



# Public Works Manual

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# **AUTHORITY**

The following special conditions and design criteria (Gypsum Public Works Manual) shall be used in the preparation of design plans and specifications for land development and public works projects in the Town of Gypsum, Colorado.

The applicant is responsible for complete compliance with these specifications. The Gypsum Public Works Manual will take precedence over the Town of Gypsum's review. The Town of Gypsum is not responsible for omissions that may occur during its plan review process. Variances are allowed only after approval by the Town Council.

## 1.0 SEWAGE COLLECTION SYSTEM DESIGN AND LAYOUT

The sewage collection system shall be designed to the capacity required for the estimated ultimate tributary population. Unless otherwise approved by the Town Council, every subdivision shall have a central sewage collection system, the design of which shall be prepared by a registered professional engineer and meet the Colorado Department of Health Standards. The use of individual systems must be approved by the local public health agency (Eagle County), who shall give written opinion concerning the suitability of the proposed subdivision for the individual systems, before they will be considered for approval by the Town Council.

### 1.01 PIPE SIZE

The minimum sewer main size shall be 8-inch I.D. Under special conditions, such as low tributary population, 6-inch I.D. sewer main will be considered. Sewer service lines shall be a minimum of 4-inches in diameter.

### 1.02 MINIMUM PIPE COVER

The minimum cover from top of pipe to finished grade shall be three and one half feet (3.5'). For depths greater than twenty feet (20'), Town approval is required. Insulation may be installed for depths less than 3.5' at the rate of 1" of blue board per foot of lacking cover; with a minimum of 2" of blue board by 24" wide.

### 1.03 MINIMUM SLOPES

Gravity sewers should be designed to provide a minimum velocity of 2 fps at full flow based on the Manning Equation with  $n = 0.013$ . Refer to Table 1.03, below, for the minimum allowable slopes.

**TABLE 1.03**  
Minimum allowable sewer main slopes:

SEWER SIZE IN INCHES	MINIMUM SLOPE IN FEET PER 100 FEET
6	0.50
8	0.40
10	<b>NOT ALLOWED</b>
12	0.22
15	0.15
18	0.12
21	0.10
24	0.09

The Town of Gypsum may, at its sole discretion, require that during the course of installation of sewer main designed at a grade flatter than 125% of minimum, the designed

elevation of each pipe joint be confirmed by level measurements taken with an engineering level and certified by a registered professional land surveyor. For pipe grades with slopes flatter than .7% with sagging pipe, either SDR 26 or ductile iron pipe must be installed to avoid problems.

#### 1.04 MATERIALS

The type and class of pipe to be used in the work will be shown on the plans and/or called for in the specifications. The following specifications will apply to pipeline and appurtenant materials.

<u>Material</u>	<u>Specification</u>
SDR35, SDR26, Green Sewer Pipe	ASTM D-3034
PS46, PS115, Big Green Sewer Pipe	ASTM F-679
Black Plumbers Pipe	ASTM D-2680
Manhole Risers, Manhole Rings, Barrel Sections, Cone Sections Precast Bases	ASTM C-478
Class 200 PVC	ASTM D-2241
Schedule 40 PVC	ASTM D-1785

When required by the Town of Gypsum, the Contractor shall furnish certification by the manufacturer(s) of the pipe and materials to be furnished on this project, certifying that they comply with the applicable specifications. All pipe and materials shall be clearly marked with type, class and/or thickness as applicable. Lettering shall be legible and permanent under normal conditions of handling and storage.

When sewage collection cannot be accomplished by gravity flow, the interested party must apply for a variance, and consult Town Engineers with regards to materials that are permissible.

#### 1.05 SEWER MAIN EASEMENTS

Where possible all mains shall be installed in dedicated public streets. Otherwise, the installation shall be made in a right-of-way or easement. Minimum easement width shall be as shown in Table 1.05. The main shall be centered in the easement, or widen the easement to properly accommodate the depth of the pipe for future excavation. See Appendix A.1 for more information.

Sewer Pipe Depth of Bury	Minimum Easement Width
≤8'	20'
8' to 11'	25'
11' to 13'	30'
13' to 16'	35'
16' to 18'	40'
18' to 21'	45'
21' to 23'	50'

## **1.06 SEWER SERVICE CONNECTIONS AND SERVICE PIPES**

Note: All new sewer mains must remain plugged and shall not discharge into the existing Town of Gypsum sewer collection system until it has been flushed/cleaned, pressure tested, TV inspected and approved by the Town of Gypsum.

Sewer service connections shall be constructed in accordance with the standard detail of the SANITARY SEWER SERVICE CONNECTION AT SEWER MAIN as seen in Appendix A.2. All sewer service lines shall be of sufficient length to reach the right-of-way line or a point 5 feet beyond the outermost utility or pavement, whichever is greater. Service line construction shall be complete prior to the construction of any surface infrastructure such as streets, sidewalks and curb and gutter. Sewer service pipe and fittings shall be rubber gasket, push on joint, SDR35. Services shall be plugged or capped and restrained sufficiently to withstand air pressure testing. No connection shall be made until pressure testing has been completed and accepted by the town.

Prior to backfilling the sewer services, the horizontal and vertical position of the sewer service must be field verified. At a minimum this verification must include the horizontal and vertical location of the following: the crown of the sewer main at the service wye; the crown of the sewer service at the top of the service bend (upstream of the 45° bend); and the crown of the sewer service at its termination (or connection to an existing service pipeline). This verification of the position of the sewer service shall be performed by a representative of the Town of Gypsum or shall be certified by a Registered Professional Land Surveyor in which case, the verification information shall be promptly provided to the Town of Gypsum. If at any point during the field verification process, it is discovered that the sewer service is not constructed in accordance with either the Town specifications or the plans and specifications for the project, the surveyor must immediately notify the Town's construction inspector. In any case, the sewer service may not be backfilled until its position has been verified as described above, and the town has approved the horizontal and vertical position of the service line.

The maximum length of the sewer service line shall not exceed 52 feet from the main to the right of way line. If the ultimate length of the sewer service is greater than 100 feet, then cleanouts need to be installed every 100 feet and at bends. Service line must be installed at minimum grade of 2% and enter the top of the full body wye. No saddle taps are acceptable in newly constructed mains.

## **1.07 MANHOLES**

For all sewer pipeline installations, new construction includes manholes, and other appurtenances normally used in sewage collection systems. The work includes the furnishing of all materials, excavation of trenches, installation of materials, backfilling, construction of manholes, testing, flushing/cleaning and restoration of surface. (See Appendix A.3 and A.4)

### **1.07.1 Adjustment Rings**

Manholes shall be constructed of precast concrete rings with frames and covers and steps in accordance with the details shown on the drawings. Adjusting rings may be used for adjusting the manhole top elevation to coincide with existing ground elevations. The total height of adjusting rings used per manhole shall not exceed 12 inches. Adjusting rings shall be reinforced to withstand traffic.

### **1.07.2 Manhole Steps**

Manhole steps shall be non-corrosive type material such as rubber encased steel, aluminum, or nylon. Steps shall withstand vertical loads of 400 pounds and pull-out force of 1000 pounds.

### **1.07.3 Manhole Covers**

Manhole rings and covers and the supporting rings shall be designed to withstand H-20 AASHTO loading. Manhole rings and covers shall be non-ventilated type and shall conform to the standards of the Town's system. Manhole covers shall have a side open pick slot, similar to the Deeter Type "F", unless approved in writing by the Town of Gypsum. Manhole bases shall be precast and placed on undisturbed or compacted earth.

Any manhole wherein the depth from the rim to the top of the pipe is less than 4.0 feet shall be constructed with a full 48-inch barrel section and a flat lid.

### **1.07.4 Invert Channels**

Invert channels shall be smooth and semi-circular in cross-section conforming to the inside of the inlet/outlet sewer sections. Changes in direction of flow shall be made with a smooth curve of as large a radius as the size of the manhole and the nature of the change will permit. Changes in size and grade of the channels shall be made gradually. Additionally, changes in pipe size crowns shall match as well. The invert channels may be formed directly in the concrete of the manhole base or may be half pipe sections laid in the concrete. The floor of the manhole outside of the channel shall be smooth and shall slope toward the channel not less than one inch per foot or more than two inches per foot. Manhole inverts and channels shall be formed as shown on the detail sheets, but in no case shall the difference in inlet and outlet be less than 0.10 of a foot. (See Appendix A.5 and A.6)

### **1.07.5 Connective Materials**

All connections between manhole rings shall be joined with "Rub-R-Nek" "LTM" or approved equal, in such a manner as to make the manhole watertight. "Rub-R-Nek" sealant/primer shall be applied to both top and bottom surfaces of manhole risers before placing the "Rub-R-Nek". Two "Rub-R-Nek" gaskets shall be placed around the manhole risers, one the inner ledge, and one on the outer ledge. The sewer pipes shall be joined to the manhole base by use of expandable water stops, special purpose-made sleeves, or a rubber gasket cemented to the manhole and connected to the pipe with a stainless-steel band clamp. Both

inner and outer joints between sewer pipe and manhole shall be grouted. Rubber "O" ring gaskets may be used, to seal and join manhole riser sections, if approved by the Town of Gypsum. When a new sewer line is connected to an existing manhole, a flow-channel shall be cut from the floor of the existing manhole and re-grouted to a smooth configuration to match the inlet characteristics of the new sewer line. New entry into an existing manhole must be covered with gasketed boots. In cold weather conditions, when the "Rub-R-Nek" gasket material becomes stiffer or hard to handle, a propane torch may be used to warm the gasket before seating the next manhole riser, so long as care is taken not to damage the gasket by overheating. No grouting shall be permitted on the interior walls of a manhole, except for that which is a part of the manhole channel.

Anchor manholes will be constructed on slopes greater than twenty percent (20%). Landscaping will not be allowed to cover manholes and must be graded to drain away from the rim.

### **1.07.6 Manhole Location**

Manholes shall be installed:

1. At the end of each main line; except when the main line will be extended and there are not any existing services, a clean-out may be installed at the end.
2. At all changes of grade, size, or alignment.
3. At all sewer line intersections.
4. At distances no greater than 400 feet, unless approved by the Town of Gypsum.
5. Shall be located in an easement with vehicular access for service.

Sewer manholes shall be located in the pavement section where possible. Every effort should be made to locate the manhole in the center of the driving lane. The finished grade of a manhole lid in a paved surface shall be ½ inch below the finished grade of the paved surface to protect it from snowplows.

Manholes shall not be located in depressions where water may accumulate or temporarily pond, and the Town of Gypsum may, at its sole discretion, require that watertight lids be installed.

Unless otherwise approved, the elevation of all sewer manhole rims shall be located a minimum of 1.00 feet above the base flood elevation for the 100-year rainfall event for Gypsum Creek, Alkali Creek, Spring Creek and the Eagle River.

Cast-in-place manholes are to be used only when tying into an existing sewer line. Manholes shall be constructed to the dimensions shown on the plans.

### **1.07.7 Cleanouts**

Cleanouts will be considered at the ends of sewer mains which are outside of roadway pavement sections and where future extension of the main is anticipated. Landscaping will not be allowed to cover manholes or cleanouts. (See Appendix A.7.)

### 1.07.8 Drop Manholes

Drop manholes shall not be constructed. When it is necessary to cause a drop in sewer flow in excess of an elevation difference equal to one half the diameter of the manhole, a second manhole shall be constructed at the required distance to cause a slope between the manholes of 50%, i.e. if a drop of 5.0 feet is required, the distance between manholes will be a minimum of 10 feet.

### 1.08 PROTECTION OF WATER SUPPLIES

Sewer mains and services shall be located a minimum of ten feet horizontally from existing or proposed water mains and services. **The distance will be measured pipe wall to pipe wall.** Whenever it is necessary that a sewer main cross above or within 18 inches below a water main, the sewer main shall be made impervious by one of the methods listed below, and as shown in the detail drawings. The 10-foot separation shall be required until it enters the foundation.

Method 1: The sewer pipe shall be reinforced with a concrete encasement which shall be at least six inches thick on all sides of the sewer pipe and extend for at least ten feet each way from the crossing point with the water main, measured perpendicular to the water main.

Method 2: The sewer main shall be constructed of C-900 PVC class 200 pressure pipe or Yelomine pressure pipe, or Standard Dimensional Ratio (SDR) 26 pressure pipe or polyethylene lined ductile iron, for a distance of no less than ten feet, each way from the crossing point with the water main, measured perpendicular to the water main. The crossing point itself shall be created using Harco adapter coupling.

Method 3: Sewer services crossing over water lines shall be encased within a larger pipe having both ends grouted. Pressure pipe shall be used for the encasement, and the sewer service shall be encased for a distance of no less than ten feet each way from the crossing point with the water main, measured perpendicular to the water main. All joints within the ten feet perpendicular to the water main shall be encased in a concrete collar six inches thick and extending at least six inches on either side of the joint.

See details in Appendix A.8 and A.9.

#### 1.08.1 Sand/Oil/Water Separators

A gravity flow Sand/Oil/Water Separators shall be placed on any sewer service line, where sand/oil/water are likely to enter. Businesses that are likely to need an S/O/W separator include those that service/wash automobiles, greased, repaired or washed or where gasoline is dispensed, and others. See the Gypsum building department and IBC codes for restaurant grease traps.

S/O/W separators shall be placed at a depth of at least three and a half feet (3.5') from top of Sand/Oil/Water Separator to finish grade, or protect from freezing with insulation.

The maximum amount of discharge that shall be permitted is two times the stated flow rate in gpm. For example, a maximum anticipated discharge of 100 gallons would require a flow rate design capable of carrying 50 gpm.

S/O/W separators shall be designed to provide at least 18" of liquid seal. The capacity of oil water separators shall be designed to accommodate the following capacities

$$\begin{aligned}\text{Floor Area} \leq 100 \text{ ft}^2 &\rightarrow C = 6 \text{ ft}^3 \text{ (45 gallons)} \\ \text{Floor Area} > 100 \text{ ft}^2 &\rightarrow C = (6 + A/100) \text{ ft}^3\end{aligned}$$

Where C = Minimum capacity of separator  
A = Floor area served (ft<sup>2</sup>)

S/O/W separators shall be designed to retain no less than 6 ft<sup>3</sup> of sediment, and prevent it from flowing into waste water system.

S/O/W separators will need manhole access, to facilitate scheduled pumping (See Appendix A.10). Records and receipts shall be maintained for inspection by the Gypsum Public Works Department.

## 1.09 TESTS AND INSPECTION

New sewer manholes and lines will not be accepted until tests have been made to assure the Town of Gypsum that the manholes are properly constructed and grouted, and that pipe laying and jointing are satisfactory. The contractor shall provide the labor and materials to conduct the following tests in the presence of the Town of Gypsum.

- a. Lamp Test Sewer mains shall be checked by the Town of Gypsum to confirm that the alignment of the pipe has not shifted during backfilling of the trench. The Town of Gypsum will inspect lengths of sewer main between manholes by using a bright light and observing for a "full moon" circle of the opposite end of the pipe. The Town of Gypsum may elect to "lamp" the sewer main from both ends of the pipe. Any visible alignment deflection, earth, rocks or other debris, or any other defect found by the Town of Gypsum shall be remedied prior to acceptance.
- b. Flushing of Sewer Mains- all earth or rock found in the sewer main, which, in the opinion of the Town of Gypsum, is detrimental to the inspection, or function of the sewer, shall be removed prior to acceptance by the Town. All new sewer mains shall be cleaned by flushing with a quantity of water sufficient to develop a minimum velocity of 10 fps in the flattest portion of the sewer main, for a period of at least two minutes. The procedure used to flush the sewer mains shall be subject to review by the Town of Gypsum, but in all cases, it shall be the responsibility of the Contractor to install plugs at the connection to the existing sewer system and to pump out all flushing water and debris to a disposal tank or to a suitable open area. Under no circumstances shall the flushing water or the debris flushed from the sewer mains be allowed to enter the Town's sewer system or treatment plant. The Contractor shall take all steps necessary to prevent damage from erosion, deposition, or any other cause related to the disposal of flushing water or debris, and shall be responsible for all aspects of the cleaning of the sewer mains and disposal of flushing water and debris. The Town of Gypsum shall be notified in writing 24 hours prior to the flushing of the sewer mains, and shall witness the flushing process.

- c. Video Camera Inspection- All sewer mains shall be inspected by television (TV) camera on a minimum of two occasions prior to final acceptance by the Town of Gypsum. The first TV inspection must occur prior to the placement of Hot Bituminous Pavement on the road and the second TV inspection must occur within three months prior to the expiration of the warranty period.

The end-of-warranty video shall be made without flushing the line, in order for the Town's inspector to observe how well the sewer main is performing. If too much debris is present, then the sewer main must be jetted and video taped a second time. All deflections in the sewer pipe, which retain a depth of water equal to one-half inch, shall be deemed defective, and shall be repaired at the Contractor's sole expense. No pipe couplers are allowed on new pipe installation. The television camera system used shall have the ability to produce a high quality image of the interior of the pipe and its contents and also have the ability to turn and "look up" a sewer service connection. The Town of Gypsum shall receive the original videotape from the inspection. The contractor may make and keep copies of the tape.

## **1.10 PRESSURE TESTING OF SEWER MAINS AND SERVICE LINES**

There are two main methods available to testing sewer mains and manholes. Pressure testing, which is outlined in this section, and vacuum testing with is outlined in section 1.11. Either method is acceptable.

### **1.10.1 Scope**

The work shall consist of pressure testing sewer mains and service lines. The contractor shall furnish all facilities and equipment necessary to conduct the pressure testing of the sewer pipe, including but not limited to sewer pipe plugs and connections, air compressor, pressure gauges, bulkheads, regulator to avoid over pressurization and all miscellaneous hoses and fittings. The Town of Gypsum shall witness the test. The contractor shall at all times be responsible for the safe performance of this test, and that all relevant safety precautions are adhered to, including the requirements of OSHA regarding confined space entry procedures.

### **1.10.2 General**

The contractor shall notify the Town of Gypsum in writing 48 hours in advance of all vacuum testing.

### **1.10.3 Pressure Test Equipment**

- a. The pipe plug for the low-pressure air testing of the sewer line shall be equipped with two taps. One tap will be used to supply air into the line being tested with appropriate valves and fittings to regulate air flow to the test section of pipe. The second tap shall be fitted with a valve and fittings to accommodate a pressure test gauge.
- b. The system shall include a pressure relief valve to prevent the pressure in the test section from exceeding 5.0 psig for standard sewer mains, plus external pressure from ground water as per 1.10.4.e. below.

c. The pressure test gauge shall meet the following minimum specifications:

ASME Grade A

1) Diameter = 4.5 inches

2) Pressure range = 0 to 15 psi

3) Gauge increments = 0.20 psi

4) Accuracy = 1% of maximum scale reading

Calibration data shall be supplied with all pressure test gauges. Certification will be required from the gauge manufacturer. Calibration and certification data shall be available to the Town of Gypsum prior to testing.

d. Compressor for air supply.

#### **1.10.4 Pressure Testing Standard For Sewer Mains:**

After completion of installation and backfilling, each section of sewer pipe between manholes shall be tested in the following procedure:

- a. Plug ends of test section and all service taps with fittings capable of withstanding pressure up to 5.0 psig. One of the plugs provided must be equipped to connect testing system.
- b. Pressure test section up to **4.0 psig** and maintain pressure, with air supply, between 3.5 and 4.0 psig for two minutes to allow air temperature to equalize with pipe wall temperature. During this period, check all plugs to detect any leakage. Bleed off pressure and tighten any leaking plugs.
- c. After temperature is stabilized, allow pressure to decrease to 3.5 psig, begin timing to determine time for pressure to drop from 3.5 psig to 2.5 psig. If the time, in seconds, for the air pressure to decrease from 3.5 psig to 2.5 psig is greater than that shown in the table below, the pipe section shall be presumed to be free of defects that would cause leakage.

The following sections apply to both Standard SDR 35 Sewer Mains and to SDR 26 Sewer Mains.

<b>PIPE SIZE (INCHES)</b>	<b>REQUIRED TIME PER 100 L.F. OF TEST SECTION (Minutes: seconds)</b>	<b>MAXIMUM REQUIRED TIME (Minutes: seconds)</b>	<b>MAXIMUM TIME APPLIES TO ALL PIPE <u>OVER</u>:</b>
8	(1:10)	(3:47)	325 L.F.
10	(1:50)	(4:43)	258 L.F.
12	(1:38)	(5:40)	216 L.F.
15	(4:08)	(7:05)	172 L.F.
18	(5:56)	(8:30)	144 L.F.
21	(8:05)	(9:55)	123 L.F.
24	(10:34)	(11:20)	108 L.F.
27	(12:45)	(12:45)	100 L.F.
30	(14:11)	(14:11)	100 L.F.
33	(15:35)	(15:35)	100 L.F.

- d. If test fails, locate and repair leaks and repeat tests.
- e. In areas with high ground water, the air pressure shall be increased to compensate for the external pressure caused by the height of the ground water. To determine how much to increase testing air pressure, one pound per square inch (1 psig) of pressure shall be added to the test pressure for each two point three feet (2.30') of ground water above the flow line of the sewer main. The height of ground water shall be estimated by the Town of Gypsum, based on the best available information, and will be determined from the greatest depth in any given section of pipe being tested.

## **1.11 VACUUM TESTING OF MANHOLES**

### **1.11.1 Scope**

The work shall consist of vacuum testing sewer manholes. The contractor shall provide all required equipment, materials and labor. The Town of Gypsum shall witness the test. The contractor shall at all times be responsible for the safe performance of this test, and that all relevant safety precautions are adhered to, including the requirements of OSHA regarding confined space entry procedures.

### 1.11.2 General

The contractor shall notify the Town of Gypsum in writing 48 hours in advance of all vacuum testing.

### 1.11.3 Vacuum Test

- a. Each manhole shall be tested immediately after assembly and prior to backfilling.
- b. All lift holes shall be plugged with an approved non-shrink grout.
- c. No grout will be placed in the horizontal joints before testing.
- d. All pipes entering the manhole shall be plugged, taking care to securely brace the plugs from being drawn into the manholes.
- e. The test head shall be placed at the inside of the top of the cone section and the seal inflated in accordance with the manufacturer's recommendations.
- f. A vacuum of **10 inches of mercury** shall be drawn and the vacuum pump shut off. With the valves closed, the time shall be measured for the vacuum to drop to 9 inches. The manhole shall pass if the time is greater than 60 seconds for a 48-inch manhole, 75 seconds for a 60-inch manhole and 90 seconds for a 72-inch manhole.
- g. If the manhole fails the initial test, necessary repairs shall be made with a non-shrink grout while the vacuum is still being drawn. Retesting shall proceed until a satisfactory test is obtained.
- h. Sewer mains may be vacuum tested along with the manholes according to the schedule outlined in item F adding 30 seconds to the time stated. For example, if testing a 48-inch manhole with one section of pipe, 10-inches of mercury shall be drawn and time measured to drop to 9-inches of mercury in a period of no less than 90 seconds, 105 seconds for a 60-inch manhole and 120 seconds for a 72-inch manhole.

The contractor shall repair and/or replace any section of the system that fails to meet testing standards, or fails to pass visual inspection, following which the section shall be retested. The test section of sewer shall not exceed 800 feet in length.

### **SEWER LINE ACCEPTANCE PROCEDURE**

Sewer Line will not be accepted until it has passed all tests including flushing, lamp test video inspections, vacuum and/or air pressure testing.

## **1.12 WASTE WATER COMPOSITION**

No material may ever be discharged to the Town of Gypsum sewage collection system, which contains organic or inorganic substances that in nature or concentration would be hazardous or deleterious in any way to the operation and maintenance of the sewage collection system or the sewage treatment system. This includes but is not limited to flammable materials, paint, petroleum products, cleaning solutions, anti-freeze, excessively high concentrations of organic waste from food and beverage manufacturing/processing, animal and vegetable fat, and soaps/ detergents.

It is also prohibited to direct intermittent or continuous flows of water into the sewage system from sources other than normal plumbing fixtures and/or in quantities greater than would normally be expected from those plumbing fixtures, based on the population being served by those plumbing fixtures. This includes, but is not limited to: drainage from roof, sump pumps, hydroponic gardening, fish tanks, swimming pools, and decorative water features.

Before connecting to the Town of Gypsum sewage system, any activity which will require the disposal of waste material which has a composition that differs from the average composition of normal household domestic sewage by a factor of 25% or may potentially contain, on a regular basis, or from time to time, materials which may be hazardous and/or otherwise deleterious to the sewage collection or treatment systems, must submit a plan of mitigation, prepared by a registered professional engineer. The plan must provide for a system of pretreatment of the waste stream, prior to disposal in the Town of Gypsum system, which will render the waste stream acceptable to the Town of Gypsum System. The Town of Gypsum will review the plan, and if it is approved, it must be constructed, in place and operational before a physical connection is made to the Town of Gypsum sewage treatment system.

## **2.00. WATER DISTRIBUTION SYSTEM DESIGN AND LAYOUT**

### **2.01 SIZING DISTRIBUTION MAINS**

All mains shall be sized large enough to provide for domestic, irrigation, and fire protection flows to the area requesting service. The minimum size of all Town of Gypsum mains shall be eight inches (8") except for fire hydrant laterals of less than 100 feet in length, which may be six inches (6"). Fire hydrant laterals longer than 100 feet in length, as measured from the centerline of the main to the mechanical joint coupling on the hydrant, shall be eight inches (8") with an 8" x 6" reducer immediately ahead of the hydrant. All mains must be buried at a frost depth of 5.5' or greater, but not more than 9.0' from top of pipe.

Water mains shall be sized for fire protection in compliance to the current ISO recommendations and as called for by the Fire District and the Town of Gypsum. The Gypsum Fire district includes the entire Town west of Alkali Creek and the Greater Eagle Fire Protection District covers east of Alkali Creek.

The Town of Gypsum reserves the right to over-size mains to provide service for projected future needs or as outlined in the Town's Master Plan. Unless otherwise agreed to by the

Town, this over-sizing shall be at the sole expense of the developer with no reimbursements from the town, or future users, or future developers.

## **2.02 FIRE PROTECTION**

The Town of Gypsum must approve the number and location of fire hydrants in a given area. Spacing shall be determined by depth of lot from street, type of business/use and requirements of the Towns fire authority. However, the distance between hydrants shall not exceed 500'. A fire hydrant must be installed at the end of all water mains and in cul-de-sacs. Fire hydrants must be painted red and face the street. The hydrant shall be installed a minimum of 2' behind the sidewalk. If no curb is present, hydrant shall be placed at roadside elevation on the opposite side of the roadway drainage ditch. No horizontal or vertical bends or offsets shall be used in installing fire hydrant branch lines unless approved by the Town of Gypsum.

Under no circumstances shall any size or manner of tap be made on a fire hydrant branch line between the hydrant and hydrant valve. The hydrant valves shall be located at the tee and all joints from the tee to the hydrant shall be restrained. (Please see Appendix B-2 ).

### **2.02.1 Fire Hydrants**

Fire hydrants shall be Mueller "Centurion Super 250", U.S. Pipe Metropolitan Sentinel 250, conforming to AWWA Standard C502. Standard features will include:

- Minimum bury of five and one half (5.5) feet to top of pipe.
- Maximum working pressure of 250 psi
- Six-inch mechanical joint inlet
- Minimum 5-1/4" compression type main valve, which closes under pressure
- ANSI B26 nozzle threads
- Two 2-1/2" hose nozzles
- One 4-1/2" pump nozzle
- Open left with direction arrow cast in top of hydrant
- Traffic flange with breakable coupling near ground level
- Red only in color.**

Fire hydrants must be installed with guard valves and at the end of all main lines. The guard valve will be installed on a main line tee with flange fittings or mechanical joint restraining gland on the hydrant side of the valve and on the hydrant. Fire hydrants shall be installed at the relative elevation to the surrounding finished grade such that the portion of the hydrant below the breakaway flange is protected from damage by vehicle collision.

## **2.03 DISTRIBUTION REGULATING AND MONITORING INSTALLATIONS**

When water main extension plans are submitted for review, the need for regulating installations must be approved by the Town of Gypsum based on existing and proposed pressure zones, booster pump areas and the existing distribution system piping. These installations shall conform as outlined below. All regulating installations will be reviewed and approved by the Town of Gypsum and installed by the Owner/Developer.

### **2.03.1 Pressure Reducing Valves (PRV)**

Pressure reducing valves shall be installed such that the main line pressure shall not exceed 100 PSI. PRV valves shall be installed in vaults as described in Appendix B-3. No less than two Pressure Relief Valves are required. One for high flow conditions and one for low flow conditions. In some cases a third PRV maybe required. All pressure reducing valves shall be CLA-VAL or Golden-Anderson cushioned, single globe, pilot pattern, hydraulically operated with flanged ends. The valve body shall be cast iron ASTM - 126 with flanges conforming to the latest ANSI standards. The valve body shall be extra heavy construction throughout. The valve interior trim shall be bronze B-62 as well as the main valve operation. The valve seals shall be easily renewable. All controls and piping shall be non-corrosive construction. All PRV must have a strainer installed upstream of the valve.

### **2.03.2 Air Release/Vacuum Valve**

At all high points in the main line distribution system, a combination air vacuum and air release valve shall be installed in a minimum four foot (4') diameter manhole in accordance with the Town of Gypsum details and specifications. See Appendix B-3. Air release/vacuum valves shall be APCO Series or Valmatic and be 1-inch diameter minimum. The valve shall have a cast iron body, cover and baffle with a stainless steel float. The seat shall be fastened into the valve cover, without distortion, and shall be easily removed, if necessary. Air release/vacuum valves shall be installed on all main line extensions at the high points in the system.

### **2.03.3. Main line flow meter**

Main line flow meters may be required to be installed on extensions to the existing distribution system at the sole discretion of the Town of Gypsum.

### **2.03.4 Pumping Facilities**

All proposed booster-pumping facilities shall be considered as a special feature and dealt with on a case by case basis. The size, location, and type of booster pumping facilities shall be reviewed and approved by the Town of Gypsum. Every effort shall be made to provide facilities that are consistent with the Town of Gypsum's existing booster pump stations. Pump stations shall include telemetry control equipment compatible with the Town of Gypsum. Check valves shall be: bronze mounted; AWWA C508; high strength cast iron gate with bronze gate ring; bronze, back-faced seat ring; and solid bronze Y-shaped hinge.

### **2.03.5 Storage Facilities**

Water storage tanks are required throughout the distribution system to maintain adequate supply during peak demand period. The size, location and type of storage tanks shall be reviewed and approved by the Town of Gypsum.

## **2.04 LAYOUT OF THE DISTRIBUTION SYSTEM**

Every subdivision shall have a central water system, designed and prepared by a registered professional engineer, in accordance with the Town of Gypsum design standards approved

by the Colorado Department of Health. The water main system shall be connected to and become part of the Town of Gypsum municipal water system. The water services are privately owned and maintained

Right-of-way width requirements for water main installations are as follows:  
 All mains shall be installed in a Public Street. Every effort should be made to locate water valves outside of normal vehicle wheel paths, preferably in the center of the driving lane. Valves shall never be located on curb, gutter, pans or sidewalks. The finished grade of a lid for a water valve box in a paved surface shall be 1/2 inch below the finished grade of the paved surface. If it is not possible or feasible for an installation to be made in a dedicated street right-of-way, the installation shall be made in a dedicated utility easement. The minimum width, right-of-way or easement which will be accepted by the Town of Gypsum is twenty feet (20'), ten feet (10') each side of the main. In the case of extreme depths of bury or nearby utilities more easement may be required. Easements must be granted which will provide sufficient room for future excavation and maintenance of the line (see following table).

<u>WATER MAIN COVER DEPTH</u>	<u>MINIMUM EASEMENT WIDTH REQUIRED</u>
7' TO 8'6"	20'
8'7" to 9'	25'

Looping of the water distribution system will be required at the discretion of the Town of Gypsum. Installed pipe shall have a minimum depth of cover of 5.5 feet from finished grade to the top of the pipe, with a maximum depth of bury at 9 feet. When a pipe must be installed under a culvert or other structure wherein the cover between the pipe and open air is less than 5.5 feet, a site specific design must be prepared and construction accomplished for insulating the pipe from freezing. A general rule is 1" of blue-board insulation for each foot of missing cover; 2" minimum.

(10)-gauge insulated tracer wire shall be required on all main line installations. Tracer wire must be taped on top of all pipes, at each coupling and at the mid- point between couplings. The interval between tape points shall not exceed 10 feet. Wire shall loop to the surface at all valve boxes.

Line valves shall be installed in all water mains at a maximum interval of 750 feet or at the discretion of the Town of Gypsum. Isolation valves shall be installed on all branches of all Tees and Crosses except at fire hydrant and service isolation valves. In the event that a pipeline must be installed at a depth greater than 5.5-foot, cover a valve nut extension with centering plate shall be provided such that the depth to a valve nut shall be no more than 4.0 feet.

Warning tape shall be placed two (2) feet above all water mains. Tape shall be blue in color, to indicate water.

## **2.05 SERVICE LINE STUB OUT DESIGN AND LAYOUT FOR ALL NEW AND REPLACEMENT SERVICE LINES**

All service line taps shall be made before the main line has been pressure tested. All direct taps to ductile iron mains must engage a minimum of three complete threads on the corporation stop. When this cannot be accomplished, a saddle must be used. The Town of Gypsum must inspect all service line taps while under test pressure before the service line is accepted.

An expansion loop (3/4" through 2" only) must be left in the service line where it is connected to the corporation stop at the water main, to allow for expansion and contraction. This loop shall be made in a vertical plane at the level of required pipe depth.

Service lines for residences shall be a minimum of three-quarter inch (3/4") in diameter. No couplings shall be allowed from the main line to the curb stop. Curb stops shall be located 12 inches inside the property line. In the case of nearby utilities, service lines must extend beyond the curb stop to the greater of; 6 feet beyond the back of walk, or the nearest utility.

Service lines for commercial, light industrial or industrial subdivisions or developments require 8 inch lines be extended between common lot lines to serve two lots. An isolation valve shall be provided at the main line tee. Cap shall be located at the right of way or the greater of 6 feet beyond the back of walk, or nearest utility. These water main extensions may be provided within utility easements on common lot lines to serve both lots. The plug at the end of the 8-inch service line shall be restrained and the service line isolation valve shall remain open during the pressure testing of the main. Domestic and fire suppression water must enter the building in separate lines. The main shall be fully retained from main to tee. The curb stop for domestic water must be located outside the building.

Service lines between the corporation and the curb stop (3/4" through 2" only) shall be constructed of type "K" copper (or Town of Gypsum approved material e.g. PureCor) 3/4 inch services shall not exceed 60 feet from corporation to curb stops. Water service lines over two inches (2") shall be ductile iron or other Town of Gypsum approved material.

Service lines (3/4" through 2" only) shall have only compression fittings. Service lines shall be installed with five and one-half feet (5.5') of cover. Depth of bury shall be determined from finished street grade or roadway ditch (which ever is greater) and finished grade of property being served. The Town of Gypsum will require an U.F. insulated ten gauge (10) copper wire to be installed with the service line and taped every three feet (3') to the pipe and extended into the meter pit for the purpose of locating the service. (Appendix B-1)

All service lines are required to have pressure-reducing valves (PRV's). The PRV's shall be installed ahead of meters.

Water mains and services shall be located a minimum of ten feet horizontally from existing or proposed sewer mains and services. The distance will be measured pipe wall to pipe wall. Whenever it is necessary that a water main cross below or within 18 inches below a sewer main, the sewer main shall be made impervious by one of the methods listed in

section: Protection of Water Supply, and as shown in the detail drawings. The 10-foot horizontal separation shall be required until it enters the foundation.

Taps shall not be made after November 15th of any year, or before April 15th, unless specific approval of the Town of Gypsum is given. Taps may be allowed during this period, with specific approval, provided the area is heated, is outside the roadway and 48 hours prior noticed has been given.

The Town of Gypsum shall perform all operation of water main valves. Absolutely no operation of water valves by contractors, developers, homeowners, or any unauthorized personnel will be allowed. All water must be metered, except for initial flushing of high chlorine.

All line stub outs shall be marked as indicated in the Standard Drawings with a metal t-post. No wooden markers shall be used. (Appendix B-1)

As-built drawings must show ties to two (2) permanent surface structures from the end of the service line.

## **2.06 MATERIALS FOR SERVICE CONNECTIONS, SERVICE LINES, METERS AND APPURTENANCES**

### **2.06.1 Scope**

This section covers the installation of corporation stops, service lines, meters, yokes, meter boxes and pressure reducing valves and backflow prevention devices for services.

### **2.06.2 Materials**

- a. Saddles--Saddles shall be brass (ASTM B-62 & AWWA C-800) with flattened, silicon bronze straps and brass alloy (ASTM B-62 & AWWA C-800) nuts or stainless steel with double flat stainless steel straps and nuts. Manufactured by Ford, Mueller or approved equal.
- b. Direct taps--All direct taps to ductile iron mains must engage a minimum of three complete threads on the corporation stop. When this cannot be accomplished, a saddle must be used. Corp stops shall be Mueller 300 Ball Valve No. B-25008, AWWA 800 inlet thread shall be Mueller and discharge connection shall be Mueller 110 compression connection.
- c. Corporation Stops--Corporation stops shall be all brass construction (AWWA C-800) with threads suitable for the coupling or saddle to which the connection is being made, and shall be Mueller 300 Ball valve B-25008 compression fitting, no substitutes.
- d. Service Lines--Service lines shall be PurCor or Type K copper, soft, meeting ASTM B88-62 for service lines from 3/4 inch to 2 inch. Service connections larger than 2 inch shall be considered water mains and shall be as specified under the applicable

sections. All copper service line connections shall be compression joints. Polyethylene service lines may be installed with a trace wire from the curb stop to the meter at the discretion of the Town. Only Mueller 110 compression connections shall be acceptable.

- e. Curb Stops--Curb stops shall be Mueller 300 Ball curb valve no. B-25209 compression fitting or AWNA C-800, no substitutes.
- f. Valve Boxes for Curb Stops-- Valve boxes for curb stops shall have one inch extension rod to within **24 inches of the surface** with arch pattern and stationary rod as called for in the following table:

MANUFACTURER	MODEL NO. FOR 3/4 AND 1 INCH	MODEL NO. FOR 1-1/2 AND 2 INCH
MUELLER	H-10334	H-10310
MCDONALD	5601	5603
FORD	EA-2	EA-2

- g. Meters--The Town of Gypsum shall determine meter type and manufacture. For outside installation, the Town staff shall install the meter pit and meter yoke. For inside installation, the meter yoke shall be installed by the customer's plumber. Installation must be in a freeze-proof, accessible area and will be near floor level in a horizontal position.

The customer shall install wire from the meter location to the touch-read pad prior to meter installation. Touch-read pad will be located on the street side of building, four to five feet (4'-5') above the ground in an accessible location free from snow.

A pressure-reducing valve (PRV) shall be installed before the meter. A backflow preventer shall be installed following the meter. Isolation valves shall be located before the PRV and after the backflow preventer (i.e. isolation valve-PRV-meter-backflow preventer-isolation valve). The backflow preventer shall be provided and installed in accordance with the Town of Gypsum plumbing code.

Schedule installation with Town of Gypsum personnel 48 hours in advance. Service will be turned on and billing will commence when the meter is installed. Town of Gypsum personnel only will turn on water.

- h. Pressure Reducing Valve--Pressure reducing valves (PRV) for service lines shall be Cash-Acme Type EB-74 (1/2" through 1") or Type EB-86 (1-1/4" through 2") or approved equal with a range of adjustment of discharge pressure from 20 to 70 psi.
- i. Isolation valves of service line size shall be installed ahead of the pressure-reducing valve (PRV) and after the meter (i.e. valve, PRV, meter, backflow preventer, valve).

## 2.07 JOINT RESTRAINT

Unless otherwise approved by the Town of Gypsum, concrete thrust block joint restraints are not allowed. All joint restraints must be made with EBAA IRON SALES, MEGALUG fittings, or U.S. Pipe Field Loc Gaskets, only. All joint restraint calculations shall be prepared with the specific equipment manufacturers' programs and shall be certified by a registered professional engineer. These calculations shall be submitted to the Town of Gypsum during the development approval process. All tees shall be calculated as 90° bends and fully retained in all three directions.

In the course of construction of water system infrastructure, all required joint restraint installation must be observed by an authorized Town of Gypsum representative and tentatively approved, prior to backfill. Final approval of water system infrastructure will only be given after successful completion of all flushing and testing of the system.

## 2.08 WATER PIPELINE CONSTRUCTION

All materials shall conform to the Material Specifications and shall be furnished new and undamaged. Everything necessary to complete all installations shall be in accordance with the Specifications and all installations shall be completed as fully operable functioning parts of the Town of Gypsum's System.

Unless otherwise approved, pipe installation sequencing shall be as follows:

- a. Trench excavation shall not precede pipe installation by more than 250 feet.
- b. Pipe installation shall not precede backfill by more than 100 feet.
- c. Trench excavation shall not precede clean-up by more than 1000 feet.

Additionally, no timber, bracing, lagging, sheathing, or other lumber shall be left in any trench.

## 2.09 MATERIALS

The type and class of pipe to be used in the work will be shown on the plans and/or stated in the specifications. The following specifications apply to pipeline and appurtenant materials.

<u>Material</u>	<u>Specification</u>
Ductile Iron Pipe (DIP)	AWWA C-151
Polyvinyl Chloride pipe (PVC) (Limited to special circumstances when approved by the Town)	AWWA C-900
DIP Cement Mortar lining	AWWA C-104
DIP Mechanical and push on joint	AWWA C-111
DIP Compact Fittings	AWWA C-153
DIP & Gray Iron Fittings	AWWA C-110
Gate valves	AWWA C-500
Butterfly valves	AWWA C-504
Resilient Seated Gate valve	AWWA C-509
Resilient Seated Gate valve int. coating	AWWA C-550
Fire Hydrant	AWWA C-502
Loose Polyethylene Encasement	AWWA C-105

- a. **Valves**--Isolation valves shall be the same size as the main pipeline. Gate valves shall be Mueller A- 2360, U S Pipe Metroseal 250 or American Flow series 2500. Valves shall be cast iron body, 250 psi pressure rating, bronze-mounted, resilient wedge, epoxy coated interior and exterior, meeting AWWA C509. Valves shall have ring stem seal, two inch (2") square operating nut, open left. Gate valves shall be installed on all pipe sizes up to and including twelve inches (12"). Valves larger than twelve inches (12") shall be butterfly configuration and shall be Mueller 5227, Lineseal XP with buried service actuators requiring a minimum of 30 turns to open or close and shall have epoxy coating interior. Butterfly valves shall be tight closing with rubber seals attached to the valve body. Butterfly valves shall conform to AWWA C504. Valves shall be flange or MJ with Mega Lug ends. To determine the correct valve application, contact the Town of Gypsum Inspector prior to ordering material.
- b. **Valve Boxes**--All buried valves shall be provided with a six-inch (6") cast iron valve box, screw type. The valve box shall be of a design, which will not transmit shock or stress to the valve and shall have enough extension capability to be raised to final street grade. The valve box shall be cast iron, adjustable screw type, with minimum five-inch (5") diameter shaft provided with cover, marked "water".

## 2.10 WATER PIPE INSTALLATION

The pipe shall be installed in accordance with the manufacturer's recommendations for installing the type of pipe used unless modified or changed in the Special Provisions. The Contractor shall provide all tools and equipment including any special tools for installing each particular type of pipe used.

- a. Pipe shall be laid with the bells pointing in the direction that the work is progressing.
- b. Where pipes are installed on grades of 10% or greater, installation shall start at the bottom and proceed upslope.
- c. The joint shall be completed in accordance with the applicable pipe material specification and the pipe shall be adjusted for line and grade. Adjustments to line and grade of the pipe shall be made by adjusting the bedding along the entire length of the pipe, and not by wedging, blocking, or mounding up the pipe or bell.
- d. Secure the pipe in place with the specified bedding tamped under and around the pipe except at the last bell. The pipe bedding material shall be placed around the pipe by hand and compacted by hand tamping. For all other pipe bedding and trench backfill see Appendix A-1.
- e. Install the pipeline such that a constant positive or negative grade is maintained between high and low points. Record the location of high and low points so that they may be readily located for the installation of air-vacuum valves or blow offs.

- f. Polyethylene encasement (polywrap) shall be installed on ductile iron pipe, due to the soils found in the Town. Encasement shall be tube type, in accordance with AWWA C-105, and shall be installed by advancing a bunched length of material around each length of newly laid pipe. Overlap and tape encasement joints. Repair rips, punctures or other damage with adhesive tape or short length of encasement wrapped and secured around the damaged area.
- g. Furnish and install insulated 10 gage copper trace wire on all water pipe lines. Installation will be on the top one third of the pipe, taped at 6-foot intervals, outside polyethylene encasement when DIP is used. Connect all branch line trace wire to main trench wire with a twist splice. Bring trace wire to finished grade surface adjacent to all valve boxes. Ground trace wire at a maximum of 500 foot intervals, with grounds being located at hydrants or valves, wherever possible.
- h. All temporary (dead end) plugged ends longer than 10 feet in length **and** larger than one-inch diameter shall be provided with a temporary tap for flushing and testing.
- i. All pipe, fittings and appurtenances (poly wrap, trace wire, etc.) must be inspected by the Town of Gypsum prior to backfill.
- j. **Pipeline Insulation**- When it becomes necessary to insulate a new pipeline due to shallow depth, and when this type of installation is approved by the Town of Gypsum, the following method and materials shall be used:
  1. 36" or more to the top of pipe. For every foot of depth missing, add 1" of blue-board; 2" minimum. Place on top of pipe, at least 24" wide, or encase sides and top with Town approval.
  2. Less than 36" to top of pipe
    - i. The carrier pipe shall be installed within an encasement of ADS-N12 pipe, the inside diameter of which shall be a minimum of 4 inches greater than the maximum outside diameter of the carrier pipe (i.e. bell or fitting);
    - ii. The carrier pipe shall be mounted on Cascade spacers, as supplied by Grand Junction Pipe, or approved equal, at spacing of 2 per pipe joint of carrier pipe, but no more than 7.0 feet apart;
    - iii. The space between the outside of the carrier pipe and the inside of the ADS-N12 shall be filled with foam or dense packed fiberglass insulation.
- k. **Procedures** – Service meters shall be purchased from the Town of Gypsum.  
**Master Meter Vaults:** All master meter vaults in the Town of Gypsum shall be equipped with a main (high flow) Invensys turbine meter of a size necessary for the function of the vault, and a Invensys, positive displacement low flow meter. The contractor will be required to submit a piping schematic to the Town of Gypsum prior to any installation, showing the meters valve location, pipe and inlet screen. Refer to Standard Drawings for additional detail, shown in Appendix B-4 and Appendix B-5.

- I. **Pipe Bedding and Trench Backfill** – All trenches shall be backfilled immediately after grade, alignment and jointing of the pipe has been inspected and accepted by the Town of Gypsum. Leakage tests, pressure tests or tests for alignment, grade and/or pipe cross-section deflection shall be performed after backfill has been accomplished. Pipe bedding material placed around and up to a point twelve inches over the pipe shall consist of select earth, sand, or fine gravel free from clods, lumps of frozen material or stones larger than 1 ½ inches in their maximum dimension. The pipe bedding material shall be placed around the pipe in layers of six inches thick or less and compacted by tamping. Water settling of this portion of the trench will not be allowed, and the addition of water shall be limited to that required for optimum compaction. After the select pipe bedding material has been placed and compacted as called for above, the remainder of the trench shall be backfilled. All backfill material shall be free from cinders, ashes, refuse, organic and frozen material, boulders, or other unsuitable material. From twelve inches over the pipe to a point 12 inches below the surface or road sub grade, stones which do not exceed 12 inches in maximum dimension may be included in the backfill. Materials used for backfill shall be placed in the trench in layers suitable to the equipment used for compaction and shall be compacted to a minimum of 95% of the maximum dry density as determined by the Standard Proctor test (ASTM D698) at a moisture content within 2% of optimum. Completion of backfill in roads, streets and sidewalks shall include the reconstruction of paving surfaces to a condition as good as or better than the original surface, and shall include replacement of all sub-base and base course gravels. Trench configuration shall be shown as in Appendix A-1.

The Contractor shall be responsible for the safe and proper storage/handling of all material intended for the until it has been incorporated in the completed and accepted work.

Every precaution shall be taken to prevent foreign material from entering the pipe while it is being handled, stored or installed. At times when pipe laying is not in progress, the open ends of the pipe shall be closed by a water-tight plug or other means approved by the Town of Gypsum.

## 2.11 PIPE DEFLECTION

Alignment layout shall not exceed one-half (1/2) the deflection value listed below and the actual individual joints in the field shall not exceed the deflection values listed below:

### **MAXIMUM DEFLECTION FULL LENGTH PIPE -- MECHANICAL JOINT PIPE APPROX. CURVE RADIUS, MAX DEFLECT. PRODUCED BY SUCCESSION**

Pipe Size (inches)	Maximum Offset, (inches)		Approx. Radius of Curve – R Produced by Succession of Joints, feet.	
	L = 18 ft	L = 20 ft	L = 18 ft	L = 20 ft
3	31	35	125	140
4	31	35	125	140
6	27	30	145	160
8	20	22	195	220
10	20	22	195	220
12	20	22	195	220
14	13.5	15	285	320
16	13.5	15	285	320
18	11	12	340	380
20	11	12	340	380

### **MAXIMUM DEFLECTION FULL LENGTH PIPE -- PUSH-ON TYPE JOINT APPROX. CURVE RADIUS PRODUCED BY SUCCESSION**

Pipe Size (inches)	Maximum Offset, (inches)		Approx. Radius of Curve – R Produced by Succession of Joints, feet.	
	L = 18 ft	L = 20 ft	L = 18 ft	L = 20 ft
3	19	21	205	230
4	19	21	205	230
6	19	21	205	230
8	19	21	205	230
10	19	21	205	230
12	19	21	205	230
14	11	12	340	380
16	11	12	340	380
18	11	12	340	380
20	11	12	340	380

The cutting of pipe as necessary in the course of the work shall be accomplished in neat workmanlike manner without damage to the pipe and any coating thereon. The cut shall result in a smooth cut at right angles to the axis of the pipe and a grinder shall be used to bevel the pipe end for jointing and smooth the rough edges of the cut end. **Flame cutting of**

**pipe shall not be allowed.** Cuts shall be made with a saw or abrasive wheel for ductile iron pipe.

Acceptance of materials, or the waiving of inspection thereof, shall in no way relieve the Applicant of the responsibility for furnishing materials meeting the requirements of the Specifications.

## **2.12 TESTING AND ACCEPTANCE**

### **2.12.1 Scope Flushing And Disinfection Of Water Lines**

The work consists of the disinfection of potable water lines. **IT SHOULD BE NOTED THAT THE ACTUAL WORK OF THIS SECTION BEGINS WITH AND CONTINUES THROUGHOUT THE CONSTRUCTION OF THE WATER LINE. CARE IN THE MANNER IN WHICH THE PIPE AND FITTINGS ARE STORED, HANDLED AND INSTALLED WILL GREATLY REDUCE THE POTENTIAL FOR DIFFICULTIES IN OBTAINING ACCEPTABLE BACTERIOLOGIC TESTS.** The wide variety of water main configurations that must be flushed and disinfected require that the Contractor and the Town of Gypsum cooperate to insure that no contamination exists which may be a hazard to public health when the water system is placed in service. The contractor is responsible for disinfection of water lines and shall furnish all materials labor and equipment necessary for the work.

### **2.12.2 Testing And Acceptance Of Water Lines**

Acceptance of water lines is dependent upon proof by testing and inspection that the system has been constructed and prepared to transport domestic water in accordance with specifications and regulations of the Town. The order of testing is as follows:

- a. Continuity of tracer wire
- b. Disinfection (30 ppm for 24 hours, if greater than or equal to 80 ppm, flush at 3 hours with high chlorine.)
- c. Flushing--if flushing results in the discharge of an inordinate volume of dirt, rocks or other debris, the Town of Gypsum may require, at its sole discretion, an additional course of disinfection. The flushing of high chlorine content water to surface stream is prohibited.
- d. Low chlorine
- e. Bacteriological sampling
- f. Hydrostatic testing (See section 2.13)

### **2.12.3 Connection To Existing Water Facilities**

Where connections are to be made to existing water facilities, such connections shall be made in strict conformance with the details shown on the Plans and called for in the Specifications, and shall be begun only after prior consultation with the Town of Gypsum. Connections shall not be initiated until all appropriate fittings are on hand and ready for use. Connections shall be made at such time and conditions to provide for minimum interruption of service to users. Care shall be taken to insure protection of water supplies. The Contractor shall notify the Town of Gypsum at least 48 hours prior to the time that a connection to existing facilities is planned. Disinfection of the connection shall be

accomplished in accordance with current edition of AWWA C651, "Standard for Disinfecting Water Mains".

## **2.13 HYDROSTATIC TESTING**

### **2.13.1 Scope**

The work shall consist of the hydrostatic testing of water distribution lines. Pressure tests and leakage tests shall be conducted concurrently. The Contractor shall provide all required equipment, materials and labor, including any special temporary taps necessary for the testing. A hydrostatic test shall not be considered valid unless the Town of Gypsum witnesses it.

### **2.13.2 General**

- a. The Contractor shall notify the Town of Gypsum 48 hours in advance of all hydrostatic testing.
- b. No tests shall be conducted until all required pipe and joint restraint features are in place.
- c. No allowance shall be made for pressure reductions accomplished by means of pressure reducing valves or other mechanical means.
- d. Prior to tests, inspect valves within the test section to make sure they are fully open. When fire hydrants are in the test section, the test shall be conducted with the hydrant turned off and the hydrant isolation or guard valve open. The operation of all valves shall be verified by the Town of Gypsum staff.

### **2.13.3 Pressure Test**

#### **a. Preparation**

The Town of Gypsum shall slowly fill the pipe section to be tested with water. Remove all air from the test section. The pipe filled with water shall stand a minimum of 24 hours prior to the hydrostatic pressure test, if cement mortar lined pipe is being tested.

#### **b. Test pressure**

1. The test pressure shall be 150% of the working pressure measured at the lowest elevation of the pipeline test section, or 150 psi whichever is greater.
2. Pressure shall be maintained within +/- 5 psig of the required test pressure for at least 2 hours.

### 2.13.4 Leakage Test

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

b. Maximum allowable leakage where:

L = maximum allowable leakage in gallons per hour over two hour test

S = length of pipe tested in feet

D = nominal pipe diameter in inches

P = average test pressure during the leakage test in psig

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

### 2.13.5 Passing

a. The contractor shall locate and repair defective materials and joints if the tests disclose pressure or leakage greater than that specified.

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

The contractor shall submit manufacturer's certification that the hypochlorite materials (no tablets allowed) to be used in the disinfection conform to the AWWA B300 Standard for Hypochlorites.

## 3.00 ROAD AND STREET DESIGN AND LAYOUT

### 3.01 STREETS

The street system shall be designed to provide traffic safety, allow for alternate access and routing in emergencies, be practical to construct and maintain, provide access to all lots, tracts, parcels, adjoining public lands and private lands, and coordinate with existing or planned streets, as may be shown on the master plan. Intersections shall be located and designed to provide conditions optimizing traffic safety.

a. Streets shall bear a logical relationship to the topography.

b. Where two streets intersect a common street from opposite sides, the intersections shall be directly aligned on centerline, or shall be offset not less than 150 feet, centerline to centerline. Where two streets intersect a common street from the same side, the intersections shall be separated by no less than 150 feet centerline to centerline.

c. Intersections shall be designed as nearly to right angles as possible, with no intersecting angles of less than 75 degrees.

- d. There shall be no less than two street rights-of-way accessing a subdivision or major land development, to minimize traffic congestion and/or blockage in times of emergency.

### 3.02 STREET NAMES

Street names shall comply with guidelines shown below, and shall not duplicate any previously platted street names within the Town, unless the new street is a continuation of an existing alignment. Gypsum Fire Protection and Eagle County 911 shall approve all proposed street names.

- a. Road--this suffix should be applied to existing roads comprising the basic network throughout the Town. (ex. Valley Road)
- b. Boulevard--this suffix should be used sparingly and applied only to Major collector streets with 4 lanes and a divided highway configuration. (ex. Lundgren Boulevard)
- c. Avenue--this suffix may be used broadly. Generally "avenues" should run approximately at right angles to "streets". (ex. Railroad Avenue)
- d. Street--this suffix may be used broadly. Generally "streets" should run approximately at right angles to "Avenues". (ex. First Street)
- e. Drive--this suffix should be used for a minor roadway starting at one roadway or street and ending at another. (ex. Rangeview Drive)
- f. Circle--this suffix should be used for roadways that start and end at the same roadway street or avenue. (ex. Quail Circle)
- g. Place--this suffix should be used for relatively long roadways ending in a cul-de-sac or a turnaround. \* (ex. Pine Place)
- h. Court--this suffix should be used for relatively short roadways ending in a cul-de-sac or a turnaround. \* (ex. Vista Court)
  - \*--These suffixes should not be used where the turnaround or cul-de-sac is temporary and the roadway is expected to be extended in the future.
- i. Mall, Terrace, Lane, and other suffixes are generally not appropriate and should not be used.
- j. A logical, systematic pattern of street names should be developed for each subdivision or development. A name assigned to a "street" or "avenue" should not also be used for a "court" or "drive".

### 3.03 STREET NAME SIGNS

Street name signs shall be installed at all intersections in the subdivision, according to the street names approved on the Final Plat. Street name sign design, material, color and installation shall be in accordance with the Manual on Uniform Traffic Control Devices, and Town of Gypsum standards, which are as follows:

- a. Color shall be reflective white letters on reflective green background. Sign shall be six inches in height.
- b. Letter size shall be four inches (4").
- c. Signs naming both streets shall be installed at intersections at the position of the STOP or YIELD sign, on steel posts. Street name signs shall be mounted at an elevation of not less than 7 feet or more than 11 feet above back of curb. (See MUTCD)

### **3.04 SPECIAL ROAD FEATURES**

Circle drives, elephant/mouse ears, etc. shall be designed for fire trucks, trash trucks, snow storage and maintenance. Minimum inside radius shall be 35' minimum. Minimum snow storage shall be 10'x40'; location and number to be determined by Town of Gypsum Public Works Department.

#### **3.04.1 Dead End Streets**

Dead-end streets, shall be prohibited, unless they are designed as a cul-de-sac and serve no more than 20 dwelling units or designed to connect with future streets in which case a temporary turnaround shall be provided. Cul-de-sac or temporary turnaround right-of-way radius shall be 50 feet with 40-foot pavement radius. Minimum length of cul-de-sacs, as measured from the center point of the turn around, perpendicular to the nearest right-of-way line of the intersecting street, shall be sixty feet (60').

#### **3.04.2 Half Streets**

Half streets shall not be permitted. When a proposed half street in a subdivision adjoins another property the entire street shall be platted. Acquiring right-of-way from the adjoining property owner shall be the responsibility and expense of the developer.

#### **3.04.3 Reserve Strips**

Reserve strips, controlling access to streets, are permitted only when the control of such strip is given to the Town under conditions approved by the Planning Commission and Town Council.

### **3.05 ALL WEATHER ACCESS**

All-weather access to the subdivision from Town, County or State roads shall be provided by the developer through public streets that conform to Town of Gypsum Street and Roadway Classification and Design Standards as illustrated in Table 3.07.1.

### **3.06 CONSTRUCTION ACCESS**

Vehicle tracking control pad shall be located at every access point to the construction site. Additionally, a sign shall be placed next to the vehicle tracking control pad to designate the location as the construction entrance/exit.

### **3.07 DETERMINATION OF DESIGN CAPACITY - VEHICLES PER DAY (VPD)**

10.0 VPD PER SINGLE FAMILY DWELLING UNIT  
6.0 VPD PER MULTI FAMILY DWELLING UNIT  
7.5 VPD PER FULL SERVICE RESTAURANT SEAT  
22.0 VPD FAST-FOOD RESTAURANT SEAT  
170.0 VPD PER 1,000 SQUARE FEET OF SUPER MARKET  
160.0 VPD PER ACRE OF BUSINESS PARK  
10.0 VPD PER MOTEL ROOM  
31.0 VPD PER 1,000 SQUARE FEET BUILDING MATERIAL/LUMBER STORE

For uses not specified in the above noted factors, a traffic study, prepared by a registered professional engineer shall be submitted. The traffic study shall be based on "Trip Generation - –Current Edition", Published by the Institute of Transportation Engineers.

**Table 3.07.I  
TOWN OF GYPSUM  
STREET AND ROADWAY CLASSIFICATION AND DESIGN STANDARDS**

<i>DESIGN CRITERIA</i>	<i>MAJOR COLLECTOR STREET</i>	<i>MINOR COLLECTOR STREET</i>	<i>LOCAL COMMERCIAL STREET</i>	<i>LOCAL RESIDENTIAL STREET</i>
<i>DESIGN CAPACITY VPD (3.07)</i>	MORE THAN 10,000	10,000 TO 2,500	LESS THAN 2,500	LESS THAN 2,500
<i>MINIMUM R.O.W.</i>	80'	70'	70'	50'
<i>PAVEMENT WIDTH, FLOWLINE TO FLOWLINE</i>	52'	33'	33'	27'
<i>DRIVING LANES NO. WIDTH</i>	4 EA. 12'	2 EA. 15'	2 EA. 15'	2 EA. 12'
<i>PARKING LANES</i>	NOT ALLOWED	NOT ALLOWED	NOT ALLOWED	NOT ALLOWED
<i>SHOULDER LANES (NO., WIDTH &amp; USE)</i>	2 @ 4' PAVED IF NO CURB & GUTTER	2 @ 4' PAVED IF NO CURB & GUTTER	NONE	NONE
<i>CURB STYLE</i>	VERTICAL	VERTICAL	VERTICAL	MOUNTABLE
<i>GUTTER</i>	24-INCH	18-INCH	18-INCH	18-INCH
<i>PEDESTRIAN &amp; BIKE PATH OR SIDEWALK (3.10)</i>	1 EA. 8'	2 EA. 6'	2 EA. 5'	2 EA. 4'
<i>LANDSCAPED SEPARATION BETWEEN PATH &amp; STREET</i>	8' MIN TO 10' MAX	10'	10'	7' MIN
<i>MINIMUM CROSS SLOPE</i>	2%	2%	2%	3%
<i>DESIGN SPEED</i>	45 MPH	35 MPH	30 MPH	25 MPH
<i>K-VALUE (CREST CURVE)</i>	110 MIN.	50 MIN.	30 MIN.	20 MIN.
<i>K-VALUE (SAG CURVE)</i>	70 MIN.	50 MIN.	40 MIN.	30 MIN. 167 MAX
<i>TEMPLATE DESIGN</i>	<i>MAJOR COLLECTOR</i>	<i>MINOR COLLECTOR</i>	<i>LOCAL COMMERCIAL STREET</i>	<i>LOCAL RESIDENTIAL STREET</i>
<i>MIN. RADIUS</i>	850'	475'	300'	200'
<i>% GRADE</i>	MAX. 6% MIN. 1%	MAX. 8% MIN. 1%	MAX. 8% MIN. 1%	MAX. 8% MIN. 1%
<i>PAVEMENT &amp; STABILIZATION SECTION (3.11)</i>	MIN. 4" HBP MIN. 8" CL6 GEO FABRIC	MIN. 4" HBP MIN. 8" CL6 GEO FABRIC	MIN. 4" HBP MIN. 8" CL6 GEO FABRIC	MIN. 4" HBP MIN. 8" CL6 GEO FABRIC
<i>EQUIVALENT DAILY LOAD APPLICATION( EDLA-18 KIP AXLES) (MINIMUM)</i>	350	200	100	50

### **3.08 EXISTING DESIGNATED ROUTES**

The following existing routes are designated as Major Collector Streets:

- 1) Cooley Mesa Road
- 2) Jules Drive
- 3) CottonWood Pass Road
- 4) US Highway 6
- 5) Valley Road/Gypsum Creek Road

New Developments that will access Major Collector streets will do so via Minor Collector, Local Commercial or Residential Streets. Should the adjacent development cause the improvement of the Major Collector to a four-lane divided boulevard for the total contiguous length of the street and the development, other options may be appropriate. If the developer chooses only to access the Major Collector with other streets, then that developer must agree to pay their pro rata share of the cost of the ultimate road improvement based on traffic generation volume.

The following streets are designated as Minor Collector Streets:

- 1) Spring Creek Road
- 2) Buckhorn Valley Blvd
- 3) The first primary road paralleling Highway 6 between the Eagle River and the railroad right-of-way, and east of the wallboard plant.

### **3.09 ALTERNATIVE TO CURB AND GUTTER**

Consideration will be given to the replacement of curb and gutter with paved shoulders and grass drainage swales separating the sidewalk/bike path from the street for:

- 1.) Low Density PUD conditions;
- 2.) Few intersections
- 3.) Council directed.

Drainage swales shall be designed for the velocities and hydraulic capacity of runoff flows generated by the 25-year storm event. All roads and streets shall be designed to maintain their physical integrity during runoff flows generated by the 100-year storm event. Where this configuration is used, right-of-way width shall be modified to accommodate both transportation and drainage facilities.

When the above alternatives to curb and gutter are used, delineator posts shall be installed on both sides of the street, with reflectors facing both traffic directions. Delineators shall conform to Colorado Department of Transportation, Typical Delineator Installation, Standard Plan #S612-1 sheets 1 through 5. Reflectors shall be in conformance with specifications listed in the Department of Highways, State of Colorado, Standard Specifications for Road and Bridge Construction.

### **3.10 PEDESTRIAN/BIKE PATHS**

Pedestrian/bike paths shall be separated from the street surface as illustrated on the typical sections and as noted in Table 3.07.1. In areas where development can only occur on one side of a street the pedestrian/bike path need only be constructed on that side of the street. In areas where a street will never have any development on either side, but only connects areas of development, a single pedestrian/bike path shall be constructed on only one side of the street. The determination of location for this path shall consider the parameters of topography, safety and ultimate convenience. The structural bike path section design including Hot bituminous pavement (HBP), Aggregate Base Course, Geotextile Fabric, and Subgrade Stabilization shall be prepared by a Professional Engineer Registered in the State of Colorado specializing in Geotechnical Engineering and based on site specific soil and groundwater conditions, with the heaviest load being a pickup-snowplow with a sand bin/spreader in the bed. If the bike path is in a location where it will be crossed by either commercial or residential driveways, then the structural section for the bike path must be consistent with the structural section of the adjacent road or street.

### **3.11 ROAD SECTION DESIGN BY GEOTECHNICAL ENGINEER**

The Road Section Design including Hot bituminous pavement (HBP), Aggregate Base Course, Geotextile Fabric, and Subgrade Stabilization shall be prepared by a Professional Engineer Registered in the State of Colorado specializing in Geotechnical Engineering and based on site specific soil and groundwater conditions. The information provided in Table 3.07.1 above shall be considered the minimum allowable road section design. The subgrade stabilization shall be designed and constructed so that the prepared subgrade surface will comply with all of the Construction Specifications of the Town of Gypsum including compaction and proof-rolling, and shall also be designed to maintain the stabilized condition under all anticipated traffic loading and seasonal fluctuations of temperature and groundwater conditions. If the Geotechnical Engineer does not specify a specific geotextile fabric, then the geotextile used shall be Geogrid BX-1200 (or approved equal) for grid type functions and Mirafi 500X (or approved equal) for fabric functions or proposed approved alternate.

### **3.12 SUBGRADE STABILIZATION IN AREAS OF POTENTIALLY HIGH GROUNDWATER**

Areas of potentially high groundwater will be defined as follows: Areas with evidence or a history of high groundwater with seasonal fluctuations which bring the groundwater level to within 3-feet of the surface at any time during the year. For the purposes of these design criteria, a fine-grained road subgrade material shall be defined as follows: Materials with more than 20% passing the #200 sieve. Based on these definitions, in areas of potentially high groundwater where the road subgrade consists of a fine-grained material, the road subgrade shall be stabilized with a minimum of 24-inches of Class 2 material or pit run material with a quality and gradation approved by the Town of Gypsum, placed over Mirafi 500X geotextile fabric. In any case, road section and subgrade stabilization designs shall be based on saturated conditions for both the subgrade and the aggregate base course in any areas with seasonal groundwater fluctuations where the groundwater level could potentially reduce the strength of the road structure.

### **3.13 ACCESS POINTS**

Access points on to Major and Minor Collector streets may require accel/decel and left hand turn lanes. These shall be studied on a case-by-case basis.

No commercial or residential access point shall enter a Local Commercial or Local Residential street within a distance of 150 feet measured from the centerline of an intersecting Major/Minor Collector street.

### **3.14 INTERSECTIONS**

Intersections of all streets with Major Collector streets shall be provided with right turn acceleration and deceleration lanes on the Major Collector Street.

At the intersection of a Minor Collector to a Major Collector or at the intersection of two Major Collector streets, both streets shall be provided with a left turn holding lane and a left turn acceleration lane in addition to right turn acceleration and deceleration lanes.

The vertical alignment of all road intersections for Collector streets shall have grades no less than 1.5% and no greater than 3% and for local streets no less than 1.5% and no greater than 4% in all four directions for a minimum distance of 100 feet as measured from the intersecting street right-of-way line.

In no case shall grade of the flow line of any asphalt paved drainage channel be less than 1.5% or the grade of any concrete paved drainage channel be less than 1.0%, including the drainage channels created in the course of intersecting two streets.

The length of the transition from road section with a typical centerline crown to a road section with a cross slope to match an intersected street shall not be more than 100 feet. All minimum grades as stated in this manual shall apply to the transition portion of roads.

### **3.15 INTERSECTION SIGHT DISTANCE**

At intersections of roads and streets, clear zones shall be maintained to provide sight distance for the vehicle on the intersecting road (stop or yield) to observe a moving vehicle on the through or intersected road. The sight distance shall be measured from a point on the intersecting street (stop or yield), which is 20 feet from the edge of pavement on the through or intersected street. Assume that the height of the eye is 3.5 feet and height of the object is 4.5 feet. Nothing in the line of sight should be higher than these values. The minimum sight distance shall be in accordance with Table, 3.15.1.

DESIGN SPEED OF THROUGH STREET	MINIMUM CORNER INTERSECTION SIGHT DISTANCE (FEET)
20	210
25	260
30	310
35	365
40	415
45	465
55	515
60	650

**TABLE 3.15.01**

### 3.15.1 Private Signs at Intersections

All proposed signage at intersections shall conform to the restrictions set forth in the Town of Gypsum Municipal Code, Title 18.64 'Sign Regulations'.

### 3.15.2 Traffic Control Devices

The following represents a sampling of common signs used within the Town of Gypsum. For a more exhaustive list, please see the Manual on Uniform Traffic Control Devices for streets and Highways.

Sign	MUTCD CODE	CONVENTIONAL ROAD SIZE	OVERSIZED ROAD SIZE
<b>STOP</b>	R1-1	30X30	36X36
<b>Yield</b>	R1-2	36x36x36	48x48x48
<b>4-Way</b>	R1-3	12x6	12x6
<b>Yield for Pedestrians (Middle of Road)</b>	R1-6	12x36	NA
<b>Speed Limit</b>	R2-1	24X26	36X48
<b>Mandatory Mvmt Lane Control</b>	R3-5	30x36	NA
<b>Optional Lane Control</b>	R3-5	30x36	NA
<b>Mandatory Mvmt Lane Control (LLMTL/RLMTR)</b>	R3-7	30x30	36x36
<b>Advanced Intersection Lane Control</b>	R3-8	60x30	NA
<b>Advanced Intersection Lane Control</b>	R3-8A/B	60x30	NA

### 3.16 UTILITIES AND STREET CONSTRUCTION

Street construction shall not proceed beyond subgrade preparation until all utilities, under any part of the street, are completed and inspected.

### **3.17 STREET LIGHTS**

Streetlights shall be installed at all intersections and fire hydrants, at intervals of no greater than 400 feet along street alignments without intersections. Streetlights for residential areas shall be ELA COMPANY, L-180-4BH/P-3016-10'/MTG1874C, minimum 70W, high-pressure sodium/120V; finish-painted black or approved alternative by the Public Works Department. Lights shall have Lexan Lenses and be mounted with the photocell unit facing north.

Streetlights in commercial areas shall be installed at all intersections with an illumination level of 1.4 foot-candles throughout the intersection; at all fire hydrants providing an illumination level of 1.0 foot-candles within a 20 foot radius of the fire hydrant; in parking areas providing an illumination level of 1.0 foot-candles throughout the parking area. Lighting structure style and design shall be submitted to the Town of Gypsum for approval.

### **3.18 PAVEMENT MARKING**

Street pavement marking shall be provided on all Major Collector, Minor Collector and Local Commercial Streets and at the intersections of all Local Residential Streets with Major and Minor Collector and Local Commercial Streets.

#### **3.18.1 Scope**

The work consists of all material, labor and equipment for the applications of the pavement marking of streets and highways in accordance with the design criteria for streets.

#### **3.18.2 Striping Specifications**

The work shall be accomplished in accordance with the Manual of Uniform Traffic Control Devices for Streets and Highways (MUTCD), the Colorado Supplement and Section 627 of the State Department of Highways, State of Colorado, Standard Specifications for Road and Bridge Construction.

#### **3.18.3 Materials**

Paint materials used may be either of the following alternatives:

- a. Epoxy Pavement Marking Material as called for in section 713.16, Division of Highways, State of Colorado, Standard Specifications for Road and Bridge Construction;
- b. Oil Base Pavement Marking Paint as called for in section 708.05, Division of Highways, State of Colorado, Standard Specifications for Road and Bridge Construction.

#### **3.18.4 Pavement Preparations And Application**

Prior to application of pavement marking material, all ice, snow, sand and debris shall be removed from the surface of the pavement and said surfaces shall be as least 40 degrees F and rising. Application shall be accomplished in accordance with the specifications noted herein and the pavement-marking plan.

### **3.18.5 Crosswalks And In-Pavement Directional Arrows**

Cross walks and in-pavement arrows shall NOT be painted onto asphalt. Rather, crosswalks and arrows shall be ground into the pavement. The actual arrow and crosswalk material shall be made of preformed thermoplastic.

### **3.19 GUARDRAIL**

Guardrail shall be provided for streets and roads that do not have curb and gutter when conditions warrant the need for guardrail as defined in Chapter 5: ROADSIDE BARRIERS, in the most recent edition of Roadside Design Guide of American Association of State Highway and Transportation Officials. Specifications and design for materials and placement of guardrail shall be in compliance with Colorado Department of Transportation Standard Plan No. M-606-1 (12 sheets), and Section 606 of Standard Specifications for Road and Bridge Construction.

### **3.20 ROAD AGGREGATE**

#### **3.20.1 Scope**

This work shall consist of furnishing and placing one or more courses of aggregate on a prepared surface in accordance with these specifications and in reasonably close conformity with the lines, grades, thickness, and typical cross-sections shown on the plans and/or called for in the specifications.

#### **3.20.2 Materials**

All aggregate shall consist of clean, hard, durable particles of crushed gravel or stone free from soft, thin, elongated, or laminated pieces or organic material, and the material retained on the #4 sieve shall show a percentage of wear of not more than 50 percent (50%) when subjected to 500 revolutions in the ASTM C-131-81 test.

Sub base aggregate shall meet the standards of Class 1 and base course aggregate shall meet the standards of Class 6 as called for in the most recent edition of Division of Highways, State of Colorado, Standard Specifications for Road and Bridge Construction.

Geotextile fabric, when called for specifically or as an alternative shall be Mirafi 500X or approved equal.

All aggregate material shall be placed in a manner, which will minimize size segregation and disturbance of the sub-grade configuration. When geotextile fabric is used, it shall be laid on the sub-grade, and the gravel shall be bladed over it without running trucks or aggregate placement equipment directly on the fabric. If the required compacted depth of sub-base course exceeds six inches, the course shall be constructed in two or more layers of approximately equal thickness. The maximum compacted thickness on any one layer shall not exceed six inches. When vibrating or other approved types of special compacting equipment are used, the depth of a single layer of the course may be increased upon approval by the Town of Gypsum.

### **3.20.3 Placing**

Each layer shall be compacted to a density of not less than 95 percent of maximum density as determined in accordance with ASTM 1557, AASHTO T 180 (Modified Proctor) unless otherwise called for on the plans. The surface of each layer shall be maintained during the compaction operations in such a manner that a uniform texture and surface is produced and the aggregates firmly keyed. Water shall be uniformly applied over the materials before or during compaction in the amount necessary for proper consolidation.

### **3.20.4 Proof Rolling, Stability**

Following the placement and compaction of the aggregate, the entire surface shall be proof rolled under the direction and observation of the geotechnical engineer. Proof rolling shall be accomplished using a pneumatic-tired tandem axle dump truck or water truck loaded to a minimum of 18 kips per axle. Surface that is pumping or is deformed by the proof roll vehicle shall be reworked and retested. If the pumping or deformation is the result of subgrade failure due to poor compaction or excessive moisture, the subgrade condition must be corrected and the aggregate replaced and compacted. Subsequent layers, such as hot bituminous pavement or concrete pavement shall not be placed on the aggregate surface until the Town of Gypsum has received compaction and proof rolling reports from the geotechnical engineer approving the aggregate section.

## **3.21 CURB, GUTTER & SIDEWALK**

### **3.21.1 Scope**

The work consists of the construction of concrete curbs, combined curbs and gutters, sidewalks, driveways, driveway approaches, curb turn fillets, valley gutters and miscellaneous concrete work related thereto.

### **3.21.2 Materials**

(a) Portland Cement Concrete.

Portland cement concrete shall conform to the requirements for air-entrained Portland cement concrete as called for in section P.C.C., PORTLAND CEMENT CONCRETE, of the specifications and shall contain Fibrous Reinforcing Material as specified.

(b) Reinforcing Steel.

Reinforcing steel shall conform to the requirements of section P.C.C., PORTLAND CEMENT CONCRETE, of the specifications.

(c) Pre-formed Expansion Joint Material.

Pre-formed expansion joint material shall conform to the requirements of AASHTO M-213, ASTM D-994, ASTM D-1751, OR ASTM D-1752.

(d) Truncated Domes.

For all intersections, truncated domes shall be installed on all handicap ramps. Truncated domes shall meet ANSI requirements; however under no circumstances will rubber/plastic truncated domes be permitted. The following Vendors develop products that meet ANSI and ADA requirements, however this is not an exhaustive list. Other vendors may be used, with approval of Town Engineer.

<b>Vendor Name</b>	<b>Product</b>	<b>Phone Number</b>
East Jordan Iron Works	Cast Iron Warning Plates	800-874-4100
Neenah	Cast Iron Warning Plates	800-558-5075

### **3.21.3 Subgrade Preparation**

The work shall include the excavation and preparation of subgrade for all concrete structures to the lines and grades shown on the plans, called for in the specifications and/or staked in the field by the Town of Gypsum in accordance with the specifications for EARTHFILL and ROAD AGGREGATE. All soft, yielding and otherwise unsuitable subsoil material shall be removed and replaced with suitable compacted backfill. Filled sections shall extend a minimum of one foot (1') outside structure limits and shall be compacted. The subgrade shall be compacted to 95% of maximum dry density as determined by ASTM D-698, AASHTO T-99, standard Proctor method. The subgrade shall be in a moist condition at the time that the concrete is placed.

### **3.21.4 Concrete Placement**

The forms shall be of wood, metal or other suitable material that is straight and free from warp, having sufficient strength to resist the pressure of the concrete without displacement and sufficient tightness to prevent the leakage of mortar. Forms shall be placed and secured in the configuration necessary to construct the intended structure in close conformity to the plans and specifications. Forms shall extend for the full depth of the concrete and shall be braced and staked so that they remain in both horizontal and vertical alignment until their removal. The forms shall be cleaned and coated with an approved form-release agent before concrete is placed against them. Flexible forms or rigid forms of proper curvature may be used for curved structures. Low roll curbs may be formed without the use of a face form by using a straight edge and template to form the curb face. When curb face forms are used, they shall be removed as soon as possible to permit finishing. Reinforcing steel, as shown on the plans, shall be placed and secured in the forms prior to placement of concrete. Reinforcing steel shall be secured in the designed position in a manner that will prevent movement during the process of concrete placement and finishing. The concrete shall be deposited in the forms in a manner that will not cause segregation and then it shall be tamped and spaded or vibrated mechanically for thorough consolidation to a dense concrete free of air pockets. The concrete shall be worked until the coarse aggregate is forced down into the body of the concrete and no coarse aggregate is exposed. The surface shall then be floated with a wooden float to a smooth and uniform surface. When the concrete has hardened sufficiently, the appropriate finished surface shall be applied.

### **3.21.5 Finishing**

Finishing of concrete structures shall be either "smooth" or "broomed" depending upon the primary function of the structure. Structures whose primary function is the transport of water shall be finished smooth. Structures whose primary function is for a walking and/or driving surface shall be given a broomed finish. Broom finish shall be accomplished with a broom of approved type. The strokes shall be square across the structure surface from edge to edge, perpendicular to the predominant traffic direction on the structure. Adjacent strokes shall overlap and shall produce regular corrugations not over one-eighth inch (1/8") in depth without tearing the floated concrete surface. Concrete that is adjacent to forms, and formed joints shall be edged with a suitable edging tool, which will produce an even, smoothly

rounded corner with a radius of less than one inch. The same radius shall be used throughout the work. If the work connects to pre-existing concrete work, the edging radius of the new work shall be matched as near as possible to that on the existing concrete work.

### **3.21.6 Stripping Forms**

Forms shall be removed at such time as the concrete is sufficiently set that removal will be accomplished without danger of chipping or spalling. When forms are removed before the expiration of the curing period, the edges of the concrete shall be protected with moist earth, or sprayed with curing compound. All forms shall be cleaned, coated with an approved form-release agent and inspected for defects before they are used again.

### **3.21.7 Jointing**

Transverse weakened-plane contraction joints shall be constructed at right angles to the long dimension of the structure. Joint depth shall average at least 1/4 of the cross-section depth of the structure. Contraction joints shall be no greater than 15 feet apart for curb and gutter, valley gutter, curb structures, driveways and streets; and shall be no greater than 6 feet apart for sidewalk sections. Expansion joints shall be placed in concrete structures using specified materials during placement of concrete. Expansion joints shall be constructed at right angles to the long dimension of the structure. Expansion joints for sidewalk, curb and gutter and valley gutter shall be no farther apart than 200 feet. Expansion joints for streets, driveways and alleys shall be no farther apart than 500 feet. Additionally, expansion joints shall be constructed at all "cold" joints.

### **3.21.8 Curing**

Immediately upon completion of the finishing, concrete shall be moistened and kept moist for a minimum of 72 hours. In lieu of wetting, use liquid membrane curing compound (white) conforming to ASTM C 309, or sheet material conforming to ASTM C171.

### **3.21.9 Tolerances**

The work shall be performed in a manner, which results in the completed structure being true to design line and grade, uniform in appearance and structurally sound. Items found with unsightly bulges, ridges or other defects shall be removed and replaced to the satisfaction of the Town of Gypsum. When checked with a ten-foot straight edge, the structure shall not deviate from grade by more than one-quarter inch (1/4") and shall not deviate from alignment by more than one-half inch (1/2"). Surfaces of the sidewalk, curb and gutter that shall remain exposed after completion of adjacent backfilling and paving shall be free of any observable voids. Following the completion of the work, including asphalt pavement, if any, the concrete surfaces (and asphalt surfaces) shall be flooded with water for "flow testing". The flow testing shall be coordinated with and observed by the Town of Gypsum. Any puddles of water which remain, after all flow has stopped, which are greater than one-quarter (1/4) of an inch deep or cover more than six (6) square feet shall be corrected.

## 3.22 STREET CUT

### 3.22.1 Work Commencement and Permitting

Street cuts will only be allowed between April 15 and November 15 and only after issuance of a permit to construct in the public way from the Town of Gypsum. All street cuts will require the completion of a permit to construct in the right of way. This permit is required for existing town roads as well as new streets that have yet to be dedicated. A permit form may be found at <http://www.townofgypsum.com>. Street cuts may be allowed at other times of the year, weather permitting, when reviewed on a case by case basis, and approved by the Town of Gypsum with special procedures in place.

All bonds and permits must be in place before a street cut will be allowed. Street cuts shall be performed at the sole expense and responsibility of the owner and contractor.

### 3.22.2 Materials and Placement

Disturbed bedding around water and sewer main lines will be restored in accordance with existing construction specifications.

The existing asphalt pavement near the road cut shall be cut and removed over width as illustrated on the Road Cut Detail (see Appendix C-8). This may occur either before or after the trench excavation has been made and backfilled, however, the minimum cutback of asphalt shall be measured from the edge of the actual, final trench width.

Class 6 aggregate, shall be compacted to a density of not less than 95% standard proctor, plus or minus 2% moisture of O.M.C. and a 100% within the top two feet. Geotextile fabric, such as Tensar BX-1100, Mirafi 500X or approved equal shall be placed under the Class 6 aggregate backfill. When flow fill is used, geotextile fabric is not required.

A thickness of hot bituminous pavement shall be placed in accordance with current construction specifications and the road section design prepared by a geotechnical engineer. The minimum thickness shall be four (4) inches.

#### a.) Infrared Patch Option.

Hot bituminous pavement patch joints shall be sealed and secured by means of infrared heating systems applied by qualified operators, approved by the Town of Gypsum, with equipment specifically designed for the sealing of hot bituminous pavement patches. Documentation shall be submitted to the Town of Gypsum that verifies the qualifications of the equipment and operators for infrared sealing prior to commencement of work.

Equipment must be specifically built for INFRARED asphalt repairs, and capable of producing true INFRARED RAYS. Open flame heat sources such as weed burners and shop heaters are not acceptable methods.

Preparation of the areas to be patched requires the exposure of the full depth of the asphalt and cleaning of the edges to be contacted and repaired by infrared. Full depth penetration is required to soften the existing pavement in order to provide thermal bonding of the old and new surface. Asphalt is placed and compacted in lifts as needed while maintaining adequate temperature for bonding, therefore producing

a seamless asphalt repair. All asphalt repairs shall be sealed on the surface with CSS1H. The desired end result of the patch is to provide a surface over the patch that is equal to or better than adjacent undisturbed pavement.

b.) Roto-Mill and Overlay Option (Also Known as Tee Patch)

Asphalt shall be cut back from the trench edge as illustrated on the Street Cut Detail. A minimum width of 2 feet of additional asphalt, adjacent to the trench, shall be roto-milled to a depth of one-half the original asphalt thickness (minimum 1.5 inches). The roto-milled area shall be replaced in the final overlay of the entire trench area.

All excavated material shall be removed from the site and properly disposed.

### **3.22.3 Schedule**

The street cut patch shall be completed within 48 hours (match municipal code) of completing the road cut.

### **3.22.4 Temporary Pavement Patch**

When asphalt availability does not permit repair within 10 days, concrete flow fill, as specified in PORTLAND CEMENT CONCRETE shall be used as a temporary patch.

The owner and contractor shall be responsible for maintaining the road cut as needed until the hot bituminous pavement is permanently placed.

### **3.22.5. Roadway Usage Between Operations**

When work is not actually in progress, Contractor shall make open, passable, and maintain to traffic such portions of the Project and temporary roadways or portions thereof as may be agreed upon between Contractor and District and all other authorities or parties having jurisdiction over properties involved.

### 3.23 PARKING LOT LAYOUT

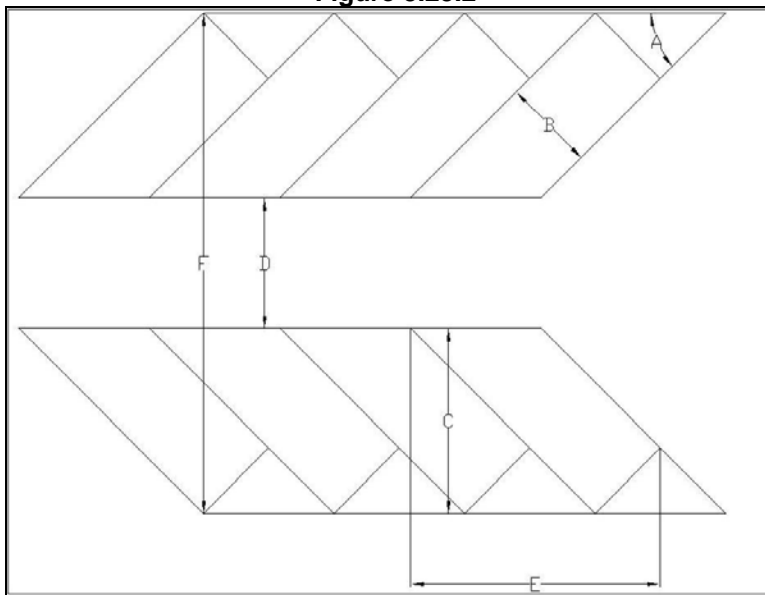
Table 3.23.1 and Figure 3.23.2 are to assist in the design of a parking lot. Information regarding how many spaces dependant upon business type is available in the Town of Gypsum Code and Regulations, section 17.24.120.

**Table 3.23.1**

A	B	C	D	E	F
0 deg	9'	9'	12'	22.4'	42'
	10'	10'	12'	21.9'	44'
45 deg	9'	16.8'	13'	15.8'	57.6'
	10'	17.1'	13'	15.5'	58.2'
90 deg	9'	20'	24'	9.0'	64'
	10'	20'	24'	10.0'	64'

- A – Parking Angle**
- B – Stall Width**
- C – Length of Stall to Curb**
- D – Aisle Width**
- E – Curb Length per Stall**
- F – Width of Double Row with Aisle**

**Figure 3.23.2**



### 3.24 ALLEYS

Alleys shall not be planned in residential subdivisions; however, alleys or other suitable means of service access shall be provided in commercial and industrial developments.

### **3.25 BLOCKS**

Block lengths and widths shall be designed to allow convenient access and circulation for emergency vehicles and be practical and compatible with the overall design of the subdivision, topography, and natural features.

Where block lengths exceed 1,000 feet, pedestrian rights-of-way no less than 10 feet wide shall be provided through blocks, where needed for pedestrian circulation.

## **4.00 DRAINAGE ANALYSIS AND SYSTEMS DESIGN CRITERIA**

### **4.01 GENERAL**

Drainage systems for development shall be designed and constructed to insure that the public and private property and improvements within the development and down stream from the development are not adversely affected by storm water flow resulting from rainfall and snowmelt and associated hazards such as erosion, sedimentation and debris flow. Adequate positive drainage must be provided for all streets, gutters, ditches, culverts, storm sewers and other forms of drainage structures, which must drain to natural drainage ways, or other means of positive conveyance of runoff water. All drainage structures, road and street configurations and site grading shall be designed and constructed to carry the flow from a (Base Storm) 100 year frequency storm event with no damage to the drainage system or any public or private structures, improvements, infrastructure, or property.

The developer shall investigate and where appropriate, provide mitigation and adequate drainage capacity for storm flow as set forth in this section. Additionally, the developer shall investigate the potential for debris flow and provide detention storage with provisions for maintenance and cleanup following a debris flow event, as outlined in this section.

Drainage analysis and design of all systems related to drainage shall be prepared by a Colorado Registered Professional Engineer and submitted to the Town of Gypsum for review and approval. Analyses must be accomplished by methods acceptable to the Town of Gypsum.

### **4.02 OFF SITE DRAINAGE AND BASE STORM DISCHARGE**

The major drainage system which serves as the primary drainage channel for the development and all drainage structures therein must safely convey the Base storm peak discharge and maintain it within the confines of public rights-of-way and easements.

The off-site Base storm event flow must be conveyed through the site in a manner which will not result in a peak flow at the discharge from the site which would be greater than the historic, pre-development peak flow. Street surfaces shall not be used to convey off-site Base storm event flow through the site, but these flows must be conveyed through the site in structures which do not result in an increase in flow rate from this off-site flow.

#### **4.03 MINOR STORM EVENT AND MITIGATION BY DETENTION**

The minor drainage system which collects on-site drainage and conveys it through the development to primary drainage channels shall consist of curb, gutter, inlets, storm drains, culverts, swales, ditches and detention facilities and shall be designed, at a minimum, to convey flows from the Minor storm (25 year frequency) event and shall be designed to maintain their integrity if overtopped by flows from a Base storm (100 year frequency) event. The post-development peak discharge for the Minor storm event shall not exceed the historic or pre-development peak discharge conditions for the Minor storm event.

If there is an increase in peak discharge from either the Minor or Base storm event, due to the change in site conditions as a result of the development, mitigation of the peak discharge must be accomplished by either detention or conveyance of peak discharge flow directly into Gypsum Creek or the Eagle river through drainage systems that do not have any adverse effect on any public or private property or improvements.

The mitigation of the peak discharge is required for each drainage channel that leaves the development and not simply the development as a whole. Trans-basin diversions of drainage shall be prohibited unless provisions are made for transportation of Base Storm peak flow and the potential accumulative effects thereof directly to the Eagle River without any adverse effect on any public or private property, infrastructure or improvements.

The design and implementation of mitigation of a storm event post-development flow must consider and mitigate any additive effect that the drainage from the site may have on other previously developed downstream sites.

When the drainage discharge from a development is modified from a pre-development "sheet flow" to one or more points of concentrated, post-development flow, facilities must be provided to convey the concentrated flow through the downstream properties to the next, existing, natural or created concentrated flow structure which is hydraulically capable of handling the Base Storm flow and the potential accumulative effects thereof, without any adverse effect on any public or private property, infrastructure or improvements.

#### **4.04 DEBRIS FLOW MANAGEMENT SYSTEMS**

Developments that may be subject to debris flows shall provide an analysis of the potential debris flow conditions and character, prepared by a geotechnical engineer with experience in debris flow management. The analysis shall establish a bulk-loading factor for the potential debris content to be expected in the flow from a 100-year storm event. The analysis shall also include an estimate of the gradational analysis of the potential debris.

Facilities shall be designed and constructed to detain the portion of the potential debris material which may be retained behind screening systems with a maximum opening size of 4 inches and to convey the water and the debris material passing the screening system, to surface drainage facilities where it may be cleaned up. In all cases, the minimum amount of debris, which may be assumed to be retained, shall be 50% of the debris produced during the base storm event. Under no circumstances shall debris flow be directed to underground storm drainage systems (storm sewers).

#### 4.05 CALCULATION METHODS

Determination of storm runoff shall be made by the methods defined in the following Table.

AREA OF BASIN FOR DETERMINATION WHICH PEAK FLOW OR HYDROGRAPH IS BEING CALCULATED	SPECIFIC APPLICATIONS AND/OR BASIN CHARACTERISTICS	METHOD
LESS THAN 25 ACRES	TO DETERMINE STORAGE	MODIFIED
	VOLUME FOR PEAK DISCHARGE CONTROL WHERE BASIN CHARACTERISTICS ARE APPLICABLE TO THE RATIONAL METHOD	RATIONAL METHOD
ZERO TO 5 ACRES	AREA CHARACTERISTICS	SCS TR-55
	NOT APPLICABLE TO RATIONAL METHOD	
MORE THAN 5 ACRES AND LESS THAN 25 ACRES	IF ONLY ONE MAIN TRIBUTARY	TR-55
	IF THERE ARE MULTIPLE TRIBUTARIES	TR-20
MORE THAN 25 ACRES AND LESS THAN 640 ACRES	ALL CIRCUMSTANCES	TR-20
MORE THAN 640 ACRES		ARMY CORPS OF ENGINEERS HEC-1

Exemptions from the peak discharge control requirement are as follows:

- 1) Residential development occurring which does not require new subdivision of land.
- 2) Subdivisions which will result in a gross residential density of two (2) dwelling units per acre or less.
- 3) Waivers from peak discharge control requirements must be requested in writing and must include supporting engineering documentation. Waivers may only be granted when:
  - a. Increase in peak discharge for the Minor storm from the subdivision is less than ten percent (10%) over historic levels.

- b. It has been determined and can be demonstrated that natural or man made detention exists downstream and there is adequate capacity to handle the increased peak discharge. The subdivider has obtained legal right to utilize the required capacity of the existing facility.
- c. It has been determined that detention will cause a deleterious impact relative to Base storm drainage and peak discharge.
- d. Additions to existing structures do not result in a net increase of impervious area of a basin by more than fifty percent (50%).

The size and modeling of detention structures shall be calculated using the following methodologies:

**A. Hydrology:** TR-55, TR-20 and HEC-1 may be used to calculate the flow hydrology for both the Minor and Base storm events for off-site drainage and for calculating inflow hydrographs for the design of drainage detention facilities for on-site drainage. In the course of determining the Time of Concentration for the hydrologic analysis, "Overland Flow" or "Sheet Flow" shall be limited to a maximum length of 300 feet.

The Rational Method may be used in calculating on-site flows for the design of water conveyance structures. The Rainfall Intensity Curve included herein (Time-Intensity-Frequency Values) on page 54 shall be used for any Rational Method calculations within the Town of Gypsum.

When storm flows exceed 100 cfs an analysis of the water surface profile and a delineation of the flood plain must be provided using Standard Step or HEC-2 methodology.

**B. Detention Pond Analysis:** A routing analysis of runoff through the detention structure is required. This analysis shall include an inflow hydrograph, a stage storage curve of the detention basin and a stage discharge curve of the outlet structure. Acceptable computer programs for the preparation of the routing analysis are: Pond-2 by Haestad Methods and the Hydrologic module provided with the Soft Desk Civil Design software.

When drainage detention structures are used to mitigate post-development storm water flows, the drainage detention structures shall be designed for the maximum allowable impermeable area with the development at build-out conditions. Following is a table that provides the minimum acceptable percentage of impervious areas for various developments. For developments not included on this table, the maximum potential impervious areas will be determined by the Town of Gypsum zoning subdivision regulations, zoning regulations, land development code, and building codes.

**Table 4.05**  
**Minimum Acceptable Percentage of Impervious Areas for Developments**

Development Type/ Density	Percent Impervious
Commercial/ Light Industrial/ Industrial	80%
Residential - Average Lot Size: 0.125 Acre or less	67%
Residential - Average Lot Size greater than 0.125 Acre and less than or equal to 0.25 Acre	40%
Residential - Average Lot Size greater than 0.25 Acre and less than or equal to 0.33 Acre	32%
Residential - Average Lot Size greater than 0.33 Acre and less than or equal to 0.5 Acre	27%
Residential - Average Lot Size greater than 0.5 Acre and less than or equal to 1.0 Acre	22%

#### **4.06 DRAINAGE DESIGN CRITERIA**

The following criteria shall be used in the design of drainage systems.

**A. Pipe Size:** The minimum storm sewer main size shall be 18-inch I.D. Under special conditions, such as low potential tributary flow, 12-inch I.D. storm sewer main will be considered. The minimum cover from top of pipe to finished grade shall be 2 feet. The minimum cover from backfill surface to top of pipe shall be 12-inches prior to crossing with heavy equipment.

When post-development storm water flows are to be mitigated by conveying the flows downstream as outlined in this manual, the required hydraulic capacity for the drainage conveyance structures shall be determined based on the maximum allowable impermeable area with the development at build-out conditions. Table 4.05 provides the minimum acceptable percentage of impervious areas for various developments. For developments not included on this table, the maximum potential impervious areas will be determined by the Town of Gypsum zoning subdivision regulations, zoning regulations, land development code, and building codes.

**B. Curved Storm Sewer Alignment:** For storm sewers, which are designed for construction in a curved alignment, the maximum deflections at pipe joints shall not exceed the maximum deflection called for in the manufacturer's recommendations. Storm sewers, which are constructed in a curved alignment, shall be provided with an insulated, 10 gauge copper trace wire, "UF" grade insulation or approved equal. The tracer wire shall be secured to the top of the pipe with tape, at intervals no greater than 10 feet and shall be continuous between manholes or daylighted ends of the pipe with no splices allowed. The tracer wire shall extend into the manhole by extending the wire up the outside of the manhole and

entering the manhole under the ring and cover. A steel nail shall be placed on each side of the wire under the cast iron cover ring to prevent crushing of the wire. The crossing of wire and nails under the cast iron cover ring shall be sealed with layers of manhole joint sealant both under and over the wire and nails. The tracer wire shall be tested for continuity after back fill of the pipeline and manholes is complete. Construction control of a curved storm sewer shall be accomplished by the confirmation of the designed elevation on each joint with an engineer's level.

**C. Storm Sewer/Culvert Grades:** All storm sewers and culverts shall be designed and constructed to provide a flow velocity of a minimum of 2 fps during the flow calculated as 50% of the peak flow generated by the 2-year storm event. In no case will a minimum grade for a culvert be required which exceeds two percent (2%).

**D. Storm Sewer Manholes:** Manholes shall be constructed in accordance with the detail drawings. The minimum grade difference in a manhole between the inlet and the outlet shall be 0.10 feet. The Town of Gypsum may, at its sole discretion, require individual manhole surveys to confirm adequate manhole grades, and any manholes found to have less than 0.10 feet of grade difference shall be reset.

Manholes shall be installed at all changes of grade, size, or alignment; at all storm sewer line intersections; and at distances no greater than 400 feet, unless approved in writing by the Town of Gypsum, and shall be located in an access easement for service. Landscaping will not be allowed to cover manholes.

Any manhole wherein the depth from the rim to the top of the pipe is less than 4.0 feet shall be constructed with a full 48-inch barrel section and a flat lid.

When it is necessary to locate a manhole within the pavement section of streets and roads, the manhole lid shall be provided with a concrete collar as illustrated in the details. Every effort should be made to locate the manhole outside of normal vehicle wheel paths. The finished grade of a manhole lid in a paved surface shall be 1/4 inch below the finished grade of the paved surface.

**E. Storm Drain Materials:** Unless specifically approved otherwise by the Town of Gypsum, all storm drain pipe and culverts shall be smooth interior corrugated polyethylene pipe in accordance with AASHTO M-252 and M-294, and shall be ADS- N12 or approved equal. Use of corrugated metal pipe (CMP) is strongly discouraged and may only be used for special conditions when specifically approved by the Town of Gypsum. At all culvert entrances/exits and at the entrance/exit of any day lighted storm sewer, the pipe entrance/exit shall be provided with a Flared End Section. Flared End Sections shall be polyethylene except for pipe sizes for which polyethylene end sections are not manufactured

**F. Surface Drain Systems:** Street sections shall be designed and constructed to prevent sheet flow or cross street drainage. If surface drainage from land adjacent to a street is to be directed to the street right-of-way, the curb and gutter or drainage swale on that side of the street shall be configured and sized to accommodate that drainage without cross street flow except at valley pans. No valley pans shall be constructed except at the position of the "STOP" condition at street intersections.

**G. Pedestrian-Friendly Gutters:** The surface drainage system shall be designed and constructed to result in flow in the curb and gutter section no wider than two and one half feet (2.5 ft) resulting from a two-year intensity storm. When the flow from a two-year intensity storm will result in a curb and gutter flow in excess of 2.5 feet wide, the flow shall be directed to an alternate drainage system such as a storm sewer or drainage channel.

**4.07 STORM DRAINAGE**

**4.07.1 Scope**

The work consists of the construction of storm sewer pipelines including manholes, catch basins, and other appurtenances normally used in storm sewer collection systems. The work includes the furnishing of all materials, excavation of trenches, installation of materials, backfilling, construction of manholes and catch basins, testing, cleaning and restoration of surface.

**4.07.2 Materials**

The type and class of pipe to be used in the work will be as shown on the plans and/or called for in the specifications. The following specifications will apply to pipeline and appurtenant materials.

<u>Material</u>	<u>Specification</u>
Polyvinyl Chloride pipe (PVC)	ASTM D-3034
PVC Over 15 inches I.D.	ASTM F-679
PVC Min. Standard Dimension Ratio	SDR 35
Acrylonitrile Butadiene Styrene (ABS)	ASTM D-2680
Precast Concrete Manhole Rings	ASTM C-478
Reinforced concrete Low- Head Pressure pipe	ASTM C-361-85a
Ductile Iron Pipe	AWWA C-151
Corrugated Polyethylene Pipe & fittings	ASTM F-405
Large Diameter Corrugated Polyethylene Pipe and fittings	ASTM F-667
Polyethylene Corrugated Drainage Pipe	AASHTO M-252
Polyethylene Corrugated Pipe 12" to 48"	AASHTO M-294
Corrugated Metal Pipe (CMP)	AASHTO M-218
	ASTM A-444
	ASTM A-760
	ASTM A-761
	ASTM A-762

#### **4.07.3 Certification by Manufacturer**

When required by the Town of Gypsum, the Contractor shall furnish certification by the manufacturer(s) of the pipe and materials to be furnished, certifying that they comply with the applicable specifications.

All pipe and materials shall be clearly marked with type, class and/or thickness as applicable. Lettering shall be legible and permanent under normal conditions of handling and storage.

#### **4.07.4 Pipe Installation**

The pipe shall be installed in accordance with the manufacturer's recommendations. The Contractor shall provide all tools and equipment including any special tools designed for installing each particular type of pipe used.

The Contractor shall be responsible for the safe and proper storage and handling of all material intended for the work furnished by him or to him and accepted by him until it has been incorporated in the completed and accepted work. Every precaution shall be taken to prevent foreign material from entering the pipe while it is being handled, stored or installed.

### **PROTECTION OF WATER SUPPLIES**

Storm sewer pipelines shall be located a minimum of ten feet horizontally from existing or proposed water mains. Whenever it is necessary that a storm sewer pipe cross above or within 18 inches below a water main, the storm sewer pipe within 10 feet of the water line shall be constructed of either ADS N12 pipe with concrete collar-encased joints or specification PVC sewer pipe with concrete collar-encased joints

#### **4.07.5 Manholes**

Manholes shall be constructed to the specifications set forth in section 1.07, on page 4. However, for storm drainage manholes ONLY, contractors do not need to re-grout the base to a smooth configuration.

#### **4.07.6 Manholes and Catch Basins**

Manholes and catch basins shall be constructed of precast concrete rings with frames and covers and steps in accordance with the details shown on the drawings.

Adjusting rings may be used for adjusting the manhole and catch basin top elevation to coincide with existing ground elevations, except the total height of adjusting rings used per manhole shall not exceed 12 inches. Adjusting rings shall be reinforced with the same percentage of steel as the riser and top.

Manhole and catch basin steps shall be non-corrosive type material such as rubber encased steel, aluminum, or nylon. Steps shall withstand vertical loads of 400 pounds and pull-out force of 1000 pounds.

Manhole and catch basin rings and covers, catch basin grates, and the supporting rings shall be designed to withstand H-20 AASHTO loading. Manhole rings and covers shall be non-ventilated type and shall conform to the standards of the Owner's system.

Manhole and catch basin bases shall be either Precast or cast in place on undisturbed or compacted earth. Manhole and catch basin base concrete shall have a minimum compressive strength of 3000 pounds per square inch in 28 days.

The cutting of pipe as necessary in the course of the work shall be accomplished in neat workmanlike manner without damage to the pipe. The cut shall result in a smooth cut at right angles to the axis of the pipe.

#### **4.07.7 Tests**

New storm sewer pipelines, which are constructed of pipe materials with watertight joints, will be tested to assure the Town of Gypsum that pipe laying and jointing are satisfactory. The contractor shall provide the labor and materials to conduct the following tests in the presence of the Town of Gypsum.

- a. Lamp Test Sewer mains shall be checked by the Town of Gypsum to confirm that the alignment of the pipe has not shifted during backfilling of the trench. The Town of Gypsum will inspect lengths of sewer main between manholes by using a bright light and observing for a "full moon" circle of the opposite end of the pipe. The Town of Gypsum may elect to "lamp" the sewer main from both ends of the pipe. Any visible alignment deflection, earth, rocks or other debris, or any other defect found by the Town of Gypsum shall be remedied prior to acceptance.
- b. Deflection Test. After the pipe has been installed and backfilled, all pipe shall be tested for deflection in the presence of the Town of Gypsum. This test shall consist of pulling a mandrel or rolling a ball (go-no go device) through the pipe. The maximum deflection allowable shall not exceed 5 percent of the pipe's internal diameter for final inspection.
- c. Storm Sewer pipeline shall be water tight with no ground water infiltration.

The contractor shall repair and/or replace any section of the system, which fails to meet testing standards, following which the section shall be retested.

#### **4.07.8 Pipe Bedding and Trench Backfill**

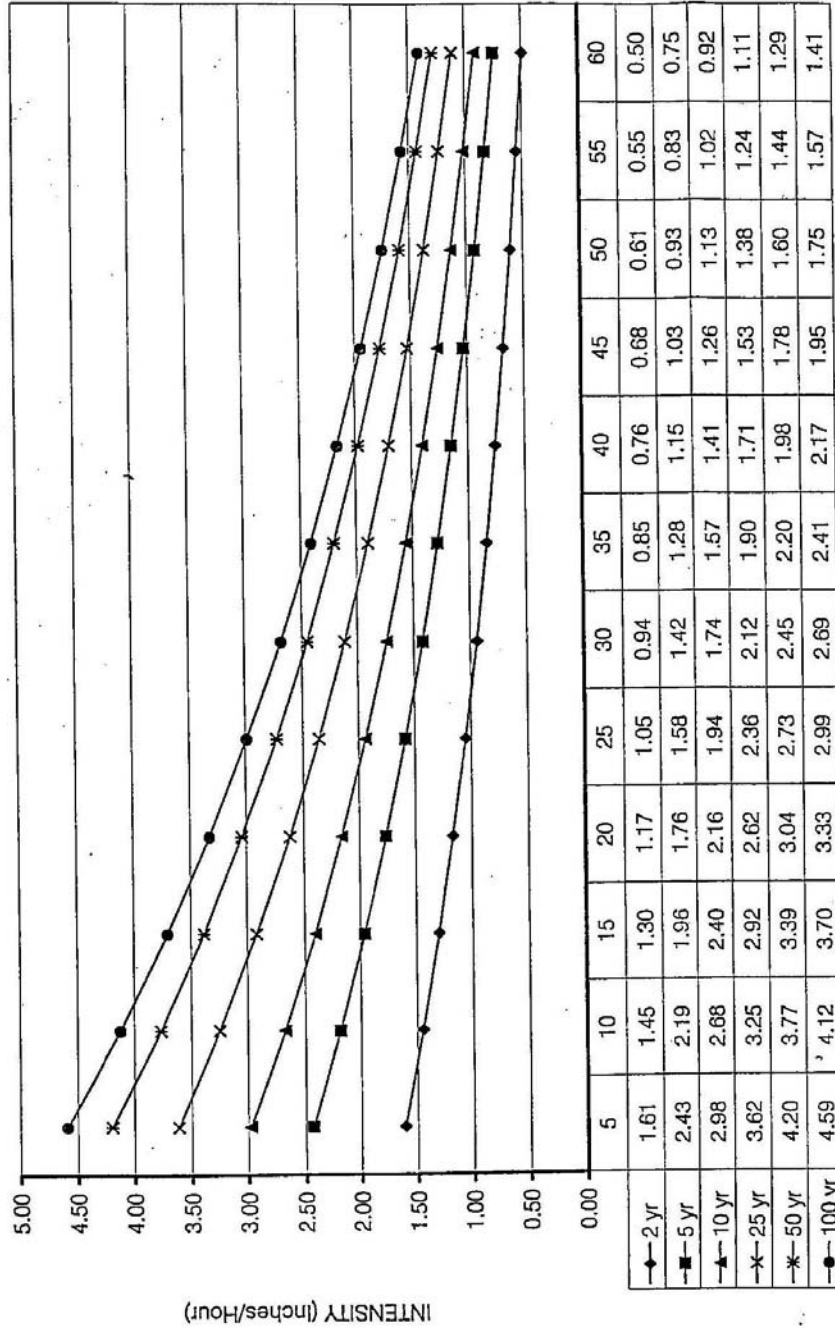
Pipe bedding material placed around and up to a point twelve inches (12") over the pipe shall consist of 3/4 inch washed rock. In the event that the subsurface drainage system is serving as an "under drain" under a water or sewer main, the 3/4 inch washed rock bedding material shall be continued up to a point six inches (6") above the top of the water or sewer main pipe.

After the select pipe bedding material has been placed and compacted as called for above, a single layer of geotextile fabric shall be placed over the top of the washed rock. The geotextile fabric shall be Mirafi 500X or approved equal. After placement of the fabric, the remainder of the trench shall be backfilled. All backfill material shall be free from cinders,

ashes, refuse, organic and frozen material, boulders or other unsuitable material. From one foot above the pipe to a point 24 inches below the surface or road sub grade, stones which do not exceed 15 inches in maximum dimension may be included in the backfill.

# TOWN OF GYPSUM RAINFALL INTENSITY CURVE

Town of Gypsum - TIME-INTENSITY-FREQUENCY VALUES



2 yr    
  5 yr    
  10 yr    
  25 yr    
  50 yr    
  100 yr

## **5.00 UNDERDRAINS AND SUBSURFACE DRAINAGE SYSTEMS**

### **5.01 GENERAL**

Underdrains and subsurface drainage systems shall be constructed as a part of land development infrastructure when it is necessary to lower the level of near surface ground water in order to facilitate the construction and/or long-term maintenance of underground utilities and improve the stability of street subgrades.

### **5.02 PIPE SIZE AND GRADES**

The selection of a pipe size and the design of the vertical alignment for an underdrain or subsurface drainage system shall be made only after consultation with representatives of the Town of Gypsum who can provide historical, empirical data from previous installations within the Town. At a minimum, the underdrain pipe shall consist of 8-inch smooth interior factory perforated SDR35 PVC or ADS-N12 pipe. Underdrain alignments will typically follow sanitary sewer mains and shall be designed and constructed so that the spacing between the underdrain and the sewer main pipe will be as follows: Minimum Horizontal Spacing between outside edges of pipe shall be 3-feet. Underdrain pipe shall be constructed below the Sewer Main Pipe and there shall be a minimum vertical spacing of 12-inches between the bottom of the Sewer Main Pipe and the crown of the Underdrain Pipe.

### **5.03 CLEANOUTS AND MANHOLES**

A cleanout shall be installed at the upstream end of each subsurface drain or underdrain pipeline, at each vertical or horizontal bend and at intervals not greater than 400 feet. Cleanouts shall be constructed in accordance with the standard detail for sanitary sewer cleanouts. A manhole shall be installed at the confluence of two or more pipelines. Manholes shall be constructed in accordance with the standard detail for Storm Sewer Manholes.

### **5.04 SUBSURFACE DRAINAGE**

#### **5.04.1 Scope**

The work consists of the construction of subsurface drainage pipelines including cleanouts, manholes, catch basins and other appurtenances normally used in subsurface drainage collection systems. The work includes the furnishing of all materials, excavation of trenches, installation of materials, backfilling, construction of manholes and catch basins, testing, cleaning and restoration of surface.

### 5.04.2 Materials

The type and class of pipe to be used in the work will be shown on the plans and/or called for in the specifications. The following specifications will apply to pipeline and appurtenant materials.

<b><u>Material</u></b>	<b><u>Specification</u></b>
Polyvinyl Chloride pipe (PVC)	ASTM D 3034
PVC Over 15 inches I.D.	ASTM F 679
PVC Min Standard Dimension Ratio	SDR 35
Acrylonitrile Butadiene Styrene (ABS)	ASTM D 2680
Precast Concrete Manhole Rings	ASTM C478
Reinforced concrete Low Head Pressure Pipe	ASTM C 361 85a
Ductile Iron Pipe	AWWA C151
Corrugated Polyethelene Pipe and Fittings	ASTM 405
Large Diameter Corrugated Polyethelene pipe and fittings	ASTM F 667
Polyethlene Corrugated Drainage Pipe	AASHTO M 252
Polyethylene Corrugated Pipe 12' to 14'	AASHTO M 294

Unless specifically approved otherwise by the Town of Gypsum, all subsurface drainage pipes shall be factory perforated, smooth interior corrugated polyethylene pipe in accordance with AASHTO M 252 and M 294 and shall be ADS N12 or approved equal; or factory perforated, PVC sewer pipe SDR 35. Field perforation of ADS N12 of SDR35 PVC will not be accepted.

## **6.00 EROSION AND SILTATION CONTROL AND REVEGETATION**

### **6.01 TEMPORARY AND PERMANENT EROSION CONTROL DURING CONSTRUCTION**

An erosion and sediment control plan shall be submitted, for review, to the Town of Gypsum as a part of the subdivision or development improvement and infrastructure plan submittal. The approved plan shall be implemented, prior to and throughout the course of construction and surface restoration of the site. Additionally, drainage surfaces shall be constructed to prevent erosion during flood flow resulting from a 100-year storm event. An erosion control plan must be submitted and a permit obtained from the State for all land disturbed over one acre.

The erosion and sediment control plan shall contain provisions for:

- A. The diversion of clear and off-site water from excavation areas and onsite drainage and detention structures;
- B. Velocity and sediment control of onsite drainage through the use of silt fences and straw/hay bale check dams;

C. Protection of culverts and storm drainage systems from sedimentation with straw/hay bale check dams;

D. Protection of surfaces until permanent erosion protection and vegetation are accomplished.

Structures and methods illustrated on Standard Plan No. M-107-1, Colorado Department of Transportation, Standard Details, may be considered in the preparation of the erosion and sediment control plan.

Silt fence shall be constructed around all earthwork areas to control erosion and siltation of adjacent public or private lands. Silt fence shall be comprised of geotextile fabric expressively manufactured for use in silt filtration, attached to and supported by 14 gage livestock wire fence with maximum 6 inch openings. The silt fence shall be a minimum of 30 inches high, above the adjacent grade, with a minimum of 12 inches of the geotextile fabric buried in a 6 inch deep ditch on the upslope side of the fence. The geotextile fabric shall be attached to the upslope side of the livestock fence. The silt fence shall be supported by 5 foot long steel posts, driven 2 feet in the ground on the down slope side of the fence at maximum 10 foot intervals along the fence.

Temporary erosion control measures shall remain in place and functional until the permanent erosion control revegetation efforts are approved by the Town of Gypsum to be sufficiently mature to perform their intended function.

A permanent erosion control plan shall be submitted, for review, to the Town of Gypsum as a part of the subdivision or development improvement and infrastructure plan submittal. The approved plan shall be implemented, as a part of construction of the development or subdivision infrastructure.

The erosion control plan shall contain provisions for:

A. The stabilization of all surfaces potentially subject to erosion from surface water flows or wind. For purposes of surface stabilization design, the following factors shall be used for Maximum Permissible Mean Channel Velocities:

Unprotected soil .....	1.50 fps
Unreinforced vegetation with density equivalent to sod .....	5.00 fps
Loose rip-rap (size designed for velocity).....	10.00 fps

Permanent synthetic reinforced matting for vegetation reinforcement will be considered. Flexible channel lining systems are preferred over concrete pavement.

B. Velocity control of onsite surface drainage systems to maintain the velocity of flood flow from a 100 year storm event at rates less than the maximum permissible erosional velocity of the drainage structure surface;

C. Protection of inlets and outlets of culverts and storm drainage systems from erosion by high velocity flow;

D. Inclusion of minimal maintenance erosion protection surfaces: i.e. synthetic matting reinforced vegetation with dry land species;

## 6.02 REVEGETATION

A permanent revegetation plan shall be submitted, for review, to the Town of Gypsum as a part of the subdivision or development improvement and infrastructure plan submittal. The approved plan shall be implemented, as a part of construction of the development or subdivision infrastructure.

The revegetation plan shall contain provisions for:

A. Complete revegetation of all disturbed surfaces in accordance with the Seeding and Mulching specifications included herein;

B. The planting of live native or ornamental trees and shrubs of species acceptable to the Town of Gypsum where applicable.

In residential developments, live ornamental trees shall be planted at a minimum spacing of 100-feet along each side of residential streets or one tree per lot, whichever is greater.

In areas where roads are constructed through native trees and shrubs, the cut and fill slopes of the road shall be replanted with native tree and shrub species, which match those adjacent to the road in both species and approximate density. These revegetation specifications shall consider vehicular line of site at intersections and curves in the roads. Minimum line of sight shall be maintained in accordance with AASHTO standards. In these areas, the cut and fill slopes should be revegetated only with native grass and low-lying shrub species.

In commercial developments, live ornamental trees, shrubs, and ground cover shall be planted in the landscape areas around the perimeter of the development as well as within non-paved islands within the roads and parking lots and adjacent to buildings. The live plantings shall have an average spacing of one (1) tree and five (5) shrubs per 100-feet of perimeter or per 200 square feet of island. The Town of Gypsum shall approve all tree, shrub, and groundcover species. Drought resistant and "xeriscape" plantings are encouraged to reduce irrigation water usage and consumption.

When revegetation is called for to be accomplished by the placement of sod, the sod shall be drought resistant, blue grass as provided by Rivendell Sod Farm, Inc., of Garfield County, Colorado or approved equal. Areas to be revegetated with sod shall be prepared by rototilling the soil to a depth of 6-inches. Prior to placement of the sod, the area shall be fertilized in accordance with the recommendations of the provider of the sod.

Mutton grass	<i>Poa fendleriana</i>	3 lbs/Acre
Blue joint Reed grass	<i>Calamagrostis canadensis</i>	2 lbs/Acre
Western Wheat grass	<i>Agropyron smithii</i>	2 lbs/Acre
Bunchgrass	<i>Sporobolus airoides</i>	2 lbs/Acre
Rushes	<i>Juncus balticus</i>	1 lb/Acre

## WETLANDS

Rushes	Juncus balticus	3 lbs/Acre
	Scirpus americanus	3 lbs/Acre
Sedge	Carex, spp	3 lbs/Acre
Spikesedge	Eleocharis macrostachya	2 lbs/Acre
Cottongrass	Eriophorum angustifolium	2 lbs/Acre
Marsh Marigold	Caltha leptosepala	.5 lbs/Acre
Lousewort	Pedicularis groenlandica	.5 lb/Acre

Rate refers to Pure Live Seed (PLS) and corresponds to USDA-SCS recommendations, Colorado Agronomy Note No. 61, March 16, 1981.

### 6.02.1 Certification by Manufacturer

When requested by the Town of Gypsum, the Contractor shall furnish certification by the manufacturer(s) of the erosion control materials to be furnished on this project, certifying that they comply with the goals of the project and applicable specifications.

All seed tags and containers shall be delivered to the Town of Gypsum upon request and planting material identification labels shall remain legible and attached to the individual plant until Town of Gypsum authorizes removal.

### 6.02.2 Temporary Erosion Control

During construction activities, efforts shall be made to minimize disturbed soil movement by both wind and water. Should wind erosion become an evident problem, a water truck shall be required to maintain a moist condition in the construction area.

Existing natural vegetation shall be protected where possible.

Straw bales or fabric silt fences shall be installed at critical points where potential water erosion with resultant soil movement off the site exists.

The Town of Gypsum shall direct placement of temporary erosion control measures on a site-specific basis as needed and as phase development of the project occurs.

### 6.02.3 Permanent Erosion Control

Slopes shall be constructed per project drawings and specifications. Erosion control and revegetation procedures shall be implemented according to the angle of repose of the finish grade slope.

Existing natural vegetation shall be protected where possible.

## **6.03 DUST CONTROL**

### **6.03.1 Scope**

The contractor's equipment and construction operations shall not contribute excessively to air pollution by discharging smoke, exhaust fumes, dust or other contaminants into the air in such quantities as to exceed the limits legally imposed by any local, State, or Federal standards.

Control of dust generation on the site and measures taken to prevent dust from leaving the site shall be a continuous process from project start up to final acceptance. The Contractor shall furnish and apply dust palliative on earthwork areas and haul roads to prevent the generation of dust on the site or other work areas.

Dust palliative may consist of water or a dilution of water and an approved substance. Application of water or water mixture shall be accomplished with acceptable sprinkling equipment. Whenever earthwork or other activity is taking place on the site, which could result in the generation of dust, the Contractor shall have a water truck available on site to immediately wet down dust generating areas.

If dust is generated to the degree that it may be observed exiting the site, the dust generating activity shall be recessed until measures are taken to prevent further dust generation.

### **6.03.2 Topsoil**

Pre-Construction;

Prior to any excavation within the project, Contractor shall provide a composite soil sample for each major plant community to an appropriate testing facility for evaluation. The soil evaluation shall consist of the following parameters:

1. Soil Texture
2. Sodium Absorption Ratio (SAR)
3. Electro conductivity
4. PH
5. Organic Content
6. Nutrient content
  - Nitrogen
  - Phosphorous
  - Potassium
7. Micronutrient needs

During Construction;

All available topsoil within the areas proposed for grading shall be stripped to a depth suitable for reuse (as determined from the pre-construction soil tests) and stockpiled for revegetation. Large, woody plant material shall be removed (grubbed) prior to topsoil stripping to minimize the amount of unsuitable materials in the topsoil, however a lesser amount of these materials is desirable since these materials contain native seed or plant parts (rhizomes, roots and sprigs) that will grow and aid in establishing plant cover. The woody plant material shall be either chipped and spread over the final surface as mulch, or removed from the site and properly disposed.

Post-Construction, Revegetation;

Prior to the use of the stockpiled topsoil, the Contractor shall collect and provide a composite topsoil sample to an appropriate testing facility for evaluation. The results of the evaluation shall indicate the required soil amendments to bring the topsoil to the acceptable chemical and organic quality desired for the successful establishment and optimum growing media standards for the specific revegetation treatments. The results of the soil evaluation shall be distributed to the Owner and Town of Gypsum upon completion of the evaluation.

Additional topsoil required to complete the proposed erosion control and revegetation treatments shall be imported, stockpiled, tested and amended as needed to conform to the desired amounts and quality.

### **6.03.3 Revegetation Procedure**

All proposed plantings (trees, shrubs and ornamental plants) shall be installed after topsoil placement and seedbed preparation and prior to seeding of the completed cut/fill slopes. Shrubs shall be spaced 3 to 4 feet apart in a random arrangement or grouping rather than in rows. Planting holes shall be dug perpendicular to the face of the slope and shall be large enough to accept the plant without bending or curling the roots. Remove containers before planting and pack firmly to eliminate air pockets. If soil moisture is deficient, water the plants immediately after transplanting.

Protection of the plantings from wildlife foraging shall be accomplished by installing individual or group forage protection/exclusion devices or by the use of boundary electric (two-wire) fencing. Said protection appurtenances and methods shall be reviewed and approved by the Town of Gypsum prior to installation.

For Repose Angle steeper than 2:1:

Scarification shall be required on all slopes designated for topsoil application. Scarify hard surfaces to provide at least 6- inches of loosened material. Scarification operations shall be performed across the slope, not up and down. Where rock outcrops prevent scarification, additional rocks shall be worked into the slope and combined with cluster plantings of shrubs. Topsoil shall be applied at an average depth of six (6) inches (18.6 cubic yards per 1000 square feet). Surfaces shall be smoothed following topsoil application and all rocks (> 6-inch diameter), debris and unsuitable materials shall be removed.

Fertilizer (slow release nitrogen) and soil amendments should be applied in the final stages of seedbed preparation and worked into the soil surface prior to seeding. Application rates shall be determined by the site-specific soil tests and/or as specified by the Town of Gypsum. Minimum application rates shall be approximately 40 to 80 lbs available Nitrogen and 50 to 100 lbs available P<sub>2</sub>O<sub>5</sub> per acre.

Seed mixtures shall be broadcast seeded by the use of hand held canister seeder or other approved mechanical means using the specified seed mixture and rate.

Immediately following seeding, the area shall be raked to assure that the seed is buried to a depth of 3 inch.

Seeded areas (Dryland Mix) shall be mulched with an application of Soil Guard, Bonded Fiber Matrix (Weyerhaeuser) by a certified applicator according to manufacturers instructions, utilizing standard hydraulic mulching equipment at a rate of 3,000 pounds p acre. The applicator shall not apply the product in advance of rainfall, such that the bonded fiber matrix has an opportunity to cure for a minimum of 24 hours after installation.

For Repose Angle 2:1 or flatter:

Scarification shall be required on all slopes designated for topsoil application. Scarify hard surfaces to provide at least 6- inches of loosened material. Scarification operations shall be performed across the slope, not up and down. Where rock outcrops prevent scarification, additional rocks shall be worked into the slope and combined with cluster plantings of shrubs.

## **6.04 RESTORATION OF GROUNDS**

### **6.04.1 Scope**

Restoration of grounds (also called clean-up) shall be a continuous process from project start-up to Final Acceptance of the work by the Town of Gypsum. The Contractor shall, at all times, keep property on which Work is in progress free from an accumulation of waste material or rubbish caused by employees or caused by the Work, and he shall carry on a constant program to maintain plant areas, structure sites, rights-of-way, and the surface of streets and roads in a condition satisfactory to the appropriate authority, grantor of the rights-of-way, and the Town of Gypsum.

Upon completion of the Work, the Contractor shall remove all remaining rubbish, tools, equipment, scaffolds and surplus materials from the job and leave the Work areas clean and free of debris.

Unless otherwise provided for in the construction specifications, clean-up shall include the re-grading, re-surfacing, rebuilding and replacing of all, asphalt pavement gravel and concrete on roads on which construction took place or affected. It shall also include the regrading or rebuilding of all borrow pits, borrow ditches, irrigation ditches and driveways and the regrading and revegetation of landscaped areas disturbed by the construction. Revegetation of lawn areas shall be accomplished using sod. Clean-up shall commence as soon as the construction site is occupied and shall be a continuous process, if necessary, in order that the site of the work shall always have an appearance and/or utility equal to that which existed at start of the work.

Surfaces shall be smoothed and topsoil shall be applied at an average depth of six (6) inches (18.6 cubic yards per 1000 square feet). Finished surface shall be smoothed following topsoil application and all rocks (> 6-inch diameter), debris and unsuitable materials shall be removed.

Fertilizer (slow release nitrogen) and soil amendments should be applied in the final stages of seedbed preparation and worked into the soil surface prior to seeding. Application rates shall be determined by the site-specific soil tests and/or as specified by the Town of Gypsum. Minimum application rates shall be approximately 40 to 80 lbs available Nitrogen and 50 to 100 lbs available P<sub>2</sub>O<sub>5</sub> per acre.

Seed mixtures shall be broadcast seeded by the use of hand held canister seeder or other approved mechanical means using the specified seed mixture and rate.

Immediately following seeding, the area shall be raked to assure that the seed is buried to a depth of 3 inch.

Seeded areas (Dryland Mix) shall be Hydromulched with an application of Silva-Fiber Plus, wood fiber mulch and tackifier or Town of Gypsum approved equal, using only designated materials per manufacturers recommendations over the seeded area at a rate of 2000 lbs/acre.

Some cut or fill areas may require an alternative treatment once the initial construction practices (Grading) are completed to assure success in erosion control and revegetation.

#### **6.04.2 Alternative Protection**

Site excavation may produce slopes that shall not be conducive to the above erosion control and revegetation practices due to rock outcrops or other impervious subsurface materials. In this case, rock aggregate, which is aesthetically pleasing to view, Crib Retaining Walls, or stacked boulder walls may be substituted for topsoil and planting in limited areas. Revegetation of the rock slopes shall be performed by creating pockets of soil that provide adequate rooting depth. Treatment of bare root plantings with polyacrylamide slurry to hold the moisture around the roots shall be performed at the direction of the Town of Gypsum.

#### **6.04.3 Maintenance**

Successful plant establishment is obtained by the following principles:

- a. Provide for adequate water control of the area;
- b. Prepare a seedbed or site that will provide soil stability during plant establishment;
- c. Use proper planting techniques at the proper season;
- d. Mulch to protect the soil and provide a better environment for plant growth;
- e. Fertilize and apply soil amendments as needed; and
- f. Protection from wildlife (Deer and Elk, etc.) foraging.

Artificial irrigation shall be provided and encouraged during the first and subsequent growing seasons, indefinitely, to assure establishment and continued success of the revegetated and planted areas.

Apply irrigation water in a fine spray and at a rate that does not cause runoff and erosion.

Irrigation system design and details shall be provided within the applicable project drawings and specifications.

#### **6.04.4 Success and Approval of Revegetation Work**

The results of the work of seeding and mulching and other revegetation and landscape work can only be evaluated after a sufficient period of time has elapsed for germination to occur or for live plants to root and become established in the new environment. This period of time is normally a minimum of one growing season and may be as long as two years. The Town of Gypsum will evaluate the work after, what is in their best judgment, a reasonable period of vegetation establishment and will approve the work if, in their best judgment, functional success has been achieved. Deficiencies in functional success shall be corrected.

### **7.00 EXCAVATION**

#### **7.01 SCOPE**

The work shall consist of the excavation required by the drawings and specification and disposal of the excavated materials.

#### **7.02 CLASSIFICATION**

Excavation will be classified as common excavation or rock excavation in accordance with the following definition or will be designated as unclassified. Common excavation shall be defined as the excavation of all materials that can be excavated, transported, and unloaded by the use of heavy ripping equipment and wheel tractor-scrappers with pusher tractors or that can be excavated and dumped into place or loaded onto hauling equipment by means of excavators having a rated capacity of three cubic yards and equipped with attachments such as shovel, backhoe, bucket, dragline or clam shell appropriate to the character of the materials and the site conditions. Rock excavation shall be defined as the excavation of all hard, compacted or cemented materials the accomplishment of which requires blasting or the use of excavators larger than defined for common excavation. The excavation and removal of isolated boulders or rock fragments larger than one cubic yard in volume encountered in materials otherwise conforming to the definition of common excavation shall be classified as rock excavation. Excavation will be classified according to the above definitions by the Town of Gypsum, based on its judgment of the character of the materials and the site conditions. The presence of isolated boulders or rock fragments larger than one cubic yard in size will not in itself be sufficient cause to change the classification of the surrounding material. For the purpose of this classification, the following definitions shall apply: Heavy ripping equipment shall be defined as rear-mounted, heavy duty, single-tooth, ripping attachment mounted on a tractor having a power rating of at least 300 horsepower (at the flywheel). Wheel tractor-scraper shall be defined as a self-loading (not elevating) and unloading scraper having a struck bowl capacity of 12 to 20 cubic yards. Pusher tractor shall be defined as a track type tractor having a power rating of at least 300 net horsepower (at the flywheel) equipped with appropriate attachments.

#### **7.03 UNCLASSIFIED EXCAVATION**

Items designated, as "Unclassified Excavation" shall include all materials encountered regardless of their nature or of the manner in which they are removed. When excavation is unclassified, none of the definitions or classifications stated in Section 2 of this specification shall apply.

#### **7.04 BLASTING**

The transportation, handling, storage, and use of dynamite and other explosives shall be directed and supervised by a person of proven experience and ability in blasting operation and who shall be currently licensed and/or permitted for such work by all prevailing government agencies. Blasting shall be done in such a way as to prevent damage to the work or unnecessary fracturing of the foundation and shall conform to any special requirements called for in the specifications.

#### **7.05 USE OF EXCAVATED MATERIALS**

To the extent that they are needed, all suitable materials from the specified excavations shall be used in the construction of required permanent earth fill or rock fill. The Town of Gypsum will determine the suitability of materials for specific purposes. The contractor shall not waste or otherwise dispose of suitable excavated materials.

#### **7.06 DISPOSAL OF WASTE OR SURPLUS MATERIALS**

All surplus or unsuitable excavated materials will be designated as surplus or waste and shall be disposed of at the locations shown on the plans and/or staked in the field by the Town of Gypsum.

#### **7.07 BRACING AND SHORING**

Excavated surfaces too steep to be safe and stable if unsupported shall be supported as necessary to safeguard the work and workmen, to prevent sliding or settling of the adjacent ground, and to avoid damaging existing improvements. The width of the excavation shall be increased if necessary to provide space for sheeting, bracing, shoring and other supporting installations. The contractor shall furnish, place and subsequently remove such supporting installations. All excavations shall at all times comply with all applicable rules and regulations of OSHA regarding trench safety. The contractor shall be solely responsible to ensure that all crews working within or around excavations are informed and trained in all applicable rules and regulations of OSHA, and that safety procedures are followed at all times.

#### **7.08 STRUCTURE AND TRENCH EXCAVATION**

Structure and trench excavation shall be completed to the specified elevations and to sufficient length and width to include allowance for forms, bracing and supports, as necessary, before any concrete forms, concrete, pipe, or other structures for which the excavations are intended are placed in the excavation.

#### **7.09 BORROW EXCAVATION**

When the quantities of suitable materials obtained from specified excavations are insufficient to construct the specified fills, additional materials shall be obtained from the designated borrow areas. The extent and depth of borrow pits shall be as directed by the Town of Gypsum. Borrow pits shall be excavated and finally dressed in a manner to eliminate steep or unstable side slopes or other hazardous or unsightly conditions.

## **7.10 OVEREXCAVATION**

Excavation in earth beyond the specified lines and grades shall be corrected by filling the resulting voids with approved compacted earth fill, except that earth that is to become the subgrade for rip-rap, rock fill, sand and gravel fill, or drain fill may be filled with material conforming to the specifications for the rip-rap, rock, sand and gravel or drain material.

## **7.11 DEWATERING**

Excavations shall be dewatered by pumping at any time when: the presence of water creates a hazard for personnel in the excavation; the water interferes with installation or inspection of the installed utilities; or water mains may be contaminated by groundwater entering the open end of pipes.

## **7.12 SITE PREPARATION**

When trucks are laving site and onto town or county paved street, tracking pads, shall be used as an apron onto street to stop mud and dirt from entering roadway.

## **8.00 EARTH FILL**

### **8.01 SCOPE**

The work shall consist of the construction of earth embankments and other earth fills required by the drawings and specifications.

### **8.02 MATERIALS**

All fill materials shall be obtained from required excavations and designated borrow areas. The selection, blending, routing and disposition of materials in the various fills shall be subject to approval by the Geotechnical Engineer. Fill materials shall contain no sod, brush, roots or other perishable materials. Rock particles larger than the maximum size specified for each type of fill shall be removed prior to compaction of the fill. The types of materials used in the various fills shall be as listed and described in the specifications and drawings as prepared by the Geotechnical Engineer.

### **8.03 FOUNDATION PREPARATION**

Foundations for earth fill shall be stripped to remove vegetation and other unsuitable materials or shall be excavated as specified. Except as otherwise specified, earth foundation surfaces shall be graded to remove surface irregularities and shall be scarified parallel to the axis of the fill or otherwise acceptably scored and loosened to a minimum depth of 12 inches. The moisture content of the loosened material shall be controlled as specified for the earth fill, and the surface materials of the foundation shall be compacted and bonded with the first layer of earth fill as specified for subsequent layers of earth fill. Earth abutment surfaces shall be free of loose, un-compacted earth in excess of 2 inches in depth normal to the slope and shall be at such moisture content that the earth fill can be compacted against them to affect a good bond

between the fill and the abutment. Rock foundation and abutment surfaces shall be cleared of all loose materials and shall be free of standing water when fill is placed upon them. Occasional rock outcrops in earth foundations for earth fill, shall not require special treatment if they do not interfere with compaction of the foundation or placement and compaction of layers of the fill. Foundation and abutment surfaces shall not be steeper than 1 1/2 horizontal to 1 vertical unless otherwise specified. Test pits or other cavities shall be filled with compacted earth fill conforming to the specifications for the earth fill to be placed upon the foundation.

#### **8.04 PLACEMENT**

Fill shall not be placed until the required excavation and foundation preparation have been completed and the foundation has been inspected and approved by the Geotechnical Engineer. Fill shall not be placed upon a frozen surface, nor shall snow, ice or frozen material be incorporated in the fill. Fill shall be placed in approximately horizontal layers. The thickness of each layer before compaction shall not exceed the maximum thickness specified. Materials placed by dumping in piles or windrows shall be spread uniformly to not more than the specified thickness before being compacted. Hand compacted fill including fill compacted by manually directed power tampers, shall be placed in layers whose thickness before compaction does not exceed the maximum thickness specified for layers of fill compacted by the particular manually directed power tampers being used. Fill placed adjacent to structures shall be placed in a manner that will prevent damage to the structures and will allow the structures to assume the loads from the fill gradually and uniformly. The height of the fill adjacent to a structure shall be increased at approximately the same rate on all sides of the structure. If the surface of any layer becomes too hard and smooth for proper bond with the succeeding layer, it shall be scarified parallel to the axis of the fill to a depth of not less than 2 inches before the next layer is placed. The top surfaces of embankments shall be maintained approximately level during construction, except that a crown or cross-slope of not less than 2 percent shall be maintained to insure effective drainage and except as otherwise directed. Embankments shall be constructed in continuous layers except where openings to facilitate other construction are specifically called for in the plans and specifications.

#### **8.05 CONTROL OF MOISTURE CONTENT**

During placement and compaction of fill, the moisture content of the materials being placed shall be maintained within the specified range as determined by the geotechnical engineer. The application of water to the fill materials shall be accomplished at the borrow areas insofar as practicable. Water may be applied by sprinkling the materials after placement of the fill, if necessary. Uniform moisture distribution shall be obtained by disking, blading or other approved methods prior to compaction of the layer. Material that is too wet when deposited on the fill shall be either removed or be dried to the specified moisture content prior to compaction. If the top surface of the preceding layer of compacted fill or a foundation or abutment surface in the zone of contact with the fill becomes too dry to permit suitable bond, it shall be scarified and moistened by sprinkling to an acceptable moisture content prior to placement of the next layer of fill.

## 8.06 COMPACTION

Fill adjacent to structures shall be compacted to a density equivalent to that of the surrounding fill by means of hand tamping or by manually directed power tampers or plate vibrators. Heavy equipment shall not be operated within 2 feet of any structure. Vibrating rollers shall not be operated within 5 feet of any structure. Compaction by means of drop weights operating from a crane or hoist will not be permitted. The passage of heavy equipment shall not be allowed over any type of conduit until the backfill above the conduit has been placed to a depth of 2 feet. Compacting of fill adjacent to concrete structures shall not be started until the concrete has attained the strength specified by the Geotechnical or Structural Engineer for this purpose. The strength will be determined by compression testing of test cylinders cast by the Geotechnical Engineer for this purpose and cured at the work site in the manner specified in ASTM Method C 31 for determining when structures may be put into service. When the required strength of the concrete is not specified as described above, compaction of fill adjacent to structures shall not be started until the following time intervals have elapsed after placement of the concrete.

### Structure Time Interval

Retaining walls	14 days
Walls backfilled on both sides simultaneously	7 days

## 8.07 REMOVAL AND REPLACEMENT OF DEFECTIVE FILL

Fill placed at densities lower than the specified minimum density or at moisture contents outside the specified acceptable range of moisture content or otherwise not conforming to the requirements of the specifications shall be reworked to meet the requirements or removed and replaced with an acceptable fill. The replacement fill and foundation and abutment surfaces upon which it is to be placed shall conform to all requirements of this specification for foundation preparation, approval, placement, moisture content and compaction.

## 8.08 TESTING

During the course of the work, the Project Geotechnical Engineer shall perform such tests as are required to identify materials, to determine compaction characteristics, to determine moisture content, and to determine density and stability of fill and subgrade in place. These tests performed by the Project Geotechnical Engineer will be used to verify that the fills conform to the requirements of the specifications. The number and frequency of tests will be established according to standard industry procedures. If the Town of Gypsum is not satisfied with the number, frequency, or results of the tests, the Town of Gypsum may require such additional testing as he judges to be appropriate.

## 8.09 LIMITS OF CONTRACTOR WORK ACTIVITY

Unless otherwise specified in the plans and specifications or approved by written authorization from the Town of Gypsum, the contractor shall confine all work activity within the boundaries defined by the construction stakes that define "clearing and grubbing", "excavation" and/or "earthfill". When necessary, sites for material and equipment storage outside the work area will be designated by the Town of Gypsum. Destruction of construction stakes through careless

activity of the contractor shall result in replacement of the stakes at the expense of the contractor. The Town of Gypsum shall be the sole judge of whether construction stakes were lost through normal activity or carelessness.

## **9.00 SHALLOW UTILITIES (UNDER GROUND ELECTRIC, TELEPHONE, CABLE TELEVISION, NATURAL GAS & IRRIGATION)**

### **9.01 SCOPE**

Shallow utilities are defined as any wire, pipe conduit or cable and shall include but not be limited to underground electric, telephone, cable television, natural gas and irrigation water systems.

### **9.02 SPECIAL CONDUIT ENCASEMENT**

Any shallow utility which crosses under or is within 5 feet horizontally of any road or street structure, including, pavement, curb and gutter, sidewalk, bike path, or bridge shall be encased in conduit so that repair or replacement of the utility may be accomplished without disturbing the road or street structure.

For natural gas and irrigation water systems, the carrier pipes for the natural gas and irrigation water shall be installed inside of a second pipe having strength equal to or greater than the carrier pipe and of sufficient diameter to allow free movement of the carrier pipe in the event that replacement is required.

It is recommended that consideration be given to the potential for future increase in size/capacity of the respective utility when sizing the conduit.

### **9.03 SHALLOW UTILITY INSTALLATION**

- a. Electric system underground facilities shall be buried a minimum of 4.0 feet below finished grade. Electric system vaults and transformers shall be designed to be located and installed in areas that will not be subject to concentrated surface drainage flow.
- b. Telephone system underground facilities shall be buried a minimum of 2.0 feet below finished grade. Telephone pedestals shall be designed to be located and installed in areas that will not be subject to concentrated surface drainage flow.
- c. Cable television system underground facilities shall be buried a minimum of 2.0 feet below finished grade. Cable television risers and surface facilities shall be designed to be located and installed in areas that will not be subject to concentrated surface drainage flow.
- d. Natural gas system underground facilities shall be buried a minimum of 3.5 feet below finished grade.
- e. Whenever any shallow utility parallels or generally parallels a domestic water or sewer utility, a minimum horizontal separation of 4 feet shall be maintained between the domestic water or sewer main or service and the shallow utility.

Where it must cross domestic it must cross above and with a 1' minimum separation.  
Nonpotable water tape.

## **10.00 PORTLAND CEMENT CONCRETE**

### **10.01 MATERIALS**

- a Cement. Cement shall conform to ASTM C 150, C 175 or C 595. The cement supplier shall submit to the Town of Gypsum a certification that the cement used on the project conforms to the applicable specifications with complete mill analysis.

The following list illustrates the type of cement that shall be used for particular structures;

TYPE I--Slabs, pavement, sidewalks, driveways, curbs and gutters.

TYPE II--Pipeline encasements

TYPE I, or II--Vaults, cut-off walls

- b. Aggregate. Aggregate shall conform to ASTM C 33. Fine aggregate in the sieve size range of 3/8" to #100 shall comprise 34% to 39% by weight of the total aggregate and shall conform to AASHTO M-6. The coarse aggregate in the sieve size range 1-1/2" to #4 shall conform to AASHTO M-80
- c. Admixtures. Air entraining admixtures shall conform to ASTM C 260. Type A water reducing admixtures (normal setting) shall conform to ASTM C 494 and may be used when air temperature is between 40 and 80 degrees F. Type D water reducing admixtures (retarders) shall conform to ASTM C 494 and may be used when air temperature is over 80 degrees F. Type E water reducing admixtures (accelerating) shall conform to ASTM C 494. Fly-ash shall conform to ASTM C 618 and when fly-ash is used, the proportions of materials shall be determined in accordance with the American Concrete Institute (ACI) Standard 318-77 Section 4.2.
- d. Materials for curing concrete. These materials shall be liquid membrane curing compound (white) conforming to ASTM C 309, or sheet material conforming to ASTM C171.
- e. Joint filling compound. Where joints are required to be filled, material shall be hot poured rubber asphalt joint filling compound conforming to AASHTO-M-173 or Federal Specification SS-S-164 or SS-S-1401a.
- f. Water. If water quality is questionable, it shall be tested in accordance with AASHTO-T-26.
- g. Fibrous Reinforcing Material. Fibrous reinforcing materials shall be 100% virgin polypropylene, fibrillated fibers containing no reprocessed olefin materials and specifically manufactured for use as a concrete secondary reinforcement. Material shall conform to ASTM C-1116 Type III 4.1.3 and ASTM C-1116 Performance Level I outlined

in Section 21 Note 17. Fibrous Concrete reinforcement shall be as manufactured by Fibermesh Company, 4019 Industry Drive, Chattanooga, Tennessee, 37416 or approved equal. Fibrous reinforcement shall be added to concrete materials at the time concrete is batched. The amounts added and the methods of mixing shall be in accordance with the instructions and recommendations of the manufacturer.

## **10.02 PROPORTIONING**

Cement:	470 pounds per cubic yard minimum
Air content:	5% to 8%
Coarse aggregate:	1-1/2 inch maximum, but not greater than one-fourth of the thickness of the slab or structure wall
Slump:	2 to 4 inch maximum for surface vibrated or 1 to 3 inch maximum for internally vibrated.

## **10.03 STRENGTH REQUIRED**

All concrete shall have a specified compressive strength of 4000 psi at 28 days. Flow fill shall have a specified compressive strength of not less than 75 psi at 28 days and not greater than 300 psi at 28 days. Conformance to strength requirements shall be determined by ASTM C 94 Section 16.5.1.

The compressive strength of flow fill shall never exceed 700psi, as determined by ASTM C 94 Section 16.5.1, or it shall be removed.

## **10.04 APPLICABLE STANDARDS**

- a. "Specifications for Structural Concrete for Buildings" ACI 301.
- b. "Building Code Requirements for Reinforced Concrete" ACI 318.
- c. "Standard Specification for Ready Mixed Concrete" ASTM C 94 or ACI 304.

## **10.05 REINFORCEMENT STEEL**

All reinforcement steel bars shall conform to ASTM A 615, ASTM A 616 or ASTM A 617, Grade 60.

## **10.06 MIXING AND HAULING**

All ready-mixed concrete shall meet the requirements of either ASTM C 94 or AASHTO-M-157. The maximum elapsed time from time water is added to the mix until the concrete is in place shall not exceed 1.5 hours when concrete is transported in revolving-drum truck bodies.

## **10.07 FORMING**

The subgrade or sub base under the forms shall be compacted and cut to grade so that the forms when set will be at the required elevation. Forms shall be of such configuration as to produce the structure or pavement shown on the plans. They shall be of such strength and so secured as to resist the pressure of the concrete when placed and the impact and vibration of

any equipment that they support, without springing or settlement. The method of connection between form sections shall be such that the joints shall not move in any direction. The maximum deviation of any final structure surface shall not exceed 1/4 inch in 10 feet. Forms shall be capable of being removed without causing damage to the structure or pavement. Flexible or curved forms of proper radius shall be used for pavement curves of 100 feet radius or less. When concrete is to be placed against rock, the rock surface shall be scaled and cleaned with a high-pressure hose to remove all loose material. All forms shall be cleaned to remove all mortar, grout or other foreign material from the surfaces and oiled prior to each use. Form oil shall be light colored paraffin oil, or other non-staining material. For exposed surfaces not in contact with earth backfill, acceptable chemical release agents are Protex Industries "Pro-Cote", Symons Corp., "Magic Kote", L & M "Debond" or equal. Form ties shall be commercially manufactured permanently embedded type with removable ends for all exposed surfaces. The permanently imbedded portion of the tie shall terminate not less than one inch from the face of the concrete. Chamfer strips shall be placed in forms to bevel salient edges and concrete corners of exposed surfaces, except for the top edges of walls and slabs, which are to be tooled. Unless otherwise noted on the Drawings, bevels shall be 3/4 inch wide. Forms shall remain in place a minimum of 12 hours after concrete is placed. The edge of previously placed concrete gutter section may be used as grade for a road pavement.

**10.08 PLACING**

The concrete shall be deposited in the structure forms or on the pavement grade in such a manner as to require as little rehandling as possible. All reasonable care shall be taken to prevent any segregation of the concrete materials.

**10.09 VIBRATING**

The concrete shall be thoroughly consolidated throughout by means of vibrators inserted in the concrete. Vibrators shall not be permitted to come in contact a joint assembly or the subgrade. Vibrators shall not be used to drag the concrete into place and shall not be operated longer than 10 seconds in one place.

**10.10 JOB CONDITIONS**

Concrete shall not be placed during rain, snow or sleet unless protection is provided to prevent precipitation from entering the concrete mix.

- a. Cold Weather Concreting. The work shall conform to the specifications of ACI 306, "Recommended Practice for Cold Weather Concreting". The Temperature of concrete when placed shall not be less than that shown in the following table.

Minimum concrete temp. (°F) in sections with least dimensions:

<b>Air Temp. (°F)</b>	<b>Under 12 inches</b>	<b>12 inches &amp; over</b>
30 to 45	60	50
0 to 30	65	55
Below 0	70	60

Temperature of concrete when placed shall not exceed 85 °F.

Prior to placing concrete, all ice, snow, surface and subsurface frost shall be removed from surfaces to be in contact with new concrete and said surfaces shall be at least 35 degrees F but less than 90 degrees F. Concrete shall be protected from freezing during the specified curing period. Heated enclosures shall provide adequate protection of corners, edges and thin sections. Heating units shall not heat or dry concrete, or during the first 24 hours, expose the concrete to exhaust gasses containing carbon dioxide.

- b. Hot Weather Concreting. The work shall conform to specifications of ACI 305, "Recommended Practice for Hot Weather Concreting". Temperature of concrete when placed shall not exceed 85 F. Forms and reinforcing steel shall be cooled to a maximum of 90 F with water spray prior to placing concrete. Concrete shall not be placed when the actual or anticipated evaporation rate equals or exceeds 0.20 pounds per square foot per hour, as determined by Figure 2.1.4 of ACI 305. Approved set retarding and water reducing admixtures may be used when ambient air temperature is 90 F or above to offset the accelerating effects of high temperature.

### 10.11 TESTING

Concrete shall be sampled and tested as follows:

- a. Slump tests--performed at any time that concrete being placed appears to contain excessive moisture and at each time that cylinders are prepared for strength tests. The following Table illustrates the maximum allowable slump for various types of construction.

TYPE OF CONSTRUCTION	MAXIMUM SLUMP (INCHES)
EXTRUDED CURB, CURB & GUTTER CAST-IN-PLACE MANHOLE BASE	2
CONCRETE PAVEMENT NOT INTEGRAL WITH CURB, SIDEHILL SURFACE DRAINAGE STRUCTURES	3
CURB, INTEGRAL CURB & PAVEMENT, GUTTER, SIDEWALK, GUTTER, APRONS, PIPE BEDDING & ANCHORS BRIDGES, BUILDING FOOTERS, FOUNDATIONS & RETAINING WALLS CAST-IN-PLACE PILES CHANNELS AND BOX CULVERTS WALLS AND DECKS	4
PIPE COLLARS & PIPE ENCASEMENT FENCE AND GUARD RAIL POST FOUNDATIONS FLOW FILL (TRENCH BACKFILL SLURRY)	5

- b. Strength tests--prepare four (4) each 6" x 12" cylinders for each test sample. A sample shall be taken for each 50 cubic yards up to 100 cubic yards and for each 100 yards there after. Flow fill concrete shall be sampled at each truckload. The four cylinders from the sample shall be broken as follows: one cylinder shall be broken at 7 days and two cylinders shall be broken at 28 days. The remaining cylinder shall be retained to break

later if necessary, or may be broken at 28 days for confirmation of the other cylinder breaks.

## **11.00 HOT BITUMINOUS PAVEMENT TESTING**

### **11.01 SCOPE**

The work shall consist of constructing one or more courses of bituminous pavement on a prepared base in accordance with these specifications, and in reasonably close conformity with the lines, grades, thicknesses and typical cross-sections shown on the plans or established.

### **11.02 REFERENCE SPECIFICATIONS**

The Standard Specifications of the Colorado Department of Highways (current edition) are herein included by reference and the section and subsection numbers listed herein refer to that document.

### **11.03 MATERIALS**

The materials shall conform to the requirements of subsections 401.02 through 401.06. A tack coat of emulsified asphalt Grade CSS-1H conforming to the requirements of section 702 shall be applied to all existing paved surfaces including edges and joints at all stations where a bituminous overlay or edge addition is required. Additionally, a tack coat shall be applied to the face of any concrete, curb, gutter or sidewalk to which it will abut.

A job mix formula shall be established and submitted to the Town of Gypsum for approval. The job mix shall be based on Grade C or C Modified mixes and conforms to the requirements of sections 702 and 703. Asphalt shall be grade AC-10.

### **11.04 CONSTRUCTION**

The placement of hot bituminous pavement shall not commence until reports have been submitted by the Geotechnical Engineer to the Town of Gypsum, which state and illustrate that the subgrade preparation and the base course aggregate installation meet specifications. The construction requirements shall be as prescribed in subsections 401.07 through 401.20. The tack coat shall be installed in conformance with the requirements of section 407. After the bituminous mixture has been spread, struck off, and surface irregularities adjusted, it shall be thoroughly and uniformly compacted by rolling. Rolling shall be continued until all roller marks are eliminated and a density of 92% to 96% of the maximum theoretical density according to AASHTO T 209 is achieved.

## **12.00 TRAFFIC REGULATION**

### **12.01 SCOPE**

Whenever construction activities are on, adjacent to a traffic way, or in any way impact traffic, these specifications shall apply.

Traffic Regulation in the construction area shall conform to "Manual on Uniform Traffic Control Devices" (MUTCD), U.S. Department of Transportation, or applicable statutory requirements of Government authority having jurisdiction in the construction area.

- a. Unless otherwise authorized, at least one lane of traffic shall be kept open at all times.
- b. When work is not in progress all traffic lanes shall be kept open.
- c. All traffic lanes shall be open during hours of darkness, weekends, and holidays.

Operations on or about traffic areas and provisions for regulating traffic will be subject to the regulation of governmental agencies having jurisdiction over the affected areas.

Traffic areas shall be kept free of excavated material, construction equipment, pipe, and other materials and equipment.

## **12.02 FLAG PERSON (S)**

The contractor shall provide for public safety and the regulation of traffic, by the use of qualified and properly equipped flag persons.

## **12.03 WARNING SIGNS AND LIGHTS**

The Contractor shall:

- a. Protect all roadways by effective barricades on which are placed warning signs.
- b. Provide barricades and warning signs for open trenches, other excavations and obstructions.
- c. Illuminate by means of warning lights all barricades and obstructions from sunset to sunrise.

## **13.00 TESTING AND INSPECTION**

### **13.01 SCOPE**

The work shall consist of providing for independent testing of soils compaction, aggregate compaction, concrete strength and welding, when, as a part of the work of the contract, soils and/or aggregate materials are placed and compacted, concrete is placed or welding is accomplished. Additionally, the work includes providing notice to the Town of Gypsum of the work schedule of the CONTRACTOR. The CONTRACTOR shall be responsible for calling for and the DEVELOPER shall be responsible for paying for all testing and inspection necessary in the course of the work, to illustrate that the specifications and design criteria are being met.

### **13.02 COMPACTION TESTING**

The compaction testing shall be accomplished by an approved geotechnical engineering firm. The number of tests performed shall conform to normal industry and ASTM standards and shall be sufficient for the geotechnical engineering firm to confirm that the quality of the work meets the contract specifications. Copies of the test results shall be promptly supplied to the Town of

Gypsum by the testing firm. The field representative of the geotechnical engineering firm shall immediately (within 2 hours) notify the town's construction inspector for the project of failed tests or any tests which do not comply with either the Town of Gypsum Construction Specifications or the design or construction specifications for the project. If the Town of Gypsum has reason to suspect that the tests performed do not sufficiently confirm the quality of the work accomplished, the Town of Gypsum may require that the DEVELOPER provide and pay for additional tests.

### **13.03 CONCRETE TESTING**

The concrete sampling and testing shall be accomplished by an approved materials testing engineering firm. The number of tests performed shall conform to normal industry and ASTM standards or called for in the PORTLAND CEMENT CONCRETE specifications, whichever is greater, and shall be sufficient for the materials testing engineering firm to confirm that the quality of the work meets the contract specifications and may require work to stop until such documentation is provided. Copies of the test results shall be promptly supplied to the Town of Gypsum by the testing firm. **If the Town of Gypsum has reason to suspect that the tests performed do not sufficiently confirm the quality of the work accomplished, the Town of Gypsum may require that the CONTRACTOR provide and pay for additional tests.**

### **13.04 WELDING INSPECTION AND TESTING**

The special inspection and testing of welds shall be accomplished by an approved materials testing engineering firm. The number of tests and type of tests performed shall conform to normal industry and ASTM standards and shall be sufficient for the materials testing engineering firm to confirm that the quality of the work meets the contract specifications. Copies of the test results shall be supplied to the Town of Gypsum by the testing firm. If the Town of Gypsum has reason to suspect that the tests performed do not sufficiently confirm the quality of the work accomplished, the Town of Gypsum may require that the CONTRACTOR provide and pay for additional tests.

### **13.05 NOTIFICATION of the TOWN OF GYPSUM by the CONTRACTOR of WORK SCHEDULE**

The CONTRACTOR shall notify the Town of Gypsum CONSTRUCTION INSPECTORS of the proposed schedule of work. When the work is intermittent, the CONTRACTOR shall give notice to the Town of Gypsum CONSTRUCTION INSPECTORS, 48 hours in advance of proceeding with a portion of the work. The notice shall advise the Town of Gypsum CONSTRUCTION INSPECTORS of the nature of the work and the time that the work is proposed to start. If, after proper notification, the Town of Gypsum CONSTRUCTION INSPECTORS are not represented at the work site at the appointed time, the CONTRACTOR may proceed with the work after placing a call to the office of the Town of Gypsum CONSTRUCTION INSPECTORS. If the CONTRACTOR fails to attend the work at the appointed time, after notifying the Town of Gypsum CONSTRUCTION INSPECTORS of their intention to do work, or if the CONTRACTOR fails to notify the Town of Gypsum CONSTRUCTION INSPECTORS of his intention NOT to show up on the job site to conduct work when he would normally be expected to do so, the CONTRACTOR shall be responsible for the cost of the time of the representative(s) of the Town of Gypsum in waiting for the CONTRACTOR to show up on the job. This time shall include travel time to and from the office of the Town of Gypsum CONSTRUCTION INSPECTORS to the site of

the work. The developer for whom the CONTRACTOR is working shall be billed for the time of the Town of Gypsum CONSTRUCTION INSPECTORS at the regular hourly billing rates of the Town of Gypsum CONSTRUCTION INSPECTORS. All references to the CONTRACTOR shall be considered to include all SUB-CONTRACTORS to the CONTRACTOR.

### **13.06 STOPPAGE OF WORK**

It is the sole discretion of the Town of Gypsum inspector to stop work due to unsuitable condition that may negatively affect the quality of work.

### **13.07 SEWER INSPECTION/VIDEO**

In order to facilitate the review of the sewer video, the interior of all sewer service wyes' shall be labeled with service address or lot number per the approved construction plans. In addition, the interior of all sewer manholes shall be labeled per the approved construction plans. The labels shall be located and sized so that they can be readily seen by the pipe camera.

### **14.00 RECORD DRAWINGS**

#### **14.01 SCOPE**

It is required that the developer provide a set of as-built survey plans and details of all infrastructure constructed that shall be prepared and certified by a Land Surveyor registered in the State of Colorado and tied to permanent survey monuments on or near the project. The details shall be prepared and certified by a Professional Engineer registered in the State of Colorado. The plans and details shall be submitted to the Town of Gypsum prior to the Town accepting the infrastructure for maintenance and ownership dedication. The as-built survey and details shall provide the location of all utilities including water, sewer, sub-surface under drain, gas, electric, phone, cable-TV, irrigation lines; and storm sewer.

The purpose of these drawings is to provide information for the preparation of "as-built" drawings of the project.

The as-built drawing shall be based on the Town of Gypsum coordinate system and control network. The accuracy of as-built location data shall be as follows:

Sewer inverts, vertical = +/- 0.02 feet

All other infrastructure features, vertical = +/- 0.10 feet

All infrastructure features, horizontal = +/- 0.10 feet

#### **14.02 RECORDING DURING CONSTRUCTION**

- a. Each drawing shall be labeled "DRAWING OF RECORD" in neat large printed letters.
- b. Information shall be recorded concurrently with construction progress. Work shall not be covered until required information is recorded.

This drawing shall illustrate the infrastructure system, complete with dimensions and "swing ties" to service line ends and other subsurface features as required. Drawings shall be marked to record actual construction. Following is a list of all information required to be located for each infrastructure system:

*Water System:* Horizontal locations of the following: Water Main Pipelines; Bends; Tees; Crosses; Gate Valves; Air-vac Valves; Pressure Reducing Valves; Pump Stations; Water Service Lines (Appendix B-14.02; Water Services Taps; and Water Service Curb Stops. Details of all water system components listed above which provides a description, pipe diameter, material classification, manufacturer, part number, and supplier as applicable for all individual parts and components.

*Sewer System:* Horizontal and vertical locations of the following: Sewer Main Pipeline; Sewer Manholes; Sewer Service Connections; Sewer Service Pipelines, and Sewer Service Cleanouts. Details of each sewer manhole that provide the location and elevation of all inverts in and out, and rim elevation. Details of all sewer system components listed above which provides a description, pipe diameter, material classification as applicable for all individual parts and components.

*Sub-surface Under drain System:* Horizontal and vertical locations of the following: Under drain Pipeline; under drain Manholes; and under drain Cleanouts. Details of each under drain manhole that provide the location and elevation of all inverts in and out, and rim elevation. Details of all under drain system components listed above which provides a description, pipe diameter, material classification, as applicable for all individual parts and components.

*Natural Gas System:* Horizontal locations of the following: Natural Gas Pipeline; pressure reducing stations; pigging stations; main meters; and Natural Gas Service Lines.

*Electrical System:* Horizontal locations of the following: Electrical Main Lines; Electrical Service Lines; splice vaults; and Electrical Transformers.

*Telephone System:* Horizontal locations of the following: Telephone Main Lines, Telephone Service Lines; and Telephone Risers.

*Cable Television System:* Horizontal locations of the following: Cable Television Main Lines, Cable Television Service Lines; and Cable Television Risers.

*Irrigation System:* Horizontal locations of the following: Irrigation Main Pipelines; Bends; Tees; Crosses; Gate Valves; Air-vac Valves; Pressure Reducing Valves; Pump Stations; Wells; Service Lines; Services Taps; Service Curb Stops; drain valves; and Sprinkler Heads.

*Storm Sewer System:* Horizontal and vertical locations of the following: Storm Sewer Main Pipeline; Manholes; Catch Basins; Curb Inlets; Scuppers; Valley Pans; Ditches; Culverts; Headwalls; Inlet Structures; Outlet Structures; Stilling Basins; Curb Openings; Trench Drains; and Detention Ponds. Details of each storm sewer manhole that provide the location and elevation of all inverts in and out, and rim elevation. Details of all storm sewer system components listed above which provides a description, pipe diameter as applicable for all individual parts and components.

*Roadway System:* Horizontal locations of the following: Edge of Pavement; Crown of Road; Grade Breaks in Paved Surface; Flowline of Curb; Top Back of Curb; and Edge of Sidewalks. Details of all roadway system components listed above and constructed cross sections for each different section of roadway, which shall provide descriptions of materials, depths of materials, material classification, manufacturer, and supplier as applicable for all roadway components.

When required by the Town of Gypsum, the as-built plans shall illustrate the horizontal and vertical location of all flood plain benchmark or monuments within the project boundary.

In instances where utilities cross over and under, elevations will be required on all.

#### **14.03 SUBMISSION**

At the completion of the work, the Contractor/Project Owner shall submit the as-built information to the Town of Gypsum with a transmittal letter.

Each drawing title block shall contain the following:

- a. Date.
- b. Project title and number.
- c. Contractor's name, address and telephone number.
- d. Title and number of each Record Document.
- e. Statements of certification with signatures and seals by engineer and surveyor.

All information requested two copies shall be provided, one for Public Works and one for Engineering and on disk in an AutoCAD Release 12 or higher DWG file. All entities on the AutoCAD file which represent separate infrastructure components shall be placed on readily identifiable layers such as: Sewer Manholes (layer: SMH); Water Line (layer: WTRLIN); etc. All text entities on the AutoCAD drawing shall also be placed on separate layers which represent the infrastructure system which they are describing for example: SEWERTXT; WATERTXT; UDRNTXT; etc. The AutoCAD file shall also include the survey point blocks compatible with Softdesk (node, point number, elevation, and description) for both the permanent survey monuments as well as all points surveyed for the improvements. The AutoCAD layers for these points and the AutoCAD blocks shall be submitted in the format provided on disk by the Town of Gypsum. This disk will be available, upon request, to project engineers and surveyors, from the office of the Town of Gypsum.

Hard copies (paper, mylar, etc.) shall be prepared to illustrate a single infrastructure system on a separate drawing. Other infrastructure features shall be illustrated on this drawing in a shaded gray scale, which clearly differentiates them from the primary system of the drawing.

The dedication exhibit drawings shall show street names, lot numbers, block numbers and the horizontal control coordinate system on a 500-foot grid and shall be drawn at a scale of 1 inch= 100 feet.

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## SEWER & GROUND WATER DRAIN INSPECTION REPORT

DATE: \_\_\_\_\_

INSPECTOR SIGNATURE: Steve Cock

PROJECT \_\_\_\_\_

# \_\_\_\_\_ Time: \_\_\_\_\_

LOCATION: \_\_\_\_\_

CONTRACTOR \_\_\_\_\_

WEATHER: \_\_\_\_\_

1) PIPE MATERIAL/SIZE		10) MANHOLE INVERT GROUTING		19) SEWER PIPES CLEAN	
2) BEDDING MATERIAL		11) MANHOLE STEPS		20) GROUND WATER DRAIN SYSTEM PIPE SIZE, MATERIAL, GRADE & GEOMETRY	
3) MAIN LINE PIPE GRADE		12) PIPELINE PRESSURE TESTS		21) GROUND WATER DRAIN SYSTEM BEDDING MATERIAL/GEOTEXTILE	
4) BACKFILL/COMPACTION		13) PIPELINE VIDEO/LAMP TEST		22) DOMESTIC WATER PIPELINE CROSSING SPECIFICATIONS	
5) SERVICE MARKERS		14) MANHOLE VACUUM TEST		23) GEOTECHNICAL COMPACTION REPORTS	
6) SERVICE CONNECTION		15) MANHOLE RING & COVER		24) CLEANUP, RESTORATION & REVEGETATION	
7) SERVICE LINE GRADE		16) MANHOLE COVER GRADE, POSITIVE SURFACE DRAINAGE AWAY		25) SEWER FORCE MAIN PIPE SIZE MATERIAL, GRADE & GEOMETRY	
8) MANHOLE LOCATION, CONSTRUCTION & SPECS		17) CLEAN-OUT MATERIAL & INSTALLATION		26) SEWER FORCE MAIN VALVE, SPECIFICATION, ACCESS & OPERATION	
9) MANHOLE/PIPELINE CONNECTIONS		18) CLEAN-OUT LID GRADE		27) BORING, MATERIAL, LOCATION, SIZE GRADE	

CODE:    A= CHECKED & MEETS SPECIFICATIONS FOR MATERIAL, INSTALLATION & PERFORMANCE  
           F= CHECKED & DOES NOT MEET SPECIFICATIONS FOR MATERIAL, INSTALLATION OR PERFORMANCE  
           N = NOT APPLICABLE OR NOT INSPECTED DURING THIS VISIT

DETAILS: REFERENCE BY ITEM NUMBER

PROJECT REPRESENTATIVE: **PRESENT ( ) NOT PRESENT ( )**

REPORT RECEIVED BY PROJECT REPRESENTATIVE:

\_\_\_\_\_  
SIGNED

ORIGINAL:    TOWN OF GYPSUM (FILE)  
 COPIES:     PROJECT REPRESENTATIVE  
               TOWN ENGINEER



Town of Gypsum, PO Box 1617, Gypsum, CO 81637  
Public Works Department 970-524 5024

**STREETS & ROADS**

DATE: \_\_\_\_\_ INSPECTOR: SIGNATURE: Steve Cock

PROJECT: \_\_\_\_\_ # \_\_\_\_\_ TIME: \_\_\_\_\_

LOCATION: \_\_\_\_\_

CONTRACTOR: \_\_\_\_\_

WEATHER: \_\_\_\_\_

1) CULVERT PIPE MATERIAL, SIZE, GRADE, DEPTH & LOCATION		11) DRAINAGE STRUCTURE, DROP INLET, SCUPPER, END SECTION TREATMENT, ETC		21) STREET CUT & ASPHALT PATCHING GEOMETRY & PROCEDURES	
2) CULVERT BEDDING		12) ASPHALT PAVING, MIX DESIGN SPEC		22) VALVE BOX & MANHOLE GRADE TO ASPHALT	
3) STREET SUBGRADE MATERIAL, NATURAL & FILL		13) ASPHALT PAVING TEMPERATURE CONDITIONS		23) STREET LIGHT MATERIALS AND PLACEMENT	
4) STREET SUBGRADE GEOMETRY		14) CURB/GUTTER SIDEWALK GEOMETRY		24) STREET SIGN MATERIALS AND PLACEMENT	
5) STREET SUBGRADE PROOF ROLL TESTING		15) CURB/GUTTER SIDEWALK MATERIAL & SURFACE		25) STREET SIGN MATERIALS AND PLACEMENT	
6) ABC MATERIAL		16) CONTROL & EXPANSION JOINTS		26) GEOTEXTILE FABRIC SPEC & REVEGETATION	
7) ABC GEOMETRY-BLUETOPS, ETC		17) CONCRETE TEST CYLINDER & TEST REPORTS		27) CLEANUP, RESTORATION & REVEGETATION	
8) ABC PROOF ROLL TESTING		18) ASPHALT GEOTECHNICAL TEST REPORTS		28) DRAINAGE & DEBRIS FLOW DETENTION STRUCTURES & OUTLET CONTROLS	
9) EARTHWORK, TRENCH BACKFILL & ABC GEOTECHNICAL TEST REPORTS		19) FLOOD TESTING OF GUTTER & STREET SECTIONS		29) DRAINAGE CHANNEL ALIGNMENT AND GEOMETRY CLEAN UP, RESTORATION & REVEGETATION	
10) OVERLOT GRADING GEOMETRY		20) EROSION CONTROL MATERIAL & STRUCTURE		30)	

CODE: A = CHECKED & MEETS SPECIFICATIONS FOR MATERIAL/INSTALLATION/PERFORMANCE  
 F= CHECKED & DOES NOT MEET SPECIFICATIONS FOR MATERIAL/INSTALLATION/PERFORMANCE  
 N= NOT APPLICABLE OR NOT INSPECTED DURING THIS VISIT  
 S= SAMPLE TAKEN, RESULTS PENDING

DETAILS: REFERENCE BY ITEM NUMBER

PROJECT REPRESENTATIVE **PRESENT ( )** **NOT PRESENT ( )**

REPORT RECEIVED BY PROJECT REPRESENTATIVE:

\_\_\_\_\_  
SIGNED

ORIGINAL: TOWN OF GYPSUM (File)  
 COPY: PROJECT REPRESENTATIVE  
 TOWN ENGINEER

## UTILITY STRUCTURES, IRRIGATION SHALLOW UTILITY INSPECTION REPORT

DATE: \_\_\_\_\_ INSPECTOR: SIGNATURE: Steve Cock

PROJECT: \_\_\_\_\_ # \_\_\_\_\_ TIME: \_\_\_\_\_

LOCATION: \_\_\_\_\_

CONTRACTOR: \_\_\_\_\_

WEATHER: \_\_\_\_\_

1) IRRIGATION PIPE MATERIAL/SIZE BACKFLOW PREVENTER		10) SHALLOW UTILITY TRENCH LOCATION & GEOMETRY		19) WATER STORAGE TANK AND LIFT STATION LEAK TESTING	
2) IRRIGATION SYSTEM GEOMETRY		11) WATER SYSTEM VALVE VAULT STRUCTURE		20) WATER PUMP STATION STRUCTURE	
3) TRACE WIRE/SPEC/LOCATION & CONTINUITY		12) WATER SYSTEM VALVE VAULT PIPING, MATERIAL SPECS AND INSTALLATION		21) WATER PUMP STATION PIPING, MATERIAL SPECS & INSTALLATION	
4) BEDDING, BACKFILL/COMPACTION		13) WATER SYSTEM TELEMETRY CONTROLS		22) SEWAGE LIFT STATION STRUCTURE	
5) SYSTEM MARKERS		14) WATER STORAGE TANK SITE GRADING & COMPACTION		23) SEWAGE LIFT STATION EXCAVATION & SITE GRADING	
6) VALVE NUT ACCESS		15) WATER STORAGE TAN ABC/SAND BASE, MATERIAL, PLACEMENT & COMPACTION		24) SEWAGE LIFT STATION PIPING MATERIAL SPECS & INSTALLATION	
7) MINIMUM BURY DEPTH FOR ELECTRIC, GAS, PHONE, T.V. IRRIGATION		16) WATER STORAGE TANK PIPE INSTALLATION & TANK ERECTION		25) SEWAGE LIFT STATION ALARM SYSTEM	
8) TRENCH COMPACTION GEOTECHNICAL REPORTS		17) WATER STORAGE TANK PREPARATION FOR PAINTING		26) CLEAN UP, RESTORATION & REVEGETATION	
9) BORING LOCATION, MATERIAL, SIZE & GRADE		18) WATER STORAGE TANK PAINTING		27)	

CODE: A = CHECKED & MEETS SPECIFICATIONS FOR MATERIAL/INSTALLATION/PERFORMANCE  
 F= CHECKED & DOES NOT MEET SPECIFICATIONS FOR MATERIAL/INSTALLATION/PERFORMANCE  
 N= NOT APPLICABLE OR NOT INSPECTED DURING THIS VISIT  
 S= SAMPLE TAKEN, RESULTS PENDING

DETAILS: REFERENCE BY ITEM NUMBER

PROJECT REPRESENTATIVE **PRESENT ( )** **NOT PRESENT ( )**

REPORT RECEIVED BY PROJECT REPRESENTATIVE: \_\_\_\_\_ SIGNED \_\_\_\_\_

ORIGINAL: TOWN OF GYPSUM (File)  
 COPY: PROJECT REPRESENTATIVE  
 TOWN ENGINEER

# **Appendix A**

## **Typical Sewer Details**

- A.1 – Sewer Trench
- A.2 – Sanitary Sewer Service Connection
- A.3 – Typical Sewer Manhole Detail
- A.4 – Typical Straight Sewer Manhole Detail
- A.5 – Sewer Manhole Channels
- A.6 – Sewer Manhole Channel Section
- A.7 – Sewer Cleanout
- A.8 – Water Line Crossing Detail
- A.9 – Stream Crossing Detail
- A.10 – Oil/Sand/Water Separator





















## **Appendix B**

### **Typical Water Details**

- B.1 – Typical Hydrant Setting
- B.2 – Typical Tees and Cross Installation
- B.3 – Pressure Reducing Vault
- B.4 – Plan View of Pressure Reducing Vault
- B.5 – Typical Air Vacuum and Air Release Valve
- B.6 – Typical Gate Valve and Box
- B.7 – Service Connection Detail
- B.8 – Typical Vertical Joint

HYDRANT MANUFACTURER AS PER SPECIFICATIONS  
 MUELLER CENTURION SUPER 250"  
 U.S. PIPE METROPOLITAN 250"

HYDRANT ISOLATION VALVE

GATE VALVE WITH BOX

10 AWG "UF" TRACER WIRE  
 NOT ALWAYS NECESSARY.  
 SEE TOWN INSPECTOR

MAIN LINE TEE WITH EBAA  
 IRON INC. MEGALUG

WINGNUT SPLICE  
 W/ ELECTRICAL TAPE

10 AWG "UF" INSULATED  
 COPPER TRACE WIRE  
 TO FOLLOW WATER MAIN

— PROVIDE 2 - 3/4" GREASED STEEL  
 TIE RODS WITH "STAR" TIE BOLTS  
 ENCAPSULATED IN POLYETHYLENE  
 SHEETING, OR "PROTECTO WRAP".

IF MORE THAN 60" OF 6" DIP IS USED,  
 THEN THE HYDRANT SHALL BE MODELED  
 FOR FIRE FLOW.

SAFETY FLANGE

WRAP TRACER AROUND BASE,  
 THEN TIE TO ITSELF.

10 AWG "UF" GRADE  
 INSULATED COPPER  
 TRACE WIRE

5.5 FEET  
 MINIMUM  
 DEPTH  
 OF BURY

M.J. WITH  
 EBAA  
 IRON INC.  
 MEGALUG

6" GATE VALVE M.J.

2" MIN.  
 12" MAX.

GROUND SURFACE

4" X 8" X 16" SOLID  
 CONC. BLOCK

NO CONCRETE THRUST BLOCK!  
 USE FIELD LOCK GASKETS  
 AND MEGALUGS

WEEP HOLES

SCREENED ROCK  
 PIT 2'-6" DIA. BY  
 3' DEEP BELOW  
 HYDRANT DRAIN



# Typical Hydrant Setting

Appendix B-1

Location: **Dec 2008**

Date: **Water\Hydrantp**

NO. DWN. DATE. REVISION















## **Appendix C**

### **Typical Road Details**

- C.1 – Straight Curb
- C.2 – Mountable Curb and Gutter
- C.3 – Section of Typical Driveway Cut Across Sidewalk
- C.4 – Isometric of Typical Driveway
- C.5 – Isometric of Typical Handicap Ramp
- C.6 – Valley Pan
- C.7 – Street Intersection Curb Returns
- C.8 – Typical Street Cut Detail
- C.9 – Light Post Anchor Blocks
- C.10 – Major Collector Street
- C.11 – Minor Collector Street
- C.12 – Local Commercial Street
- C.13 – Local Residential Street

















**NOTES:**

- 1) PLACE TEMPORARY CAPS, OR DUCT TAPE OVER ALL CONDUIT ENDS.
- 2) USE APPROPRIATE FORMS TO ENSURE THAT BOLTS ARE MAINTAINED AT CORRECT LOCATIONS AND ARE SET VERTICAL, AS SHOWN.
- 3) PROTECT ANCHOR BOLT THREADS FROM DAMAGE AND CONCRETE WITH TAPE, OR OTHER SUITABLE METHODS.
- 4) SONO-TUBE FORM TO BE SET VERTICAL. PROVIDE ONE ENTRY AND ONE EXIT CONDUIT MINIMUM.
- 5) ORIENT ANCHOR BOLTS ONLY WITH RESPECT TO NORTH ARROW SHOWN. ORIENT CONDUIT ACCORDING TO SITE REQUIREMENTS.
- 6) ALL WIRING BETWEEN POWER SOURCE AND LAMP POSTS, AND BETWEEN EACH LAMP POST TO BE IN CONDUIT.
- 7) ALL BACKFILL PLACED AROUND ANCHOR BLOCKS TO BE COMPACTED TO 95% OF MAXIMUM DENSITY BASED ON THE STANDARD PROCTOR.
- 8) WIRE LIGHTS SO THAT SEVERAL LIGHTS ARE CONTROLLED BY A SINGLE PHOTO CELL NEAR A SINGLE DISCONNECT, WHENEVER POSSIBLE.
- 9) FOLLOW MANUFACTURERS SPECIFICATIONS FOR BOLT DIAMETER, LENGTH, CONCRETE DIAMETER AND DEPTH.
- 10) LEAVE 3" BETWEEN REINFORCEMENT AND EXPOSED EARTH.

12"-INCH DIA. BOLT CIRCLE.  
4 ANCHOR BOLTS SET AT  
90 DEG AROUND CENTER

18" DIA.  
SONO-TUBE CONC.  
FORM  
5.00' LONG, MIN

CONDUITS CENTERED  
IN SONO-TUBE

(2) TWO SCH. 40 P.V.C.  
CONDUITS, MINIMUM SIZE TO BE  
ESTABLISHED PER LATEST REVISION  
OF UNIFORM ELECTRIC CODE,  
1"-INCH MINIMUM (TYP.)

ALL BOLTS TO  
BE SET VERTICAL

FOUR (4) 3/4"-INCH DIA.  
BY 18"-INCHES LONG, MIN  
GALVANIZED ANCHOR BOLTS

FINISHED  
GROUND  
3/25' MIN  
10% ± SLOPE

ENTRY AND EXIT  
CONDUITS  
SHALL PASS THROUGH  
SONO-TUBE AT A SUFFICIENT DEPTH  
TO COMPLY WITH THE MOST  
CURRENT VERSION OF  
THE NATIONAL ELECTRICAL CODE.

6 #4 BARS EQUALLY  
SPACED RADIALLY IN CONCRETE

PLACE ON STABLE  
COMPACTED EARTH OR COMPACTED  
CLASS 6 ABC

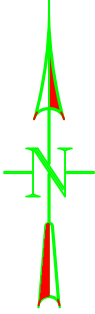
**SECTION A-A**

**LIGHT POST  
ANCHOR BLOCKS**



NOTE: ALL DIMENSIONS  
VARY BY POLE HEIGHT AND  
NUMBER OF HEADS, AS SPECIFIED  
BY TOWN CODE. CONFIRM  
SPECIFICATIONS PRIOR TO BEGINNING  
CONSTRUCTION

ORIENT BOTH ENTRY AND EXIT CONDUITS  
TO PROVIDE FOR AS STRAIGHT AS POSSIBLE  
CONDUIT RUNS BETWEEN LIGHT POSTS.



Location:

\\.\Road\Anchor

Date:

JAN 2009

NO.

DWN.

DATE. REVISION









**Appendix D**  
**Typical Storm Sewer Details**

D.1 – 4' Scupper Detail

D.2 – 6' Scupper Detail

D.3 – 8' Scupper Detail

D.4 – Storm Sewer Trench Detail

D.5 – Valley Pan Detail

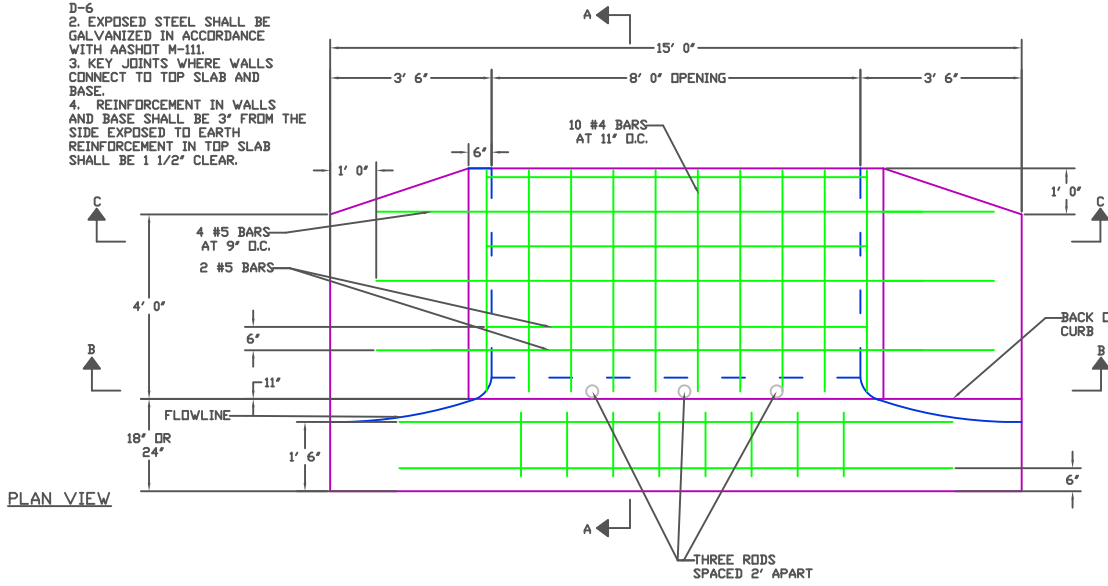
D.6 – Curb Inlet



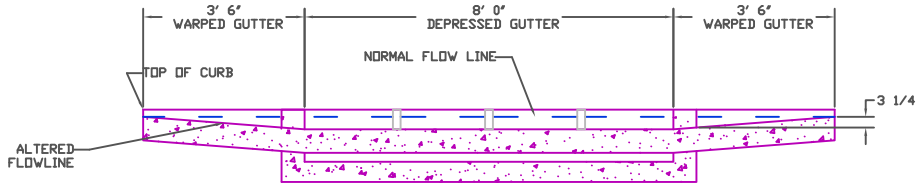


**GENERAL NOTES**

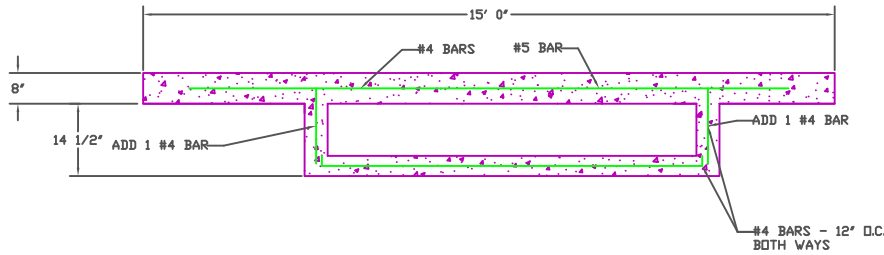
1. TOP OF SLAB OF CULVERT SHALL BE SLOPED TO MATCH SIDEWALK. SEE D-6
2. EXPOSED STEEL SHALL BE GALVANIZED IN ACCORDANCE WITH AASHTO M-111.
3. KEY JOINTS WHERE WALLS CONNECT TO TOP SLAB AND BASE.
4. REINFORCEMENT IN WALLS AND BASE SHALL BE 3" FROM THE SIDE EXPOSED TO EARTH. REINFORCEMENT IN TOP SLAB SHALL BE 1 1/2" CLEAR.



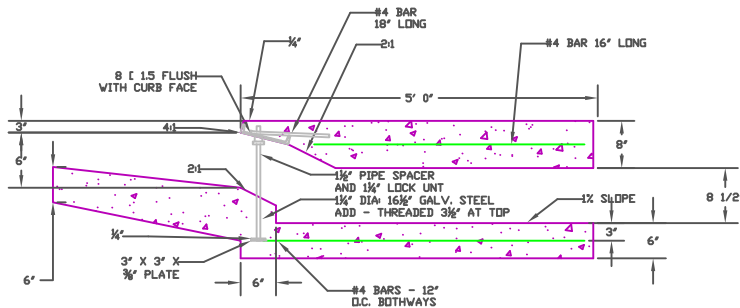
**PLAN VIEW**



**SECTION B-B**



**SECTION C-C**



**SECTION A-A**



<h1 style="font-size: 2em;">8' SCUPPER DETAIL</h1>	Date: Jan 2009
	Location: \\.. \Storm\Scupper

NO.	DWN.	DATE.	REVISION





