

# UINTAH HIGHLANDS IMPROVEMENT DISTRICT

## PUBLIC WORKS STANDARDS



March 2007



Prepared by:





**PUBLIC WORKS STANDARDS**

**AND**

**TECHNICAL SPECIFICATIONS**

**UINTAH HIGHLANDS IMPROVEMENT DISTRICT**



**SUBMITTED & RECOMMENDED**

\_\_\_\_\_  
Gregory L Seegmiller P.E.      Date  
District Engineer

**APPROVAL**

\_\_\_\_\_  
John Reeve      Date  
Chairman

\_\_\_\_\_  
Blaine Brough      Date  
District Manager

Prepared by

JONES AND ASSOCIATES  
Consulting Engineers  
1716 East 5600 South  
South Ogden, Utah 84403  
(801) 476-9767

**MARCH 2007**

## TABLE OF CONTENTS

### **PUBLIC WORKS STANDARDS and TECHNICAL SPECIFICATIONS**

Uintah Highlands Improvement District  
Ogden, Utah

<b>PART I</b>	<b>TECHNICAL SPECIFICATIONS</b>	
<b>Section</b>		<b>Page</b>
1	Excavation and Backfill for Pipelines	1.1
2	Portland Cement Concrete	2.1
3	PVC Plastic Sewer Pipe	3.1
4	PVC Pressure Pipe	4.1
5	Manholes	5.1
6	Culinary Water System	6.1
7	Disinfection of Water Distribution Systems	7.1
8	Restoration of Surface Improvements	8.1
<b>PART II</b>	<b>STANDARD DRAWINGS</b>	<b>Sheet</b>
Title Page & Index of Drawings		CS-01
Sanitary Sewer Manhole Details		CS-02
Fire Hydrant and Water Service Connection Details		CS-03
Sanitary Sewer Lateral Details/Blow Off Valve		CS-04
Typical Water Meter Stations		CS-05
Pressure Reduction Station and Air Vacuum Relief Station		CS-06
Testing & Inspection Standard		CS-07
Grease Interceptor		CS-08

## **SECTION 1**

### **EXCAVATION AND BACKFILL FOR PIPELINES**

1.1 **GENERAL:** The work covered by this specification consists of furnishing all labor, tools, materials, equipment, and in performing all operations in connection with the excavation, trenching, and backfilling for underground pipelines and appurtenances.

1.2 **CONTROL OF GROUNDWATER:** Trenches shall be kept free from water during excavation, fine grading, pipe laying and jointing, and pipe embedment operations in an adequate and acceptable manner. Where the trench bottom is mucky or otherwise unstable because of the presence of groundwater, and in all cases where the static groundwater elevation is above the bottom of any trench or bell hole excavation, such groundwater shall be lowered to the extent necessary to keep the trench free from water and the trench bottom stable when the work within the trench is in progress. The discharge from trench dewatering shall be conducted to natural drainage channels, gutters, or drains. Surface water shall be prevented from entering trenches.

1.3 **EXCAVATION FOR PIPELINES:** Excavation for pipelines shall follow lines parallel to and equidistant from the location of the pipe centerline. Trenches shall be excavated to the depths and widths required to accommodate the construction of the pipelines, as follows:

- a. Except in ledge rock, cobblerock, stones, or water-saturated earth, mechanical excavation of trenches shall not extend below an elevation four inches above the bottom of the pipe after placement in its final position. All additional excavation necessary for preparation of the trench bottom shall be made manually. Excavation shall not be carried below the grade shown on the drawings. Any unauthorized excavation made below grade for any reason shall be backfilled in accordance with these specifications.
- b. Excavation for trenches in ledge rock, cobblerock, stones, mud, or other material unsatisfactory for pipe foundation shall extend to a depth of at least four inches below the bottom of the pipe. A bedding of special material shall be placed and thoroughly compacted with pneumatic tampers in four-inch lifts to provide a smooth, stable foundation. Special foundation material shall consist of suitable earth materials free from roots, sod, or organic matter. Trench bottoms shall be hand-shaped as specified in paragraph (A) above.

Where unstable earth or muck is encountered in the excavation at the grade of the pipe, a minimum of twelve inches below grade will be removed and backfilled with crushed rock or gravel to provide a stable subgrade.

- c. The maximum width of trench, measured at the top of the pipe shall be as narrow as possible but not wider than twelve inches on each side of sewer pipe or drainage pipe and fifteen inches on each side of water pipe.

- d. Excavation for pipelines under existing curb and gutter, concrete slabs or sidewalks, shall be open cut. In no case shall tunneling be allowed. At the option of the County Engineer, jacking under permanent facilities may be allowed based on his direction. Backfill of open cut areas shall be restored as specified in Section 1.7.

1.4 GRAVEL FOUNDATION FOR PIPE: Wherever the subgrade material does not afford a sufficiently solid foundation to support the pipe and superimposed load, where water must be drained to maintain a dry trench bottom for pipe installation, and at other locations as previously defined, the subgrade shall be excavated to the specified depth and replaced with crushed rock or gravel.

Gravel for pipe foundation shall be clean, crushed rock or gravel conforming to the following gradation:

Screen	% Passing
1-1/2"	100
No. 4	5

The gravel material shall be deposited over the entire trench width in six-inch maximum layers; each layer shall be compacted by tamping, rolling, vibrating, spading, slicing, rodding, or by a combination of two or more of these methods. In addition, the material shall be graded to produce a uniform and continuous support for the installed pipe.

1.5 BLASTING: Blasting will not be allowed except by special permission of the County Engineer. When the use of blasting is necessary, the Contractor shall use utmost care not to endanger life or property. The Contractor shall comply with all laws, ordinances, and applicable safety code requirements and regulations relative to the handling, storage, and use of explosives and protection of life and property, and he shall be fully responsible for all damage attributable to his blasting operations. Signals warning persons of danger shall be given before any blast. Suitable weighted plank coverings of timber mats shall be provided to confine all materials lifted by blasting within the limits of the excavation or trench.

Excessive blasting or overshooting will not be permitted, and any material outside the authorized cross section which may be shattered or loosened by blasting shall be removed at the Contractor's expense. The County Engineer shall have authority to order any method of blasting discontinued which leads to overshooting or is dangerous to the public or destructive to property or to natural features.

1.6 SHEETING, BRACING, AND SHORING OF EXCAVATIONS: Excavation shall be sheeted, braced, and shored as required to support the walls of the excavations to eliminate sliding and settling and as may be otherwise required to protect the workmen and existing utilities, structures, and improvements. All such sheeting, bracing, and shoring and side slopes shall comply with the requirements of the Utah State Industrial Commission and OSHA.

All damage resulting from lack of adequate sheeting, bracing and shoring shall be the responsibility

of the Contractor, and the Contractor shall accomplish all necessary repairs or reconstruction resulting from such damage.

**1.7 BACKFILLING:** Backfill shall be carefully placed around and over pipes and shall not be permitted to fall directly on a pipe from such a height or in such a manner as to cause damage. In these specifications the process of preparing the trench bottom to receive the pipe and the backfilling on each side of the pipe to a level over the top of the pipe is defined as bedding. Bedding requirements are as defined on the Uintah Highlands Improvement District's Standard Drawings and in the Specifications for each pipe type. Backfill around the pipe to the level indicated in the Standard Drawings shall not contain rocks more than 2" in diameter and shall be free from sod, vegetation, and other organic or deleterious materials

Trench backfilling above the level of the pipe bedding shall normally be accomplished with native excavated materials and shall be free from rocks larger than eight inches in diameter.

**1.8 COMPACTION OF BACKFILL:** Compacted backfill shall be placed by means of pneumatic tire rollers, hoe packs or other mechanical tampers of a size and type approved by the District Engineer.

The backfill in all utility trenches shall be compacted according to the requirements of the materials being placed. Under pavements or other surface improvements the in-place density shall be a minimum of 95% of laboratory standard maximum dry density, as determined by AASHTO T-180. In shoulders and other areas the in-place density shall be a minimum of 90% of laboratory standard maximum dry density, as determined by the same laboratory method. A District approved testing laboratory shall provide in-place density tests at various depths throughout the trench backfill. In-place density tests shall be taken every 200 feet of trench section (mainline and service laterals) unless otherwise directed by the District Engineer. A copy of all in-place density tests shall be delivered to the District office and the District Engineer for review and approval. Any portion of the trench backfill which does not meet the minimum compaction requirements of this section, shall be removed, recompacted and retested at the cost of the contractor until passing tests are obtained.

The material shall be placed at a moisture content such that after compaction the required relative densities will be produced; also, the material shall be placed in lifts which, prior to compaction, shall not exceed two feet (10" maximum lifts in the pipe bedding section) or as recommended by the project soils engineer. Prior to compaction, each layer shall be evenly spread and moistened, if required, as approved by the project soils engineer.

Approval of equipment, thickness of layers, moisture content, and compactive effort shall not be deemed to relieve the Contractor of the responsibility for attaining the specified minimum relative densities. The Contractor, in planning his work, shall allow sufficient time to make tests for relative densities for the approval of the District Engineer.

**1.9 IMPORTED BACKFILL MATERIAL:** In the event the native excavated materials appear to be very difficult to compact or are unacceptable as backfill in the opinion of the District Engineer, the Contractor shall furnish and install imported granular material. This granular material shall pass

a 2 inch square sieve and shall not contain more than 15% of material passing a 200 mesh sieve, and shall be free from sod, vegetation, and other organic or deleterious materials.

## **SECTION 2**

### **PORTLAND CEMENT CONCRETE**

2.1 **SCOPE:** This section of the specifications defines materials to be used in all portland cement concrete work and requirements for mixing, placing, finishing, and curing.

2.2 **MATERIALS:** Materials used in portland cement concrete and reinforcing of portland cement concrete shall meet the following requirements.

- A. **Cement:** Portland cement shall be Type II or as approved by the District Engineer and shall comply with the Standard Specification for Portland Cement, ASTM C-150.
- B. **Aggregates:** Concrete aggregates shall conform to Tentative Specifications for Concrete Aggregates, ASTM C-33.
- C. **Water:** Water used in mixing concrete shall be clean and free from oil, acid, salt, injurious amounts of alkali, organic matter or other deleterious substances.
- D. **Entraining Agent:** An air-entraining agent shall be used in all concrete exposed to the weather. The agent shall conform to ASTM Designation C-175 and C-260.
- E. **Admixtures:** No admixture (except calcium chloride) will be permitted to be used in portland cement concrete unless such use is specifically authorized by the District Engineer. Calcium chloride shall conform to ASTM Standard Specification D-98.
- F. **Reinforced Steel:** All bar material used for reinforcement of concrete shall be grade 60 steel conforming to the requirements of ASTM Designation A-615 and shall be deformed in accordance with ASTM Designation A-305.
- G. **Welded Wire Fabric:** Welded wire fabric for concrete reinforcement shall conform to the requirements of ASTM A-185.

2.3 **CONCRETE MIX:** For the purpose of practical identification, concrete has been divided into three classes: Class A, B, and C. Basic requirements and use for each class are as defined below:



<u>CLASS</u>	<u>Minimum Cement (sacks/c.y.)</u>	<u>Minimum 28-day Compressive Strength (p.s.i.)</u>	<u>Primary Use</u>
A	6-1/2	4,000	Reinforced Structural Concrete
B	6	3,500	Sidewalks, curb, gutters, cross gutters, pavements and unreinforced footings and foundations
C	5	2,500	Thrust Blocks, anchors, mass concrete

All concrete shall also comply with the following requirements.

- A.     Aggregates:           The maximum size of the aggregate shall be not larger than one-fifth of the narrowest dimension between forms within which the concrete is to be cast, nor larger than three-fourths of the minimum clear spacing between reinforcing bars or between reinforcing bars and forms. For unreinforced concrete slabs, the maximum size of aggregates shall not be larger than one-fourth the slab thickness.
- B.     Water:                 Sufficient water shall be added to the mix to produce concrete with the minimum practicable slump. The slump of mechanically vibrated concrete shall not exceed four inches. No concrete shall be placed with a slump in excess of five inches. The maximum permissible water-cement ratio (including free moisture on aggregates) shall be 5 and 5 3/4 gallons per bag of cement respectively for Class A and B air entrained concrete.
- C.     Air-Entraining:       Air content for air-entrained concrete shall comply with the following:

<u>Course Aggregate Size (In.)</u>	<u>Air Content %</u>
_____	_____

1 ½ to 2 ½	5 +/- 1
¾ or 1	6 +/- 1
⅜ or ½	7 +/- 1

The air-entraining agent shall be added as liquid to the mixing water by means of mechanical equipment capable of accurate measurement and control.

- D. Calcium Chloride: Calcium chloride may be added as an accelerator with prior approval of the District Engineer during cold weather, with maximum amount being two pounds per sack of cement.

2.4 FORMS: Forms shall be substantially built and adequately braced so as to withstand the liquid weight of concrete. All linings, studding, walling and bracing shall be such as to prevent bulging, spreading, or loss of true alignment while pouring and displacement of concrete while setting.

All sidewalk and curb and gutter work within Public Right-of-Way shall be done in accordance with the respective City or County Standards. Otherwise, metal forms shall be used for curb and gutter work unless otherwise specified by the District Engineer. All edge forms for sidewalk pavements, curbs, and gutters shall be of sufficient rigidity and adequately braced to accurately maintain line and grade. Prior to concrete placement, all forms shall be lightly coated with oil to prevent concrete adhesion to form materials.

Forms for curved sections shall be so constructed and placed that the finish surface of walls and edge of sidewalks, curbs and gutters will not deviate appreciable from the arc of the curve.

Exposed vertical and horizontal edges of the concrete in structures shall be chamfered by the placing of mouldings in the forms at those locations shown on the Drawings.

2.5 JOINTS: Joints shall be provided for sidewalk and curb and gutter, not within public right-of-ways, as follows:

- A. Sidewalks: Shall have scribed joints at intervals of 6 feet which joints shall be approximately 1/16" wide and be approximately 1/4 of the total slab thickness. Slabs shall be ruled at 6 foot intervals.
- B. Curb and Gutter: Shall be cut into lengths of 10 feet by the use of 1/8 inch steel division plates of the exact cross section of the curb and gutter when constructed by hand methods. Curb and gutter constructed with a lay down machine shall be scribed with joints which shall be approximately 1/16" wide and be approximately 1/4 of the total curb thickness.

2.6 REINFORCEMENT AND EMBEDDED ITEMS: Reinforcing steel shall be clean and free from rust, scale, paint, grease, or other foreign matter which might impair the bond. It shall be accurately bent and shall be tied to prevent displacement when concrete is poured. Reinforcing steel shall be held in place by only metal or concrete ties, braces and supports. No steel shall extend from or be visible on any finished surface and shall have a minimum of 1 ½ inch concrete cover.

The Contractor shall use concrete chairs for holding the steel away from the subgrade, and spreader or other type bars for securing the steel in place. The spreader bars shall be not less than 3/8 inch in diameter.

2.7 PREPARATIONS: Before batching and placing concrete, all equipment for mixing and transporting the concrete shall be cleaned, all debris and ice shall be removed from the places to be occupied by the concrete, forms shall be thoroughly wetted (except in freezing weather) or oiled, and masonry filler units that will be in contact with concrete shall be well drenched (except in freezing weather), and the reinforcements shall be well drenched (except in freezing weather), and the reinforcements shall be thoroughly cleaned of ice or other coatings. Water shall be removed from spaces to receive concrete.

When placing concrete on earth surfaces, the surfaces shall be free from frost, ice, mud, and water. When the subgrade surface is dry soil or pervious material, it shall be sprayed with water immediately before placing of concrete or shall be covered with waterproof sheathing paper or a plastic membrane. No concrete shall be placed until the surfaces have been inspected and approved by the District Engineer or District Inspector.

2.8 CONCRETE MIXING: All concrete shall be ready-mixed and delivered in accordance with ASTM C-94. The concrete shall be mixed until there is a uniform distribution of the materials. Sufficient water shall be used in mixing concrete to produce a mixture which will flatten and quake when deposited in place, but not enough to cause it to flow. Sufficient water shall be used in concrete in which reinforcement is to be embedded, to produce a mixture which will flow sluggishly when worked and which, at the same time, can be conveyed from the mixer to the forms without separation of the coarse aggregate from the mortar. In no case shall the quantity of water used be sufficient to cause the collection of a surplus in the forms or exceed the maximum allowable slump as specified in 2.3 (b).

2.9 DEPOSITING: Concrete shall be deposited as nearly as practical in its final position to avoid segregation due to rehandling or flowing. The concrete placing shall be carried on at such a rate that the concrete is at all times plastic and flows readily into the corners of forms and reinforcing bars. No concrete that has partially hardened or been contaminated by foreign material shall be deposited in the work, nor shall retempered concrete be used. No concrete shall be dropped more than 3 feet. Concrete delivered to the job site having a temperature which exceeds 90° F shall not be placed. Concrete cooling methods during hot weather will be approved by the District Engineer.

All concrete in structures shall be vibrator compacted during the operation of placing and shall be thoroughly worked around reinforcement and embedded fixtures and into the corners of the forms.

2.10 PLACING CONCRETE IN COLD WEATHER: No concrete shall be poured where the air temperature is lower than 40° F, at a location where the concrete cannot be covered or protected from the surrounding air. When concrete is poured below a temperature of 35° F the ingredients of the concrete shall be heated so that the temperature of the mixture shall not be less than 50° or more than 100° F. Before mixing, the heated aggregates shall not exceed 125° F and the temperature of the heated water shall not exceed 175° F. Cement shall not be added while the temperature of the mixed aggregates and water is greater than 100°F. When there is likelihood of freezing during the curing period, the concrete shall be protected by means of an insulating covering and/or heating to prevent freezing of the concrete for a period of not less than 7 days after placing. Concrete shall not be placed on frozen soil.

Equipment for protecting concrete from freezing shall be available at the job site prior to placing concrete. Particular care shall be exercised to protect edges and exposed corners from freezing. In the event heating is employed, care shall be taken to insure that no part of the concrete becomes dried out or is heated to temperatures above 90° F. The housing, covering, or other protection used shall remain in place and intact at least 24 hours after the artificial heating is discontinued. Combustion heaters shall not be used during the first 24 hours unless precautions are taken to prevent exposure of the concrete to exhaust gases which contain carbon dioxide.

2.11 FINISHING: All concrete finish work shall be carefully performed and shall produce a top quality visual appearance as is common to the industry. After the concrete for slabs has been brought to the established grade and screened it shall be worked with a magnesium float and then given a light broom finish. In no case shall dry cement or a mixture of dry cement and sand be sprinkled on the surface to absorb moisture or hasten hardening. Surface edges of all slabs shall be rounded to a radius of ½ inch.

After concrete has been poured in curb and gutter forms it shall be puddled and spaded so as to insure a thorough mixture, eliminate air pockets, and create uniform and smooth sides. Before the concrete has thoroughly set, and while the concrete is still green, the forms shall be removed and the front and top sides shall be finished with a flat or steel trowel to make a uniform finished surface. Wherever corners are to be rounded, special steel trowels shall be used while the concrete is workable and the corners constructed to the dimensions specified.

The top and face of the curb and also the top of the apron on combined curb and gutter must be finished true to line and grade and without any irregularities of surface noticeable to the eye. The gutter shall not hold water to a depth of more than one fourth (1/4) of an inch, nor shall any portion of the surface or face of the curb or gutter depart more than one-fourth (1/4) of an inch from a straight edge ten (10) feet in length, placed on the curb parallel to the center line of the street nor shall any part of the exposed surface present a wavy appearance.

2.12 CURING AND PROTECTION: As soon as the concrete has hardened sufficiently to prevent damage, the finished surface shall be protected for curing one of the following ways:

- A. Ponding of water on the surface or continuous sprinkling.

- B. Application of absorptive mats such as 3-inch of cured hay, clean straw or fabric kept continuously wet.
- C. Application of two inches of moist earth or sand uniformly distributed on the surface and kept saturated by spraying with water.
- D. Application of light colored waterproof plastic materials, conforming to "Specifications for Waterproof Sheet Materials for Curing Concrete" ASTM C-171, placed and maintained in contact with the surface of the concrete.
- E. Application of a curing compound, conforming to "Specifications for Liquid Membrane - Forming Compounds for Curing Concrete" ASTM C-309. The compound shall be light in color and shall be applied in accordance with the manufactures recommendations immediately after any water sheen, which may develop after finishing has disappeared from the concrete surface.

The freshly finished surface shall be protected from hot sun and drying winds until it can be sprinkled or covered as above specified. The concrete surface must not be damaged or pitted by rain. The contractor shall provide and use, when necessary, sufficient tarpaulins to completely cover all sections that have been placed within the preceding twelve (12) hours.

The Contractor shall erect and maintain suitable barriers to protect the finished surface. Any section damaged from traffic or other causes occurring prior to its official acceptance, shall be repaired or replaced by the Contractor at his own expense in a manner satisfactory to the District Engineer.

Defective concrete conditions or surfaces shall be removed, replaced or repaired as directed to meet the approval of the District Engineer.

2.13 CONCRETE TESTING: In the event that the concrete placed or delivered to the job site appears to have questionable quality, the District Engineer may order the taking of concrete test cylinders to check required compressive strengths. In place concrete may be cored for testing. Cost of all required laboratory testing shall be the responsibility of the Subdivider/Developer, Contractor or ready-mix supplier. All concrete delivered to the job site shall be accompanied by a ticket specifying bag mix, air content, etc., said tickets shall be given to the District Inspector who may field check slump and air entrainment compliance.



## **SECTION 3**

### **PVC PLASTIC SEWER PIPE**

3.1 **GENERAL:** This section covers the requirements for PVC plastic sewer pipe. PVC plastic sewer pipe shall be used in District sanitary sewer, storm drainage and gravity irrigation systems. PVC plastic sewer pipe shall be used for all sanitary sewer lines 4" to 18" diameter. Any sanitary sewer main which is 21" diameter and larger shall use reinforced or non-reinforced concrete pipe as approved by the District Engineer.

3.2 **PIPE:** PVC plastic sewer pipe shall be made of compound conforming to ASTM D-1784 with a cell classification of 13364-B with a minimum tensile modular of 500,000 psi. PVC sewer pipe must meet all the dimensional, chemical, and physical requirements outlined in ASTM D-3034, shall have a SDR of 35.0 and shall be supplied in 13.0-foot laying lengths. Pipe shall carry the IAPMO UPC Seal of Approval or as otherwise specified by the District. SDR and laying length may be modified as conditions dictate when approved by the District Engineer.

PVC sewer pipe shall be installed according to the requirements of ASTM D-2321 and the manufacturer's requirements.

3.3 **JOINTS:** Joints for PVC plastic sewer pipe shall be of the rubber gasket bell and spigot type, and the rubber gaskets shall conform to ASTM D-1869.

3.4 **FITTINGS:** Fittings shall be made of PVC plastic conforming to ASTM D-1784, have a cell classification as outlined in ASTM D-3034, and carry the IAPMO UPC Seal of Approval.

3.5 **PIPE LAYING:** All pipe installation shall proceed up grade on a stable foundation with joints closely and accurately fitted. Installation requirements of the manufacturer shall be rigidly adhered to.

Rubber gaskets shall be fitted properly in place and care shall be taken in joining the pipe units to avoid twisting of gaskets. Joints shall be clean and dry and a joint lubricant, as recommended by the pipe supplier, shall be applied uniformly to the mating jointing surfaces to facilitate easy positive joint closure.

Pipe shall be installed with uniform bearing under the full length of the barrel, with suitable excavations being made to receive pipe bells. Select material shall be compacted around the pipe to firmly bed the pipe in position. If adjustment of position of a pipe length is required after being laid, it shall be removed and rejoined as for a new pipe. When laying is not in progress, the ends of the pipe shall be closed with a tight-fitting stopper to prevent the entrance of foreign material.

In addition to the above requirements, all pipe installation shall comply to the specific requirements of the pipe manufacturer.

3.6 GRAVEL FOUNDATION FOR PIPE: Wherever the subgrade material does not afford a sufficiently solid foundation to support the pipe and superimposed load, it shall be excavated to such depth as may be necessary and replaced with crushed rock compacted into place. Gravel foundation material for pipe shall be placed only when, and to the depth, requested by the Engineer or as specified on the Drawings.

Gravel for PVC pipe foundations shall be clean crushed rock or gravel with 100% passing a 1 inch screen, a maximum of 5% passing a No. 4 sieve and no more than 5% passing the #200 sieve.

3.7 INSTALLATION REQUIREMENTS FOR LINE AND GRADE: All sewer pipe shall be installed accurately to the defined line and grade with the following limits:

Variance from established line and grade shall not be greater than one thirty-second ( $1/32$ ) of an inch per inch of pipe diameter and not to exceed one-half ( $1/2$ ) inch, provided that such variation does not result in a level or reverse sloping invert; provided also, that variation in the invert elevation between adjoining ends of pipe, due to non-concentricity of joining surface and pipe interior surfaces, does not exceed one sixty-fourth ( $1/64$ ) inch per inch of pipe diameter, or one-half ( $1/2$ ) inch maximum.

3.8 PIPE EMBEDMENT: All pipe shall be protected from lateral displacement and possible damage resulting from impact or unbalanced loading during backfilling operations by being adequately bedded in suitable embedment material (native or imported as approved by the District).

The bottom of the trench shall be of stable materials. In general, coarse-grained soils, free of rocks and stones, such as graded crushed rock, is considered stable materials. A stable material shall be placed and compacted under the pipe haunches and up to the springline in uniform layers not exceeding 10 inches in depth. When bedding is required, the same material should be used for both bedding and haunching. Stable material, free of rocks and stones, shall be used to backfill the trench from the springline of the pipe to a point at least 12 inches above the top of the pipe. Each 10 inch layer of bedding, haunching and initial backfill shall be placed, then carefully and uniformly compacted to 95% of AASHTO T-180 density. Extra fine sand, clay, silt, or large soil lumps shall not be allowed as bedding, haunching or initial backfill material. The remaining backfill over the top of the initial backfill shall be placed in accordance with Section 1.

No bedding material shall be used unless accepted by the District Engineer. Samples of the materials shall be submitted by the Contractor a sufficient time in advance of intended use to enable its inspection and testing. Imported bedding material shall be gravel which is clean crushed rock or gravel with 100% passing a 1 inch screen, a maximum of 5% passing a No. 4 sieve and no more than 5% passing a #200 sieve.

3.9 TESTS: Prior to acceptance by the District, the Contractor shall conduct and successfully pass a pipe displacement test, a pipe system air test, a TV pipe inspection and a pipe deflection test in the presence of the District Engineer or his representative. If directed by the District Engineer, the contractor shall also conduct an infiltration test. The cost of all pipe testing shall be borne by the contractor, developer or project manager. Tests shall be performed as follows:

- A.     Displacement Test:     In conducting the displacement test a light will be flashed between manholes ( in the presence of a District Representative) or, if the manholes have not as yet been constructed, between the locations of the manholes by means of a flashlight or by reflecting sunlight with a mirror. If the illuminated interior of the pipe shows broken, misaligned, or displaced pipe or other defects, the defects designated by the District Engineer shall be remedied at the Contractor's expense. If a curved pipeline is approved and installed, or if displacement or breakage is suspected and is not readily visible, the internal TV inspection test shall be used to review displacement.
- B.     Infiltration Test:     The Contractor shall furnish labor, equipment and materials, including pumps, and shall assist the District Representative in making infiltration tests of the completed sewer before it can be placed into service. The Contractor shall furnish and install the measuring weirs or other measuring devices. The length of line to be tested at any time shall be subject to the approval of the District Representative. The maximum allowable infiltration shall not exceed 150 gallons per inch diameter per mile per 24 hours for all installed pipe. If the quantity of infiltration is in excess of the maximum allowable, the leaking joints shall be repaired to the satisfaction of the District Engineer at the expense of the Contractor.
- C.     Air Testing:     The Contractor or his representative (a qualified firm or individual agreed upon by the District Engineer and the Contractor) shall furnish labor, equipment, and materials, including pumps and compressors, and shall perform, in the presence of the District Representative, air tests of the completed pipe before it can be placed in service. Each section of sanitary sewer pipeline between manholes shall be tested after all the service laterals (and plugs) have been installed. Each test section shall be pressurized to 4.0 psi. For the purpose of stabilizing the air pressure in each test section, the 4.0 psi pressure shall be maintained for a two-minute period. Each test section shall then be repressurized to 4.0 psi for a period of four minutes. The test section shall be accepted if, after four minutes, the pressure gauge indicates 3.5 psi or greater. Failure of the Contractor's testing equipment to properly function shall render the test unacceptable. All faulty sections of pipeline shall be repaired and retested until the minimum air testing requirements have

been met.

D.      Television Testing:      The Contractor or his representative (a qualified firm or individual agreed upon by the District Engineer and the Contractor) shall furnish labor, equipment, and materials, including camera and video tapes, and shall perform, in the presence of a District Representative, an internal television test of the completed pipe before it can be placed in service. The contractor shall supply the District with a copy of the video tape. The television test shall be subject to the District Engineer's approval. Any defects in the pipe or the pipe installation noted on the internal TV inspection shall be corrected by the contractor and the repaired section shall be TV inspected after the repair to verify that the defective section has been corrected.

E. Pipe Deflection Testing:      The Contractor or his representative (a qualified firm or individual agreed upon by the District Engineer and the Contractor) shall furnish labor, equipment and materials to perform a pipe deflection test in the presence of a District Representative. Those performing this test shall pass a pipe mandral or other approved devices through the completed pipe sections to determine the degree of pipe deflection in the PVC pipe. Testing for pipe deflection in PVC pipe cannot be performed until the completed pipe section has been installed for a minimum period of 30 days complete with the total anticipated backfill height over the pipe sections being tested. Pipe deflection testing shall be considered passing when all tested pipe sections show a pipe deflection not exceeding 5% of the pipe diameter. The contractor shall provide the District with a copy of all pipe deflection results. Any excessive deflections in the completed pipe section shall be corrected by the contractor and the repaired section shall be retested after the repair to verify that the defective section has been corrected.

3.10    SEWER LATERAL CONNECTIONS: All sewer lateral connections into new sewer mains shall be through pre-formed tees. All connections into existing sewer line shall be done with a sewer tapping machine and as shown on the District Standard Drawings. The Contractor shall furnish all materials and perform all labor to tap the existing main and install the required tapping saddle.

## **SECTION 4**

### **PVC PRESSURE PIPE**

4.1 **SCOPE:** This specification applies to the furnishing and installation of PVC plastic pressure pipe. This pipe shall be used in pressure sanitary sewer mains and pressurized sprinkler irrigation systems. In the case of the PIP pipe, this product can be used for gravity flow irrigation systems.

4.2 **PIPE:** All PVC plastic pressure pipe with integral bell and spigot joints shall be made from clean, virgin, Type 1, Grade 1, unplasticized polyvinyl chloride (PVC) and shall meet the requirements of the latest revision of ASTM D-1784, ASTM D-2241, with standard dimension ratio (SDR) of 21 (Class 200 psi) for all pipe, unless otherwise approved. All pipe and fittings shall be NSF approved.

PVC pressure pipe used for gravity irrigation systems shall be Pressure Irrigation Pipe complying with the requirements of SCS 430DD, shall be rubber gasketed pipe and supplied with a pressure rating of 100 p.s.i. and a SDR of 41.

4.3 **JOINTS:** The bell shall consist of an integral wall section with a solid cross-section rubber ring which meets the requirements of ASTM D-1869. The bell section shall be designed to be at least as strong as the pipe wall.

4.4 **FITTINGS:** Fittings shall be short body cast iron or ductile iron, iron pipe size for PVC application, and in accordance with AWWA C-110. They shall be capable of withstanding, without bursting hydrostatic tests of three times the rated water working pressure. The fittings shall be furnished with mechanical, bell and spigot, or flange joints and shall conform to the dimensions and weights given in AWWA C-110 and AWWA C-111.

4.5 **SERVICE CONNECTIONS:** Service connection to PVC plastic pressure pipe shall be by bronze service saddles specifically designed for plastic pipe (equal to Christy) or polypropylene saddles with stainless steel reinforcing caps (equal to Smith-Blair); reducing bushings shall be of nylon.

4.6 **PIPE LAYING:** All PVC plastic pipe installation shall proceed on a stable foundation, with joints closely and accurately fitted. Joints shall be clean and dry, and joint lubricant, as recommended by the pipe supplier, shall be applied uniformly to the mating joint surfaces to facilitate easy, positive joint closure.

Pipe shall be installed with uniform bearing under the full length of the barrel, with suitable excavations being made to receive pipe bells.

Select material shall be compacted around the pipe to firmly bed the pipe in position. If adjustment of position of a pipe length is required after being laid, it shall be removed and rejointed as for a new



pipe. When laying is not in progress, the ends of the pipe shall be closed with a tight fitting stopper to prevent the entrance of foreign material.

Service lines and laterals must be assembled so that no strain is placed on the pipe during or after backfill operations. After laying of the pipe is completed, it shall be center loaded with backfill and bedding to prevent arching and whipping under pressure. Center loading should be done carefully so that joints will be completely exposed for examination.

In addition to the above requirements, all pipe installation shall comply with the specific requirements of the pipe manufacturer.

**4.7 GRAVEL FOUNDATION FOR PIPE:** Wherever the subgrade material does not afford a sufficiently solid foundation to support the pipe and superimposed load, and where groundwater must be drained, the subgrade shall be excavated to such depth as may be necessary and replaced with crushed rock or gravel compacted into place.

Gravel for PVC pipe foundations shall be clean crushed rock or gravel with 100% passing a one inch screen and 5% passing a No. 4 sieve.

**4.8 PIPE BEDDING:** All pipes shall be protected from lateral displacement and possible damage resulting from impact or unbalanced loading during backfilling operations by being adequately bedded.

A groove shall be excavated in the bottom of the trench to receive the bottom quadrant of the pipe. Before preparing the groove, the trench bottom shall be excavated or filled and compacted to an elevation sufficiently above the grade of the pipe so that, when completed, the pipe will be true to line and grade. Bell holes shall be excavated so that only the barrel of the pipe receives bearing from the trench bottom.

Pipe bedding materials placed at any point below the midpoint of the pipe shall be deposited and compacted in layers not to exceed 10 inches in uncompacted depth. Deposition and compaction of bedding materials shall be done simultaneously and uniformly on both sides of the pipe. Compaction shall be accomplished with hand or mechanical compactors. All bedding materials shall be placed in the trench with hand tools or other approved method in such a manner that they will be scattered alongside the pipe and not dropped into the trench in compacted masses. Bedding materials shall be loose earth, free from lumps; sand or gravel, free from rocks larger than one inch diameter; with all materials free from roots, sod, or other vegetable matter.

In the event trench materials are not satisfactory for pipe bedding, modified bedding will be required. Modified bedding shall consist of placing compacted granular material on each side of and to the level of 12 inches above the top of the pipe.

Modified bedding material shall be graded as follows: 100% passing a one inch screen and 5% passing a No. 4 sieve.

## SECTION 5

### MANHOLES

5.1 GENERAL: This section covers the requirements for manhole materials and installation.

5.2 CONCRETE BASES: Manhole bases may be either precast or cast-in place unless otherwise specified. Precast manhole bases shall have pipe inverts, a neoprene boot with strap for each pipe connecting to the manhole, and a minimum of six inches of compacted gravel base under the manhole. Cast in place pipe connections may also be utilized as outlined on the drawings.

Where sewer lines enter manholes, the invert channels shall be smooth and semi-circular in cross section, conforming to the details shown on the Drawings. Changes of direction of flows within the manholes shall be made with a smooth curve with as long a radius as possible. The floor of the manhole outside the channels shall be smooth and slope toward the channel at not less than ½ inch per foot.

The connecting boots shall be made of neoprene compound meeting ASTM C-443 Specifications. The boot shall have a wall thickness of 3/8 inch. The boot shall either be "cast-in-place" in the precast base or attached to the precast base by means of an internal expanding band. When the boot is attached to the precast base, a watertight seal between the boot and the precast base must be accomplished. An external band shall be supplied and used to clamp and seal the boot to the pipe. The band shall be made of 300 series non-magnetic corrosion-resistant steel. After the band has been placed, it shall be completely coated with a bituminous material approved by the Engineer.

All junction manholes with three or more pipes located in the base shall be 60 inch inside diameter. All manholes with the mainline size being 12 inch diameter or larger shall be 60 inch inside diameter. All other manholes shall be 48 inch inside diameter.

Concrete for manhole bases shall comply with the requirements of Section 2 of these Specifications.

5.3 WALL AND CONE SECTIONS: all manholes shall be precast, sectional, reinforced concrete pipe of either 48 or 60 inch I.D., as specified. Both cylindrical and taper sections shall conform to all requirements of ASTM Designation C-478 for Precast Reinforced Concrete Manhole Sections. The manhole sections shall also comply with the following:

- A. The throat section of the manhole shall be adjustable, by use of pipe sections, up to 18 inches in height.
- B. The taper section shall be a maximum of three feet in height, shall be of eccentric conical design, and shall taper uniformly to 30 inches inside diameter.
- C. The pipe used in the base section shall be furnished in section lengths of 1, 2, 3, and 4 feet as required.

- D. Reinforcing steel shall consist of a circular cage with a minimum cross sectional area of 0.25 square inch of steel per foot for cylindrical sections and 0.20 square inch per foot for cone sections.

5.4 MANHOLE INSTALLATION: All joint surfaces of precast sections and the face of the manhole base shall be thoroughly cleaned and wet prior to setting precast sections. Joints shall be set in mortar consisting of 1 part cement and 1 ½ parts sand with sufficient water added to bring the mixture to workable consistency.

Bituminous jointing material may be used in lieu of cement mortar and shall be installed in accordance with manufacturer's recommendations. All joints shall be watertight and free from appreciable irregularities in the interior wall surface.

5.5 IRON CASTINGS: All iron castings shall conform to the requirements of ASTM Designation A-48 (Class 30) for grey iron castings.

Rings and covers shall be 30" diameter as supplied in "D&L Supply" Model A-1181 or an approval equal. Each cover shall contain one (1) pick hole but shall not contain air vent holes. The cover shall be marked "SEWER" or "STORM DRAIN" or "WATER", as appropriate.

All manhole rings shall be carefully set to the grade shown on the Drawings or as directed by the District Engineer. All manhole covers shall be set to final finish grade following the paving of the associated street and raised to the finish grade with a concrete collar as shown on the drawings. The concrete collar shall be a minimum thickness of 8 inches and shall be held down ½" below the top of the adjacent asphalt pavement.

5.6 MANHOLE STEPS: all sanitary sewer and storm drain manholes over six feet in depth shall be provided with manhole steps as shown on the drawings. All steps shall be securely grouted into the wall section and shall be water tight. Steps shall be uniformly spaced at 1'-0" maximum and shall be polypropylene covered steel steps, Model PSI-PF as manufactured by "M.A. Industries" or an approved equal.

**SECTION 6**  
**CULINARY WATER SYSTEM**

**PART 1      GENERAL**

**6.1.01   WORK INCLUDED**

- A.    Inspection
- B.    Preparation
- C.    Water pipe installation
- D.    Valve and fitting installation
- E.    Thrust block installation
- F.    Corrosion protection
- G.    Field quality control
- H.    Metered Services
- I.    Pressure Reducing Stations
- J.    Fire Hydrants
- K.    Fire Lines
- L.    General

- 1.    The work to be done consists of furnishing all necessary labor, materials and equipment to provide complete installation and testing of water system facilities. Modifications to existing facilities shall conform to District specifications.
- 2.    The construction of water mains shall include: excavation, backfill and compaction, construction of concrete structures, anchors, thrust blocks, supports, encasements; furnishing, installing, testing and disinfecting water pipelines, fittings, valves, blow offs, air valves, services, fire hydrants, and all appurtenances; removal and restoration of existing improvements and all work in accordance with the project plans and specifications.

M. Unacceptable Work

1. Unacceptable work as determined by Uintah Highlands Improvement District whether the result of poor workmanship, use of defective materials, damage through carelessness or any other cause, found to exist prior to the final acceptance of the work, shall be removed immediately and replaced in an acceptable manner at the contractor's expense.

6.1.02 RELATED WORK

- A. Excavation and Backfill for Pipelines -- Section 6
- B. Disinfection of Water Distribution Systems – Section 7

6.1.03 QUALITY ASSURANCE

- A. Comply with federal, state, and local codes and regulations. Underground piping pressure testing shall be witnessed by the District Engineer or a designated District representative.
- B. Pipe, valve, and appurtenance materials and workmanship shall be in accordance with AWWA Standards or other standards as specified herein.

6.1.04 REFERENCES

- A. American Water Works Association (AWWA)
  1. C105, "Polyethylene Encasement for Gray and Ductile Cast-Iron Piping for Water and Other Liquids".
  2. C111, "Rubber-Gasket Joints for Ductile-Iron and Gray-iron pressure Pipe and Fittings".
  3. C151, "Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids".
  4. C504, "Rubber-Seated Butterfly Valves".
  5. C509, "Resilient-Seated Gate Valves for Water and Sewer Systems".
  6. C600, "Installation of Gray and Ductile Cast-Iron Water Mains and Appurtenances".
- B. American Society for Testing and Materials (ASTM):
  1. A-126: For valve bodies.

6.1.05 SUBMITTALS



- A. Submit manufacturer's specifications for all products to the District for approval.

#### 6.1.06 DELIVERY, STORAGE AND HANDLING

- A. Load and unload pipe, fittings valves, and accessories by lifting with hoists or skidding so as to avoid shock or damage. Do not skid or roll pipe on skid ways against pipe already on the ground.
- B. Each length of pipe shall be unloaded opposite or near the place where it is to be laid in the trench.
- C. At times when pipe laying is not in progress, the open ends of the pipe shall be closed by a watertight plug or other means approved by the District.

### PART 2 PRODUCTS

#### 6.2.01 DUCTILE IRON PIPE

- A. Buried Applications
  - 1. Standard: AWWA C151.
  - 2. Pressure Rating (class) - Pipe Diameters 4" to 12" shall be thickness Class 50, Pipe Diameters 14" and larger shall be pressure Class 250 p.s.i.
  - 3. Cement lined and bituminous coated in accordance with AWWA C104.
  - 4. Rubber gasketed slip-on pipe joints in accordance with AWWA C111.
  - 5. Class 250 psi mechanical joint fittings in accordance with AWWA C110.
  - 6. Standard: NSF 61 - Drinking Water System Components - Health Effects.
- B. Above Ground Applications
  - 1. Same as below ground except joints and fittings to be flanged in accordance with AWWA C115.
  - 2. Gaskets to be full faced, 1/16th inch thick rubber.

#### 6.2.02 ACCESSORIES

- A. Nuts and Bolts as required.
- B. Gaskets to be 1/16th inch full face rubber.
- C. 8 mil. polyethylene wrap in accordance with AWWA C105.

#### 6.2.03 CORROSION PROTECTION

- A. Bolts: Apply 2 coats of no oxide wax to all exposed surfaces of bolts and to all bolt threads after installation of piping, fittings, valves, and couplings.
- B. Encase all buried ductile iron valves, fittings, connections and specialties in minimum 8 mil. polyethylene sheets in accordance with AWWA C-105. Duct tape shall be used to secure polyethylene sheets to the pipe.
- C. Encase buried ductile iron pipe in minimum 8 mil. polyethylene sheets in accordance with AWWA C-105 in selected areas and soil types which required corrosion protection as approved and directed by the District Engineer.

#### 6.2.04 VALVES

- A. Gate valves (8" and smaller):
  - 1. Cast Iron Body, Bronze Mounted: Furnish resilient-seated gate valves 3 inches through 10 inches that conform to the requirements of AWWA C509, non-rising stem design with "O" ring seals.
  - 2. Operating Direction: Open counterclockwise.
  - 3. Buried Valves: Flanged, mechanical joint, or as indicated.
- B. Tapping valves and sleeves:
  - 1. Tapping valves shall have large diameter seat rings to permit entry of tapping machine cutters. Inlet shall be flanged. Outlet shall suit branch piping and shall include the required flange for tapping machine adapter connection. In other details, tapping valves shall conform to the requirements outlined for gate valves in Paragraph 6.2.06 A.
  - 2. Tapping sleeves shall be suitable for assembly around the existing main. Body shall be high strength ribbed construction. End gaskets shall be sized to suit the existing main, and the seals between the pipe and the gaskets shall be formed around the perimeter of the pipe.
  - 3. Tapping valves and sleeves shall be split cast iron or stainless steel fully gasketed.
- C. Butterfly valves (12" and Larger):
  - 1. Shall comply with the requirements of AWWA C504, Class 150 B.
  - 2. Valve bodies shall be cast in conforming to ASTM A126, Class B. Ends shall be flanged unless otherwise specified.
  - 3. Valve discs shall be streamlined and shall have a continuous 360 sealing surface of stainless steel, ASTM A276, type 304.

4. Valve shafts shall be stainless steel ASTM A276, type 304, of stub construction with at least 1-1/2 shaft diameter engagement into the disc and shall be fastened to the disc with upset pins.
5. Valve seats shall be of Buna N material bonded to the valve body.
6. Valve bearings shall be self-lubricating and non-corrosive and shall have a significant difference in hardness from the valve shaft.
7. Valve actuators shall be designed as an integral part of the valve and shall meet all the requirements of AWWA C504. All actuators shall be hermetically sealed and permanently lubricated with no exposed moving parts. All manual actuators will meet the requirements of AWWA C504 for nut input.

#### 6.2.05 VALVE BOXES

- A. Shall be suitable for HS-20 traffic loading.
- B. Shall be furnished and installed over each line valve and over each auxiliary hydrant valve. All buried valves shall be installed complete with a Tyler 564A slip valve box or approved equivalent. Valves over 5' in depth shall have a valve nut extension stem installed.

#### 6.2.06 FITTINGS

- A. Mechanical joint:
  1. Mechanical joint fittings shall be cast iron class 250 and shall conform to AWWA C-110 and C-111. Mechanical joint fittings shall be coated with a petroleum asphaltic coating 1 mil thick.
- B. Flanged fittings:
  1. Flanged fittings shall conform to AWWA C-110 and C-111 Cast Iron Fittings. Flanges shall be faced and drilled and shall be Class 250. Flanged fittings shall be coated with a petroleum asphaltic coating 1 mil thick.

#### 6.2.07 METERED SERVICES

- A. 1" Service Laterals (see Standard Details):
1. All supplies, labor, machinery, etc. will be supplied by the contractor. Uintah Highlands Improvement District will supply and set the meters.
  2. All connections must be made with compression copper fittings made of brass.
  3. Brass corporation stops Mueller B-25008 or equivalent. Tap directly into the main. All corps shall be CC thread. No saddles are allowed on ductile iron mains.
  4. Type K soft drawn copper pipe installed as one solid piece from main to meter.
  5. 18" meter yokes. Mueller B-2434-6A-0118 or equivalent (copper or brass).
  6. Meter Boxes: 21" diameter concrete meter box as approved by the District.
  7. 21" cast iron ring and lid with locking nut (D&L Supply L-2240 or District approved equal) with a 2" hole in the center of the cover.
- B. 1-1/2" and 2" Service Laterals (see Standard Details):
1. All supplies, labor, machinery, etc. will be provided by the contractor. Uintah Highlands Improvement District will provide and set the meter in excess of 1" in size.
  2. Type K soft drawn copper pipe installed as one solid piece from main to meter.
  3. Copper or brass screw type fittings (ball valves, strainers, nipples, tees, bends, etc.).
  4. Meters: Meter shall be provided and set by the District.
  5. 5 foot diameter precast concrete manhole with 30" cast iron ring and lid suitable for HS-20 traffic loading (D & L Supply 1181 or District approved equal). An alternate 30" diameter poly meter vault section can be used with the prior approval of the District Engineer.
  6. Meter box to have 12" gravel floor.

C. 3" Service Laterals (see Standard Details):

Specifications for 3" services shall be the same as 2" connections with the following exceptions:

1. Where possible flanged fittings may be substituted for screw on type fittings.
2. Meters. The district will provide and set the meter.
3. Meter Vault to have concrete floor and 18" diameter concrete drain sump with personnel access manhole and steps. See the District Standard Details.

D. 4" and Larger Service Laterals:

1. Ductile iron pipe.
2. Cast iron, flanged gate valves and fittings.
3. Concrete meter vault with cast iron lid, concrete floor and 18" diameter drain sump with personnel access manhole and steps.
4. Meters. The district will provide and set the meter.
5. Floor supports as needed.

E. All service laterals are to have 48 inches min. cover and are to be installed using one seamless section of pipe from the water main to the meter.

6.2.08 PRESSURE REDUCING VALVE STATIONS (See Standard Details)

- A. All pressure reducing valves (PRV) shall be "Clayton" brand Pressure Reducing and Sustaining Valves as shown on the Standard Drawings. Specific brand name to be installed for each specific installation shall be directed by the District Engineer.
- B. All PRV stations because of the weight of the combined fittings, must have support blocks for support. Supports shall be screw jack type and shall not restrict access to any of the bolts.
- C. On PRV's over 6", the District may determine that a low flow PRV in excess of 2" is required.
- D. Vault:
  1. Vault shall have a concrete floor with an 18" concrete pipe sump. The pipe sump shall be located near the access lid and the floor shall slope towards the sump (2% slope minimum).

2. Vault shall have 6'-6" clearance between the floor and ceiling of the vault.
3. Vault shall have two access lids:
  - a. A 36" diameter clear opening manhole ring and lid shall be centered over the PRV to provide easy access for possible removal. Ring and lid shall be D & L Supply A-1460 or equivalent.
  - b. A 24" diameter clear opening manhole ring and lid shall be located at a corner of the vault. Ring and lid shall be D&L Supply A-1181 or equivalent. All access lids (personnel lids) must be accompanied by ladder either poured into or securely fastened to the vault wall. All ladders will have rungs not farther than 1' apart. Steps poured into the vault wall shall be rubber coated as are found in pre-poured sewer cones and sections. Ladders fastened to the walls shall have lag bolts connections as shown on the plans.
  - c. The vault shall have min. 8" thick walls. Wall and roof shall have steel reinforcement designed for HS-20 traffic loading.
  - d. All piping which penetrates wall sections shall have "Romac" MJRG retainer glands and 24" square steel plate for thrust restraint on each side of the wall opening as detailed on the drawings.
4. See Standard Details for PRV general specification details.

#### 6.2.09 FIRE HYDRANTS (See Standard Details)

- A. All fire hydrants shall be red in color and shall be one of the following 6" compression type hydrants:
  1. Mueller Centurion
  2. Clow Medallion
- B. Auxiliary valve complete with valve box.
- C. Gravel for sump.
- D. Concrete for blocking and setting hydrant (Mega-lug connections utilized to replace concrete blocking is acceptable with the prior authorization of the District).
- E. All hydrants shall conform to AWWA Specifications C-502.
- F. Hydrant shall be equipped with two 2 ½" hose nozzles and one 4 ½" nozzle, and nozzles shall have the national standard threading.
- G. Each hydrant shall be supplied with O-ring seals and a national standard pentagon operating nut designed for clockwise rotation closing.

H. Auxiliary valve shall conform to Uintah Highlands Improvement District Specification for gate valves. The water line from the main to the hydrant shall be 6" minimum.

I. Blocking shall conform to District Specifications for thrust blocking.

#### 6.2.10 FIRE SPRINKLER/SUPPRESSION LINES

A. All fire lines must be equipped with a gate valve. The valve shall conform to District specifications for gate valves.

B. All fire lines shall be ductile iron pipe, thickness class 50 or as shown on the District approved site plans. Fire lines shall meet Uintah Highlands Improvement District's specifications for main lines.

C. Fire line locations shall be approved by the District.

D. Notify the District Inspector 48 hours prior to installation.

E. Unless written authorization is given by the District, no services shall be connected to the fire sprinkler/suppression lines.

### PART 3 EXECUTION

#### 6.3.01 INSPECTION

A. All pipe fittings, valves and other appurtenances shall be examined by Contractor carefully for damage and other defects immediately before installation.

B. Defective materials shall be marked and held for inspection by the District Engineer, who may prescribe corrective repairs or reject the materials.

C. Prior to installation, valves shall be inspected for direction of opening, freedom of operation, tightness of pressure-containing bolting, cleanliness of valve ports and seating surfaces, handling damage, and cracks. Defective valves shall be corrected or held for inspection by the Uintah Highlands Improvement District Engineer.

#### 6.3.02 PREPARATION

A. Furnish temporary support, adequate protection, and maintenance of all underground and surface structures, drains, sewers, and other obstructions encountered in the progress of the work.

B. The trench bottom and pipe bedding surface shall be prepared in accordance with the

approved plans, the excavation and backfill specifications in the Uintah Highlands Improvement District Public Works Standards and The Regulations for Excavation on Public Rights-of-Way prior to pipe installation.

- C. All lumps, blisters, and excess coating shall be removed from the socket and plain ends of each pipe, and the outside of the plain end and the inside of the bell shall be wiped clean and dry and be free from dirt, sand, grit, or any foreign material before the pipe is laid. Bevel and file plain end of pipe to prevent gasket damage during joint assembly.
- D. Proper implements, tools, and facilities shall be provided and used for the safe and convenient performance of the work. All pipe, fittings, and valves shall be lowered carefully into the trench by means of a derrick, ropes, or other suitable tools or equipment, in such a manner as to prevent damage to water-main materials and protective coatings and linings. Under no circumstances shall water system materials be dropped or dumped into the trench.

#### 6.3.03 WATER PIPE INSTALLATION

- A. The water pipe shall be laid and maintained to lines and grades established by the drawings and specifications with fittings and valves at the required locations unless otherwise approved by the District. Unless otherwise shown, all water lines shall have 4.0' minimum cover to final finish grade. All main lines are to be located 10' off the street centerline as shown on District approved drawings unless otherwise specified. All valves and fire hydrants are to be installed as noted on the approved plans.
- B. When crossing existing pipelines or other structures, alignment and grade shall be adjusted as necessary, with the approval of the District Engineer to provide clearance as required by federal, state, or local regulations or as deemed necessary by the District to prevent future damage or contamination of either structure.
- C. Lay all water lines on a continuous grade to avoid high points except as shown on the plans.
- D. Prevent foreign material from entering the pipe while it is being placed in the trench. During laying operations, no debris, tools, clothing, or other materials shall be placed in the pipe. If the pipe-laying crew cannot put the pipe into the trench and in place without getting earth into it, the Engineer may require that, before lowering the pipe into the trench, a heavy, tightly woven canvas bag of suitable size shall be placed over each end and left there until the connection is to be made to the adjacent pipe.
- E. As each length of pipe is placed in the trench, the joint shall be assembled in accordance with manufacturer's recommendations.



- F. The pipe shall be brought to correct line and grade, and shall be secured in place with approved backfill material in accordance with the Uintah Highlands Improvement District Standards.
- G. Wherever it is necessary to deflect pipe from a straight line, either in the vertical or horizontal plane, to avoid obstructions or plumb stems or where long-radius curves are permitted, the amount of deflection allowed shall not exceed that recommended by pipe manufacturer and shall be approved by the District Engineer.
- H. At times when pipe laying is not in progress, the open ends of pipe shall be closed by a watertight plug or other means approved by District. When practical, the plug shall remain in place until the trench is pumped completely dry. Care must be taken to prevent pipe flotation should the trench fill with water.
- I. Cutting pipe for the insertion of valves, fittings, or closure pieces shall be done in a neat, workmanlike manner without creating damage to the pipe or lining.
- J. Cut ends and rough edges shall be ground smooth. For push-on joint connections, the cut end shall be beveled.
- K. Whenever possible, all tie-ins will be made dry. The District shall turn off the water upon 48 hours minimum advance notice by the contractor. It shall be the contractor's responsibility to advise all affected water users of the interrupted service a minimum of 24 hours prior to any service interruption. In large areas where there is heavy use, where shutting down the line is not feasible in the opinion of the District Engineer, the contractor shall be required to tie onto the main by using a wet tap.
- L. All dead ends shall be plugged complete with a 2" wash out assembly (see Standard Details).

#### 6.3.04 VALVE AND FITTING INSTALLATION

- A. Valves shall be as located on the District Standard Details.
- B. Valve-operating stems shall be oriented in a manner to allow proper operation.
- C. A valve box shall be provided for every valve that has no gearing or operating mechanism or in which the gearing or operating mechanism is fully protected with a gear case. The valve box shall not transmit shock or stress to the valve and shall be centered over the operating nut of the valve, with the box cover flush with the surface of the finished area or such other level as may be directed by the owner. In paved areas, a concrete collar around the valve box is required.
- D. In no case shall valves be used to bring misaligned pipe into alignment during installation. Pipe shall be supported in such a manner as to prevent stress on the

valve.

#### 6.3.05 THRUST BLOCK INSTALLATION

- A. Thrust blocks shall be provided at reducers, valves, tees, plugs, and caps, and at bends deflecting 22-1/2 degrees or more. 11-1/4 degree pipe bends shall be installed with approved ductile iron retainer glands.
- B. Thrust block shall be placed between solid ground and the fitting to be anchored; the area of bearing on the pipe and on the ground in each instance shall be that shown on the drawings. The block shall, unless otherwise shown or directed, be so located as to contain the resultant thrust force and so that the pipe and fitting joints will be accessible for repair. Concrete shall not be located within 1-1/2" of the joints and bolts.
- C. Concrete for thrust blocks shall have a compressive strength of not less than 2500 psi in 28 days.
- D. Care shall be taken to not pour concrete around bolts.
- E. Refer to Standard Details for thrust block details.

#### 6.3.06 CORROSION PROTECTION

- A. Bolts: Apply 2 coats of no oxide wax to all exposed surfaces of bolts and to all bolt threads after installation of piping, fittings, valves, and couplings.
- B. Encase all buried ductile iron valves, fittings, connections, and specialties in minimum 8 mil. polyethylene sheets in accordance with AWWA C-105.
- C. In areas where corrosive soils may be present, all buried ductile iron pipe is to be poly-wrapped in accordance with AWWA C-105. The District Engineer will designate areas where an appropriate soils analysis is required to determine soil characteristics. Contractor shall bare the expense for soils analysis.

#### 6.3.07 1" SERVICE LATERALS

- A. Laterals shall be installed prior to the construction of concrete curb and gutter. The contractor shall be responsible to have sufficient elevation controls at the construction site to set water meter boxes at the District approved finish grades.
- B. Locate all laterals clustered in groups of two, where possible, on common lot lines. There must be a minimum clearance of 12" between clustered water meter boxes.

Location of secondary water service lines must be coordinated with the location of the culinary water services so that the culinary and secondary water service lines are located on opposite lot corners. All proposed culinary water meter locations shall be approved, prior to construction, by the District.

- C. All meters shall be located between the curb and the sidewalk unless approved otherwise by the District Engineer.
- D. Corporation stops shall be tapped at 45 degree angles unless approved otherwise by the District Engineer. The installer should firmly compact dirt around and under the corporation stop and copper loop.
- E. Type K soft drawn copper shall be connected to the top of the water main at a 45 angle by using a brass nut and a compression fitting on the end of the copper. All tubing shall be cut straight.
- F. A small loop (goose neck) of excess copper must be put in the copper tubing to accommodate for settlement that may occur (see Standard Details).
- G. All laterals must be of one continuous copper tube between the corp stop and the meter box. No joints or copper to copper connectors will be allowed.
- H. All laterals shall have a minimum of 48" cover from top of copper tubing to finished grade.
- I. All yokes shall be 18" Mueller H-1434-2W-01018 or approved equivalent and are to be connected to the service line by use of Mueller compression fittings or equivalent.
- J. From the top of the lid (cast iron) to shut off valve on the yoke, there must be a distance of not less than 18" or more than 24". No meter will be set if this or any other specification is not met.
- K. All pig-tails will be type K hard drawn copper pipe and will be stubbed into the property a minimum of 5'.
- L. All meter boxes shall be centered squarely over the yoke to provide access to the connection nuts on the bottom of the yoke. Meter box interior shall be kept clear of dirt so that connecting nuts are visible.
- M. All meter boxes will be installed so the lid of the meter box will be level with the adjacent curb after any settlement has occurred..
- N. See Standard Details for typical installation detail.

- O. Precautions should be used to prevent any foreign materials from entering the pipe. All pig-tails will be mashed on the end which is stubbed into the property. Contractor will make every effort to ensure that no kinks or restrictions occur in the copper service.

The Uintah Highlands Improvement District may require the compression fitting on the cold side of the yoke to be tested by inserting a jumper in between the yoke. Jumper shall be complete with gaskets and will be installed and ready for inspection prior to calling the District.

- P. Copper laterals may, at the discretion of the District Engineer, be required to be bedded in sand. If sand bedding is required, a minimum of 6" below and 6" above the pipe shall be placed.

#### 6.3.09 1 ½" AND 2" SERVICE LATERALS

- A. All meter vaults shall have a gravel base (floor) not less than 1' thick.
- B. The meter shall be a minimum of 36" and a maximum of 42" from the top of the box (see Standard Details). In cases where the main water line is deeper, the service lateral will be raised to conform to this specification.
- C. A bypass shall be installed on the metered line.
- D. All solder joints shall be of 95-5 solder or better or Mueller compression fittings.
- E. The area where the pipe comes into and out of the vault shall be grouted to prevent debris from washing into the box.
- F. No sprinkler systems shall be tied into the line inside of the meter vault.
- G. When subject to traffic, the box must be designed for HS-20 traffic loading and be equipped with an appropriate cover approved by the District Engineer.
- H. 1 ½" and 2" taps to the main line shall be made with a saddle. Saddles shall be stainless steel and have a minimum of two straps which hold the saddle to the main. On 1 ½" and 2" taps only, a compression type corporation stop is acceptable. Saddle is to be wrapped in polyethylene.
- I. See Detail Drawings for typical meter installation detail.

#### 6.3.10 3" AND LARGER SERVICE LATERALS

- A. The meter vault shall have a gravel base (floor) not less than one foot in depth.

- B. In case of extreme depth (over 36") a ladder shall be poured into or securely fastened to the vault wall. The access lid shall be moved so that it is centered over the ladder.
- C. The bypass shall be the same size as the metered line.
- D. No sprinkling system shall be tied inside the meter vault. Such tie-ins must be made on the owners side of the meter station (outside the vault).
- E. When subject to traffic the box must be designed for HS-20 traffic loading and be equipped with an appropriate lid approved by the District Engineer.
- F. The meter vault shall be poured so that 12" minimum clearance exists between all sides of the vault and the piping.
- G. See Detail Drawings for typical installation detail.

#### 6.3.11 FIRE HYDRANT INSTALLATION

- A. The trench for the hydrant shall be slightly over excavated to provide a 1 cubic yard gravel sump as shown on the drawings.
- B. Concrete thrust blocking shall be set behind the hydrant for support.
- C. The drain holes shall not be covered by the concrete blocking.
- D. All hydrants shall be level both at the side and at the back.
- E. All hydrants shall be turned on after installation and inspected by the District and the Fire Marshall for proper operation.
- F. See Detail Drawings for Fire Hydrant Connection Detail.

#### 6.3.12 FIELD QUALITY CONTROL

- A. Temporary connections for pressure testing shall be made by the Contractor at his expense and removed by him after the satisfactory completion of the testing work.
- B. Pressure Test:
  - 1. After completion of the installation of the system, (including water mains and all service laterals) or any reasonable length thereof, prior to backfilling and after thorough flushing of the portion to be tested, pressure tests shall be made. The system to be tested shall be subjected to a hydrostatic pressure of

200 pounds per square inch, following AWWA C600-93 procedures, unless otherwise noted on the drawings, for a period of not less than 2 hours duration.

2. The portion to be tested shall be filled with water slowly and the specified test pressure shall be applied by means of a pump connected to the pipe in a manner satisfactory to the District Engineer. The Contractor shall make the temporary connection for pressure testing.
3. Before applying the specified test pressure, air shall be expelled completely from the pipe, valves, and hydrants. If permanent air vents are not located at all high points, the contractor shall install corporation stops at such points so that the air can be expelled as the line is filled with water. After all the air has been expelled, the corporation cocks shall be closed and the test pressure applied. At the conclusion of the pressure test, the corporation cocks shall be removed and plugged by the Contractor with a brass plug.
4. All exposed pipe, fittings, valves, hydrants, and joints shall be examined carefully during the test. Any damage or defective pipe, fittings, valves, or hydrants that are discovered following the pressure test shall be repaired or replaced with sound material and the test shall be repeated until it is satisfactory to the District Engineer, at no cost to the Owner.

C. Leakage Test:

1. A leakage test shall be conducted concurrently with the pressure test, following AWWA C600-93 procedures.
2. Leakage shall be defined as the quantity of water that must be supplied into the newly laid pipe, or any valved section thereof, to maintain pressure within 5 psi of the specified test pressure after the air in the pipeline has been expelled and the pipe has been filled with water.
3. Maximum leakage during the pressure test shall not exceed one gallon per inch diameter per 1000 feet of pipe.
4. Acceptance of installation shall be determined on the basis of allowable leakage. If any test of pipe laid discloses leakage greater than that specified above, the contractor shall, at his own expense, locate and repair the defective material until the leakage is within the specified allowance.
5. All visible leaks, other than a minor amount of sweating, shall require immediate stoppage of the test and tightening of the joints so that, when pressure is again put on the system, there will be no leakage.

D. Disinfection of Water Distribution Systems:

1. Refer to Section 7.

6.3.13 CROSS CONNECTION CONTROL AND BACKFLOW PREVENTION

- A. It shall be unlawful at any place supplied with water from the Uintah Highlands Improvement District Water Distribution System to do any of the following:
1. To install after written notification from the District Manager or use any physical connection or arrangement of piping or fixtures which may allow any fluid or substance not suitable for human consumption to come in contact with potable water in the District's Distribution System.
  2. To install any connection, arrangement, or fixtures without using a backflow prevention device or assembly designed to prevent a violation of subsection A. Any such device or assembly must be approved for installation by the District Manager with respect to each application.
  3. To install any backflow prevention device or assembly described in subsection B which is not installed as required in the Utah Plumbing Code.
- B. Officers and employees of Uintah Highlands Improvement District shall have the right to enter any place which is supplied with water from the District's Distribution System and conduct a hazard survey or any other examination or test reasonably necessary to the enforcement of this section.
- C. Any user of water from the District Water Distribution System, and not Uintah Highlands Improvement District, shall pay all costs of installation and testing of backflow prevention devices or assemblies.
- D. Backflow prevention devices or assemblies required by this section shall be tested not less than once each year by a technician certified by the Safe Drinking Water Committee of the State of Utah. Test results shall be furnished to the District Manager.
- E. Water service may be discontinued to any user who is found to be in violation of this ordinance and who fails to take corrective action within ten (10) days after violation notification, except that water service may be discontinued immediately if an immediate threat to the water supply exists.
- F. Any person who violates the provisions of the section shall be civilly liable to Uintah Highlands Improvement District, and to third persons other than the District, for all damages proximately caused by said violation.

## PART 4      WATER POLICY FOR AREAS ABOVE 5234 FOOT ELEVATION

6.4.01 It shall be the policy of the District to provide culinary water service to those areas above 5234 feet elevation (approximately 40 psi of static pressure) provided the following conditions are met:

- A. Developer, subdivider, or proposed user shall provide financing for the design and construction of new deep well water supplies (if required), pumping stations and/or storage reservoirs to service the new proposed public water service zone.
- B. The District Engineer, in consultation with the requesting party, shall design all deep well facilities (if required), pumping facilities, special pipelines and/or reservoirs needed for the new pressure zone. All cost of said design and construction shall be borne by the requesting party. A reimbursement agreement between the developer and the District covering the cost of the required facilities will be negotiated. The District will collect water impact fees in the new water service zone and use these fees to reimburse the developer for the cost of design and construction.
- C. Individual home service lateral sizing shall be recommended by the District Engineer.
- D. All pressurization facilities shall be constructed to specified District and State Drinking Water Division standards and subject to construction inspection by the District staff.
- E. Following construction, all completed facilities, other than private individually metered and separated systems, shall be turned over to Uintah Highlands Improvement District for ownership, operation and maintenance.
- F. Users in any special pressure service area may be subject to a monthly surcharge for this service in addition to regular water use billings.



## **SECTION 7**

### **DISINFECTION OF WATER DISTRIBUTION SYSTEMS**

#### **PART 1 GENERAL**

##### **7.1.01 WORK INCLUDED**

- A. Flushing of water distribution system and supply lines
- B. Chlorine disinfection
- C. Final flushing

##### **7.1.02 QUALITY ASSURANCE**

- A. All disinfection and testing procedures shall be in accordance with applicable Federal, State, and local standards, and in accordance with applicable provisions of AWWA C651.

##### **7.1.03 REFERENCES**

- A. American Water Works Association (AWWA).
  - 1. C651.
  - 2. B300 - Standard for Hypochlorite
  - 3. B301 - Standard for Liquid Chlorine
- B. "Standard Methods for Examination of Water and Wastewater", American Public Health Association, AWWA, and Water Pollution Control Federation.
- C. "Utah Administrative Code" Section R309.

##### **7.1.04 SUBMITTALS**

- A. Results of chlorine residual tests.
- B. Results of bacteriological quality tests.

#### **PART 2 PRODUCTS**

##### **7.2.01 CHLORINE**

- A. Sodium Hypochlorite:

1. Shall be in accordance with AWWA B300.
  2. Shall be stored as recommended by manufacturer.
- B. Calcium Hypochlorite:
1. Shall be in accordance with AWWA B300.
  2. Shall be in granular or tablet (5 gram) form.
  3. Shall be stored in a cool, dry, and dark environment or as recommended by manufacturer.
- C. Liquid shall conform to AWWA B301.

## PART 3 EXECUTION

### 7.3.01 PREPARATION

- A. Notify the District at least 72 hours prior to any flushing or disinfecting.
- B. Contractor shall install temporary connections for flushing water lines after disinfection. After the satisfactory completion of the flushing work, the Contractor shall remove and plug the temporary connection.

### 7.3.02 TABLET METHOD

- A. Tablet Method PG AWWA C651-92, Section 5.1
- B. The tablet method consists of placing calcium hypochlorite granules and tablets in the water main as it is being installed and filling the main with potable water when installation is completed.
- C. This method may be used only if the pipes and appurtenances are kept clean and dry during construction.
- D. Placing of calcium hypochlorite granules: During construction, calcium hypochlorite granules shall be placed at the upstream end of the first section of pipe, at the upstream end of each branch main, and at 500-ft intervals. The quantity of granules shall be as shown in Table 1. Warning: This procedure must not be used on solvent-welded plastic or on screwed-joint steel pipe because of the danger of fire or explosion from the reaction of the joint compounds with the calcium hypochlorite.

**TABLE 1**  
Ounces of Calcium Hypochlorite Granules to be Placed  
at Beginning of Main and Each 500-ft Interval

Pipe Diameter (in.)	Calcium Hypochlorite Granules (oz.)
4	0.5
6	1.0
8	2.0
10	3.0
12	4.0
16 and larger	8.0

- E. Placing of calcium hypochlorite tablets: During construction, 5 gram calcium hypochlorite tablets shall be placed in each section of pipe and also one such tablet shall be placed in each hydrant, hydrant branch main, and other appurtenances. The number of 5 gram tablets required for each pipe section shall be  $0.0012d^2L$  rounded to the next higher integer, where d is the inside pipe diameter, in inches, and L is the length of the pipe section, in feet. Table 2 shows the number of tablets required for commonly used sizes of pipe. The tablets shall be attached by an adhesive such as Permatex No. 1, or equal. There shall be no adhesive on the tablet except on the broad side attached to the surface of the pipe. Attach all the tablets inside and at the top of the main, with approximately equal numbers of tablets at each end of a given pipe length. If the tablets are attached before the pipe section is placed in the trench, their position shall be marked on the section so it can be readily determined that the pipe is installed with the tablets at the top.
- F. When installation has been completed, the main shall be filled with water at a rate such that water within the main will flow at a velocity no greater than 1 ft/s. Precautions shall be taken to assure that air pockets are eliminated. This water shall remain in the pipe for at least 24 hours. If the water temperature is less than 41 °F, the water shall remain in the pipe for at least 48 hours. Valves shall be positioned so that the strong chlorine solution in the treated main will not flow into water mains in active service.

**TABLE 2**  
Tablets to be Placed in Pipe Sections

	Length of Pipe Section, ft.				
	13 or less	18	20	30	40
Pipe Diameter (Inches)	(Number of 5 gram Calcium Hypochlorite Tablets *)				
4"	1	1	1	1	1
6"	1	1	1	2	2
8"	1	2	2	3	4
10"	2	3	3	4	5
12"	3	4	4	6	7
16"	4	6	7	10	13
20"	5	8	10	14	18

\* Based on 3.25 g available chlorine per tablet (65% available chlorine per 5 gram tablet); any portion of tablet rounded to next higher number. Dose of 25 mg/l required.

- G. Chlorination of the completed culinary water distribution system shall be provide with a disinfection dosage of 25 mg/l. The dosage shall be of sufficient strength to provide a minimum of 10 ppm residual after a 24 hour contact in the pipeline.
- H. If directed by the District, the completed piping system, or specified sections, shall be "super chlorinated." "Super chlorination" shall provide doesage of 100 mg/l of chlorine for a period of at least 3 hours. The chlorine residual shall be a minimum of 50 mg/l after the 3 hour contact time.

### 7.3.03 ALTERNATIVE METHODS

- A. Alternative disinfection methods:

1. Continuous-Feed Method PG AWWA C651-92, Section 5.2.
2. Slug Method PG AWWA C651-92, Section 5.3

#### 7.3.04 FINAL FLUSHING

A. Clearing the main of heavily chlorinated water:

1. After the applicable retention period, the chlorinated disinfection water shall be drained from the line.
2. Flushing shall continue until chlorine measurements show that the concentration in the water leaving the main is no higher than that generally prevailing in the system.

B. Disposing of heavily chlorinated water:

1. The environment to which the chlorinated water is to be discharged shall be inspected. Do not discharge to any fish habitat, agricultural lands or other location where damage may occur.
2. If there is any question that the chlorinated discharge will cause damage to the environment, then a reducing agent shall be applied to the water to be wasted to neutralize thoroughly the chlorine residual remaining in the water.
3. Contractor to comply with Federal Clean Water Act. If necessary, secure permission from Utah "DEQ" or County Health Department for disposal of heavily chlorinated water.

#### 7.3.05 BACTERIOLOGICAL SAMPLING AND TESTING

A. Samples for bacteriologic analysis shall be collected in sterile bottles treated with sodium thiosulfate. A minimum of two (2) consecutive samples must be taken; 24 hours apart. A sampling tap shall be provided by the Contractor. The District shall be responsible for sampling and bacteriologic analysis by a certified testing laboratory. Contractor to give minimum 48 hours notice to the District prior to required sampling.

B. Water line:

1. After final flushing and before the water main is placed in service, a sample shall be collected from the water line and tested for the absence of coliform organisms in accordance with the latest edition of "Standard Methods for the Examination of Water and Wastewater". The testing shall be by either the multiple tube fermentation technique or the membrane filter technique.

2. All samples shall be taken from a sampling tap or fire hydrant at a representative point on the system.
3. If the initial disinfection fails to produce satisfactory samples, disinfection shall be repeated until satisfactory samples have been obtained.
4. If check samples show the presence of coliform organisms, then the main shall be re-chlorinated by the continuous-feed or slug method of chlorination until satisfactory results are obtained.
5. High velocities in the existing system, resulting from flushing the new main, may disturb sediment that has accumulated in the existing mains. When check samples are taken, water entering the new main shall also be sampled.
6. When the samples are satisfactory, the water line may be placed in service upon receiving notification from the District Engineer to do so.

#### 7.3.06 DISINFECTION PROCEDURES WHEN CUTTING INTO OR REPAIRING EXISTING MAINS

- A. The following procedures apply primarily when mains are wholly or partially dewatered. After the appropriate procedures have been completed, the main may be returned to service prior to completion of bacteriological testing in order to minimize the time customers are out of water. Leaks or breaks that are repaired with clamping devices while the mains remain full of pressurized water present little danger of contamination and require no disinfection.
  1. Trench treatment: When an old main is opened, either by accident or by design, liberal quantities of hypochlorite shall be applied to open trench areas.
  2. Swabbing with hypochlorite solution: The interiors of all pipe and fittings (particularly couplings and sleeves) used in making the repair shall be swabbed or sprayed with a 1-percent hypochlorite solution before they are installed.
  3. Flushing: Thorough flushing is the most practical means of removing contamination introduced during repairs. If valve and hydrant locations permit, flushing toward the work location from both directions is recommended. Flushing shall be started as soon as the repairs are completed and shall be continued until discolored water is eliminated.

#### 7.3.07 SPECIAL PROCEDURE FOR CAULKED TAPPING SLEEVES

- A. Before a tapping sleeve is installed, the exterior of the main to be tapped shall be thoroughly cleaned, and the interior surface of the sleeve shall be dusted with calcium hypochlorite powder, at the rate of 100 mg per square foot.



## SECTION 8

### RESTORATION OF SURFACE IMPROVEMENTS

8.1 GENERAL: The Contractor shall be responsible for the protection and the restoration or replacement of any improvements existing on public or private property at the start of work or placed there during the progress of the work. All restoration of improvements shall comply with the requirements of the respective city or county.

Existing improvements shall include but are not limited to permanent surfacing, curbs, gutters, sidewalks, planted areas, ditches, driveways, culverts, fences, and walls. All improvements shall be reconstructed to equal or better conditions in all respects than the existing improvements removed.

8.2 GRAVEL SURFACE: Where trenches are excavated through gravel surfaced areas such as roads and shoulders, parking areas, unpaved driveways, etc., the gravel surface shall be restored and maintained as follows:

- A. The gravel shall be placed deep enough to provide a minimum of eight inches of material.
- B. The gravel shall be placed in the trench at the time it is backfilled. The surface shall be maintained by blading, sprinkling, rolling, adding gravel, etc., to maintain a safe, uniform surface satisfactory to the District Engineer. Excess material shall be removed from the premises immediately.
- C. Material for use on gravel surfaces shall be obtained from sound, tough, durable gravel or rock meeting the following requirements for grading:

#### 1 Inch Gradation

<u>Sieve Size</u>	<u>Ideal Gradation</u> (Percent Passing)	<u>Ideal Gradation</u> (Tolerance)
1 inch	100	0
1/2 inch	85	+/- 6
No. 4 sieve	55	+/- 6
No. 16 sieve	31	+/- 4
No. 200 sieve	9	+/- 2

8.3 BITUMINOUS SURFACE: Where trenches are excavated through bituminous surfaced roads, driveways, parking areas, etc., the surface shall be restored and maintained as follows:



- A. A temporary gravel surface shall be placed and maintained as required in Paragraph 8.2 above after the required backfill and compaction of the trench has been accomplished.
- B. The gravel shall be placed to such depth as to provide eight inches thickness below the bottom of the asphalt pavement and shall be brought flush with the paved surface.
- C. The area over trenches to be resurfaced shall be graded and rolled to provide a subgrade which is firm and unyielded. Density of the subgrade materials shall be 95% of AASHTO T-180. Mud or other soft or spongy material shall be removed and the void filled with gravel and rolled and tamped thoroughly in layers not exceeding six inches in thickness. The edges of trenches which are broken down during the making of subgrade shall be removed and trimmed neatly before resurfacing.
- D. Before any permanent resurfacing is placed, the Contractor shall trim the existing paving to clean, straight lines as nearly parallel to the centerline of the trench as practicable. Said straight lines shall be thirty feet minimum length and no deviations from such lines shall be made except as specifically permitted by the District Engineer.
- E. Existing bituminous paving shall be cut back a minimum of six inches beyond the limits of any excavation or cave-in along the trench so that the edges of the new paving will rest on at least six inches of undisturbed soil
- F. As soon as is practical, weather permitting, the bituminous surface shall be restored by standard paving practices to the thickness shown on the Drawings and/or defined in the Proposal, or matching the existing pavement cut during excavation.
- G. Pavement restoration shall include priming of pavement of edges and sub-base with Type MC-70 bituminous material and placing and rolling plant hot mix bituminous material to the level of the adjacent pavement surfaces.

8.4 CONCRETE SURFACES: All concrete curbs, gutters, sidewalks, and driveways shall be removed and replaced to the next joint or scoring line beyond the actually damaged or broken sections; or in the event that joints or scoring lines do not exist or are three or more feet from the removed or damaged section, the damaged portions shall be removed and reconstructed to a neat "saw cut" vertical plane face. All new concrete shall match, as nearly as possible, the appearance of adjacent concrete improvements. Where necessary, lamp black or other pigments shall be added to the new concrete to obtain the desired results.

All concrete work shall conform to the requirements of Section 2 of these specifications.

# ***UINTAH HIGHLANDS IMPROVEMENT DISTRICT***

## ***STANDARD DRAWINGS***

### **SUBMITTED & RECOMMENDED**

GREGORY L. SEEGMILLER P.E.  
CONSULTING ENGINEER

DATE

### **APPROVAL**

BLAINE BROUGH  
DISTRICT MANAGER

DATE

JOHN REEVE  
BOARD CHAIRMAN

DATE



### **Index of Drawings**

***CS-01.....TITLE PAGE & INDEX OF DRAWINGS***

***CS-02.....SANITARY SEWER MANHOLE DETAILS***

***CS-03.....FIRE HYDRANT & WATER SERVICE  
CONNECTION DETAILS***

***CS-04.....SANITARY SEWER LATERAL DETAILS /  
BLOW OFF VALVE***

***CS-05.....TYPICAL WATER METER STATIONS***

***CS-06.....PRESSURE REDUCTION STATION & AIR /  
VACUUM RELIEF STATION***

***CS-07.....TESTING & INSPECTION STANDARDS***

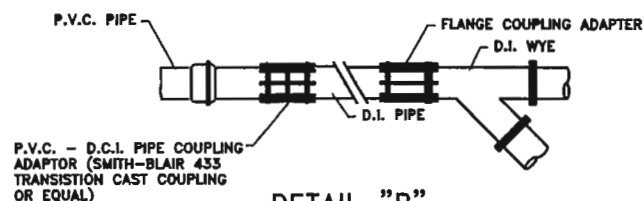
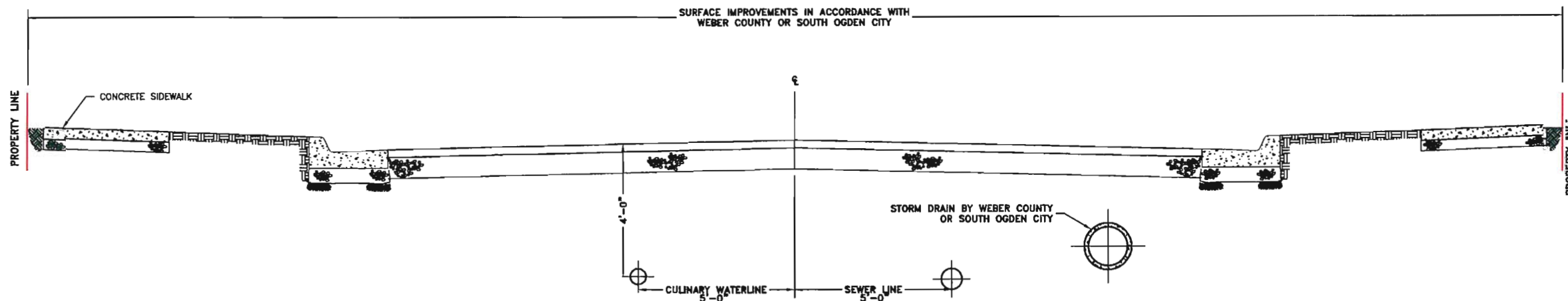
***CS-08.....GREASE INTERCEPTOR***

## ***MARCH 2007***

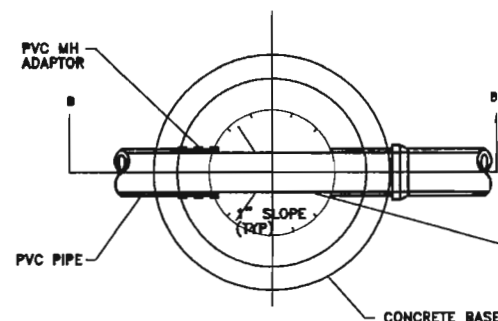


CONSULTING ENGINEERS

1716 East 5600 South  
South Ogden, Utah 84403 (801) 476-9767

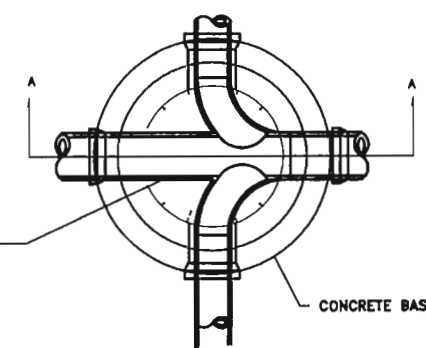


**DETAIL "B"**  
TYPICAL FOR CONNECTION D.I. PIPE TO P.V.C. PIPE

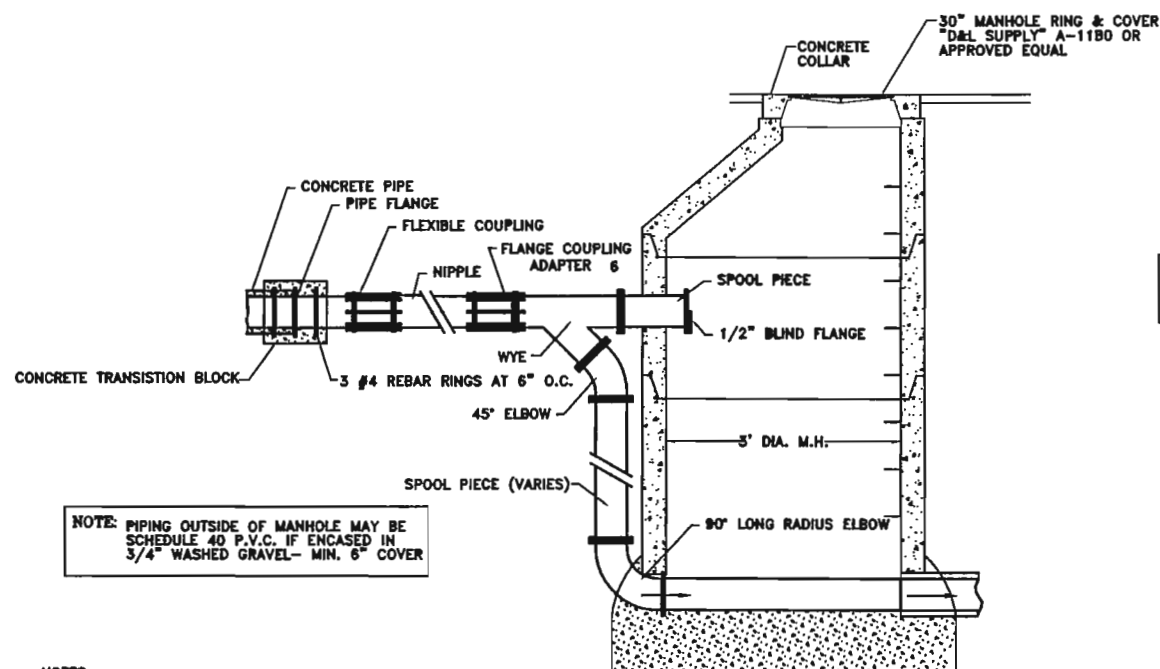


NOTE: CAST IN PLACE MANHOLE SHOWN PRECAST REINFORCED MANHOLE ACCEPTABLE

**PLAN**



**PLAN**

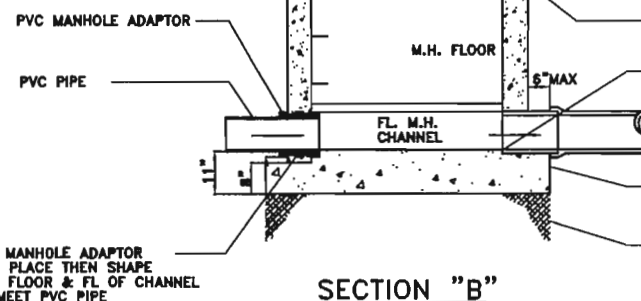


NOTE: PIPING OUTSIDE OF MANHOLE MAY BE SCHEDULE 40 P.V.C. IF ENCASED IN 3/4" WASHED GRAVEL- MIN. 6" COVER

- NOTES:
1. USE DROP MANHOLE ONLY WHEN DROP EXCEEDS 2'-0"
  2. FOR CONSTRUCTION DIMENSION OF DROP MANHOLE SEE JUNCTION MANHOLE DETAIL THIS SHEET.
  3. ALL PIPE FOR DROP MANHOLE TO BE FLANGED DUCTILE IRON PIPE OR ALTERNATE SCHEDULE 40 P.V.C. IF ENCASED IN 3/4" WASHED GRAVEL MIN. 6" COVER.

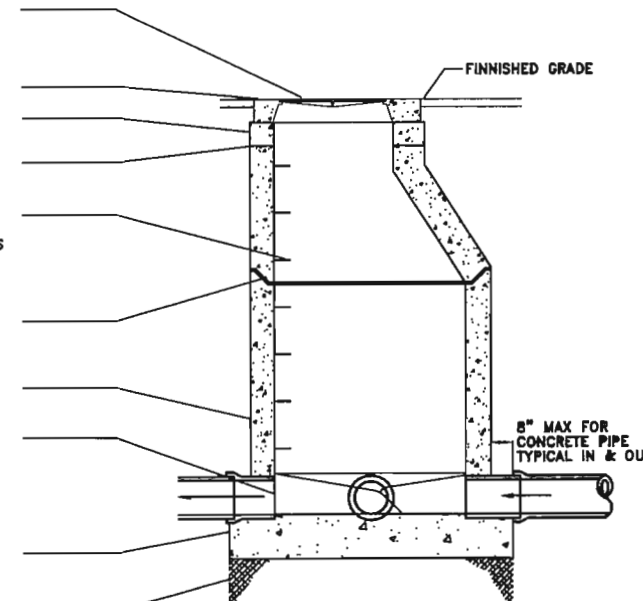
**DETAIL "A" -typical connection of D.I. pipe to conc. pipe DROP MANHOLE**

NOTE: RUBBER BOOT JOINTS WITH STAINLESS STEEL CONNECTION BAND ARE ACCEPTABLE SUBSTITUTES FOR STANDARD JOINTS SHOWN



**SECTION "B" LINE MANHOLE**

- 30" MANHOLE RING & COVER "D & L SUPPLY" A-1180 OR APPROVED EQUAL GROUT INTO PLACE
- CONCRETE COLLAR
- GRADE RING AS REQ'D (12" MAXIMUM)
- GROUT GRADE RING INTO PLACE (TYPICAL)
- MANHOLE STEPS, UNIFORMLY SPACED (1'-0" MAX) POLYPROPYLENE COVER STEEL STEPS MODEL PSI-375 AS MANUFACTURED BY M.A. INDUSTRIES OR AN APPROVED EQUAL
- GROUT ALL JOINTS ON PRECAST CONCRETE SECTION (GROUT, RAMMECT OR KENT SEAL)
- PRECAST CONC. M.H. SECTION GROUT IN CONCRETE BASE
- CUT PIPE PRIOR TO PLACING IN CONCRETE BASE
- CONCRETE BASE 9" MIN. THICKNESS REQ'D UNDER PIPE



**SECTION "A" JUNCTION MANHOLE**

PROJECT ENGINEER					
March 9, 2007					
DATE					
REV.	DATE	APPR.			

SCALE:  
N. T.S.

DESIGNED \_\_\_\_\_  
DRAWN \_\_\_\_\_  
CHECKED \_\_\_\_\_



**CONSULTING ENGINEERS**

4768 South Harrison Boulevard  
Ogden, Utah 84403 (801) 476-9767

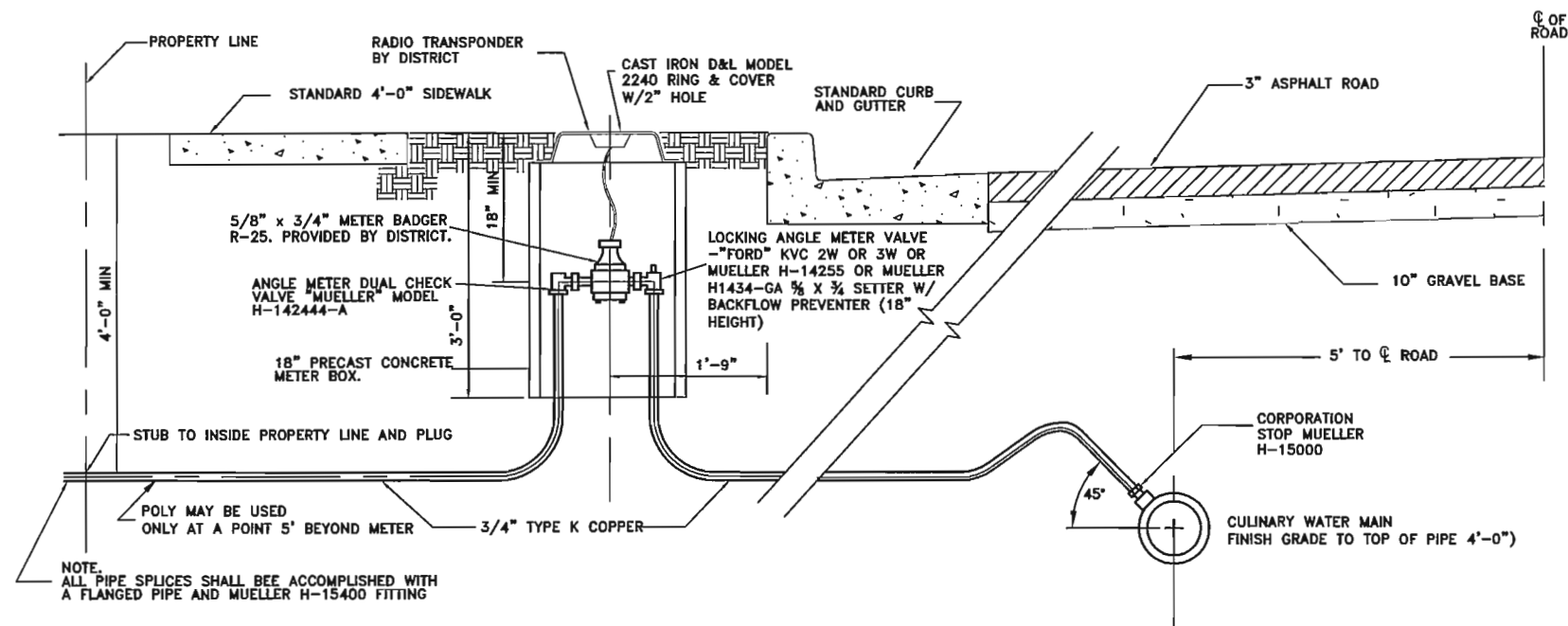
UNTAN HIGHLANDS IMPROVEMENT DISTRICT  
PUBLIC WORKS STANDARDS

**SANITARY SEWER MANHOLE DETAILS**

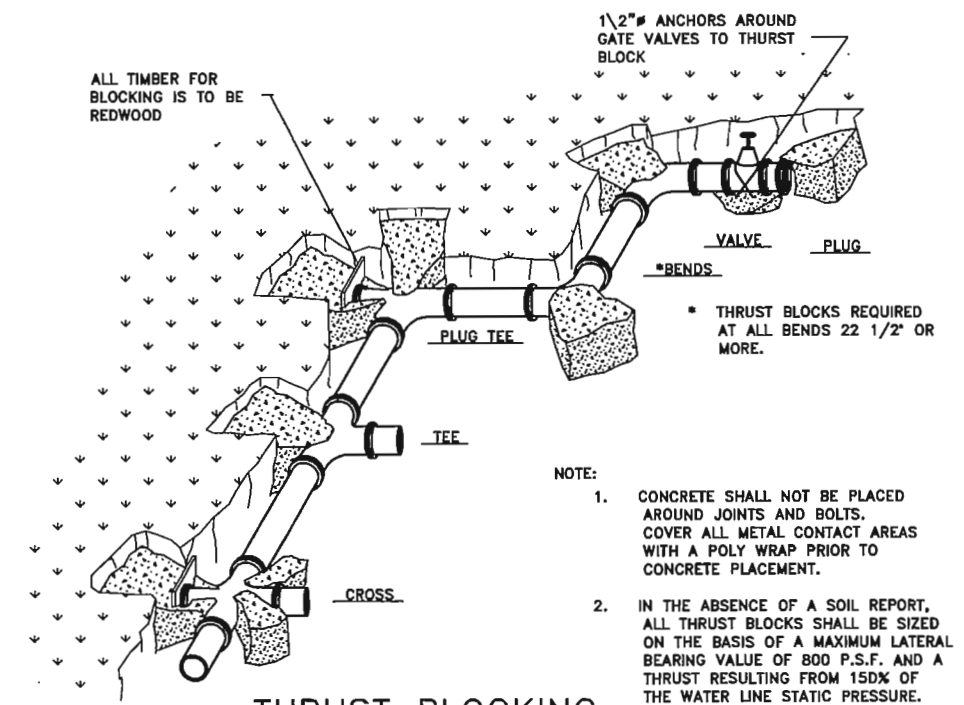
SHEET:

**CS-02**

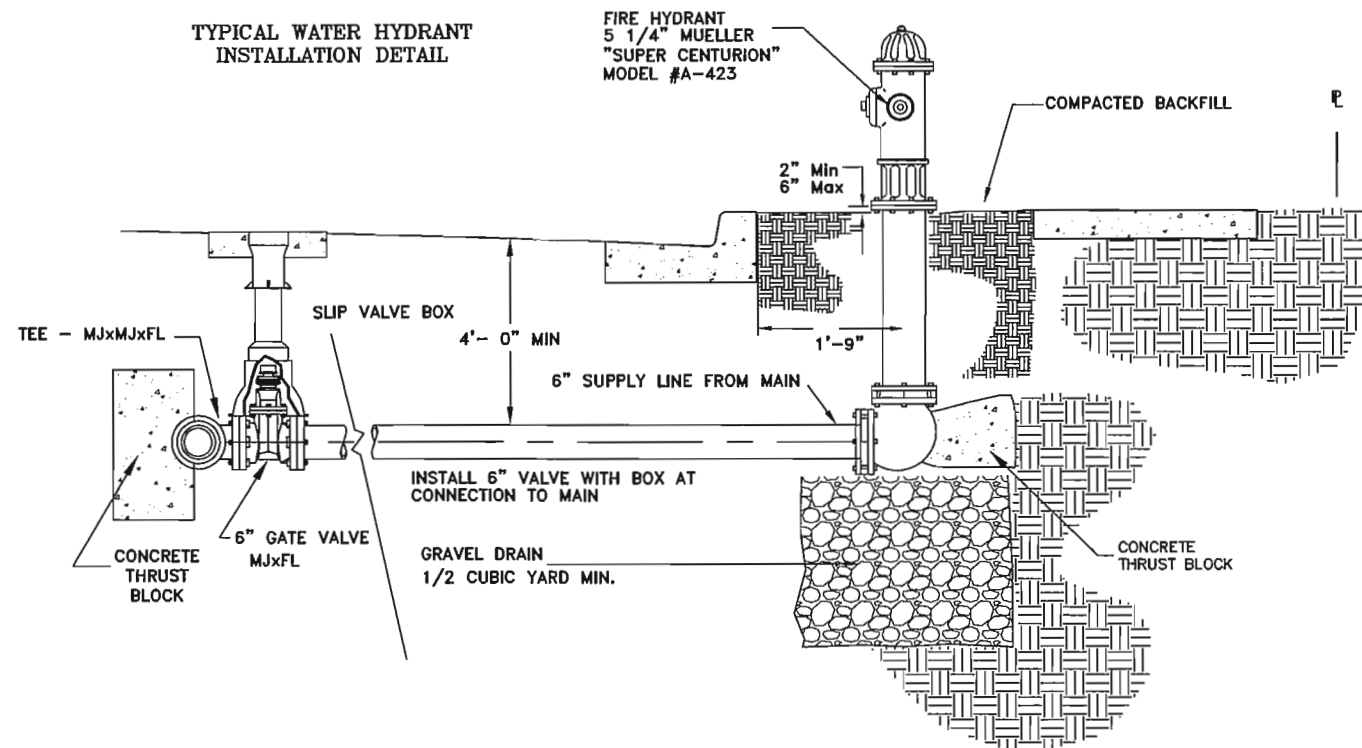
OF 8 SHEETS



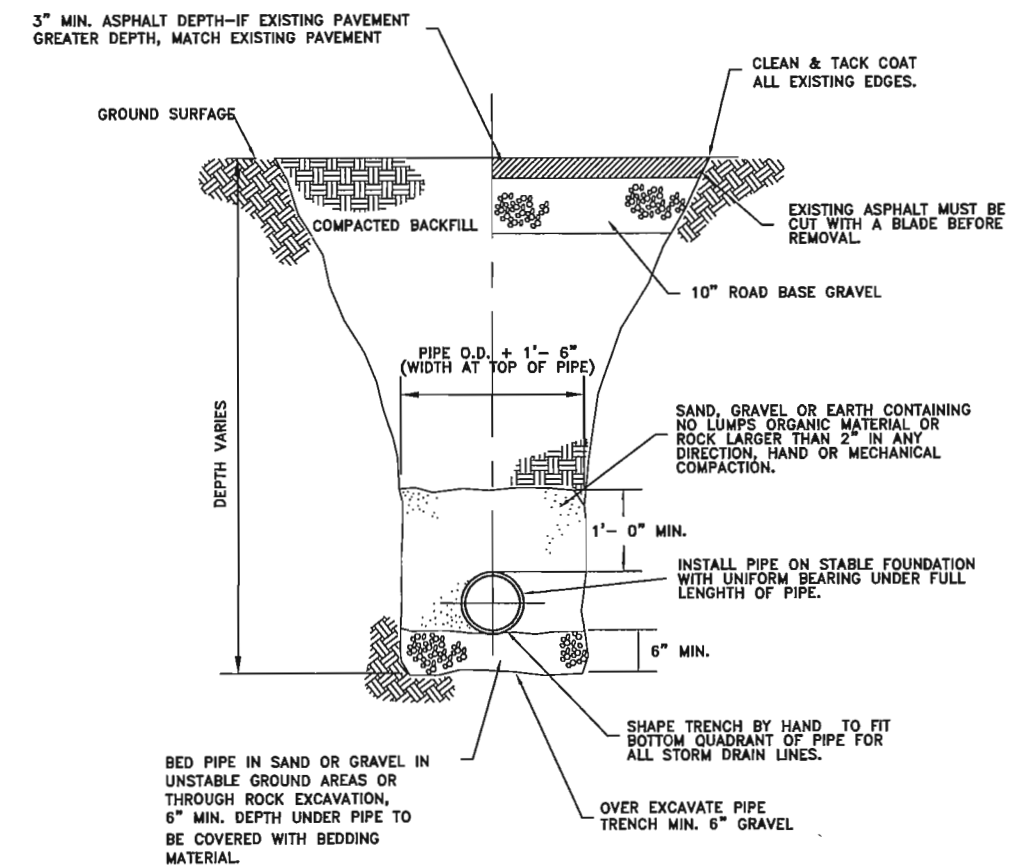
**TYPICAL WATER CONNECTION**



**THRUST BLOCKING**



**TYPICAL FIRE HYDRANT CONNECTION**



**TYPICAL TRENCH SECTION**

(WATER, SEWER, & STORM DRAINS)

1/07	GLS	POLY ON LATERALS.
PROJECT ENGINEER		
March 9, 2007		
DATE		
REV.	DATE	APPR.

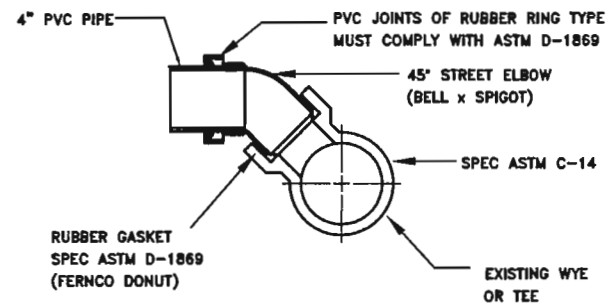
SCALE:	DESIGNED
N.T.S.	DRAWN
	CHECKED



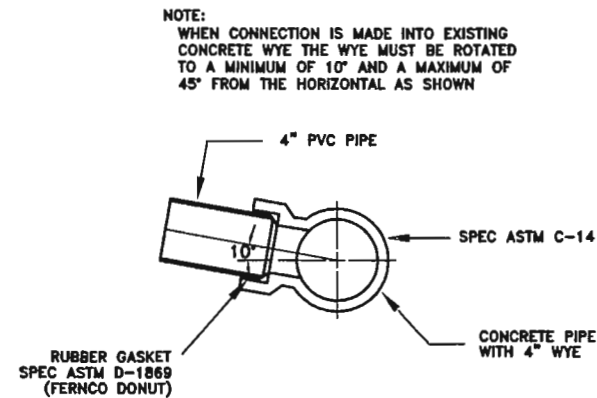
**CONSULTING ENGINEERS**

4768 South Harrison Boulevard  
Ogden, Utah 84403 (801) 476-9767

UNTAH HIGHLANDS IMPROVEMENT DISTRICT	SHEET:
PUBLIC WORKS STANDARDS	CS-03
FIRE HYDRANT & WATER SERVICE CONNECTION DETAILS	OF 8 SHEETS

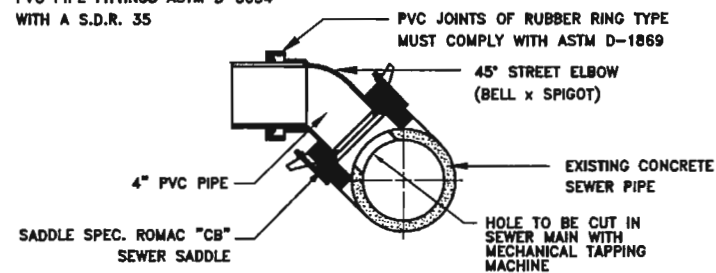


**CONNECTING INTO CONCRETE WYE**  
(WITH 45° ELBOW)

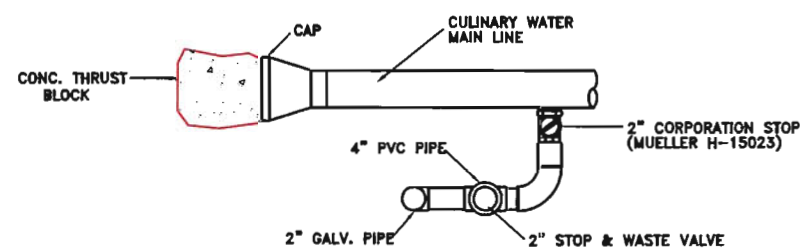


**CONNECTING INTO CONCRETE WYE**  
(WITHOUT 45° ELBOW)

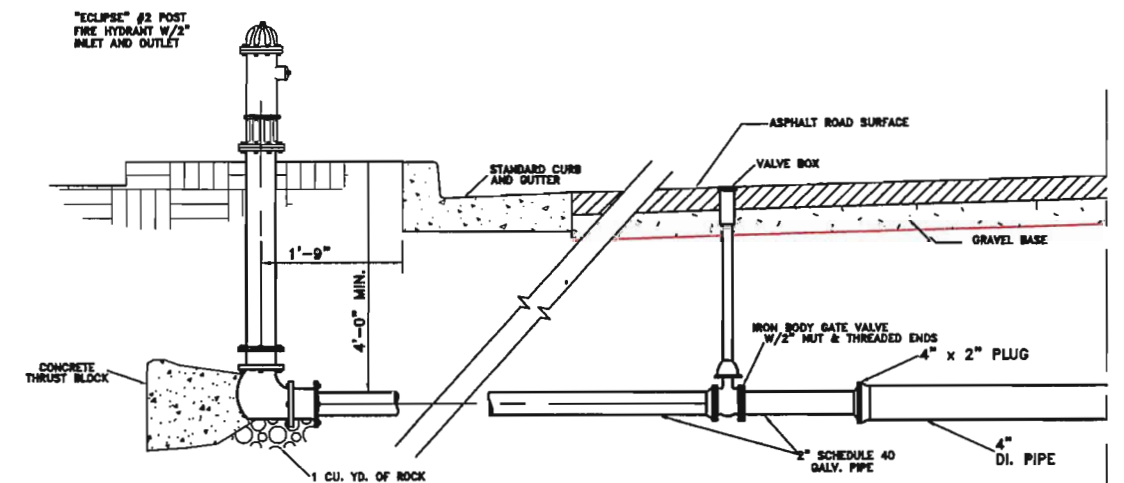
NOTE:  
PVC PIPE FITTINGS ASTM D-3034  
WITH A S.D.R. 35



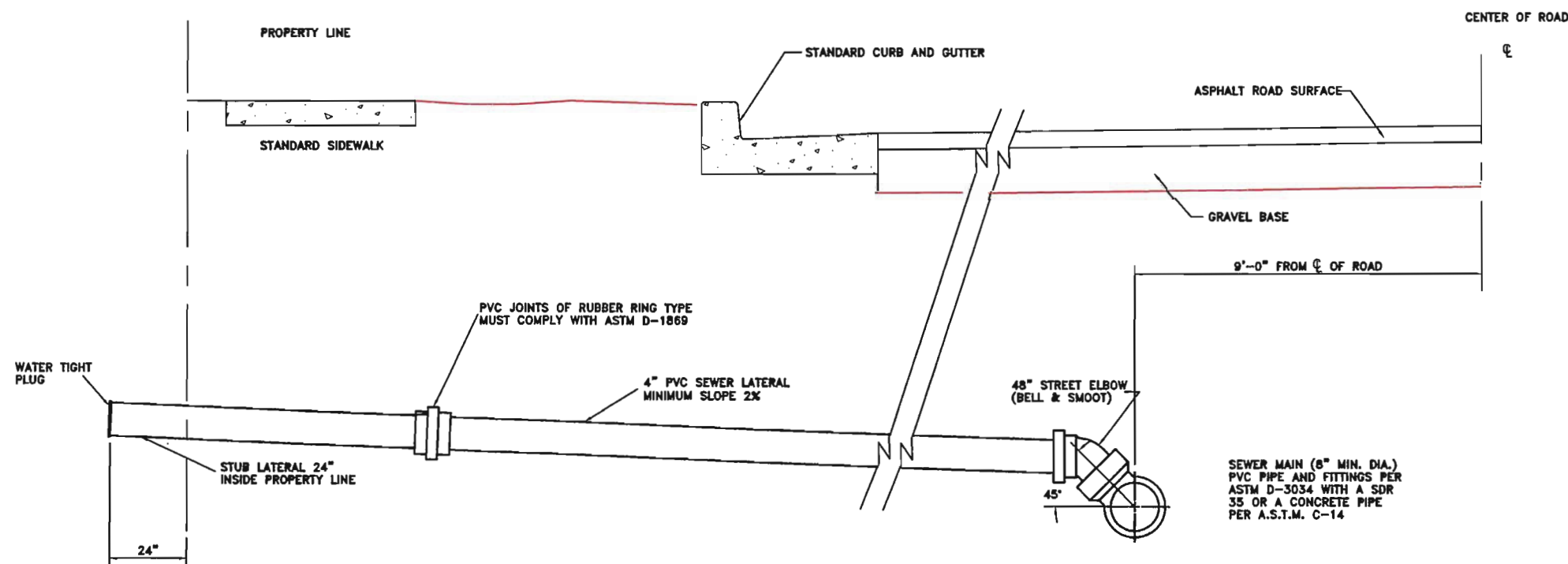
**TAPPING INTO EXISTING CONCRETE PIPE**



**TOP VIEW**



**BLOW OFF VALVE IN PARKING STRIP**



**TYPICAL SEWER LATERALS CONNECTION**

PROJECT ENGINEER					
March 9, 2007					
DATE	REV.	DATE	APPR.		

SCALE:  
N.T.S.

DESIGNED \_\_\_\_\_  
DRAWN \_\_\_\_\_  
CHECKED \_\_\_\_\_



**CONSULTING ENGINEERS**

4768 South Harrison Boulevard  
Ogden, Utah 84403 (801) 476-9767

UNTAH HIGHLANDS IMPROVEMENT DISTRICT  
PUBLIC WORKS STANDARDS

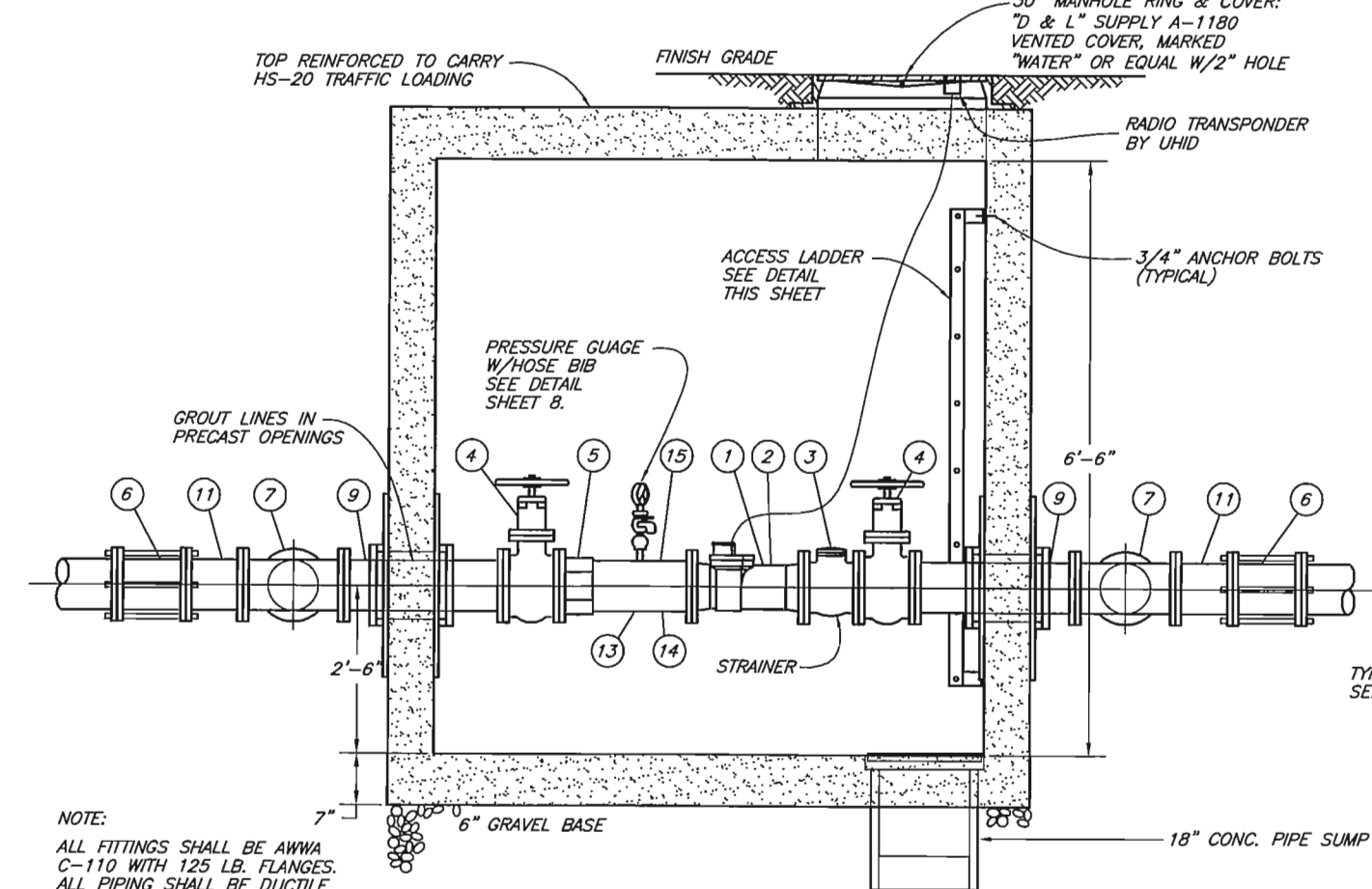
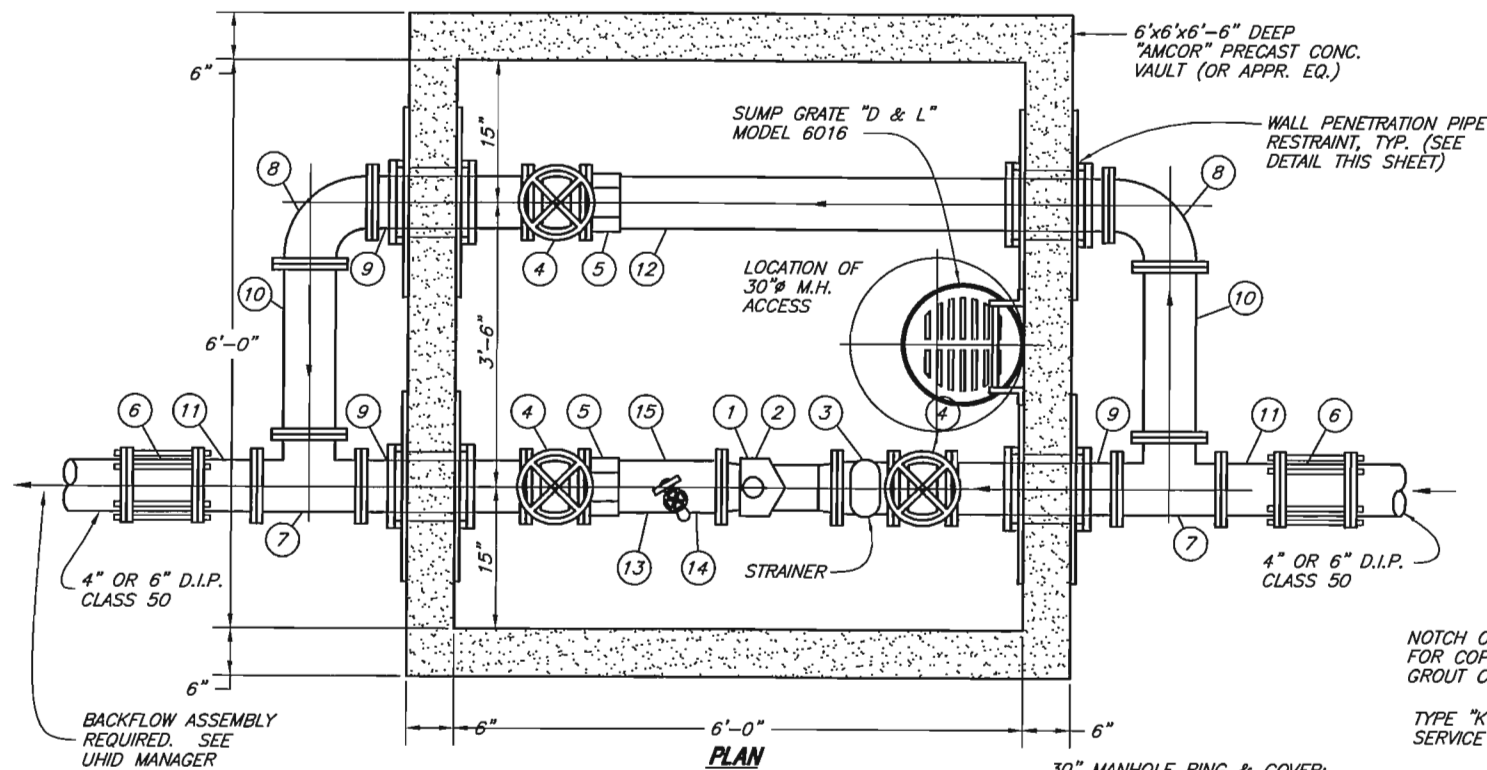
**SANITARY SEWER LATERAL DETAILS / BLOW OFF VALVE**

SHEET:

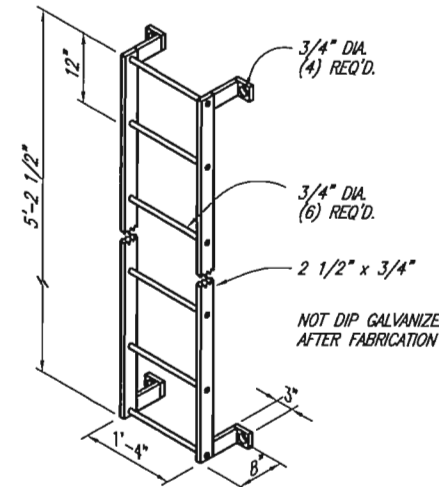
**CS-04**

OF 8 SHEETS

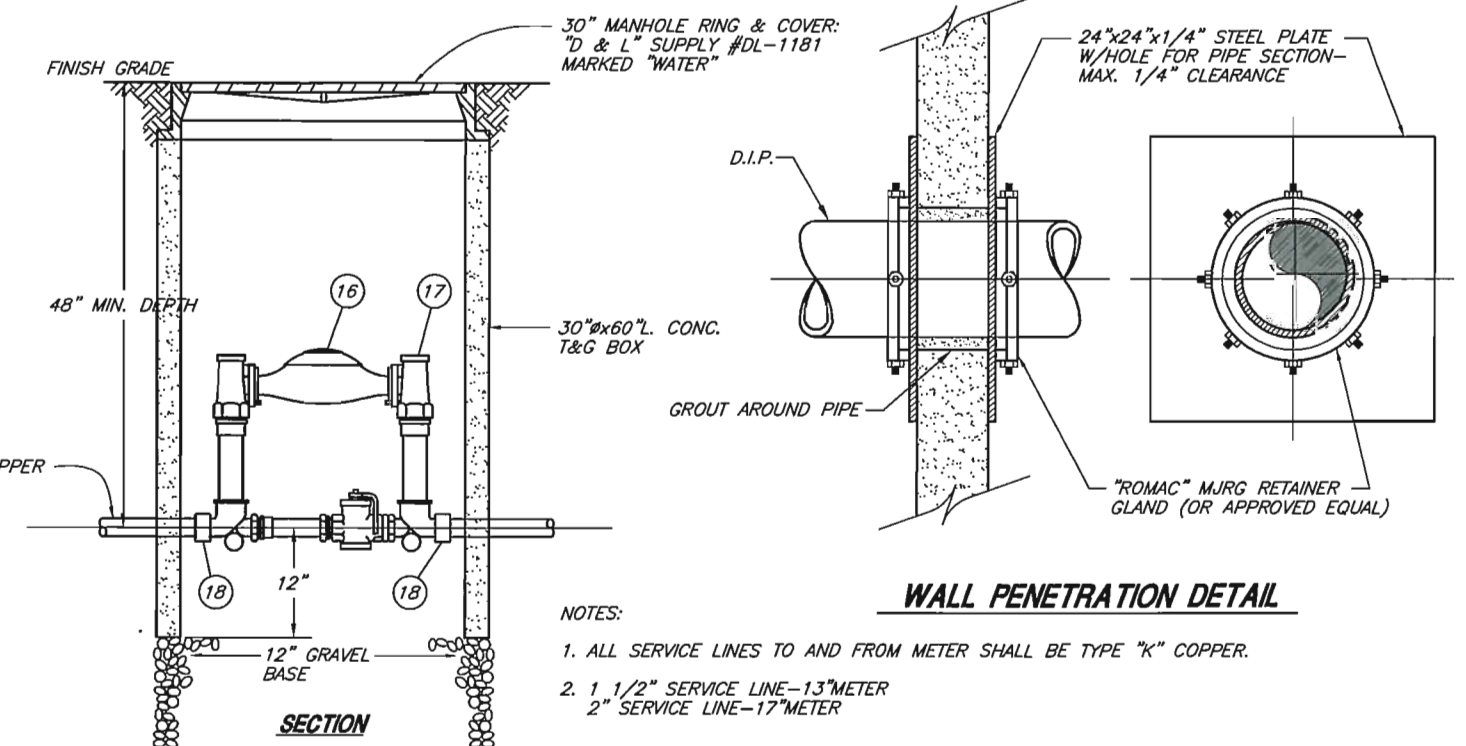
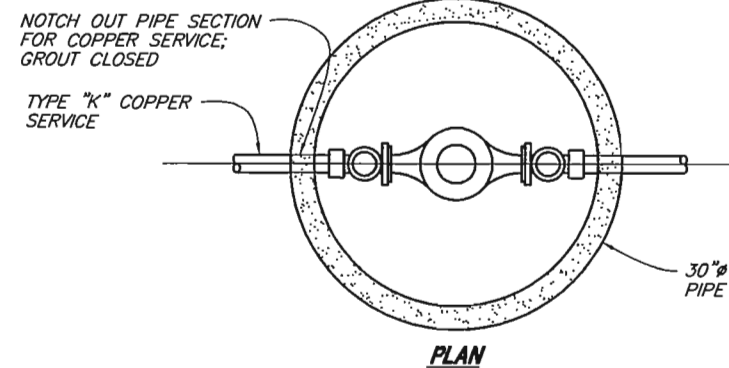




**SECTION**  
**3", 4" & 6" WATER METER STATION**



**LADDER DETAIL**



**SECTION**  
**1 1/2" & 2" WATER METER STATION**

**PIPE & FITTING SCHEDULE**

NO.	DESCRIPTION (3", 4" & 6" METER STA.)	JOINT TYPE	3" LINE	4" LINE	6" LINE
1	"BADGER" METER W/STRAINER BY UHID	FL	3"	-	-
2	"BADGER" METER W/STRAINER BY UHID	FL	-	4"	-
3	"BADGER" METER W/STRAINER BY UHID	FL	-	4"	6"
4	GATE VALVE	FL	3"	4"	6"
5	"ROMAC" FCA501 FLANGED COUPLING ADAPTER	FLxPE	3"	4"	6"
6	"ROMAC" 501 FLEXIBLE PIPE COUPLING	FLxPE	3"	4"	6"
7	TEE	FL	3"	4"	6"
8	90° ELBOW	FL	3"	4"	6"
9	SPOOL PIECE	FL	3"x24"	4"x24"	6"x24"
10	SPOOL PIECE	FL	3"x31"	4"x29"	6"x26"
11	NIPPLE	FLxPE	3"x12"	4"x12"	6"x12"
12	NIPPLE	FLxPE	3"x74"	4"x74"	6"x74"
13	NIPPLE	FLxPE	3"x23"	-	-
14	NIPPLE	FLxPE	-	4"x19"	-
15	NIPPLE	FLxPE	-	-	6"x12 3/8"

NO.	DESCRIPTION (1 1/2" & 2" METER STA.)	JOINT TYPE	1 1/2" LINE	2" LINE
16	"BADGER" WATER METER BY UHID	FL	1 1/2"	2"
17	"MUELLER" H-1423-2 METER YOKE (18" HEIGHT)	-	1 1/2"	2"
18	"MUELLER" 110 COMPRESSION CONN. COUPLING	-	1 1/2"	2"

**GENERAL NOTES:**

1. PROPERTY OWNER OR CONTRACTOR SHALL PAY FOR ALL COSTS OF INSTALLATION INCLUDING ALL MATERIALS, ALL EXCAVATION AND FILL, ASPHALT REPLACEMENT AND WATER MAIN CONNECTION.
2. INSPECTION OF ALL WATER LINE INSTALLATIONS WILL BE DONE BY UHID WATER DEPT., WITH A 48 HOUR MINIMUM NOTICE REQUIRED PRIOR TO START OF WORK.
3. IF APPLICABLE, A WEBER COUNTY CUT PERMIT MUST BE REQUESTED AND APPROVED PRIOR TO START OF WORK.

**NOTES:**

1. ALL SERVICE LINES TO AND FROM METER SHALL BE TYPE "K" COPPER.
2. 1 1/2" SERVICE LINE-13" METER  
2" SERVICE LINE-17" METER

PROJECT ENGINEER	REV.	DATE	APPR.
March 9, 2007			
DATE			

SCALE:  
N. T.S.

DESIGNED \_\_\_\_\_  
DRAWN \_\_\_\_\_  
CHECKED \_\_\_\_\_



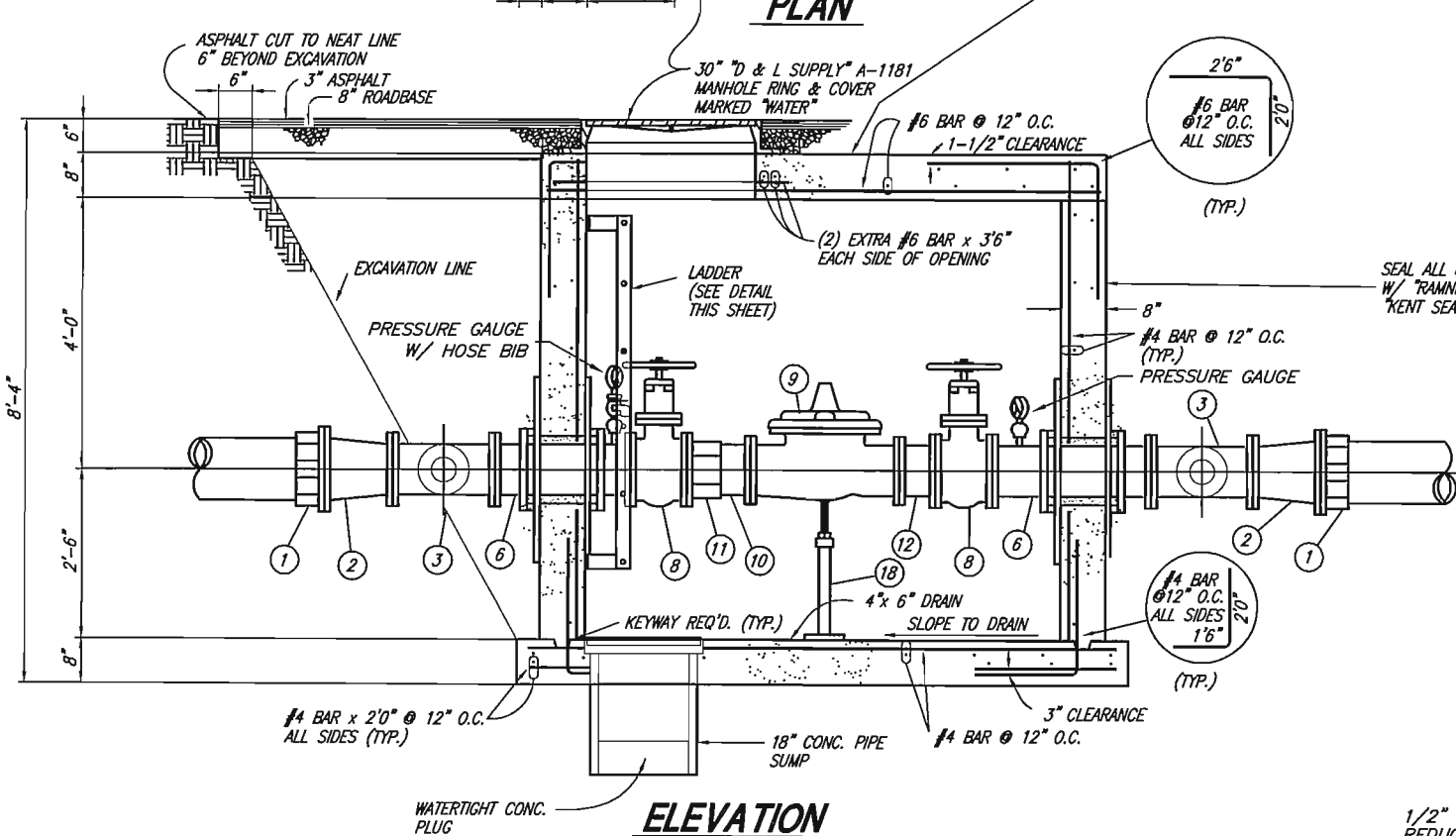
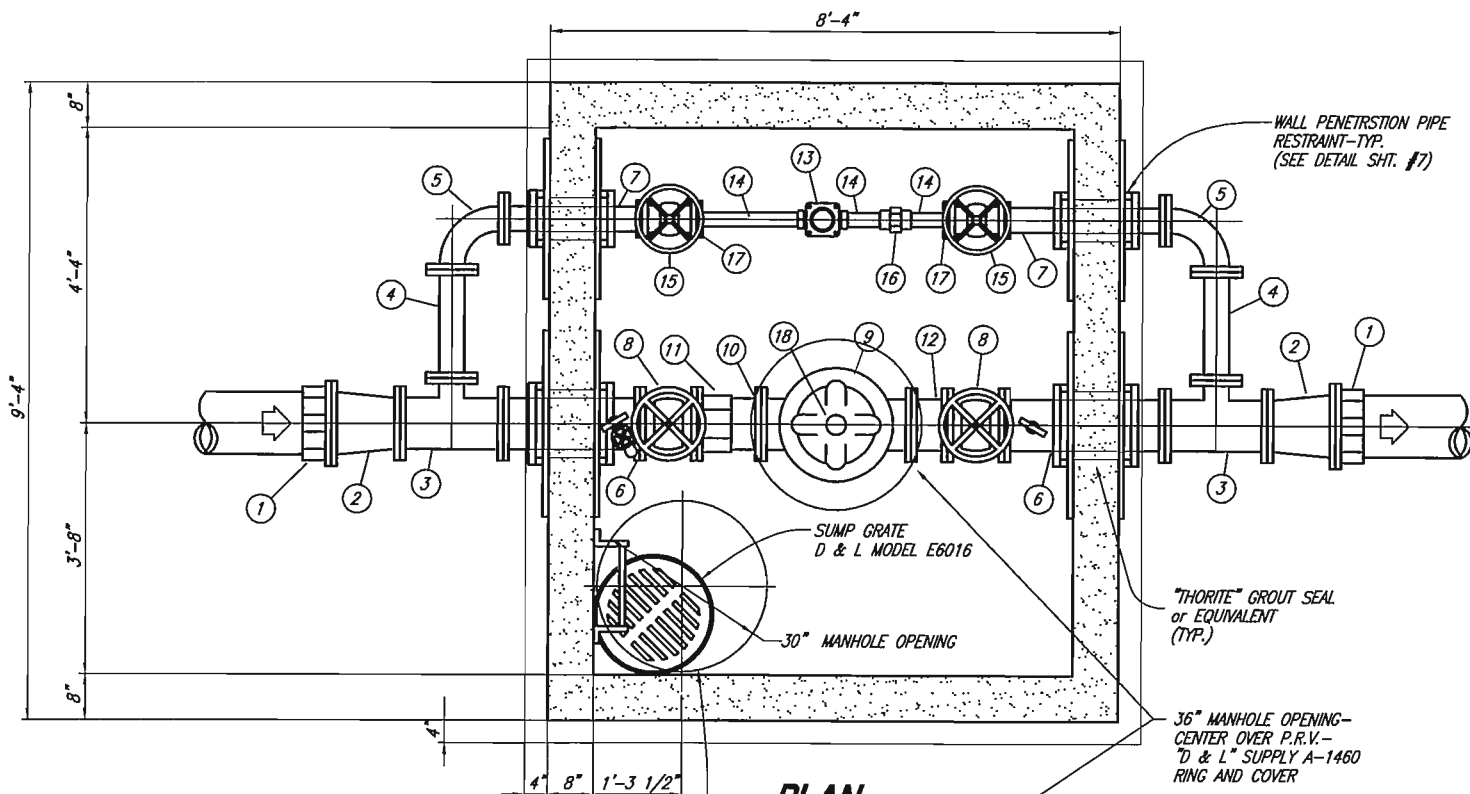
**CONSULTING ENGINEERS**

4768 South Harrison Boulevard  
Ogden, Utah 84403 (801) 476-9767

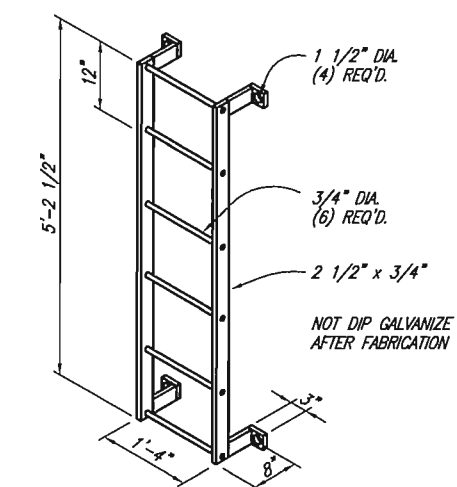
**UINTAH HIGHLANDS IMPROVEMENT DISTRICT**  
**PUBLIC WORKS STANDARDS**

**TYPICAL WATER METER STATIONS**

SHEET:  
**CS-05**  
OF 8 SHEETS



**PRESSURE REDUCTION STATION**

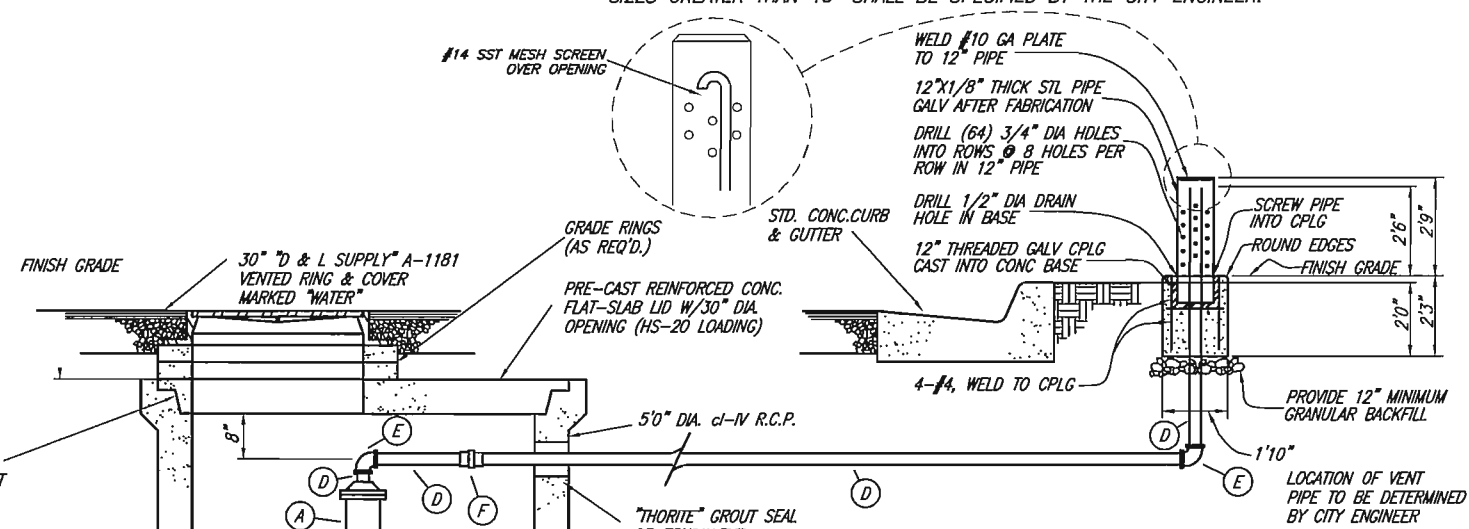


**LADDER DETAIL**

**PIPE & FITTING SCHEDULE**

NO.	DESCRIPTION	JOINT TYPE	6" LINE	8" LINE	10" LINE
1	CAST FLANGED COUPLING ADAPTOR (2)	FLxPE	6"	8"	10"
2	REDUCER (2)	FL	6"x4"	8"x6"	10"x8"
3	REDUCING TEE (2)	FL	4"x4"x4"	6"x6"x4"	8"x8"x4"
4	SPOOL PIECE (2)	FL	4"	4"	4"
5	90° ELBOW (2)	FL	4"	4"	4"
6	WALL SPOOL PIECE (2)	FL	4"	6"	8"
7	WALL SPOOL PIECE (2)	FL	4"	4"	4"
8	GATE VALVE (2)	FL	4"	6"	8"
9	PRESSURE REDUCTION VALVE ("CLAYTON" OR "AMES")	FL	4"	6"	8"
10	NIPPLE	FLxPE	4"	6"	8"
11	CAST FLANGED COUPLING ADAPTER	FLxPE	4"	6"	8"
12	SPOOL PIECE	FL	4"	6"	8"
13	PRESSURE REDUCTION VALVE ("CLAYTON" OR "AMES")	FL	2"	2 1/2"	2 1/2"
14	GALVANIZED PIPE (3)	FL	2"	2 1/2"	2 1/2"
15	GATE VALVE (2)	FL	4"	4"	4"
16	GALVANIZED UNION	FL	2"	2 1/2"	2 1/2"
17	BLIND FLANGE W/THR. CONNECTION (2)	FL	4"x2"	4"x2 1/2"	4"x2 1/2"
18	ADJUSTABLE PIPE SUPPORT (CLOW F-1608 OR EQUIVALENT)	-	-	-	-

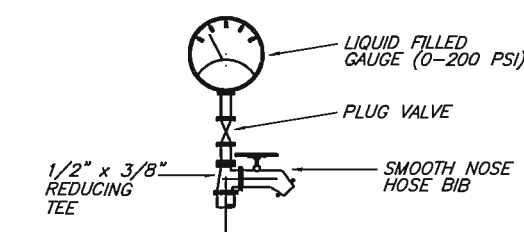
NOTE - STRUCTURE, PIPING & VALVE SIZES FOR P.R.V. STATIONS ON LINE SIZES GREATER THAN 10" SHALL BE SPECIFIED BY THE CITY ENGINEER.



**PIPE & FITTING SCHEDULE**

NO.	DESCRIPTION	FITTING
A	2" HEAVY-DUTY COMBINATION AIR-VACUUM RELIEF VALVE "APCO" MODEL 144 OR EQUIVALENT	THR.
B	2" GATE VALVE	THR.
C	2" SERVICE SADDLE	-
D	2" GALV. STEEL PIPE	THR.
E	2" GALV. STEEL 90° ELBOW	THR.
F	2" GALV. STEEL UNION	THR.

**AIR/VACUUM RELIEF STATION**



**PRESSURE GAUGE W/HOSE BIB DETAIL**

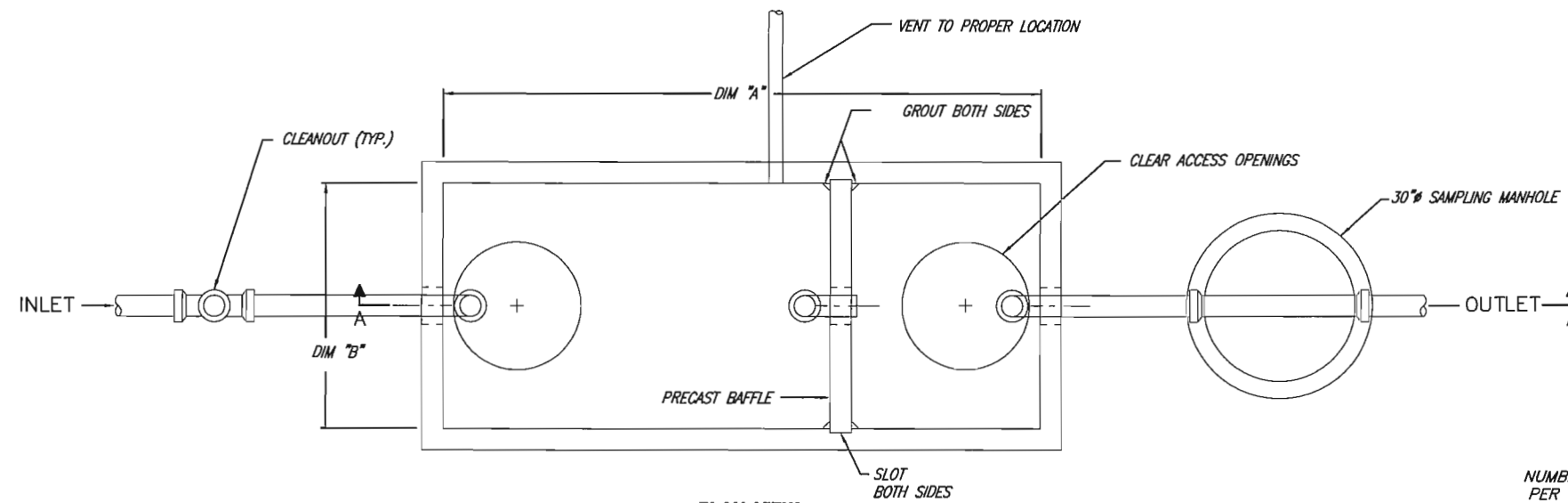
### *Uintah Highlands Improvement District Testing And Inspection Standards*

SANITARY SEWER*	PIPELINE INSPECTION – ALIGNMENT, GRADE, AND CLASS OF PIPE LOW PRESSURE AIR TEST OR INFILTRATION TEST DISPLACEMENT TEST
STORM DRAINAGE*	REQUIREMENTS OF PER WEBER COUNTY OR SOUTH OGDEN CITY
LAND DRANAGE*	REQUIREMENTS OF PER WEBER COUNTY OR SOUTH OGDEN CITY
CULINARY WATER	PIPE LINE INSPECTION – ALIGNMENT, GRADE, CLASS OF PIPE AND BRASS WEDGES INSTALATION PRESSURE TEST – MINIMUM 200 PSI FOR 2 HOUR CHLORINATION TEST – MINIMUM 30 RPM-24 HOUR CLEAR WATER TEST
ROADWAY	REQUIREMENTS OF PER WEBER COUNTY OR SOUTH OGDEN CITY
CURB & GUTTER AND SIDEWALK	REQUIREMENTS OF PER WEBER COUNTY OR SOUTH OGDEN CITY

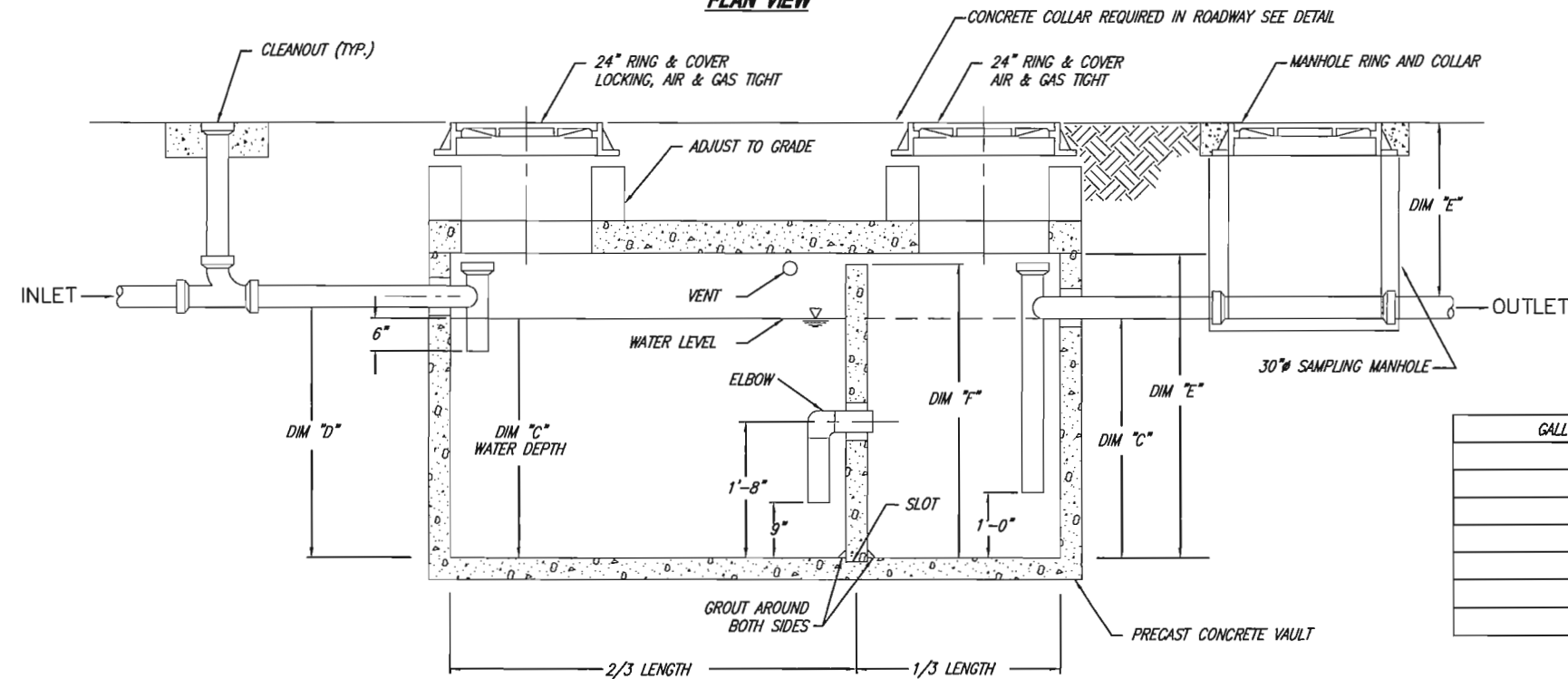
\*CONTRACTOR SHALL NOT FLUSH ROCK & DEBRIS FROM NEWLY INSTALLED PIPELINES DOWN STREAM INTO EXISTING SYSTEM.

<small>PROJECT ENGINEER</small> _____ <small>DATE</small> March 9, 2007	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 5%;">REV.</td> <td style="width: 5%;">DATE</td> <td style="width: 5%;">APPR.</td> </tr> <tr><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td></tr> </table>	REV.	DATE	APPR.										<small>SCALE:</small> N.T.S.	<small>DESIGNED</small> _____ <small>DRAWN</small> _____ <small>CHECKED</small> _____	 <b>JONES &amp; ASSOCIATES</b> <small>CONSULTING ENGINEERS</small> <small>4768 South Harrison Boulevard</small> <small>Ogden, Utah 84403 (801) 476-9767</small>	<b>UINTAH HIGHLANDS IMPROVEMENT DISTRICT</b> <b>PUBLIC WORKS STANDARDS</b> <b>TESTING &amp; INSPECTION STANDARDS</b>	<small>SHEET:</small> <b>CS-07</b> <small>OF 7 SHEETS</small>
REV.	DATE	APPR.																





**PLAN VIEW**



**SECTION VIEW AA**

**DESIGN CRITERIA:**  
 UNIFORM PLUMBING CODE — APPENDIX H  

$$\frac{\text{NUMBER OF MEALS PER PEAK HOURS} \times \text{WASTE FLOW RATE} \times \text{RETENTION TIME} \times \text{STORAGE FACTOR}}{1} = \text{CAPACITY IN GALLONS}$$

- NOTES:**
1. 30" MINIMUM SAMPLING MANHOLE REQUIRED DOWNSTREAM OF INTERCEPTOR IF EXTENSIVE SAMPLING IS NEEDED
  2. CONCRETE: 28 DAY COMPRESSIVE STRENGTH  $f'_c = 4500$  psi
  3. REBAR: ASTM A-615 GRADE 60
  4. MESH: ASTM A-185 GRADE 65
  5. DESIGN: ACI-318-83 BUILDING CODE  
ASTM C-857 "MINIMUM STRUCTURAL DESIGN  
LOADING FOR UNDERGROUND PRECAST CONCRETE  
UTILITY STRUCTURES"
  6. LOADS: H-20 TRUCK WHEEL w/ 30% IMPACT PER AASHTO
  7. FILL w/ CLEAN WATER PRIOR TO START-UP OF SYSTEM
  8. CONTRACTOR TO SUPPLY & INSTALL ALL PIPING & SAMPLING TEES
  9. GRAY WATER ONLY, BLACK WATER SHALL BE CARRIED BY SEPARATE SIDE SEWER

NOTE: UHID MINIMUM CAPACITY OF 1,000 GALLONS REQUIRED

GALLON CAPACITY	1000	1500	1800	2500	3000	3500	5000
DIM "A"	11'-0"	11'-0"	11'-0"	12'-0"	12'-0"	15'-0"	18'-0"
DIM "B"	4'-0"	4'-0"	4'-0"	6'-0"	6'-0"	6'-0"	6'-0"
DIM "C"	3'-2"	4'-7"	5'-6"	4'-6"	5'-6"	5'-4"	6'-2"
DIM "D"	3'-4"	4'-9"	5'-8"	4'-8"	5'-8"	5'-6"	6'-4"
DIM "E"	4'-0"	6'-0"	7'-0"	6'-0"	7'-0"	7'-0"	7'-0"
DIM "F"	3'-10"	5'-10"	6'-10"	5'-10"	6'-10"	6'-10"	6'-10"
WEIGHT	22,500	26,100	27,300	33,025	34,450	42,700	63,822

**PRECAST GREASE INTERCEPTOR**  
 1,000 - 5,000 GALLON CAPACITIES

