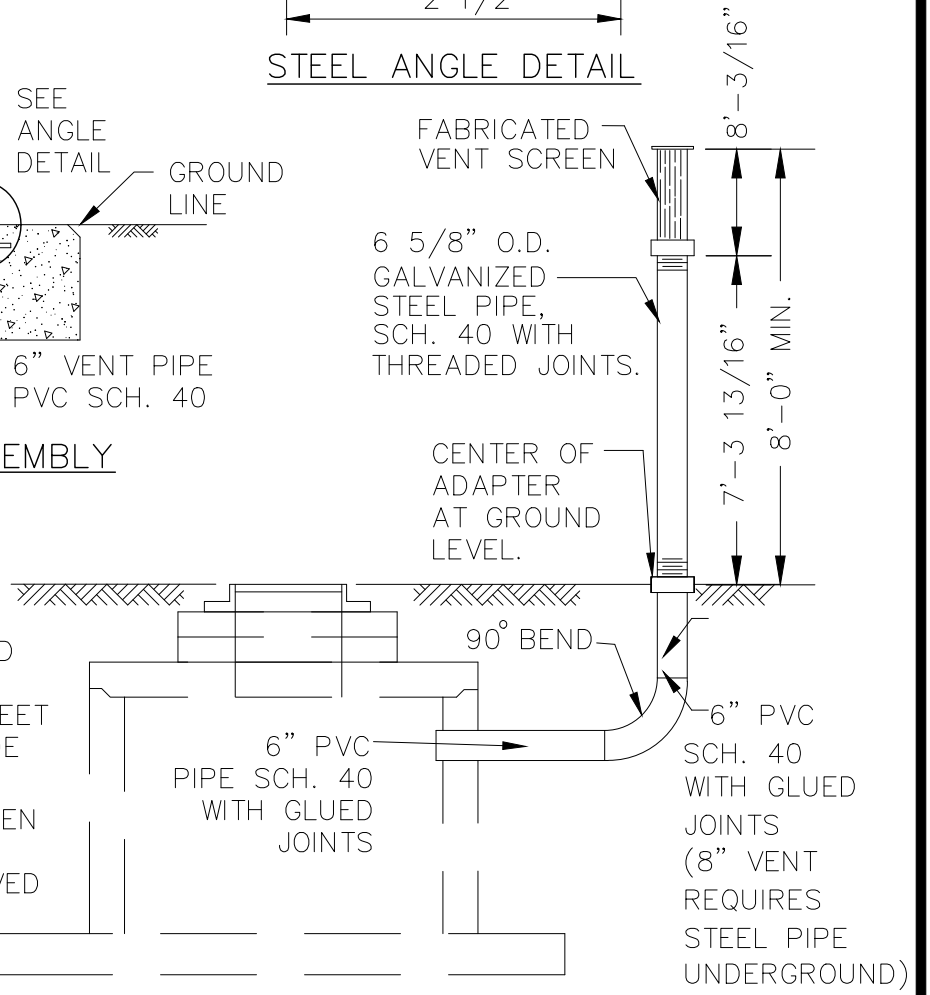
DATE: JAN 2022

DETAIL NO. W-8



RESIDENTIAL ASSEMBLY

STEEL ANGLE DETAIL



BREAKAWAY ASSEMBLY

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. OR APPROVED BY CITY.

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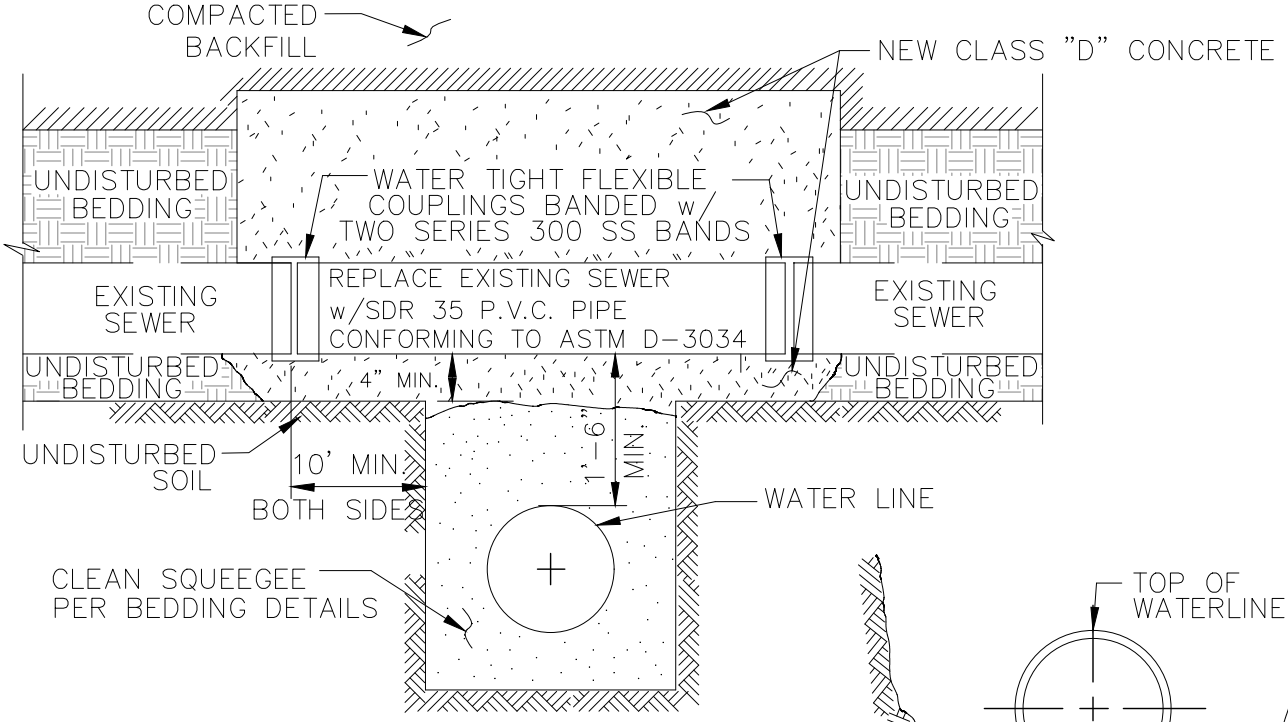
VENT PIPE ASSEMBLY

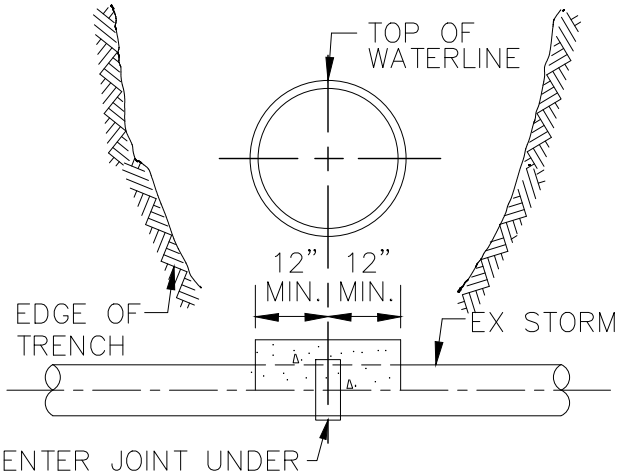
SCALE: NTS

DATE: JAN 2022

DETAIL NO. W-9

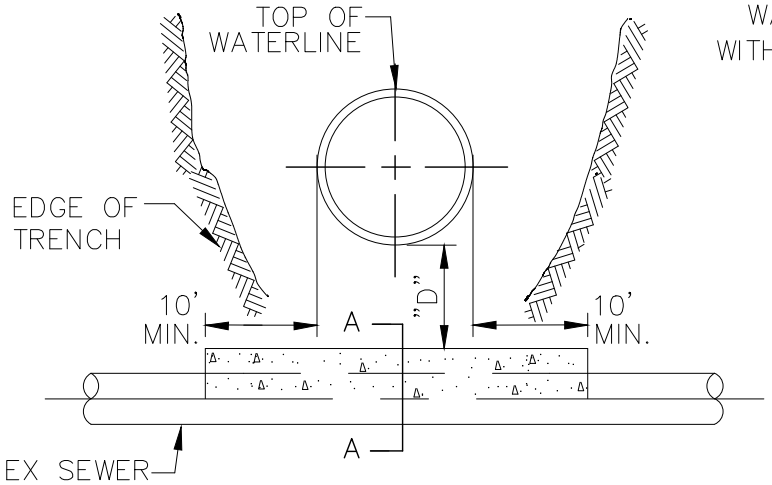


NOTE:
ANY EXISTING SUB-DRAIN UNDER THE SEWER SHALL BE REPLACED SUCH THAT NO FLOW SHALL ENTER THE WATER LINE TRENCH.

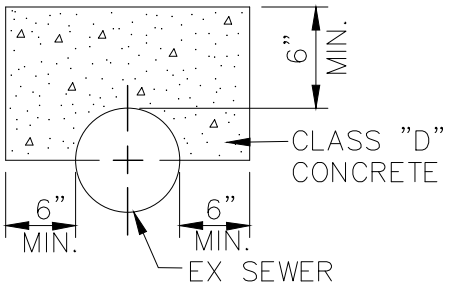


CENTER JOINT UNDER WATERLINE. ALL JOINTS WITHIN 10' OF WATERLINE ℄ SHALL BE ENCASED IN CONCRETE.

STORM CROSSING UNDER

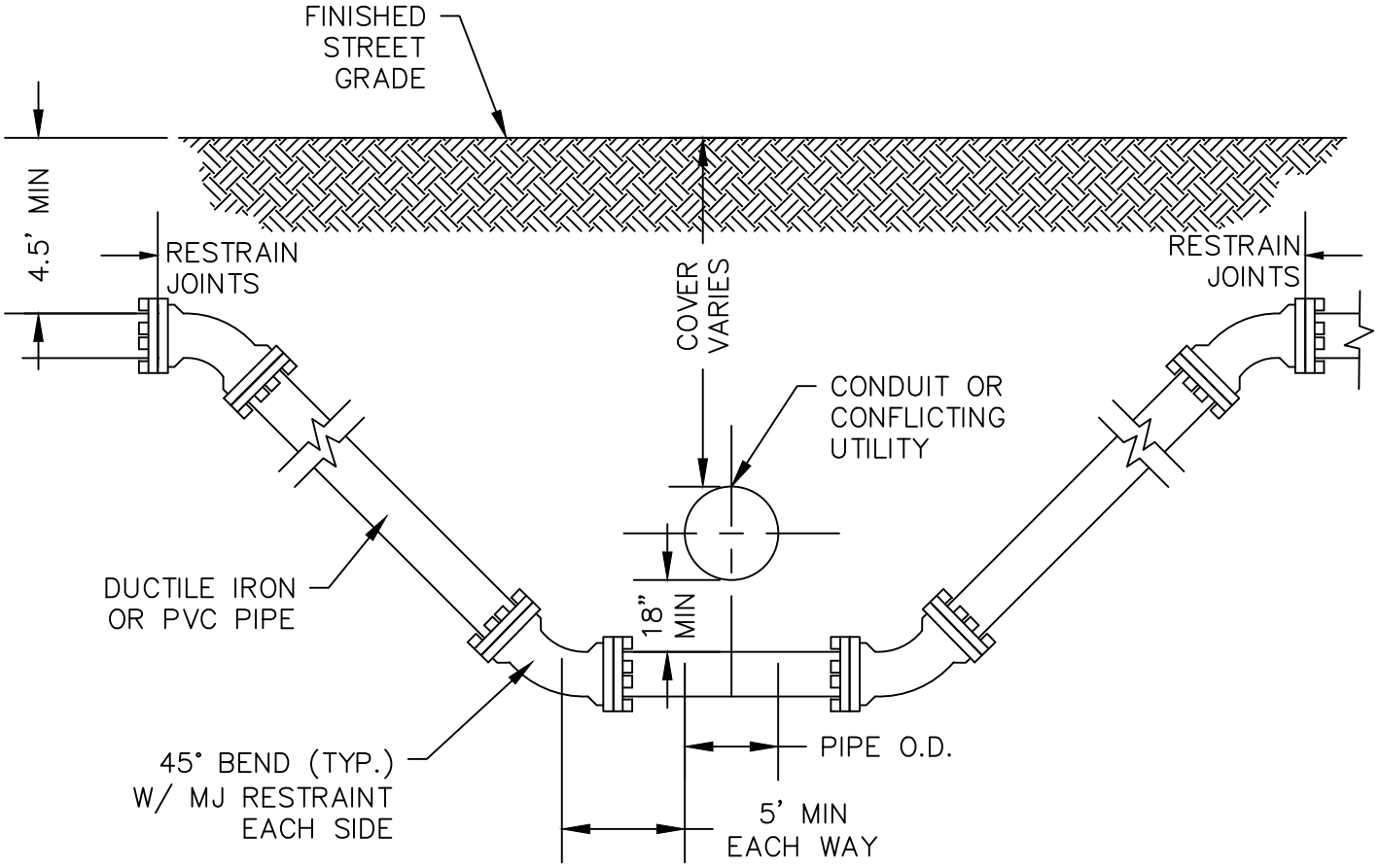


SEWER CROSSING UNDER
WITH "D" LESS THAN 2'-0"



SECTION A-A

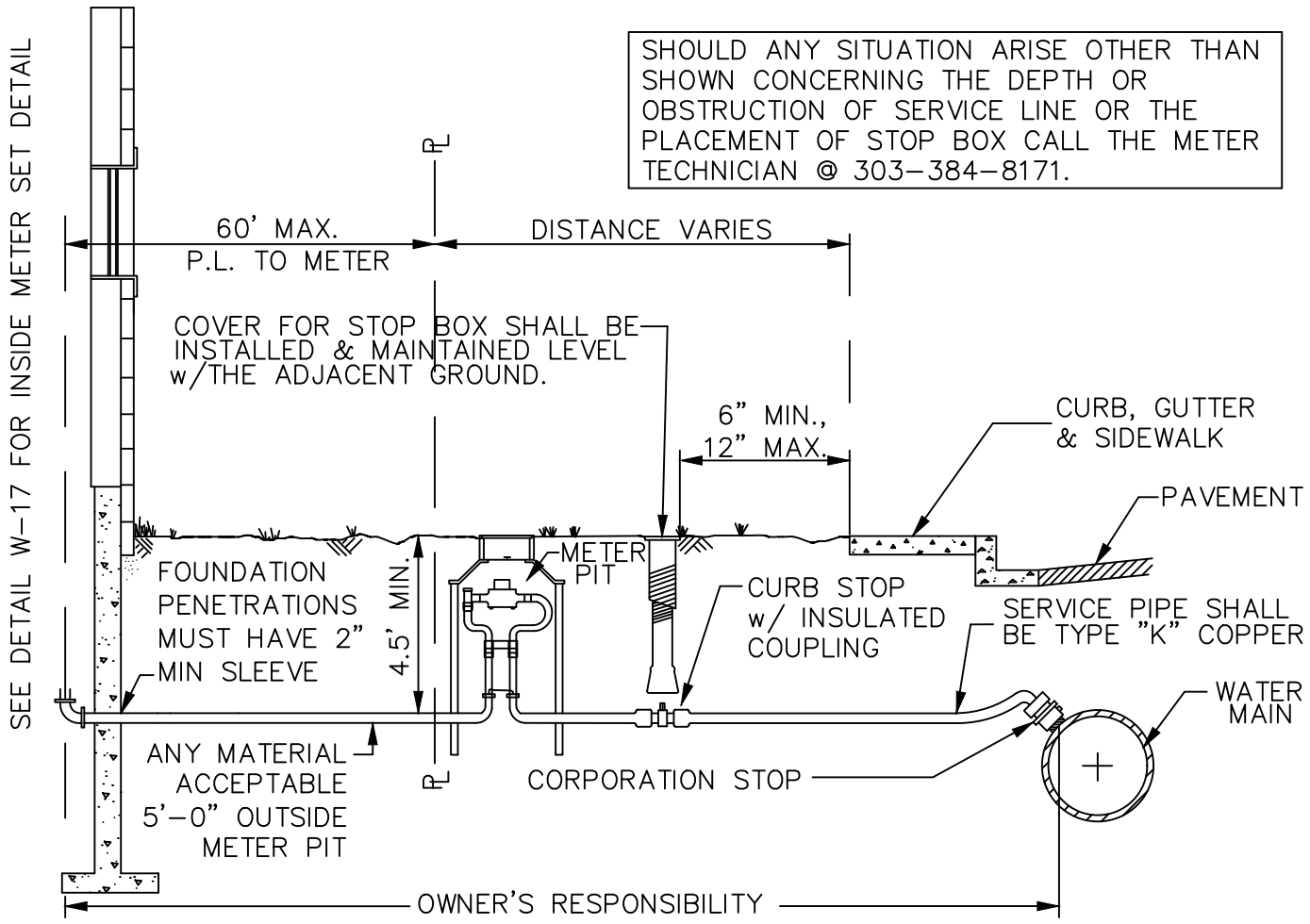
APPROVED DIRECTOR OF PUBLIC WORKS	CITY OF GOLDEN DEPARTMENT OF PUBLIC WORKS	CROSSING DETAIL FOR STORM & SANITARY SEWER
APPROVED CITY ENGINEER		SCALE: NTS DATE: JAN 2022
		DETAIL NO. W-10



NOTES

1. LENGTH OF RESTRAINED PIPE SHALL BE IN ACCORDANCE WITH THESE ENGINEERING STANDARDS/DETAILS.
2. CATHODIC PROTECTION IS REQUIRED IN ACCORDANCE WITH THE STANDARD SPECIFICATIONS AND DETAILS.
3. A BORED CROSSING MAY BE REQUIRED BY THE ENGINEER.
4. REFERENCE REVERSE KICKERS AND UTILITY CROSSING DETAILS.

APPROVED DIRECTOR OF PUBLIC WORKS	**CITY OF GOLDEN**	WATER LINE CROSSING DETAIL
APPROVED CITY ENGINEER	**DEPARTMENT OF PUBLIC WORKS**	SCALE: NTS DATE: JAN 2022 DETAIL NO. **W-11**



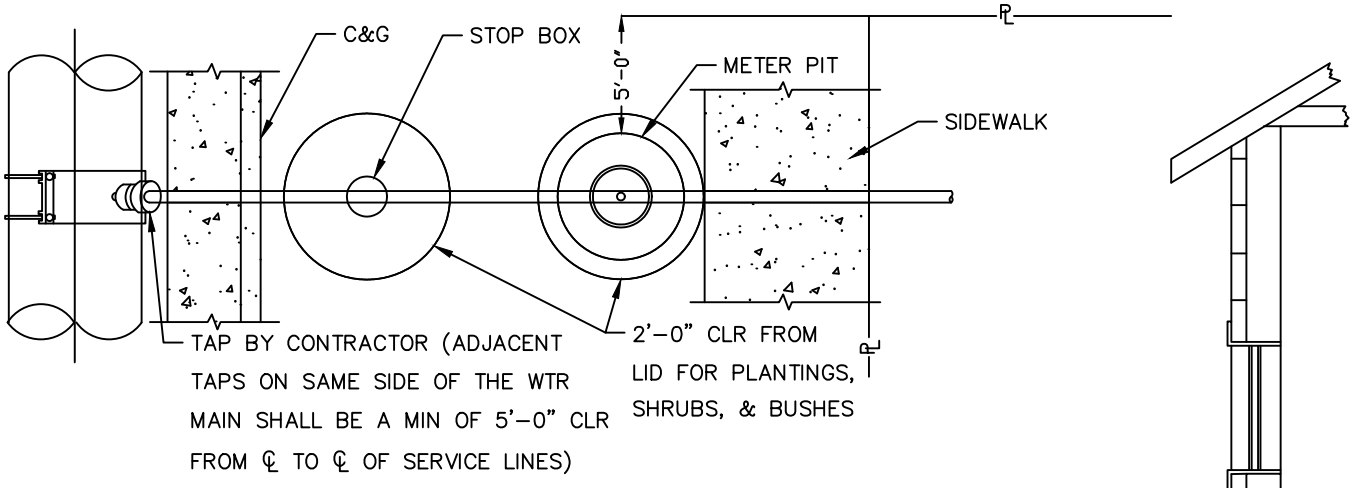
WATER SERVICE REQUIREMENTS

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. TAPPING SADDLE MUST BE USED ON ALL TAPS. ALL PIPE SHALL BE TYPE 'K' TAPPING COPPER THROUGH THE METER PIT OR TO THE METER.
   - 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.
   - G. ALL NEW RESIDENTIAL CONSTRUCTION IS TO HAVE OUTSIDE METERS.
5. ALL METERS 1.5" OR LARGER, SUPPLIED BY CITY, BUT SET BY CONTRACTOR.
6. CITY TO SUPPLY METERS. YOKE IS TO BE USED FOR ALL RESIDENTIAL METERS.
7. SEE TRACER WIRE REQUIREMENTS.

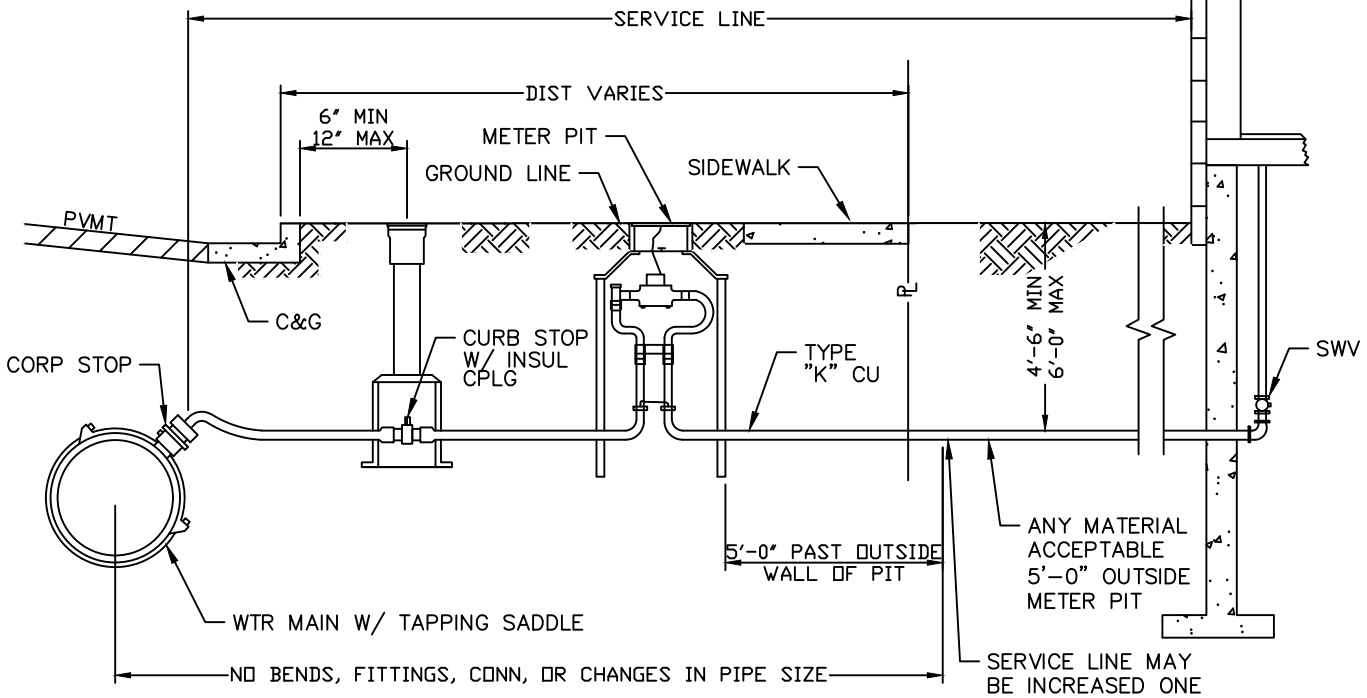
APPROVED DIRECTOR OF PUBLIC WORKS	**CITY OF GOLDEN** **DEPARTMENT OF PUBLIC WORKS**	WATER SERVICE PROFILE
APPROVED CITY ENGINEER		SCALE: NTS DATE: JAN 2022 DETAIL NO. **W-12A**

NOTES:

1. IF THERE IS A TREE LAWN BETWEEN THE CURB AND SIDEWALK, THE STOP BOX AND THE METER SETTING SHALL BE INSTALLED IN THE THREE LAWN. IF NO TREE LAWN EXISTS, AND THE SIDEWALK IS ADJACENT TO THE BACK OF THE CURB, THE CURB STOP BOX SHALL BE 6–INCHES TO 12–INCHES FROM THE BACK SIDE OF THE SIDEWALK.
2. THE STOP BOX SHALL BE LOCATED IN A PUBLIC RIGHT–OF–WAY, 6–INCHES TO 12–INCHES FROM THE BACKSIDE OF THE CURB OR SIDEWALK, IN A LANDSCAPED AREA, 24–INCHES FROM THE INLET SIDE OF THE METER PIT UNLESS PRIOR APPROVAL IS OBTAINED FROM THE CITY. FOR A CURB BREAKER, THE CURB STOP CANNOT BE LOCATED BENEATH PARKING AREAS.
3. INSTALL METER PIT AND SERVICE LINE IN ACCORDANCE WITH SPECIFICATION SECTION 7.
4. REFERENCE DETAILS UT–3A THROUGH UT–3F FOR TRACER WIRE REQUIREMENTS.

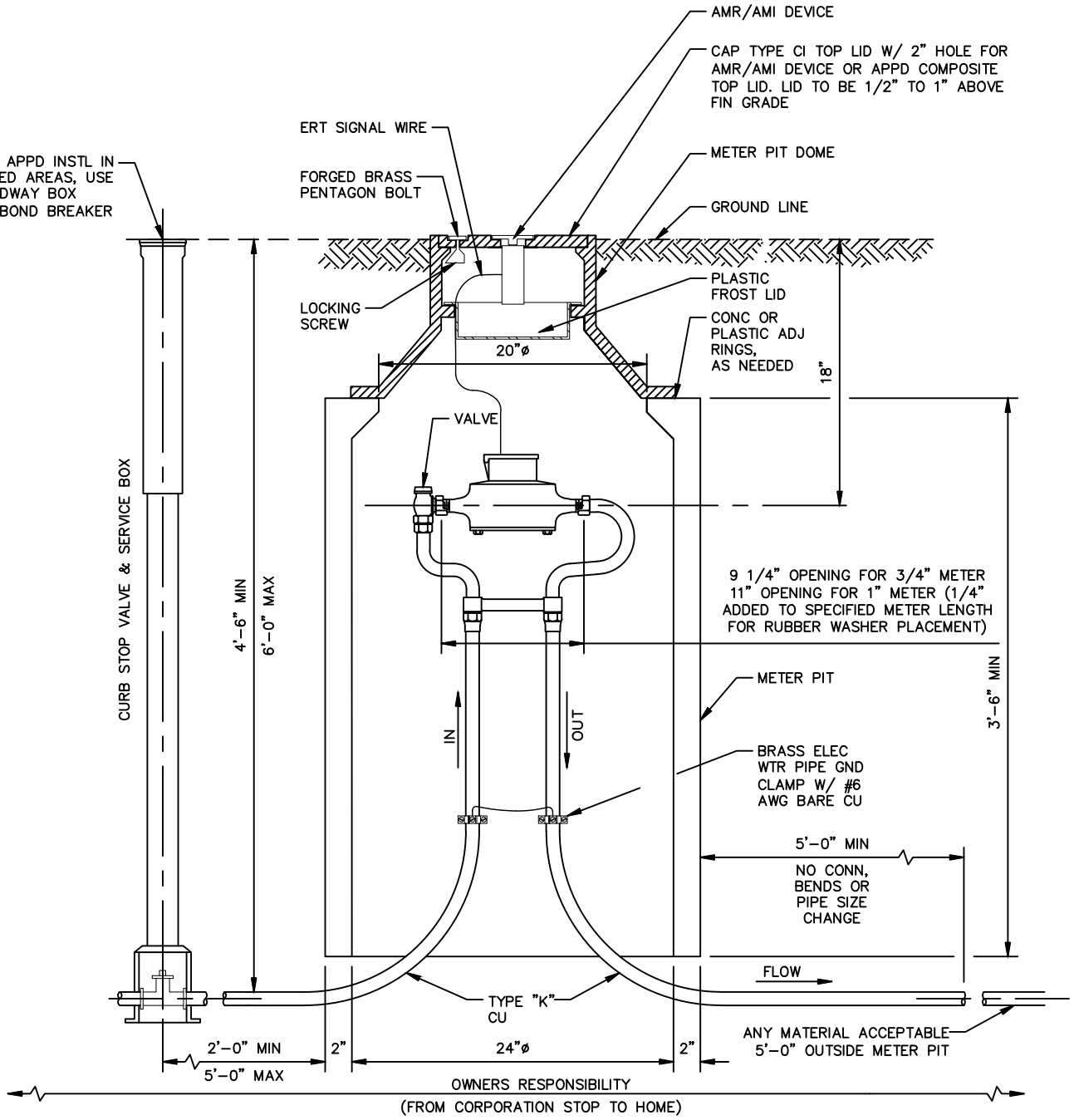


PLAN



ELEVATION

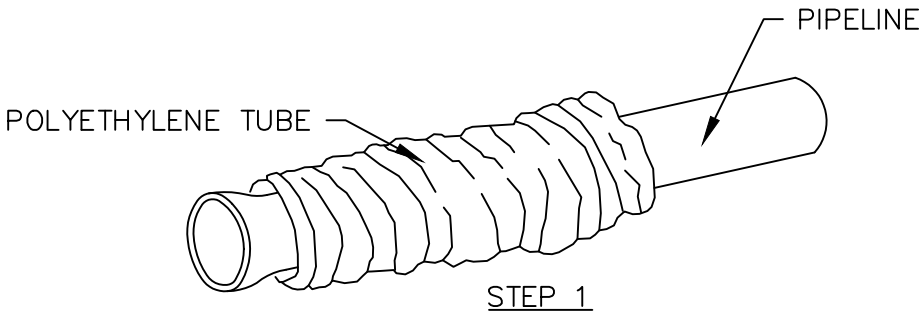
APPROVED DIRECTOR OF PUBLIC WORKS	**CITY OF GOLDEN** DEPARTMENT OF PUBLIC WORKS	¾" & 1" SERVICE LINE, STOP BOX, & OUTSIDE METER INSTALLATION
APPROVED CITY ENGINEER		SCALE: NTS DATE: JAN 2022 DETAIL NO. **W-12B**



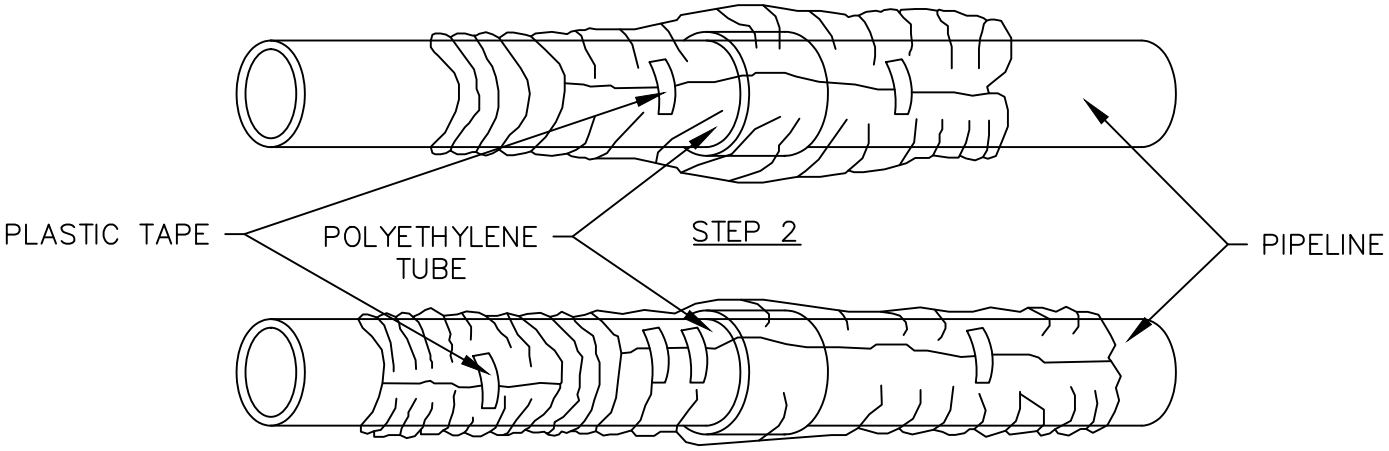
NOTES:

1. BENDING COPPER RISERS FOR GRADE ADJUSTMENT OF THE METER YOKE IS NOT PERMITTED
2. SERVICE LINES SHALL NOT CROSS IN THE METER PIT.
3. COPPER RISERS SHALL BE NEW. DAMAGED OR BENT COPPER RISERS ARE NOT PERMITTED.
4. INSTALL METER PIT AND SERVICE LINE IN ACCORDANCE WITH SPECIFICATION SECTION 7.
5. COMPOSITE METER PITS SHALL BE LOCATED IN LANDSCAPED AREAS ONLY NOT SUBJECT TO TRAFFIC LOADING.
6. ¾" LONG METERS SHALL HAVE A 9¼" OPENING. ¾" SHORT METERS SHALL HAVE A 7½" OPENING.

APPROVED DIRECTOR OF PUBLIC WORKS	CITY OF GOLDEN	OUTSIDE SETTING FOR ¾" & 1" METER
APPROVED CITY ENGINEER	DEPARTMENT OF PUBLIC WORKS	SCALE: NTS DATE: JAN 2022 DETAIL NO. W-12C



STEP 1



STEP 3

FIELD INSTALLATION – POLYETHYLENE WRAP

STEP 1– PLACE TUBE OF POLYETHYLENE MATERIAL ON PIPE PRIOR TO LOWERING IT INTO THE TRENCH.

STEP 2– PULL THE TUBE OVER THE LENGTH OF THE PIPE. TAPE TUBE TO PIPE AT JOINT, FOLD MATERIAL AROUND THE ADJACENT SPIGOT END AND WRAP WITH TAPE TO HOLD THE PLASTIC TUBE IN PLACE.

STEP 3– OVERLAP FIRST TUBE WITH ADJACENT TUBE AND SECURE WITH PLASTIC ADHESIVE TAPE. THE POLYETHYLENE TUBE MATERIAL COVERING THE PIPE SHALL BE LOOSE. EXCESS MATERIAL SHALL BE NEATLY DRAWN UP AROUND THE PIPE BARREL,, FOLDED ON TOP OF PIPE AND TAPED IN PLACE.

NOTE: ALL BURIED DUCTILE IRON PIPE, FITTINGS, VALVES, FIRE HYDRANT ASSEMBLIES, ETC. SHALL BE POLYETHYLENE WRAPPED.

APPROVED DIRECTOR OF PUBLIC WORKS	CITY OF GOLDEN DEPARTMENT OF PUBLIC WORKS	POLYETHYLENE WRAP
APPROVED CITY ENGINEER		SCALE: NTS DATE: JAN 2022 DETAIL NO. W-13

GENERAL METER NOTES

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

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

5. THE SERVICE LINE THROUGH AND ON BOTH SIDES OF THE METER PIT MUST BE OF THE SAME MATERIAL. CAN UPSIZE AND/OR CHANGE MATERIAL FIVE (5) FEET PAST THE METER FOR OUTSIDE SETS OR INSIDE JUST PAST THE METER.

6. 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.

7. 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-54d CLASS A, 125 PSI W.S.P., 200 PSI W.O.G. OR CURB STOPS IN ACCORDANCE WITH AWWA C800 AND AWWA C509.
   B. ALL GATE VALVES 3" AND LARGER SHALL CONFORM WITH GOLDEN'S STANDARD SPECIFICATIONS.

8. ALL DRESSER (OR APPROVED EQUAL) COUPLINGS SHALL HAVE THE PIPE STOP REMOVED.

APPROVED DIRECTOR OF PUBLIC WORKS	CITY OF GOLDEN	METER NOTES
APPROVED CITY ENGINEER	DEPARTMENT OF PUBLIC WORKS	SCALE: NTS DATE: JAN 2022 DETAIL NO. W-14A

GENERAL METER NOTES

9. 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.

10. 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.

11. 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.

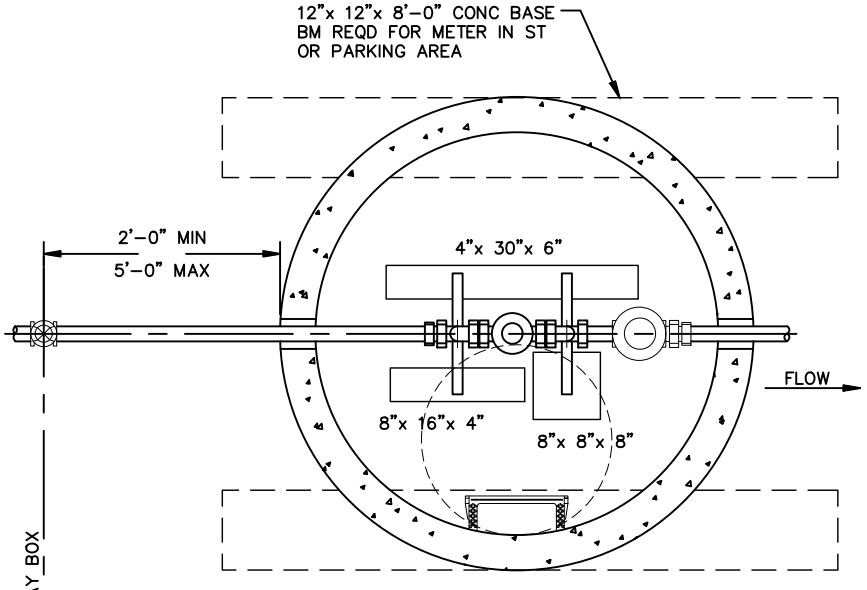
12. BACKFLOW PREVENTION DEVICES MAY BE REQUIRED PER CURRENT CITY MUNICIPAL CODE.

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

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

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

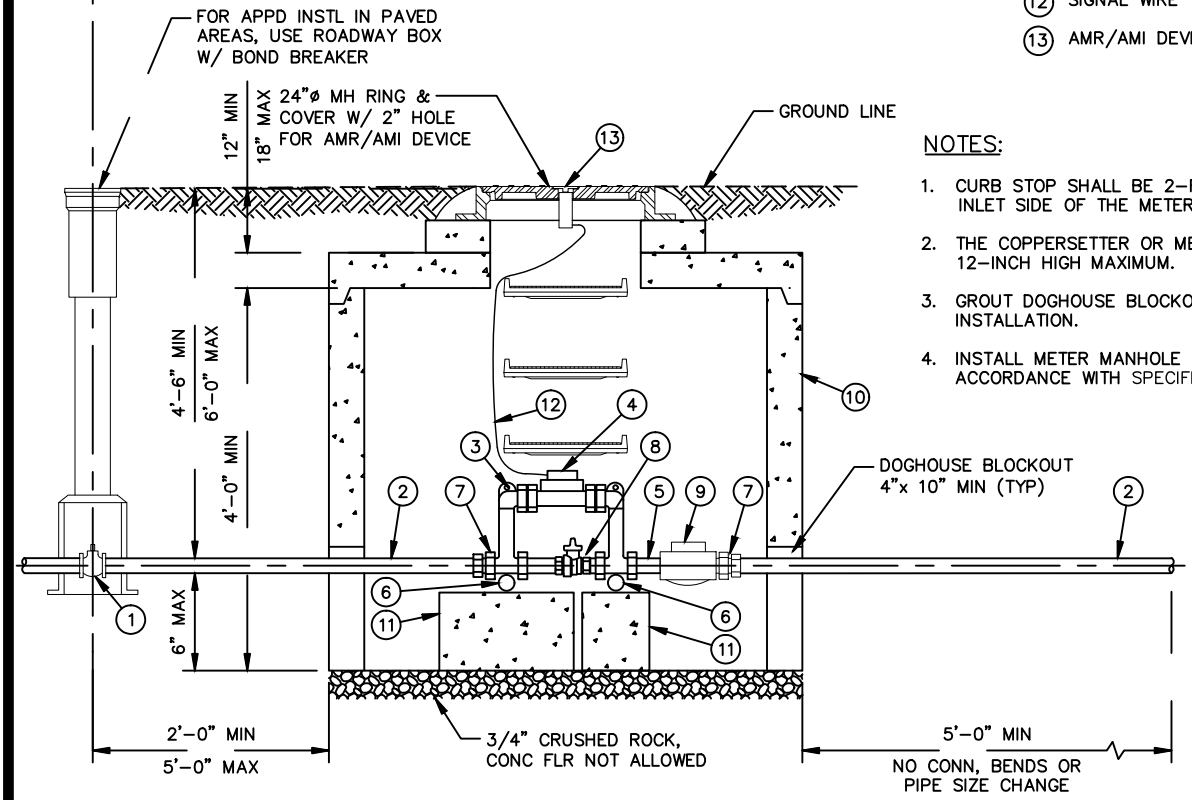
APPROVED DIRECTOR OF PUBLIC WORKS	CITY OF GOLDEN	METER NOTES
APPROVED CITY ENGINEER	DEPARTMENT OF PUBLIC WORKS	SCALE: NTS DATE: JAN 2022 DETAIL NO. W-14B



PLAN

KEY NOTES:

1. CURB STOP
2. TYPE "K" CU TUBING
3. 1 1/2" OR 2" COPPERSETTER/METER YOKE W/ BYPASS
4. WTR METER W/ ENCODER REGISTER
5. 3" NIPPLE BTWN COPPERSETTER & CHKV
6. 1"x 23" BSP-40
7. IRON PIPE TO FLARE CPLG FROM INLET SIDE OF COPPERSETTER & OUTLET SIDE OF CHKV
8. BYPASS W/ VALVE WILL BE 1" FOR 1 1/2" COPPERSETTERS & 1 1/2" OR 1 1/4" FOR 2" COPPERSETTERS; NO BYPASS FOR IRR METERS
9. CHKV (CHKV NOT REQD WHERE A BFP DEVICE IS INSTL) CHKV MAY BE REQD IF DIST TO BFP ASSY ALLOWS EXCESSIVE WTR TO DR DURING METER MAINTENANCE
10. 48"ø PRECAST CONC MH
11. 4"x 30"x 6" (TYP OF 2) OR 8"x 8"x 8" (TYP OF 4) OR 8"x 16"x 4" (TYP OF 4) CONC BLOCK SPRT
12. SIGNAL WIRE TO AMR/AMI DEVICE
13. AMR/AMI DEVICE



ELEVATION

NOTES:

1. CURB STOP SHALL BE 2-FEET MINIMUM FROM THE INLET SIDE OF THE METER MANHOLE.
2. THE COPPERSETTER OR METER YOKE SHALL BE 12-INCH HIGH MAXIMUM.
3. GROUT DOGHOUSE BLOCKOUTS AFTER SERVICE LINE INSTALLATION.
4. INSTALL METER MANHOLE AND SERVICE LINE IN ACCORDANCE WITH SPECIFICATION SECTION 7.

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CITY ENGINEER

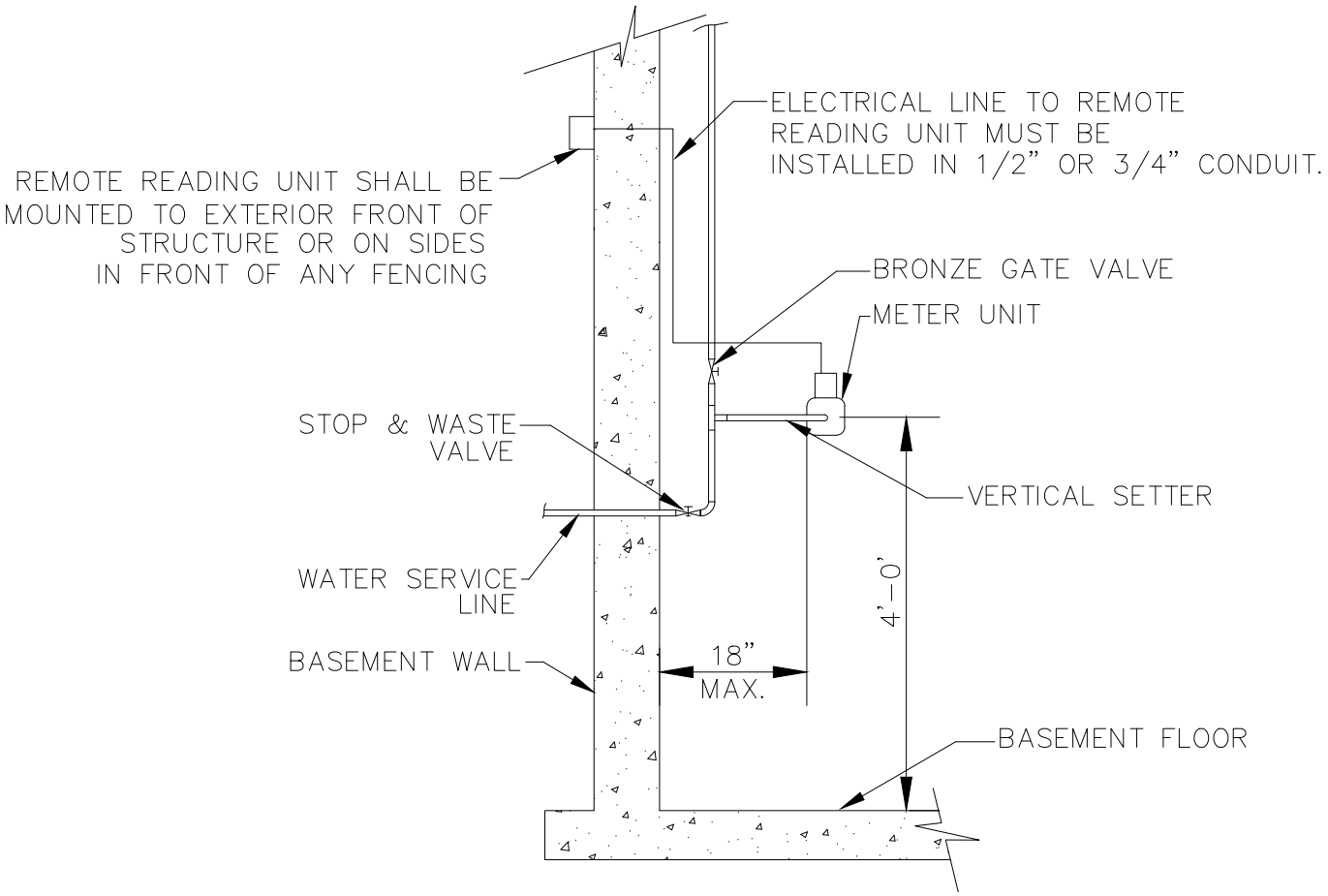
CITY OF GOLDEN
DEPARTMENT OF PUBLIC WORKS

OUTSIDE METER SETTING
1 1/2" & 2" w/CHECK VALVE
& BYPASS IN MANHOLE

SCALE: NTS

DATE: JAN 2022

DETAIL NO.
W-15



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CITY ENGINEER

CITY OF GOLDEN

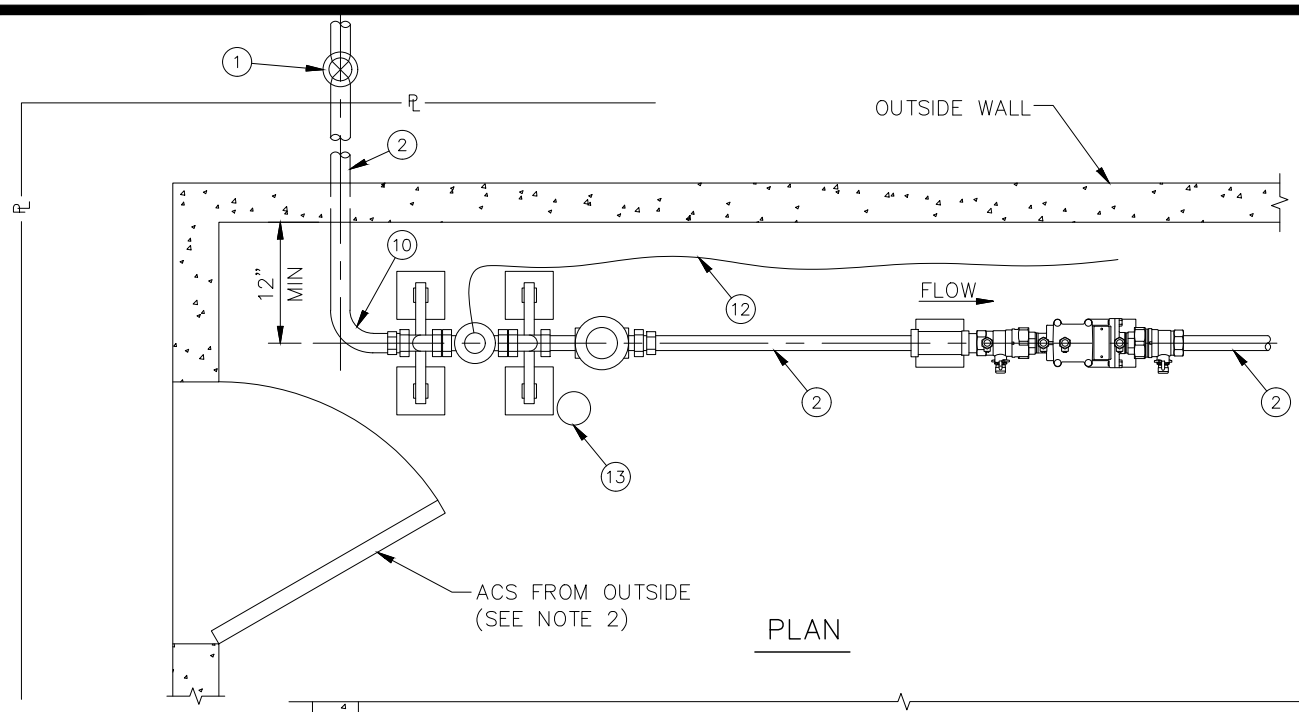
DEPARTMENT OF PUBLIC WORKS

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

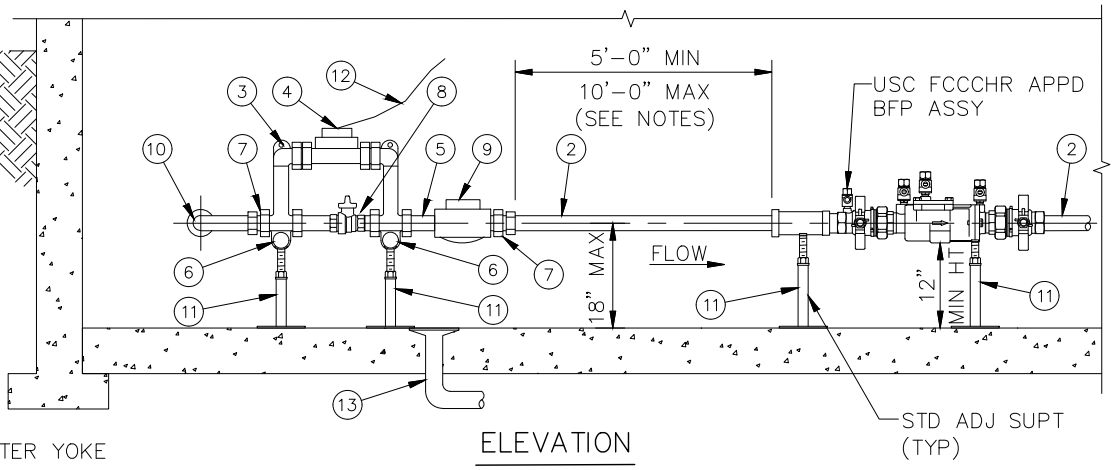
SCALE: NTS

DATE: JAN 2022

DETAIL NO.
W-16



PLAN



ELEVATION

KEY NOTES:

1. CURB STOP
2. TYPE "K" CU TUBING
3. 2" COPPERSETTER/METER YOKE
4. METER W/ ENCODER REGISTER
5. 3" NIPPLE BTWN COPPERSETTER AND CHKV (IF REQD)
6. 1"x18" BSP-40
7. MIP TO FLARE CPLG FROM INLET SIDE OF COPPERSETTING & OUTLET SIDE OF CHKV
8. BY-PASS W/ VALVE WILL BE 1" FOR $1\frac{1}{2}$" COPPERSETTERS & $1\frac{1}{2}$" OR $1\frac{1}{4}$" FOR 2" COPPERSETTERS
9. CHKV-NOT REQD WHERE A BFP ASSY IS INSTALLED BUT MAY BE REQD IF DISTANCE TO BFP ASSY IS MORE THAN 150' & ALLOWS EXCESSIVE WTR TO DRAIN DURING METER MAINTENANCE
10. 90° ELB
11. STD ADJ SPRT
12. SIGNAL WIRE TO AMR/AMI DEVICE
13. FD

NOTES:

1. NEW INSIDE METER INSTALLATION ARE PERMITTED ONLY BY WRITTEN APPROVAL. EXISTING INSIDE METER INSTALLATIONS SHALL COMPLY WITH THIS DRAWING.
2. INSTALLATION SHALL ALLOW FOR ACCESS FROM PUBLIC RIGHT-OF-WAY OR EASEMENT TO METER AND VALVES, AND PROVIDE PROTECTION FROM FREEZING.
3. A FLOOR DRAIN SHALL BE PLACED WITHIN 10-FEET OF THE METER INSTALLATION IN THE SAME ROOM.
4. METER SUPPORT MAY BE EITHER CONCRETE OR STRUCTURAL CHANNEL ATTACHED TO WALL.
5. WALL PENETRATIONS SHALL BE GROUTED WITH CONCRETE.
6. USC FCCCHR APPROVED DOUBLE CHECK VALVE OR REDUCED PRESSURE PRINCIPLE BACKFLOW PREVENTION ASSEMBLY DETERMINED BY DEGREE OF HAZARD POSED BY INTERNAL PLUMBING USE.
7. REFER TO LOCAL CODES AND MANUFACTURER REQUIREMENTS FOR SPECIFIC INSTALLATION INSTRUCTIONS.

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APPROVED
CITY ENGINEER

CITY OF GOLDEN

DEPARTMENT OF PUBLIC WORKS

INSIDE METER SETTING FOR 1-1/2" & 2" W/ BYPASS AND INSIDE BACKFLOW PREVENTION

SCALE: NTS

DETAIL NO. **W-17**

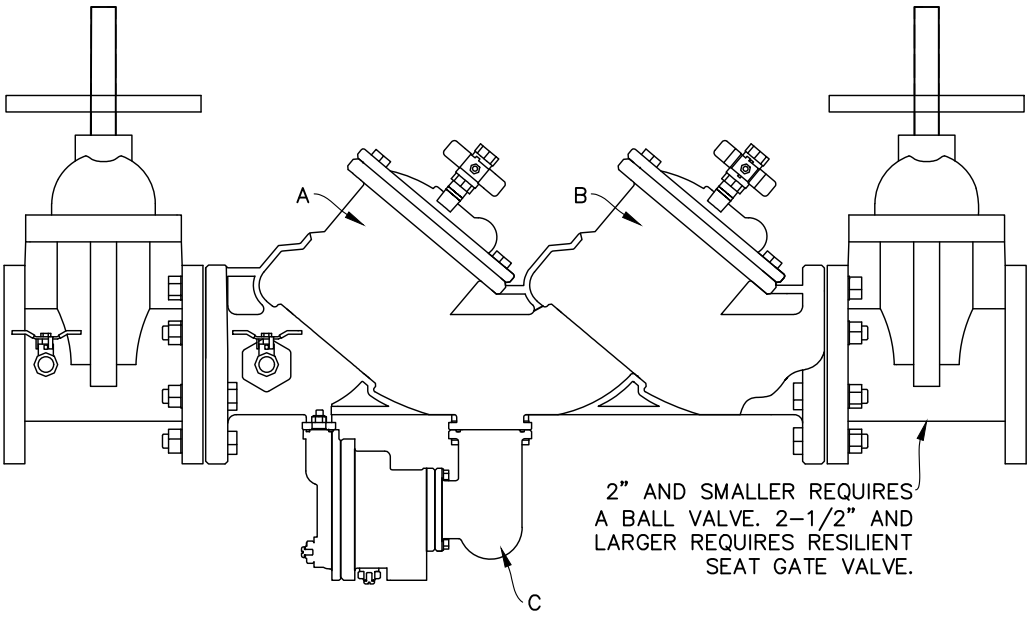
DATE: JAN 2022

TYPICAL REDUCED PRESSURE BACKFLOW PREVENTION DEVICE

DESCRIPTION:

THE REDUCED PRESSURE BACKFLOW PREVENTER OPERATES ON THE PRINCIPLE THAT WATER WILL NOT FLOW FROM A ZONE OF LOWER PRESSURE TO ONE OF HIGHER PRESSURE. IT PROVIDES MAXIMUM PROTECTION AGAINST BACKFLOW CAUSED BY BOTH BACKPRESSURE AND BACKSIPHONAGE.

THE DEVICE CONSISTS OF TWO SPRING–LOADED CHECK VALVES (A AND B) AND A SPRING–LOADED DIAPHRAGM ACTUATED DIFFERENTIAL PRESSURE RELIEF VALVE (C) LOCATED IN THE ZONE BETWEEN THE CHECK VALVES.



OPERATION:

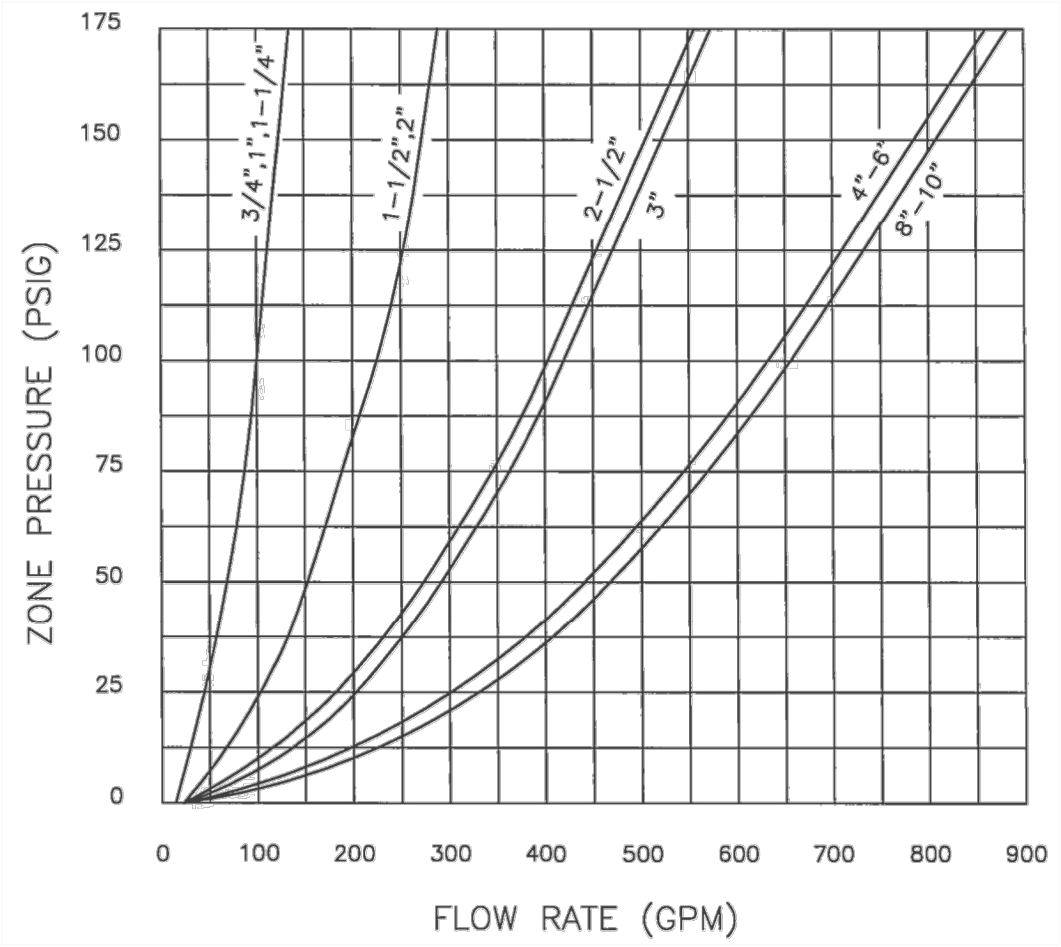
THE FIRST CHECK VALVE (A) CAUSES ALL WATER PASSING THROUGH IT TO BE AUTOMATICALLY REDUCED IN PRESSURE.

THE SECOND CHECK VALVE (B) IS LIGHTLY SPRING–LOADED AND FORMS THE "DOUBLE CHECK" FEATURE OF THE DEVICE. IT ACTS TO PREVENT UNNECESSARY DRAINAGE OF THE DOMESTIC SYSTEM IN CASE A BACKFLOW CONDITION OCCURS.

THE RELIEF VALVE (C) IS SPRING–LOADED TO REMAIN OPEN, AND DIAPHRAGM ACTUATED TO CLOSE BY MEANS OF DIFFERENTIAL PRESSURE.

SEE DETAIL W–18B FOR FLOOR DRAIN CAPACITIES.

APPROVED DIRECTOR OF PUBLIC WORKS	**CITY OF GOLDEN** **DEPARTMENT OF PUBLIC WORKS**	REDUCED PRESSURE BACKFLOW PREVENTION DEVICE
APPROVED CITY ENGINEER		SCALE: NTS DATE: JAN 2022 DETAIL NO. **W–18A**



TYPICAL FLOW RATES AS
SIZED BY FLOOR DRAIN MANUFACTURERS:

2" – 55 GPM
3" – 112 GPM
4" – 170 GPM
5" – 350 GPM
6" – 450 GPM
8" – 760 GPM

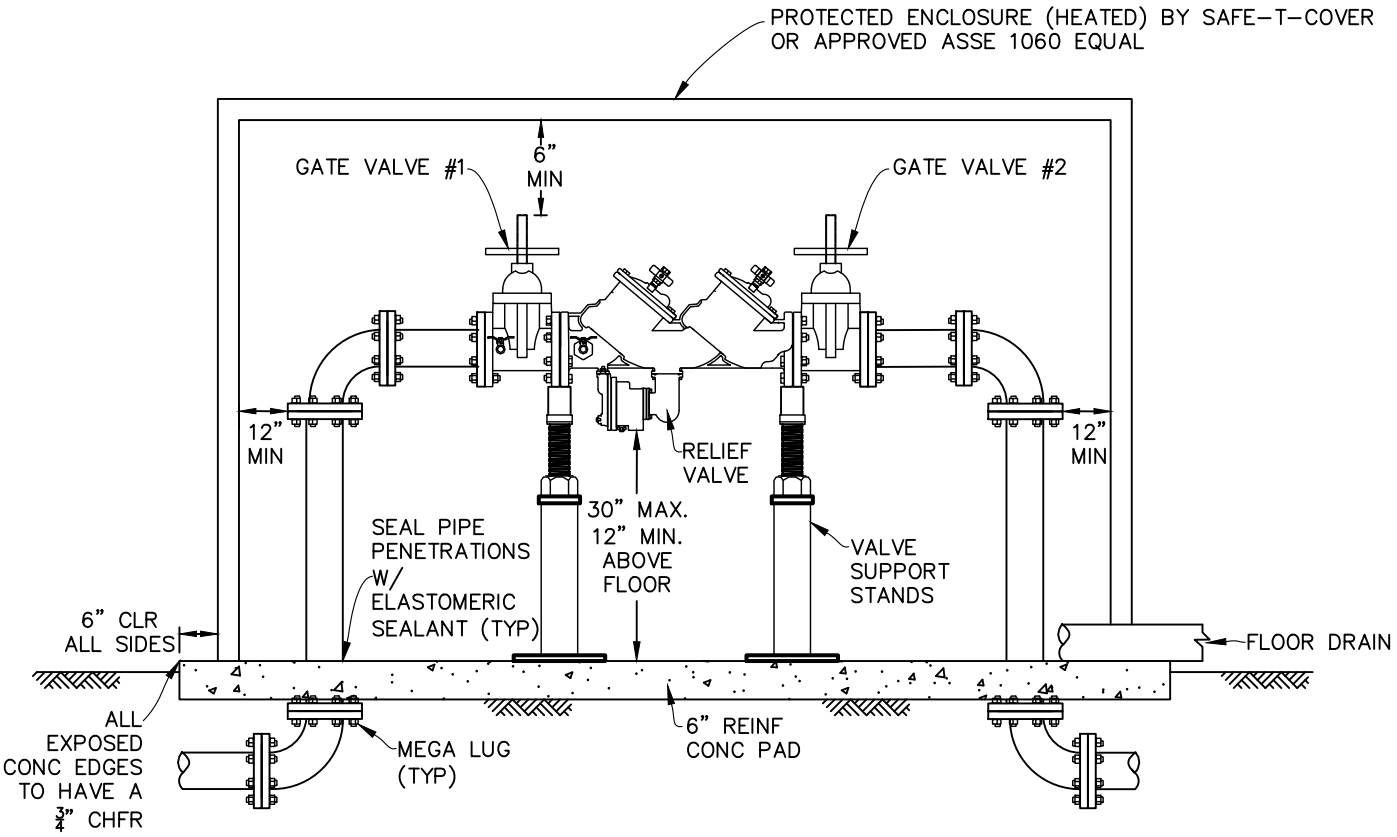
NOTE:

FLOOR DRAIN CAPACITIES ARE ESTABLISHED BY THE FLOOR DRAIN MANUFACTURER.

APPROVED DIRECTOR OF PUBLIC WORKS	CITY OF GOLDEN DEPARTMENT OF PUBLIC WORKS	BACKFLOW PREVENTER FLOOR DRAIN FLOW CHART
APPROVED CITY ENGINEER		SCALE: NTS DATE: JAN 2022 DETAIL NO. W-18B

NOTE:

1. HEATED ENCLOSURE SHALL HAVE SEPARATE APPROVED ELECTRICAL SERVICE AND SHALL BE SIZED TO ALLOW ADEQUATE ROOM FOR TESTING AND MAINTENANCE.
2. OUTSIDE COVERS MUST HAVE DOORS FOR ACCESS TO TEST COCKS FOR TESTING AND MAINTENANCE.

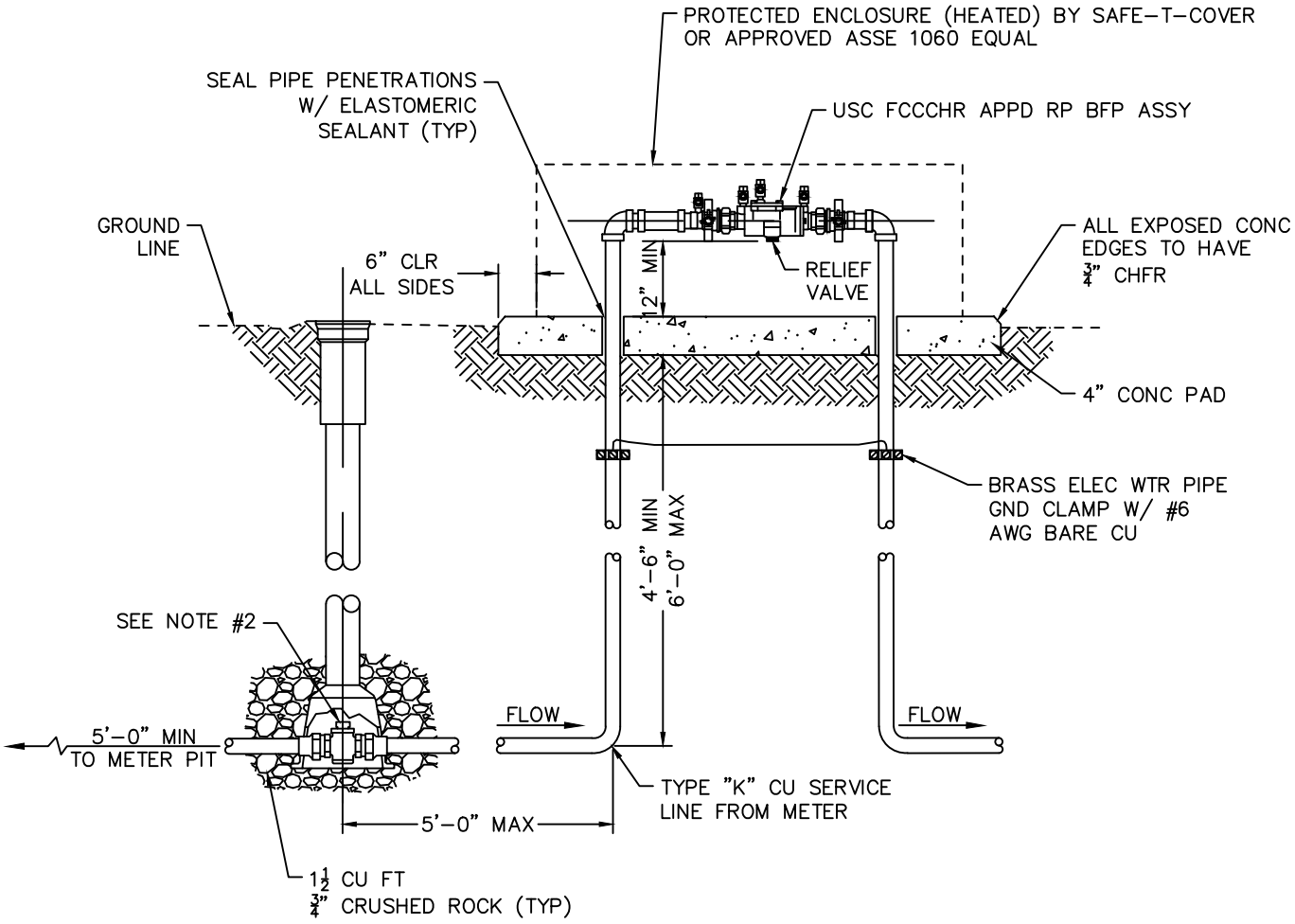


TYPICAL OUTSIDE INSTALLATION OF REDUCED PRESSURE PRINCIPAL DEVICE (3" & LARGER)

APPROVED DIRECTOR OF PUBLIC WORKS	CITY OF GOLDEN DEPARTMENT OF PUBLIC WORKS	BACKFLOW PREVENTION TYPICAL OUTDOOR INSTALLATION (3" & LARGER)
APPROVED CITY ENGINEER		SCALE: NTS DATE: JAN 2022 DETAIL NO. W-18C

NOTE:

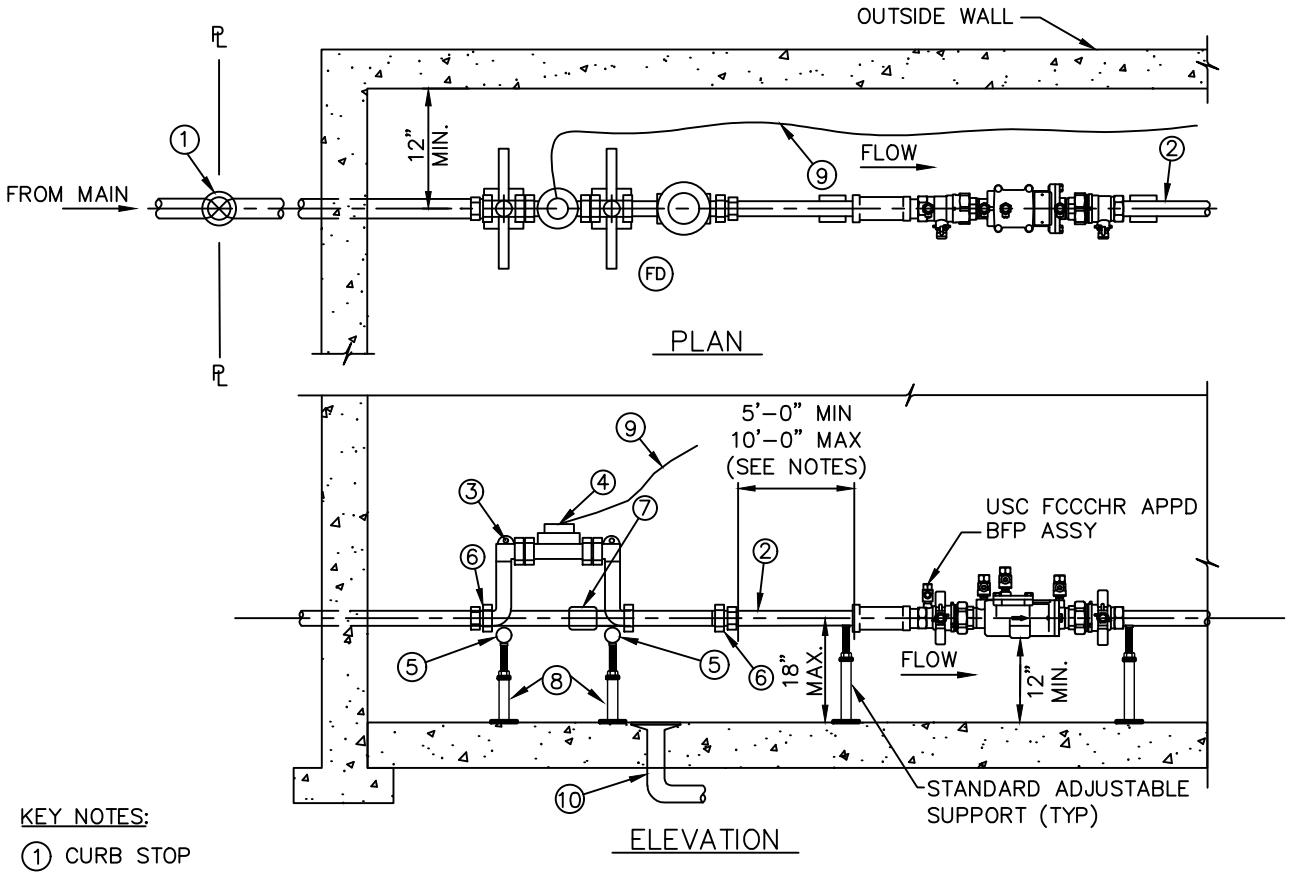
1. CONCRETE PAD PENETRATIONS SHALL BE 1–INCH LARGER THAN PIPE DIAMETER.
2. DIAMETER OF FITTINGS, NIPPLE, AND TUBING SHALL BE EQUAL IN DIAMETER TO THE BACKFLOW PREVENTER.
3. HEATED ENCLOSURE SHALL HAVE SEPARATE APPROVED ELECTRICAL SERVICE AND SHALL BE SIZED TO ALLOW ADEQUATE ROOM FOR TESTING AND MAINTENANCE.
4. REFER TO LOCAL CODES AND MANUFACTURER REQUIREMENTS FOR INSTALLATION INSTRUCTIONS.



TYPICAL OUTSIDE INSTALLATION OF REDUCED PRESSURE PRINCIPAL DEVICE (SMALLER THAN 3")

APPROVED DIRECTOR OF PUBLIC WORKS	CITY OF GOLDEN DEPARTMENT OF PUBLIC WORKS	BACKFLOW PREVENTION TYPICAL OUTDOOR INSTALLATION (SMALLER THAN 3")
APPROVED CITY ENGINEER		SCALE: NTS DATE: JAN 2022 DETAIL NO. W-18D

INSIDE SETTING FOR 1–1/2" & 2" METER & BYPASS WITH INSIDE BACKFLOW PREVENTION ASSEMBLY



KEY NOTES:

1. CURB STOP
2. TYPE "K" COPPER TUBING
3. 2" COPPERSETTER/METER YOKE
4. METER WITH ENCODER REGISTER
5. 1"X18" BSP–40
6. MALE IRON PIPE TO FLARE COUPLING FROM INLET SIDE OF COPPERSETTER & OUTLET SIDE OF CHECK VALVE
7. BY–PASS WITH VALVE WILL BE 1" FOR 1–1/2" COPPERSETTERS & 1–1/2" OR 1–1/4" FOR 2" COPPERSETTERS
8. STANDARD ADJUSTABLE SUPPORTS
9. SIGNAL WIRE TO AUTOMATIC METER READING (AMR) DEVICE
10. FLOOR DRAIN (FD)

NOTES:

1. NEW INSIDE METER INSTALLATIONS ARE PERMITTED ONLY BY WRITTEN APPROVAL. EXISTING INSIDE METER INSTALLATIONS SHALL COMPLY WITH THIS DRAWING.
2. INSTALLATION SHALL ALLOW FOR ACCESS FROM PUBLIC RIGHT–OF–WAY OR EASEMENT TO METER AND VALVES, AND PROVIDE PROTECTION FROM FREEZING.
3. A FLOOR DRAIN SHALL BE PLACED WITHIN 10–FEET OF THE METER INSTALLATION IN THE SAME ROOM.
4. METER SUPPORT MAY BE EITHER CONCRETE OR STRUCTURAL CHANNEL ATTACHED TO WALL.
5. WALL PENETRATIONS SHALL BE GROUTED WITH CONCRETE.
6. USC FCCCHR APPROVED REDUCED PRESSURE PRINCIPLE BACKFLOW PREVENTION ASSEMBLY OR DOUBLE CHECK BACKFLOW ASSEMBLY DETERMINED BY DEGREE OF HAZARD POSED BY INTERNAL PLUMBING USE.
7. REFER TO LOCAL CODES AND MANUFACTURER REQUIREMENTS FOR SPECIFIC INSTALLATION INSTRUCTIONS.

APPROVED
DIRECTOR OF PUBLIC WORKS

APPROVED
CITY ENGINEER

CITY OF GOLDEN

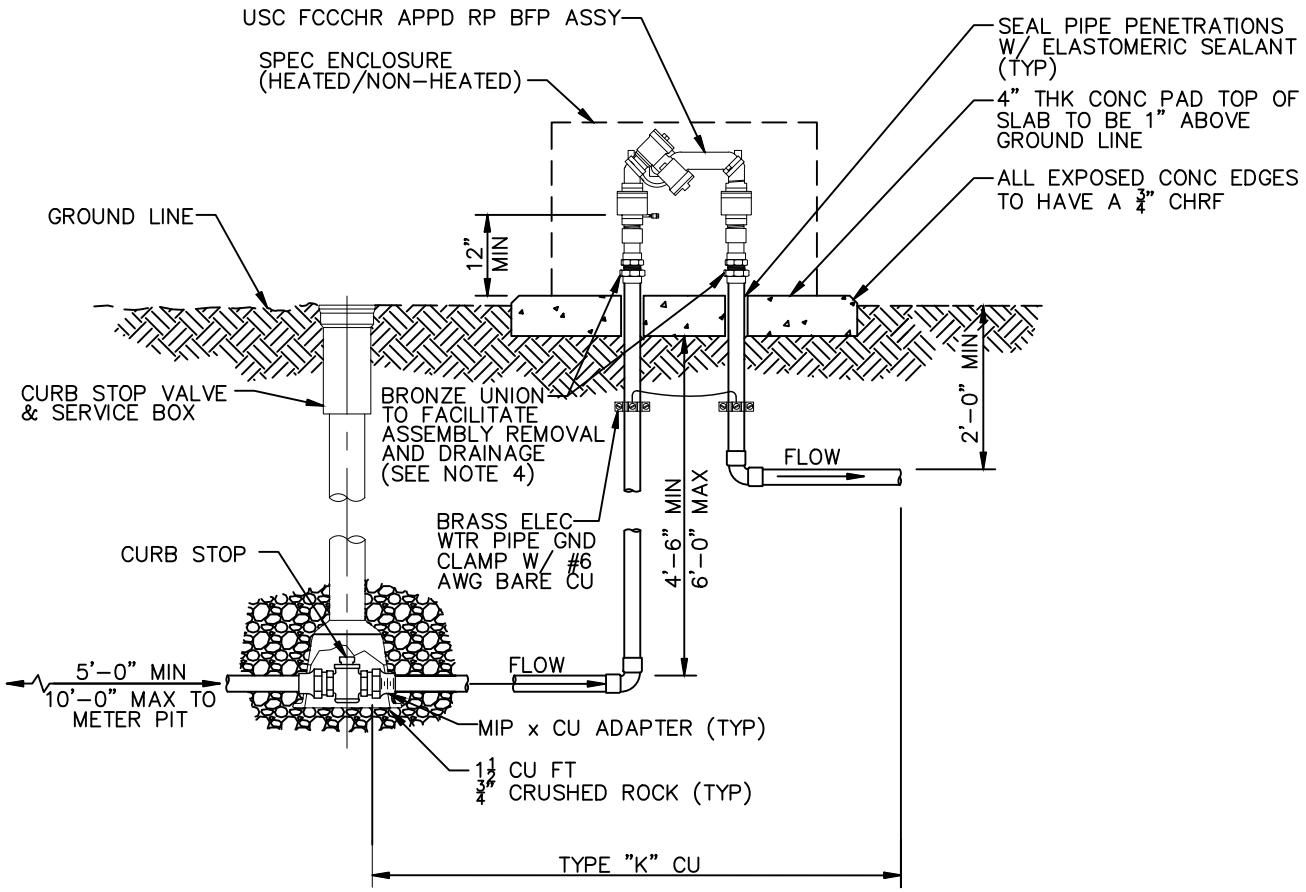
DEPARTMENT OF PUBLIC WORKS

BACKFLOW PREVENTION TYPICAL INTERIOR INSTALLATION

SCALE: NTS

DATE: JAN 2022

DETAIL NO. **W–18E**

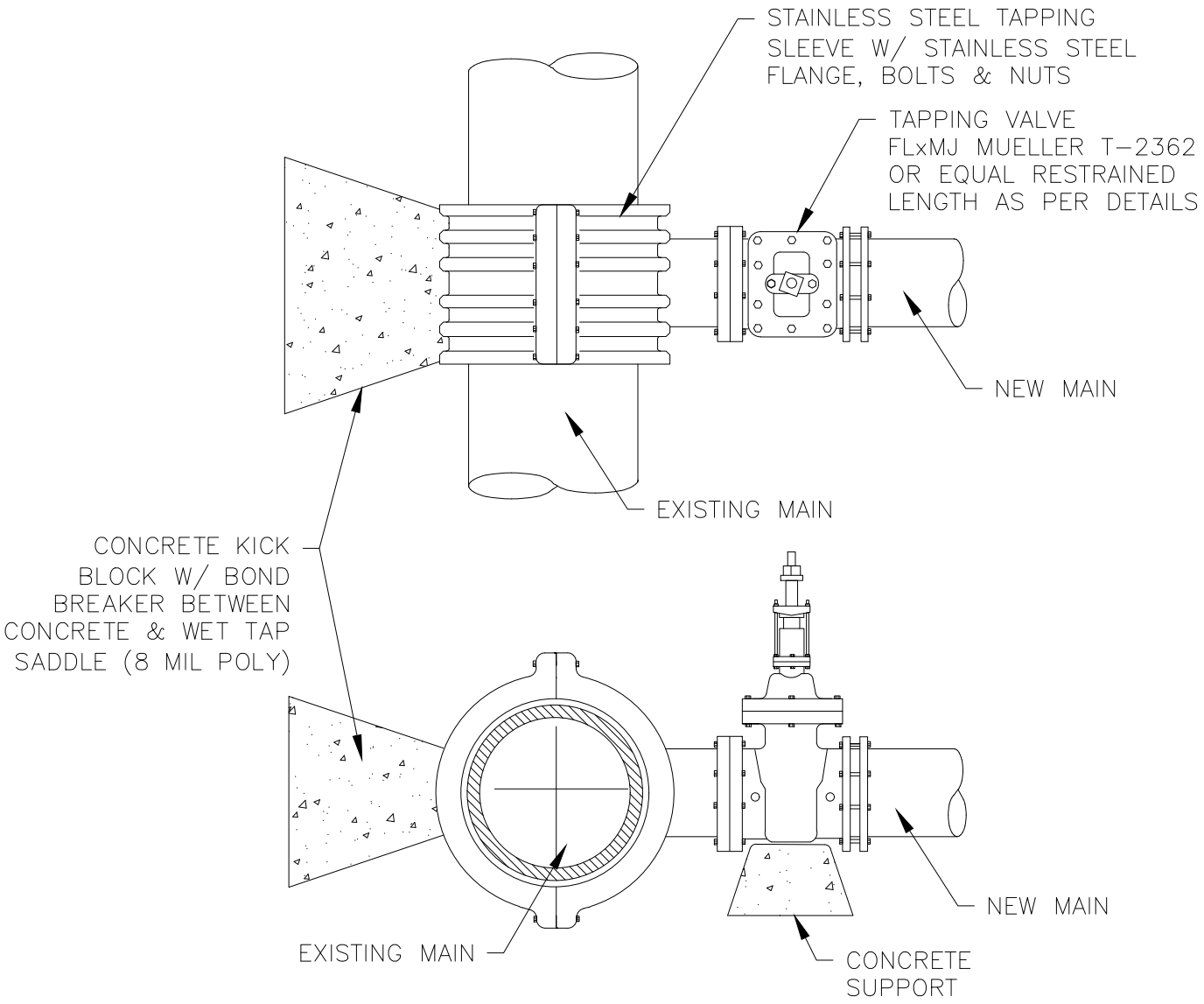


ELEVATION

NOTES:

1. CONCRETE PAD PENETRATIONS SHALL BE 1-INCH LARGER THAN PIPE DIAMETER.
2. DIAMETER OF FITTINGS, NIPPLE, AND TUBING SHALL BE EQUAL IN DIAMETER TO THE BACKFLOW PREVENTER.
3. REFER TO LOCAL CODES AND MANUFACTURER REQUIREMENTS FOR SPECIFIC INSTALLATION INSTRUCTIONS.
4. DRAINING OF LINE UPSTREAM OF ASSEMBLY CAN BE ACHIEVED BY REMOVING ASSEMBLY AT COUPLERS AND INSERTING APPROPRIATE SIZED HOSE INTO THE LINE AND BLOWING OR SUCKING EXISTING WATER OUT TO PREVENT FREEZE DAMAGE.

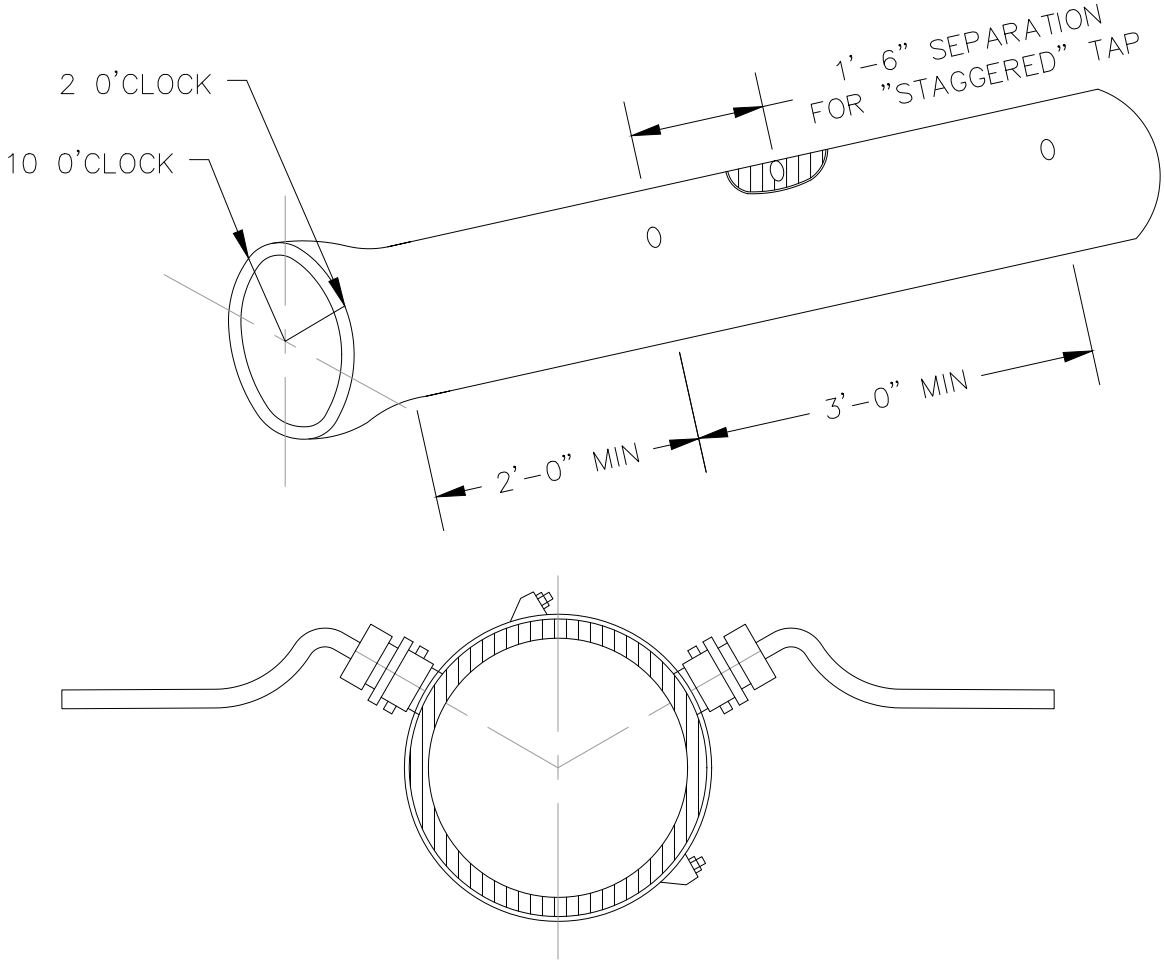
APPROVED DIRECTOR OF PUBLIC WORKS	**CITY OF GOLDEN** **DEPARTMENT OF PUBLIC WORKS**	IRRIGATION OUTSIDE SETTING FOR 2" & SMALLER REDUCED PRESSURE PRINCIPLE ASSEMBLY IN ENCLOSURE
APPROVED CITY ENGINEER		SCALE: NTS DATE: JAN 2022 DETAIL NO. **W-19**



NOTES:

1. CONTRACTOR SHALL FIELD VERIFY EXISTING MAIN SIZING, LOCATION, LAYOUT, ETC. PRIOR TO INITIATING TAPPING WORK.
2. CITY MUST BE NOTIFIED AT LEAST 24 HOURS BEFORE TAPPING AN EXISTING MAIN, A CITY REPRESENTATIVE MUST BE ONSITE DURING TAPPING. ONLY CITY PERSONNEL WILL OPERATE EXISTING VALVES OR OTHER APPURTENANCES.
3. SEE THRUST BLOCK DETAILS, AND RESTRAINED PIPE DETAILS FOR FURTHER INFORMATION.
4. THRUST BLOCK/SUPPORT CONCRETE SHALL NOT CONTACT BOLTS OR ENDS OF MJ FITTINGS.
5. TAPPING TEE & VALVE ARE ONLY ALLOWABLE WHEN SERVICE TO CRITICAL INFRASTRUCTURE CANNOT BE DISRUPTED, OR WHEN THE NEW PIPE IS SMALLER THAN THE EXISTING PIPE.
6. RUBBER GASKETS SHALL MEET SBR REQUIREMENTS. PAPER GASKETS ARE NOT ALLOWED.

APPROVED DIRECTOR OF PUBLIC WORKS	CITY OF GOLDEN	TAPPING TEE & VALVE
APPROVED CITY ENGINEER	DEPARTMENT OF PUBLIC WORKS	SCALE: NTS DATE: JAN 2022 DETAIL NO. W-20



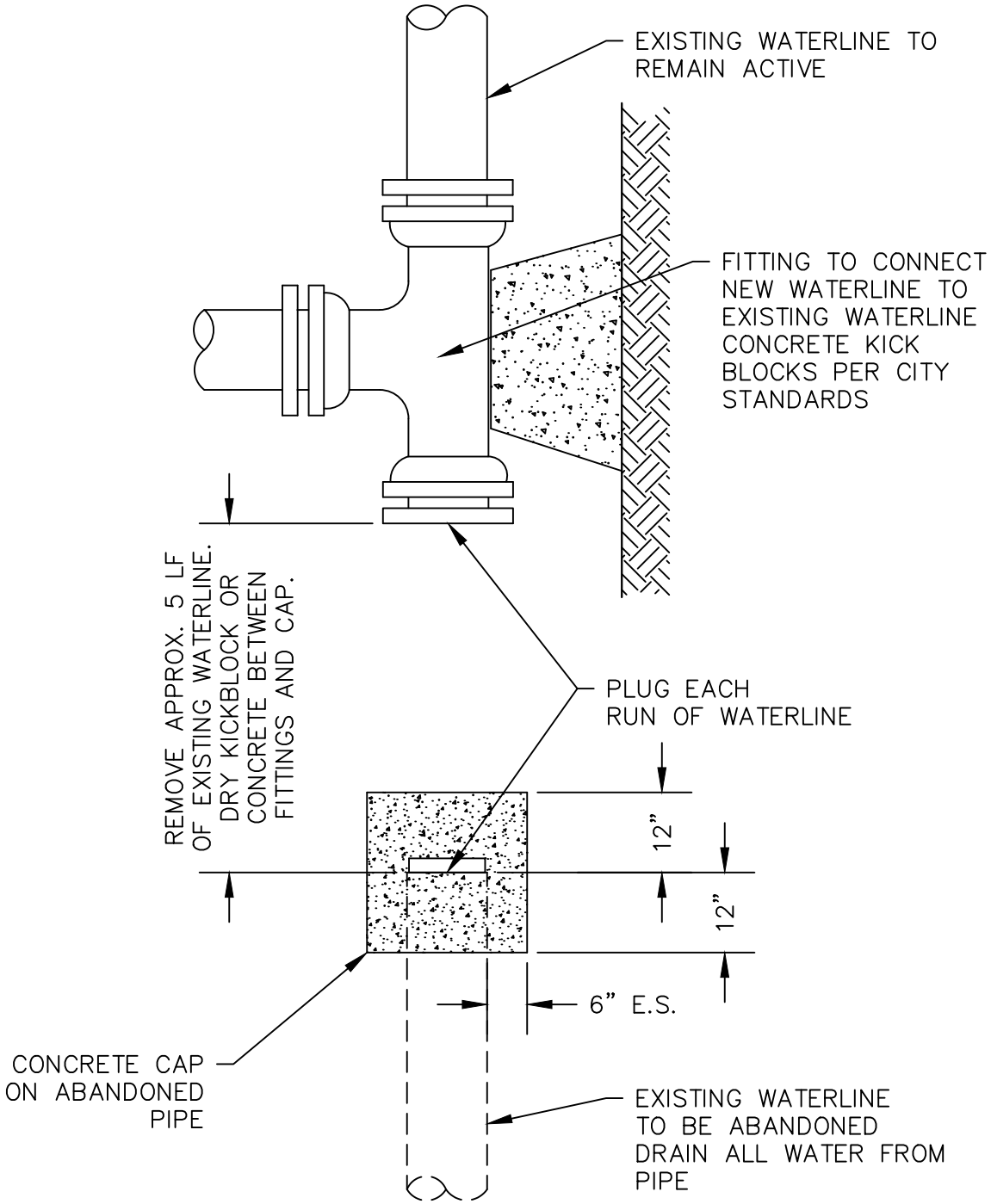
NOTES:

1. WATER SERVICE TAPS SHALL BE MADE STAGGERED AT EITHER 10 OR 2 O'CLOCK POSITION ON THE CIRCUMFERENCE OF A WATER MAIN. THE MINIMUM DISTANCE BETWEEN A TAP MADE AT 10 AND ONE MADE AT 2 SHALL BE 18–INCHES AS MEASURED ALONG THE PIPE. THE MINIMUM BETWEEN SUCCESSIVE TAPS (10–10) SHALL BE 3–FEET.

2. THE MINIMUM DISTANCE FROM EITHER THE BELL OR THE SPIGOT END OF A PIPE SHALL BE 2–FEET. A MAXIMUM OF 4 WATER SERVICE TAPS SHALL BE ALLOWED PER LENGTH OF PIPE.

3. IN THE EVENT THE PIPE SUPPLIER INSTALLATION GUIDE/RECOMMENDATIONS ARE MORE CONSERVATIVE THAN THESE GUIDELINES. THE MANUFACTURERS INSTALLATION REQUIREMENTS SHALL BE MET.

APPROVED DIRECTOR OF PUBLIC WORKS	CITY OF GOLDEN DEPARTMENT OF PUBLIC WORKS	DOMESTIC WATER TAPPING
APPROVED CITY ENGINEER		SCALE: NTS DATE: JAN 2022 DETAIL NO. W-21



APPROVED
DIRECTOR OF PUBLIC WORKS

APPROVED
CITY ENGINEER

CITY OF GOLDEN

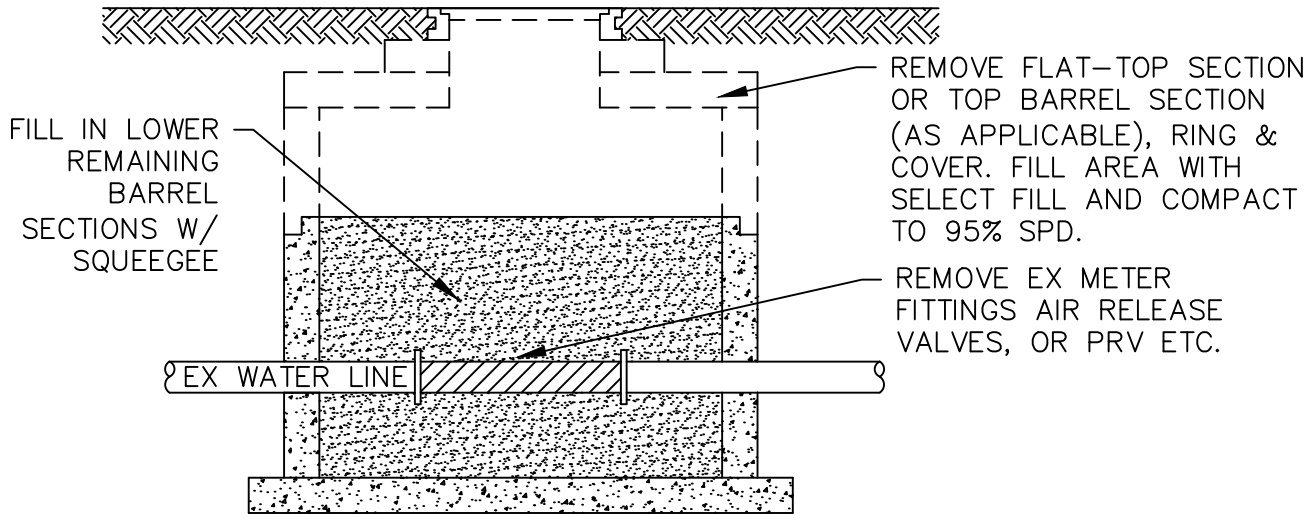
DEPARTMENT OF PUBLIC WORKS

PIPE ABANDONMENT

SCALE: NTS

DATE: JAN 2022

DETAIL NO. **W-22**



NOTES:

1. REMOVE METER, AIR RELEASE VALVES, AND ALL RELATED PIPING IN VAULT, CONFIRM WITH CITY ON RETAINAGE OF SALVAGED MATERIALS.

2. CLOSE UPSTREAM/DOWNSTREAM VALVES ON WATER MAIN AS APPLICABLE.

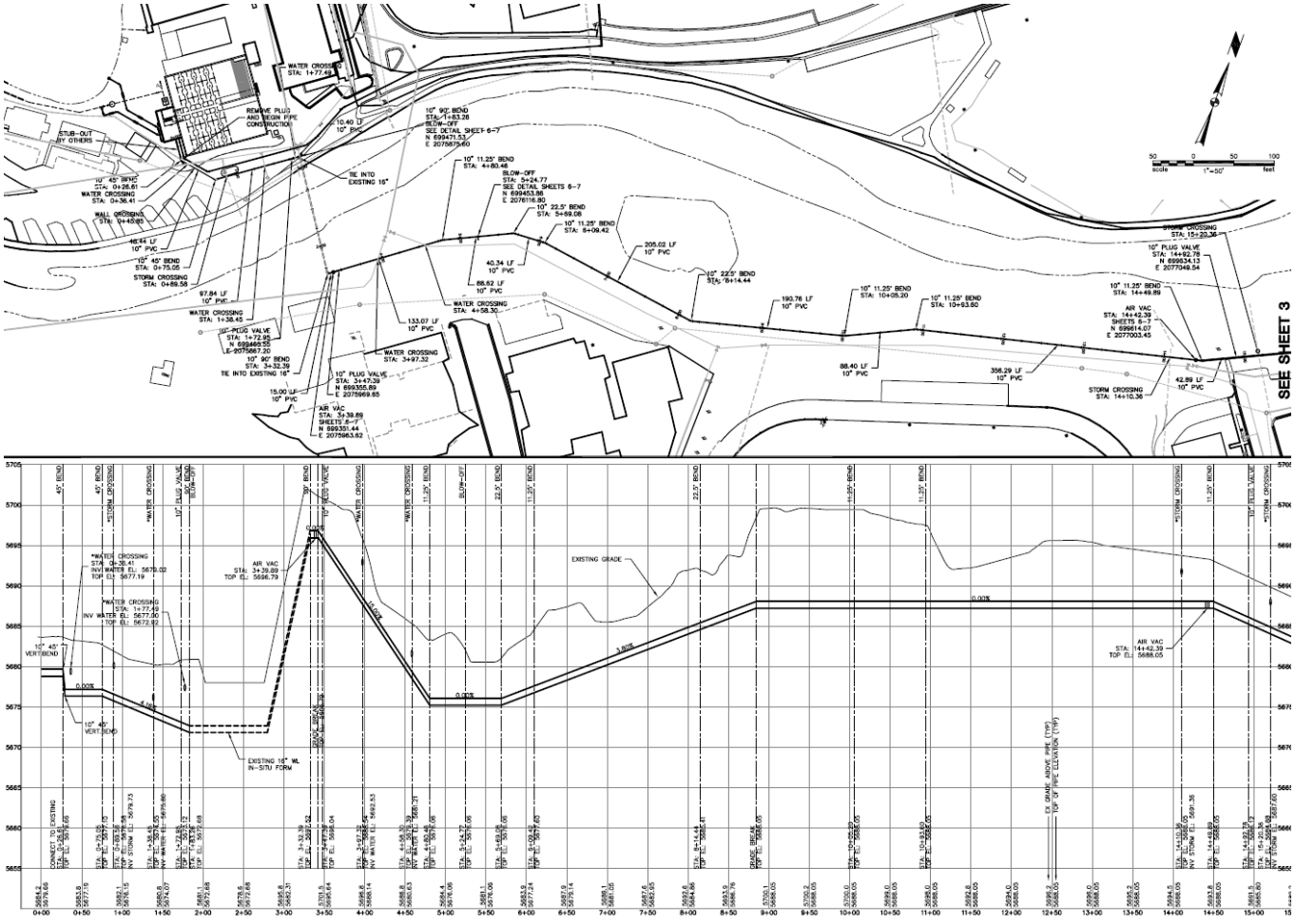
3. INSTALL BLIND FLANGE, OR RESTRAINED MJ PLUGS/CAPS ON PIPE ENDS.

4. FOR VAULTS ABANDONED IN STREET SECTIONS, DRIVES, OR PARKING AREAS, REMAINING BARREL SECTIONS SHALL BE FILLED IN WITH FLOW FILL.

APPROVED DIRECTOR OF PUBLIC WORKS	CITY OF GOLDEN DEPARTMENT OF PUBLIC WORKS	VAULT ABANDONMENT
APPROVED CITY ENGINEER		SCALE: NTS DATE: JAN 2022 DETAIL NO. W-23

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 their 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 report 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

Submittals of all types shall be submitted to the City electronically.

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.

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.
wet stamp on each sheet.

D. 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.

E. OTHER AGENCIES

Depending on the project's location, the City may also refer the plans for review and 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

	IN COMPLIANCE YES	NO	N/A	COMMENTS
1. Correct Sheet Size (24”x36”).	____	____	____	_____
2. Vicinity Map.	____	____	____	_____
3. Location Map.	____	____	____	_____
4. Index of Drawings.	____	____	____	_____
5. List of Quantities.	____	____	____	_____
6. List of Agencies, Including: Surveyor, Soils Engineer, and All Involved Agencies for the Project.	____	____	____	_____
7. General Notes	____	____	____	_____
8. Erosion Control Notes.	____	____	____	_____
9. City Approval Block on Each Sheet.	____	____	____	_____
10. P.E. Seal and Signature on Title Sheet and Each Electrical and Structural Sheet (if included).	____	____	____	_____
11. North Arrow on Vicinity Map, Location Map, and Each Plan View.	____	____	____	_____
12. Title Block on Each Sheet. Datum, Location, Elevation, and Monument Type.	____	____	____	_____
13. Street Alignment, Existing and Proposed, Shown on Overall Plan.	____	____	____	_____
14. Street Names.	____	____	____	_____
15. Horizontal Curve Data for Street Centerline and All Curbs Shown on Plan, or Recorded Plan Included in Plan Set.	____	____	____	_____
16. Street Grades, Existing and Proposed Shown on Profile.	____	____	____	_____
17. Typical Street Cross-Section(s)	____	____	____	_____
18. Street Addresses for All Lots and/or Building Indicated on Plan, or Address Plan Included in Plan Set.	____	____	____	_____
19. Lot and Block Numbers.	____	____	____	_____
20. Front Lot Dimensions.	____	____	____	_____
21. Property, Easement, and Tract Lines Shown on Plan.	____	____	____	_____
22. Private Improvements Identified.	____	____	____	_____
23. Existing Improvements Identified.	____	____	____	_____
24. Match Lines and Sheet Referenced Called Out in Plan and Profile.	____	____	____	_____
25. Street Cross-Pans Shown.	____	____	____	_____
26. Center Line of Drainage Channel(s) Shown.	____	____	____	_____
27. 100-Year Flood Plain Limits Shown.	____	____	____	_____
28. Estimated Construction Costs and Proposed Development Built-Out Schedule Submitted.	____	____	____	_____

	IN COMPLIANCE YES	NO	N/A	COMMENTS
29. Recorded Plat and Address Plat Submitted.	____	____	____	_____
30. Project in Conformance with Overall Master Plan.	____	____	____	_____

SANITARY SEWER REQUIREMENTS

	IN COMPLIANCE YES	NO	N/A	COMMENTS
A. General				
31. Sewer Line Horizontal Alignment Generally 10' South and West of Street Centerline; 3' Min. From Flow Line; 5' Min. From R.O.W. Line.	____	____	____	_____
32. All Sewer Lines Shown in Both Plan and Profile.	____	____	____	_____
33. Manning Formula Hydraulic Data 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.	____	____	____	_____
34. Sewer Easement Drawings and Legal Descriptions Submitted with PLS Seal and Signature Affixed.	____	____	____	_____
35. Sanitary Sewer System Notes Included.	____	____	____	_____
36. Sanitary Sewer System Details Included.	____	____	____	_____
37. 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.	____	____	____	_____
38. Note on Plans: "No Connections to Existing System Shall be Made Until the New Lines Have Been Tested and Accepted by the City.	____	____	____	_____
B. Sewer Plan View				
1. Maximum Scale: 1" = 50'.	____	____	____	_____
2. Pipe Size and Material Called Out.	____	____	____	_____
3. Bearings and Linear Footage Between Manholes Called Out Along Sewer Reach.	____	____	____	_____
4. Outside Angles Between Sewer Reached Called Out at Manholes.	____	____	____	_____
5. Sewer Lines Dimensioned from Street Centerline or Property Line, and From Other Utilities, Curb and Gutter, and Other Obstructions.	____	____	____	_____
6. Connection(s) to Existing System Shown on Plan and Ties to Property Corner or Section Corner.	____	____	____	_____

	IN COMPLIANCE YES	NO	N/A	COMMENTS
7. Manholes Properly Numbered on Plan.	____	____	____	_____
8. Directional Flow Arrows Shown.	____	____	____	_____
9. Service Line Connections Shown (Service Lines Within Easement Not Allowed)	____	____	____	_____
10. At Least a 10' Workable Easement Margin on Each Side of the Sewer Line.	____	____	____	_____
11. Manhole Markers Included for Sewer Line Outside of Paved R.O.W.	____	____	____	_____
12. Match Lines and Sheet References.	____	____	____	_____
13. All Utility Improvements, Including Water Lines and Storm Sewer, Shown on Plans.	____	____	____	_____
C. Sewer Profile View				
1. Maximum Scale: 1" = 50' (horizontal) 1" = 5' (vertical)	____	____	____	_____
2. Manholes Properly Numbered and Stationed.	____	____	____	_____
3. Pipe Size, Linear Footage, and Grade Called Out Between Manholes.	____	____	____	_____
4. Sewer Line Grades Checked.	____	____	____	_____
5. Invert Elevations for All Entering and Exiting Pipes, Rim Elevations, Cuts and Drop Inverts Called Out at the Manholes.	____	____	____	_____
6. Inside Manhole Drop Between Inverts of Highest Entering Pipe and Lowest Existing Pipe Not to Exceed 18".	____	____	____	_____
7. Connections to Existing System Shown on Profile.	____	____	____	_____
8. Crossings with Other Utilities Shown on Profile (18" Minimum Separation from Outside of Pipe to Outside of Pipe).	____	____	____	_____
9. Match Lines and Sheet References.	____	____	____	_____

WATER LINE REQUIREMENTS

	IN COMPLIANCE YES	NO	N/A	COMMENTS
A. General				
39. Water Line Horizontal Alignment Generally 10' North and East of Street Centerline; 3' Min. From Flowline; 5' Min. From R.O.W. Line.	____	____	____	_____
40. 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.	____	____	____	_____
41. Water Demands, Including Peak Fire Flow and Max. Hour Use, Shown at Connection(s) to Existing System. Number and Type of Units.	____	____	____	_____
42. Water Easement Drawings and Legal Descriptions Submitted with PLS Seal and Signature Affixed.	____	____	____	_____
43. Water System Notes Included and Completed.	____	____	____	_____
44. Water System Details Included.	____	____	____	_____
45. Service Trees Not Allowed.	____	____	____	_____
46. Signature of Fire Marshall on Cover Sheet	____	____	____	_____
47. Chlorination and Flushing Note.	____	____	____	_____
48. Hydrostatic Testing Note.	____	____	____	_____
49. Service Lines and Meters, Including Size to Building, Shown on "As-Builts".	____	____	____	_____
50. Backflow Detail Provided (if necessary).	____	____	____	_____
B. Water Plan View				
14. Maximum Scale: 1" = 50'.	____	____	____	_____
15. Pipe Size and Material Called Out.	____	____	____	_____
16. All Valves, Fittings, Fire Hydrants, Wet Taps, Thrust Blocks, Rodding, Blow-Offs, and other Appurtenances Called Out.	____	____	____	_____
17. Water Line Linear Footage Between Valve Fittings and Appurtenances Called Out.	____	____	____	_____
18. If Joint Deflection is Included, Call Out Degree of Deflection and Manufacturer Recommended.	____	____	____	_____
19. Water Lines Dimensioned from Street Centerline or Property Line, and From Other Utilities, Curb and Gutter, and other Appurtenances.	____	____	____	_____

	IN COMPLIANCE YES	NO	N/A	COMMENTS
20. Connections to Existing System Shown on Plan and Tied to Property Corner or Section Corner.	____	____	____	_____
21. At Least a 10' Workable Easement Margin on Each Side of the Water Line.	____	____	____	_____
22. Valves Located at Property Line Extensions. Valves Required to Isolate all Fire Hydrants, Both Ends of Water Line Through and Easement or Creek Crossing and Spaced to Minimize the Number of Units Put Out of Service During Water Line.	____	____	____	_____
23. Valve and Fitting Markers Included for Water Line Outside of Paved R.O.W.	____	____	____	_____
24. PRV Size and Inlet and Outlet Pressures Shown.	____	____	____	_____
25. Match Lines and Sheet References.	____	____	____	_____
26. All Utility Improvements, Including Sanitary Sewer, Storm Sewer, Gas, Electric, and Communications Shown on Plans.	____	____	____	_____
27. All Gate Valves Numbered.	____	____	____	_____
C. Water Profile View				
1. Max. Scale: 1" = 50' (horizontal) 1" = 5' (vertical)	____	____	____	_____
2. Water Line Stationed.	____	____	____	_____
3. Pipe Size, Linear Footage, and Grade Called Out Between Grade Breaks.	____	____	____	_____
4. Water Line Grades Checked.	____	____	____	_____
5. Top of Pipe Elevations Called Out at all Grade Breaks, Fire Hydrants, Blow-offs, Air and Vacuum Valves, Plug, Connections to Existing Water System, and Match Lines.	____	____	____	_____
6. 4.5-foot Minimum Cover from Finished Grade to Top of Pipe.	____	____	____	_____
7. Blow-offs at all Low Points.	____	____	____	_____
8. Air Relief Valves at all High Points.	____	____	____	_____
9. Restrained Pipe Length Shaded on Profile.	____	____	____	_____
10. Connections to Existing System Shown on Profile.	____	____	____	_____
11. Crossing with Other Utilities Shown on Profile (18" Min. Vertical Separation from Outside of Pipe to Outside of Pipe).	____	____	____	_____
12. Match Lines and Sheet References.	____	____	____	_____

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 seventy-two (72) 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 at least 24 hours in advance.

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 seventy-two (72) 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 (4½) 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 four thousand five hundred (4500) 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 SYTEM 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 the latest version of ASTM D-3034 SDR 35 PVC pipe in paved rights-of-way and easements, and AWWA C900-16, Class 165 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.
    4. Vacuum testing of all new MHs.

5. Manhole rims shall be set at an elevation relative to the pavement, 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.

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. All work shall comply with the City of Golden Stormwater Standards Manual (COGSSM).

2. The Contractor shall ensure erosion, sediment and pollution control measures 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.

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

4. To the extent practicable, erosion, sediment and pollution 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.

5. At a minimum, all erosion, sediment and pollution control measures must be correctly installed and functioning, in accordance with the City of Golden Stormwater Standards Manual. At all times during the project construction, all temporary and permanent erosion, sediment and pollution 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.

6. 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.

7. 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. 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.

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

9. 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.

10. Runoff from stockpiles shall be controlled to prevent erosion and resultant sedimentation of receiving waters/adjacent property. If stockpiles are located within close proximity to a drainageway, additional sediment control measures (rock socks, silt fence, etc.) shall be provided.

11. Soil surface stabilization shall be applied to all disturbed areas including stockpiles that may or may not be at final grade but will remain undisturbed for periods longer than fourteen (14) calendar days or for an indeterminate length of time. Permanent soil stabilization measures shall be applied with fourteen (14) days to disturbed area in which final grade is completed.

12. Revegetation of all disturbed areas must be performed in accordance with the City of Golden Revegetation Requirements (COGSSM Appendix E).

13. All erosion, sediment and control measures must remain in a functional condition until a viable vegetative cover has been established. 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.

CITY OF GOLDEN

WATER AND SANITARY SEWER SPECIFICATIONS

PART III – GENERAL CONSTRUCTION STANDARDS

PART III - GENERAL CONSTRUCTION STANDARDS

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 their 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, they shall be immediately notifying 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, error, 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 being 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 seventy-two (72) 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 their own cost uncover or otherwise make such work accessible for observation or testing when ordered to do so by the City if they violate 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 Public Works Department.

Hydrant meter – use of water from the City system without City issued hydrant meter is prohibited. A minimum $1000 fine will be assessed.

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. They 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 to 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

All record drawings shall be submitted to the City in PDF and CAD format.

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 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.

    a. Latest version of NASCO.

    b. Copy of the camera operator's NASCO certificate.

    c. Manhole and pipe naming must match the City's (information on naming available upon request).

    d. Wheeled or tracked cameras allowed. Push cameras are not acceptable.

    e. Quality of the video shall be sufficient enough to allow for clear measure and inspection as judged by the City of Golden.

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.