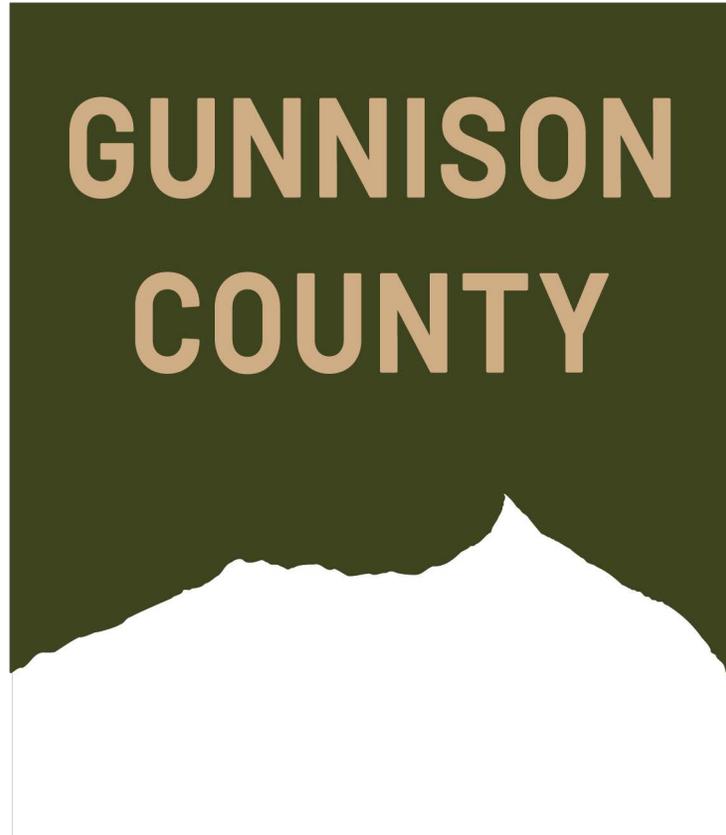


**CONSTRUCTION STANDARDS
FOR THE GUNNISON COUNTY
WATER AND SEWER
DISTRICT**



October 2023

GUNNISON COUNTY
CONSTRUCTION STANDARDS

SECTION 100	GENERAL SPECIFICATIONS
SECTION 200	GENERAL EARTHWORK SPECIFICATIONS
SECTION 300	SANITARY SEWER SPECIFICATIONS
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GUNNISON COUNTY
GENERAL SPECIFICATIONS

SECTION 100

I. SCOPE:

These specifications including material specifications and construction requirements are for all construction within Gunnison County right-of-way and in other areas under Gunnison County areas of jurisdiction or ownership.

These specifications are the minimum requirements for materials and construction and may only be modified by written approval of the Gunnison County. These specifications are intended to work in harmony with the District Rules and Regulations and the County Land Use Resolution.

II. DEFINITIONS AND ABBREVIATIONS:

Wherever the following words, phrases or abbreviations appear in these specifications, they shall have the following meanings:

Gunnison County: Gunnison County, Colorado.

Utility Manager: The Water and Sanitation Utility Manager, Gunnison County, Colorado, or an authorized representative acting on behalf of Gunnison County.

Engineer: The engineer assigned by the Public Works Director to a specific project.

Inspector: It can be the Utility Manager, the assigned Engineer, or an authorized representative acting on behalf of Gunnison County, at the site of the work.

Utility: The Gunnison County Water and Sewer District of Gunnison County, Colorado and all other utilities.

Public Improvements: The term "public improvements" includes public facilities and shall refer to the construction, installation, development or extension of the public water and / or sanitary sewer system.

Easement: See Gunnison County Land Use Resolution.

Sanitary Sewer: Conduits and related appurtenances employed to collect and

carry off water and waste water to a suitable point of final discharge.

Structures: Bridges, culverts, catch basins, drop inlets, retaining walls, cribbing, manholes, end walls, buildings, sewers, service pipes, under drains, foundation drains, fences, swimming pools and other features which may be encountered in the work and not otherwise classed herein.

Base Course: Use Gunnison County Road & Bridge Standards

Subbase: Use Gunnison County Road & Bridge Standards

Subgrade: The supporting structures on which the pavement and its special under courses rest.

Whenever the words, "as directed", "as required", "as permitted" or words of like meaning are used, it shall be understood that the direction, requirements or permission of the Utility Manager is intended. Similarly, the words "approved", "acceptable", "satisfactory" shall refer to approval by the Utility Manager.

Whenever references are made to standard specifications, methods of testing materials, codes, practices and requirements, it shall be understood that the latest revision of said references shall govern unless a specific revision is stated. Wherever any of the following abbreviations appear, they shall have the following meaning:

AASHTO - American Association of State Highway Transportation Officials

ASTM - American Society for Testing and Materials

AWWA - American Water Works Association

CDOT - Colorado Department of Transportation

OSHA- Occupational Safety and Health Administration

III. RESPONSIBILITY OF THE GUNNISON COUNTY:

1. Authority of the Utility Manager:

The Utility Manager shall have the authority on behalf of Gunnison County to

ascertain that all design and construction of facilities is equal to or better than the minimum requirements set forth in these specifications. The Utility Manager shall have the additional authority to assign an inspector to check any and all work, including all materials to be incorporated in the work, excavation, bedding, backfill, and all construction methods and practice.

2. Authority of the Inspector:

Inspectors are assigned to assist the Contractor in complying with these specifications. They have the authority to reject defective materials, or inferior materials and defective workmanship until such time as the Contractor shall correct the situation in question, subject to final decision by the Utility Manager.

IV. RESPONSIBILITY OF THE CONTRACTOR:

1. Notice Before Beginning Work:

The Contractor shall notify the Gunnison County Utility Manager at least twenty-four (24) hours before beginning any construction. If for any reason work should stop on a project during any stage of construction for a period of more than twenty-four (24) hours, it is the responsibility of the Contractor to notify the Gunnison County Utility Manager at least twenty-four (24) hours prior to any resumption of work on the project. If the Contractor intends to work extended shifts, double shifts, or hours other than the normal workday of Gunnison County personnel, he shall notify the Gunnison County Utility Manager at least twenty-four (24) hours prior to such extension, except in the event of an emergency. Failure to provide notification may provide sufficient cause for suspension of the project.

2. Traffic Control:

The Contractor shall be required to provide adequate construction signing, flagmen, barricades, etc., to warn vehicular and pedestrian traffic of work in progress and divert traffic as may be required during the course of construction. All signing shall conform to the Manual of Uniform Traffic Control Devices and shall be subject to the approval of the Traffic Control Supervisor. When specifically authorized by the Traffic Control Supervisor, portions of the streets shall be allowed to be closed to traffic for construction. However, the Contractor shall make every attempt to keep the time of closure to such streets to a minimum. It shall be the responsibility of the Contractor to notify the Fire Department, Police

Department and Ambulance Service twenty-four (24) hours prior to the closure of any street. In addition, for all work within State of Colorado highway rights-of-way the Contractor shall submit a traffic control plan to the CDOT Traffic Engineer for review.

3. Rejected Materials:

All materials installed shall be free of defects of manufacture. Any defective or damaged materials found in the construction or on the construction site shall be marked and removed from the site. In the event the Contractor fails to remove rejected materials from the construction site within a reasonable length of time, the Utility Manager may arrange for such removal at the expense of the Contractor.

4. Familiarity of Specification:

It shall be the responsibility of the contractor to read and fully comply with all the provisions of these specifications and all laws and regulations that apply to local and state agencies.

5. Maintenance of Site:

The cleanup and restoration of grounds shall be a continuous process from the beginning of construction to final completion of the work. The Contractor shall keep the work site free from the accumulation of debris and waste material caused by the work.

Immediately after the construction activity or major portion thereof is complete the area shall be cleaned and restored to the original grade and condition. All fences shall be replaced to the same elevation and alignment and restored to a condition equal to or better than that at the beginning of construction.

6. Public Relations and Notifications:

The Contractor shall carry on the work in such manner as to cause as little inconvenience as possible to the public, particularly to occupants of property along the project, as is consistent with good workmanship. They shall notify occupants at least twenty-four (24) hours in advance of proposed work that may block entrances or otherwise cause undue difficulty to occupants of property affected and shall restore such entrances to usable condition as soon as possible. The Contractor, Subcontractors and employees shall at all times be courteous to the

public while engaged upon this work.

The Contractor shall notify all business managers and residents affected by the interruption of utilities and other services caused by the work. Such notice shall be given at least twenty-four (24) hours prior to the interruption of service. Notice shall be given for the interruption of domestic water, irrigation water, sewer, trash pickup, mail delivery and changes in access to property.

Notifications may be verbal or in written form if the business manager or resident cannot be located. Water services shall not be discontinued for more than two (2) consecutive hours without special written permission from the Utility Manager.

Where trees, hedges, shrubs, or other ornamental plantings or structures within the construction limits are not designated to be protected or saved, the Contractor shall notify the owner of the property fronting the plantings or structures in question, not less than two (2) calendar days prior to their removal. This notification shall include allowing the property owner an option to transplant the plantings or relocate structures fronting his property onto his property instead of having the Contractor remove them. The Contractor shall bid the project based on assuming responsibility for all removals. This notification requirement is intended as a positive public relations action. All notifications described and required in this section are considered as incidental to the Work and will not be measured or paid for separately.

7. Protecting and Relocating Utilities:

It is the responsibility of the Contractor to provide for the protection of all structures and utilities including pipes, fences or similar items. Colorado 811 must be contacted before any and all work.

In the event of a break in an existing water main, gas main, sewer or underground cable, the Contractor shall immediately notify the responsible official of the organization operating the utility interrupted and shall lend all possible assistance in restoring services.

The Contractor shall bear the entire expense of repairing or replacing any utilities or structures disturbed or damaged during construction.

Unless otherwise specified in the Contract Documents, all utility relocations will be the responsibility of the utility companies; the Contractor shall be responsible for coordinating the relocation work with the Utility Companies and shall bear any reasonable and customary cost associated with the work.

8. Safety and Protection:

The Contractor shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the work. He shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury or loss to:

- (1) All employees on the job and other persons who may be affected thereby,
- (2) All work and all materials or equipment to be incorporated therein in storage on or off site and,
- (3) Other property at the site or adjacent thereto, including trees, shrubs, lawns, walks, pavement, roadways, structures and utilities not designated for removal, relocation or replacement in the course of construction.

The Contractor shall comply with all applicable laws, ordinances, rules, regulations and orders of any public body having jurisdiction for the safety of persons or property or to protect them from damage, injury or loss. The Contractor shall erect and maintain, as required by the conditions and progress of the work, all necessary safeguards for safety and protection.

GUNNISON COUNTY

GENERAL EARTHWORK SPECIFICATIONS

SECTION 200

I. SCOPE

The purpose of this Earthwork Specification is to set forth the criteria to be used for all construction within the rights-of-way and in any other areas of jurisdiction or ownership of Gunnison County. Work shall include but not be limited to: Surface Removals, Excavation, Dewatering, Trenching Embankment, Bedding and Backfill for all utilities, structures and roads.

II. MATERIALS:

1. Fill Material:
 - A. On-site: All on-site material suitable for STRUCTURAL BACKFILL shall be soil or soil-rock mixture which is free from frozen material, organic matter and other deleterious substances. It shall contain no rocks or lumps over eight (8) inches in greatest dimension. Wet material from the excavation shall be removed from the site and replaced with imported material.
 - B. Imported: Pit Run: Shall be well graded eight (8) inch minus material, meeting the requirements of "A" above, with less than 20 percent by weight passing the No.200 sieve and a liquid limit not greater than 35 percent.
 - C. Other Materials: Other materials may be selected by the Contractor subject to the approval of the inspector, or his authorized representative.
 - D. Bedding Material: Shall be 3/4" washed rock, with a minimum of 4" below pipe and 6" above pipe and on each side of the pipe, and shall be well graded.
 - E. Subbase - Course Aggregate: Aggregates shall be crushed stone, crushed slag, crushed gravel or natural gravel which conforms to the requirements of AASHTO M147. Aggregate

shall meet the grading requirements in the Classification Table below. The type used shall be specified on the plans or special provisions. The liquid limit (LL) shall be as shown in the table and the plasticity index (PI) shall not exceed 6 when the aggregate is tested in accordance with AASHTO T89 and T90, respectively.

- F. Base Course Aggregate: Colorado Department of Transportation Class 6 Aggregate Base Course
- G. Select Backfill Material may be either CDOT Class 6 Aggregate Base Course or Granular Bedding Material.

H. Flow-Fill:

Ingredients

Lbs./C.Y.

Cement (0.45 sack)	42
Water (39 gallons)	325 (or as needed)
Coarse Aggregate (Size no. 57)	1700
Sand (ASTM C-33)	1845

III. INSTALLATION:

A. Roadway Excavation and Grading:

This work shall consist of excavation, disposal, shaping or compaction of all material encountered within the limits of the roadway in close conformity with the lines, grades and typical cross sections shown on the plans or as directed by the inspector.

B. Clearing:

Excavation and grading for street improvements and paving projects shall include removal of trash, rubbish and low lying vegetation in the construction area. All vegetation and objects designated to remain shall be protected from injury or defacement.

C. Grubbing:

All vegetation such as trees, stumps, hedges, shrubs, brush, heavy sod, heavy growth of grass, decayed vegetable matter, rubbish and

other unsuitable material within the area of excavation or upon which embankment is to be placed shall be stripped or otherwise removed to a depth of 3 inches. All such materials shall be separated from suitable topsoil and backfill material, and hauled to a disposal site secured by the Contractor.

Except in areas to be excavated, stump holes and other holes from which obstructions are removed, shall be backfilled with suitable material and compacted in accordance with these specifications.

D. Stripping:

Stripping shall consist of removing unsuitable overburden material before removal of other material for use in the roadway. All areas to be graded and all embankments or fill areas under paved slabs shall be stripped.

E. Excavation:

After all clearing, grubbing and stripping has been done, excavation of every description and of whatever materials encountered within the grading limits of the project shall be performed. All suitable excavated materials shall be transported to and placed in embankments or fills within the limits of the work.

The excavation and embankments for the roadway and ditches shall be finished to reasonably smooth and uniform surfaces. Variation from the subgrade plane shall not be more than 1 inch of soil. Excavation operations shall be conducted so that material outside of the limits of slopes will not be disturbed, but all cuts shall be made to subgrade a minimum of 1 foot outside the proposed edge of paving slab or curb. Prior to beginning grading operations in any area, all necessary clearing and grubbing in that area shall have been performed. The Contractor shall not excavate beyond the dimensions and elevations established, and material shall not be removed prior to the staking.

If excavation to the finished graded section encounters a subgrade or slopes of spongy material, vegetable matter or trash pockets, the inspector may require the Contractor to remove the unsuitable materials and backfill to the finished graded section with suitable material. The inspector may designate as unsuitable those soils or materials that are in his judgment detrimental to the finished roadway. All unsuitable material shall be disposed of outside the construction area.

F. Shouldering and Miscellaneous Work:

The Contractor shall deposit sufficient suitable earth between curb and sidewalks, or property lines, so that when smoothed and consolidated in final deposition, it will provide a uniform smooth slope from top of curb to the adjacent sidewalk or property line. All broken concrete, trash and debris shall be removed before any fill is placed back of curb. In case excavation is necessary to accomplish the above purpose, the Contractor shall make such necessary excavation, and he shall leave the parking area so filled or excavated free from all trash and debris.

The Contractor shall set all manholes, water boxes or other service boxes, 4" below finished grade on gravel roads and 1/2" below finished grade on asphalt roads. This work will be considered as part of the grading.

G. Embankments:

Embankment construction shall consist of constructing roadway embankments, including preparation of the areas upon which they are to be placed; the construction of dikes; the placing and compacting of approved material within project areas where unsuitable material has been removed; and the placing and compacting of embankment material in holes, pits and other depressions within the project area. Only approved materials shall be used in the construction of embankments and backfills.

Free running water shall be drained from the material before the material is placed. Rocks, broken concrete or other solid materials more than 6 inches in greatest dimension shall not be placed in embankment areas less than 1 foot deep as measured from the subgrade. Materials up to about 150 pounds in weight may be placed at the base of fills over 3 feet deep measured from the subgrade. All fill material shall be free from roots, organic material, trash and frozen material.

When an embankment is to be placed and compacted on hillsides, or when new embankment is to be compacted against existing embankments, or when embankment is built one-half width at a time, the slopes that are steeper than 4:1 when measured longitudinally or at right angles to the roadway shall be continuously benched over those areas where it is required as the work is brought up in layers. Benching shall be well keyed and

where practical a minimum of 8 feet wide. Each horizontal cut shall begin at the intersection of the original ground and the vertical sides of the previous cuts. Material thus cut out shall be re-compacted along with the new embankment material at the Contractor's expense.

Embankment material shall be placed in horizontal layers not to exceed 8 inches in loose depth and compacted prior to placing each following layer.

When pipe is to be installed in areas requiring fills or embankments, the embankment or fill shall be completed a minimum of one (1) foot above the top of the pipe to be installed, prior to trenching and installation of the pipe.

The Contractor shall add moisture to or dry by aeration each layer as may be necessary to meet the requirements for compaction. Materials shall not be placed in embankments or fills when the moisture content exceeds 5% above or is 3% below optimum moisture content for that material. Under roadways and extending 1 foot beyond proposed curb line measured perpendicular from the centerline embankments shall be compacted for the entire depth of the fill to a density of not less than 90% maximum density except the top three feet which shall be compacted to at least 95% maximum density as defined by ASTM D698.

H. Trench Excavation:

1. Surface Removals and Topsoil Preservation

The Contractor shall remove surface materials and obstructions only to the widths necessary for excavation of the trench. All fences, landscaping and structures not designated for removal shall be protected or, if moved, restored to their original condition after construction is complete.

Removal of concrete curbs, gutters, sidewalks and driveways shall be along existing joints or neatly cut lines.

Where excavation is required under paved areas, the pavement shall be cut in such a manner as to effect a smooth, straight cut edge and as a vertical face six (6) inches minimum beyond the trench wall. All vegetation,

concrete, asphalt and other refuse removed from the construction limits shall be separated from suitable topsoil and backfill material, and hauled to a disposal site secured by the Contractor.

Clean topsoil suitable for final grading shall be stripped, stockpiled separately in approved locations and restored to the surface after the trench is backfilled evenly. Where excavation is in a lawn covered area the sod shall be cut and removed and replaced after trench filling so as to promote regrowth. Where sod is disturbed the contractor shall resod with like grass at his own expense.

2. Stockpiling Excavated Material:

Excavated material shall be piled in locations that will not endanger the work, create traffic hazards or obstructed sidewalks and driveways. Fire hydrants, valve boxes, manholes and other utility access points shall be left unobstructed until the work is complete.

Gutters and other water courses shall not be obstructed unless other provisions are made for runoff and street drainage.

All surplus material and excavated material unsuitable for backfilling shall be removed from the site and disposed of in areas secured by the Contractor.

3. Trenching:

Trenches shall be excavated to the width necessary to permit the pipe to be laid and jointed properly and backfill materials placed and compacted as required. Where conduit is to be installed outside of existing pavement and pipes have an inside diameter of 33 inches or less, the trench shall be excavated at pipe level a minimum of 16 inches wider than the outside diameter of the pipe so that a clear space of not less than 8 inches is provided on each side of the pipe.

For pipes having an inside diameter of 36 inches or greater, the trench shall be excavated at pipe level a minimum of 24 inches wider than the outside diameter of the pipe so that a clear space of not less than 12 inches is provided on each

side of the pipe. Wherever it is necessary to exceed these limits, approval of the inspector shall be obtained and provision shall be made for the additional load imposed on the pipe. When sheeting is used, the widths indicated above shall be measured to the inside dimension between the sheeting.

a. Bracing and Sheeting of Trenches:

All trenches shall be properly braced, sheeted or otherwise supported to provide safe working conditions and protection of the Work, workers and adjacent property.

Bracing and sheeting shall conform to the recommendations in the Occupational Safety and Health Standards for Construction (OSHA). A trench box or trench shield may be used in lieu of sheeting and bracing as permitted by OSHA. Unless otherwise approved, all trench support materials shall be removed in a manner that will prevent caving of the sides and movement or other damage to the pipe.

b. Trenches with Sloping Sides:

When working conditions and right-of-way width permit it trenches may be excavated with sloping sides in accordance with OSHA requirements.

Where trenches with sloping sides are permitted, the slopes shall not extend below a point 12 inches above the top pipe.

4. Pavement Removal:

All removed pavement and excavations made in Gunnison County Roads shall require a road cut permit obtained at Public Works prior to excavation and be replaced at the Contractor's expense.

5. Excavation below Grade:

Where the excavation is carried beyond or below the lines and grades shown on the plans or staked, the Contractor shall, at his own expense, refill and compact all such

excavated space with suitable granular material.

6. Over excavating For Rock:

When bedrock or boulders are encountered in the trench bottom or loose, stony soil where there is the possibility of pipe being subjected to "point" contacts, the trench shall be over excavated a minimum of 6 inches. The over excavated material shall be replaced with inspector-approved material (3/4" washed rock).

If blasting is required for rock excavation, all work with explosives shall conform to Federal and State Laws, and OSHA rules and regulations. Any damage caused by blasting shall be repaired by the Contractor at his expense.

7. Unstable Trench Bottom:

Where the excavation is found to consist of organic matter or any other material that the Inspector determines to be unsuitable for supporting the pipe, the trench shall be excavated to an additional depth as directed by the inspector and replaced with an approved granular stabilization material. The inspector shall determine suitability of materials to be used.

8. Removal of Water:

Trenches shall be kept free of water during pipe laying operations by draining, pumping or other approved methods. The water level shall be maintained below the trench bottom throughout the placement of bedding, pipe laying, joining and backfilling operations. The dewatering shall be carried out so that it does not destroy or weaken the strength of the soil under or alongside the trench. Water shall be disposed of in a suitable manner without damage to adjacent property or without being a menace to public health and convenience. Under no circumstances shall trench water be discharged into sanitary sewers. The method of disposal of trench water shall be approved by the inspector.

9. Bedding and Shaping Trench Bottom:

All trenches shall be excavated to at least 4 inches below the

pipe grade and backfilled to grade with 3/4" washed rock as bedding material. The bedding material shall be hand shaped and graded until the trench bottom is uniform and free from rocks, bumps, and depressions. A coupling or bell hole shall be dug at each pipe joint with sufficient length, width and depth to permit assembly of the joint and provide a minimum clearance of 2 inches between the coupling and the trench bottom. Washed 3/4" rock bedding shall be the minimum acceptable bedding for all pipe.

If in the opinion of the engineer the pipe is subjected to unusual loading Class A - Concrete Arch bedding may be required. The Contractor shall provide an analysis the load conditions and the bedding required if directed by the Inspector.

Refer to the Standard Drawings for bedding details.

10. Backfilling Pipe and Structures:

Unless otherwise specified or approved by the inspector, all backfill material shall be placed with moisture-density control in accordance with the typical trench detail shown on Gunnison County Standard Drawings. All backfill material shall be adjusted to within 3 percent of the optimum moisture content prior to its placement in the trench. Jetting or water soaking trenches to achieve compaction of the backfill will not be permitted except when: (1) soil sample tests show that the backfill and excavated trench materials consist of gravel or other granular material having less than 15 percent by weight passing on No. 200 sieve; and (2) the engineer has given written approval prior to water soaking.

During initial backfilling, the Contractor shall take all necessary precautions to prevent movement or distortion of the pipe or structure being backfilled. Pipe haunching material shall be placed and compacted in even lifts on both sides of the conduit to 6 inches above the top of the pipe. Above the bedding and haunching material, earth backfill material shall be placed full width in uniform layers not more than twelve inches thick. Each layer shall be compacted to the required density with approved mechanical or hand tamping equipment.

Concrete structures shall not be backfilled until the concrete and mortar therein has attained a minimum compressive strength of 2000 psi and can sufficiently support the loads imposed by the backfill. Select backfill shall be placed simultaneously on all sides of the structure in layers approximately 12 inches thick. Each layer shall be compacted to not less than 95 percent of the maximum dry density determined in accordance with AASHTO T-99.

11. Compacting Backfill Material:

Backfill material in trenches shall be compacted to at least 90 percent of maximum density except for the top 3 feet of the trench under existing or proposed roads or structures which shall be compacted to at least 95 percent of maximum density. Maximum density shall be defined by ASTM D698. All approved backfill material shall be adjusted to within 3 percent of the optimum moisture content prior to its placement.

12. Backfilling With Flow-Fill

At the Contractors option Flow-Fill meeting the requirements set fourth in the Materials portion of this specification may be used in lieu of compacted backfill in pipeline trenches and around structures only. Compaction testing of trench backfill will not be required if material meeting the above requirement is use

I. PIPE BORING AND JACKING

1. DESCRIPTION

- A. This section covers the furnishing and installation of casing pipe by boring or jacking.
- B. Reference Drawing 200-4.

2. QUALITY ASSURANCE

- A. Design Criteria
 - 1. Specified thicknesses for pipe and casing are based upon the superimposed loads and not upon the loads which may be placed on the pipe as a result of jacking operations.
 - 2. Provide increased pipe strength necessary to withstand jacking loads.
- B. Requirements of Regulatory Agencies
 - 1. Obtain the necessary permits from the appropriate jurisdiction.
 - 2. Obtain bonds or indemnity required by the permits for protection against damage and interference with traffic and service by construction activities.

3. SUBMITTALS

- A. Certification: Submit manufacturer's certification that materials meet referenced standards.
- B. Shop Drawings: Submit manufacturer's drawings and specifications on the materials.

4. ALTERNATIVES

- A. Request for substitution of "reject" or used pipe in lieu of new pipe may be made with written approval. Used pipe shall be clean, free from heavy corrosion, patches, cuts and holes, and shall be straight and true in centerline alignment and circular in cross section. Pipe shall in all other respects meet the requirements specified for new pipe. Acceptance of all pipe shall be at the discretion of the District Engineer.

5. CASING PIPE

- A. Smooth Steel Pipe
 - 1. Minimum Yield Point: 35,000 psi.
 - 2. Wall Thickness: Minimum allowable.

<u>Diameter, inches</u>	<u>Thickness, inches</u>
24 inch or smaller	0.250
30	0.250
36	0.312

3. Ends: Beveled for field welding.
4. Exterior Coating: Coal tar enamel, AWWA C203, Section 2.

6. ACCESSORIES

- A. Casing Seals
 1. Materials: High density rubber with stainless steel strap.
 2. Manufacturer: Pipeline Seal and Insulator Co., Model W, or equal.
- B. Casing Chocks
 1. Materials: Stainless steel casing chock
 2. Manufacturer: Pipeline Seal and Insulator Company, Model 4810, or equal.
- C. Bands: Stainless steel straps.

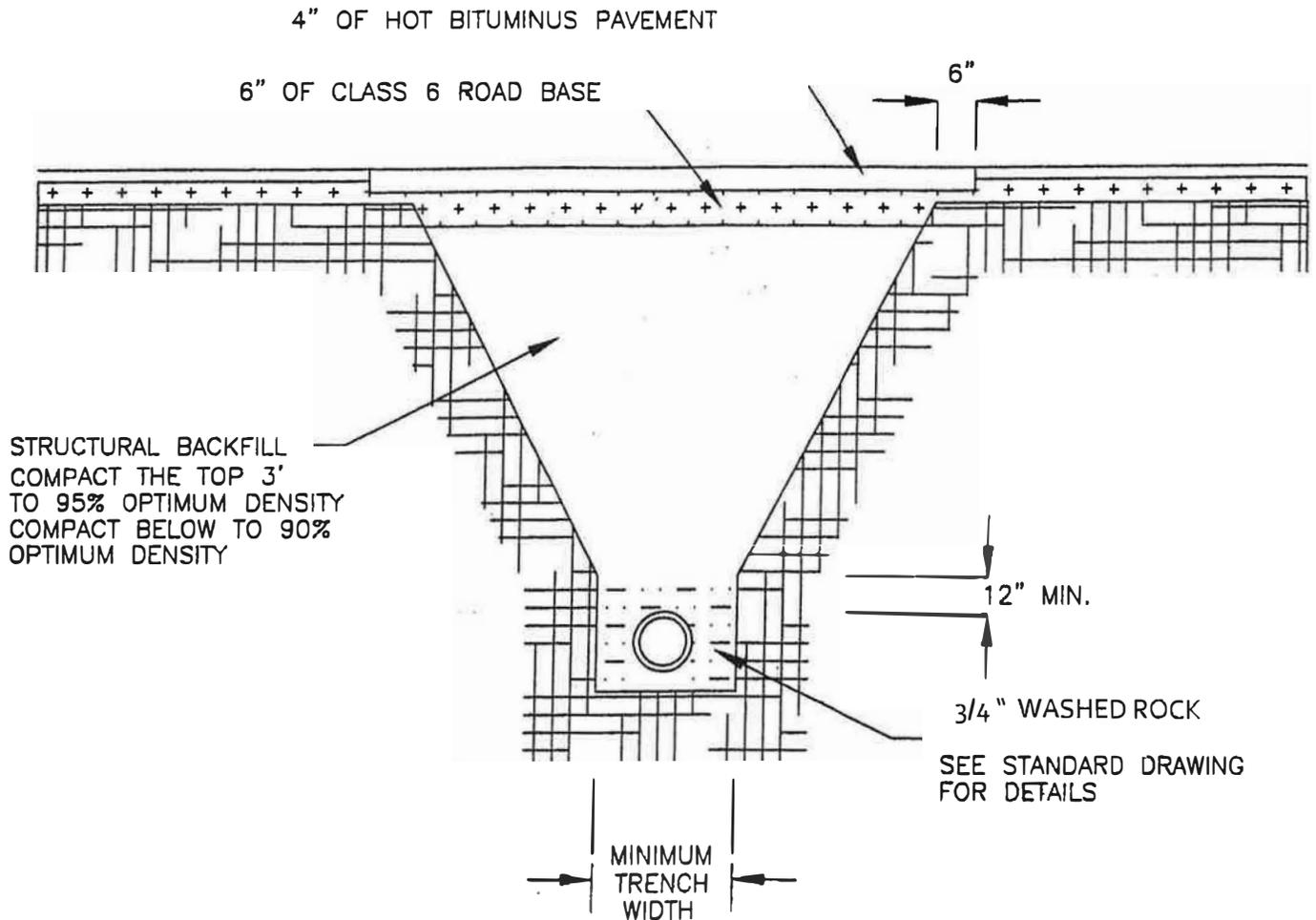
7. CASING INSTALLATION

- A. General
 1. Install the casing by jacking or tunneling through the earth.
 2. Open trench excavation shall not be permitted where boring or jacking is specified.
 3. Remove earth displaced by the casing through the interior by hand, by auger, or other acceptable means.
- B. Smooth Steel Pipe
 1. Provide adequate equipment to insure a smooth, continuous and uniform casing with no exterior voids.
 2. Weld each section of pipe with a full penetration butt weld around the entire circumference of the joint to form a continuous conduit capable of resisting all stresses, including jacking stresses.

8. CARRIER PIPE INSTALLATION

- A. Install pipe in accordance with the applicable pipe specification sections.
- B. Attach 3 pipe chocks to each pipe length with a maximum spacing of 6 feet and insert carrier pipe. Reference Drawing 200-4.
- C. Seal the ends of the casing with casing seals.

STANDARD TRENCH DRAWING



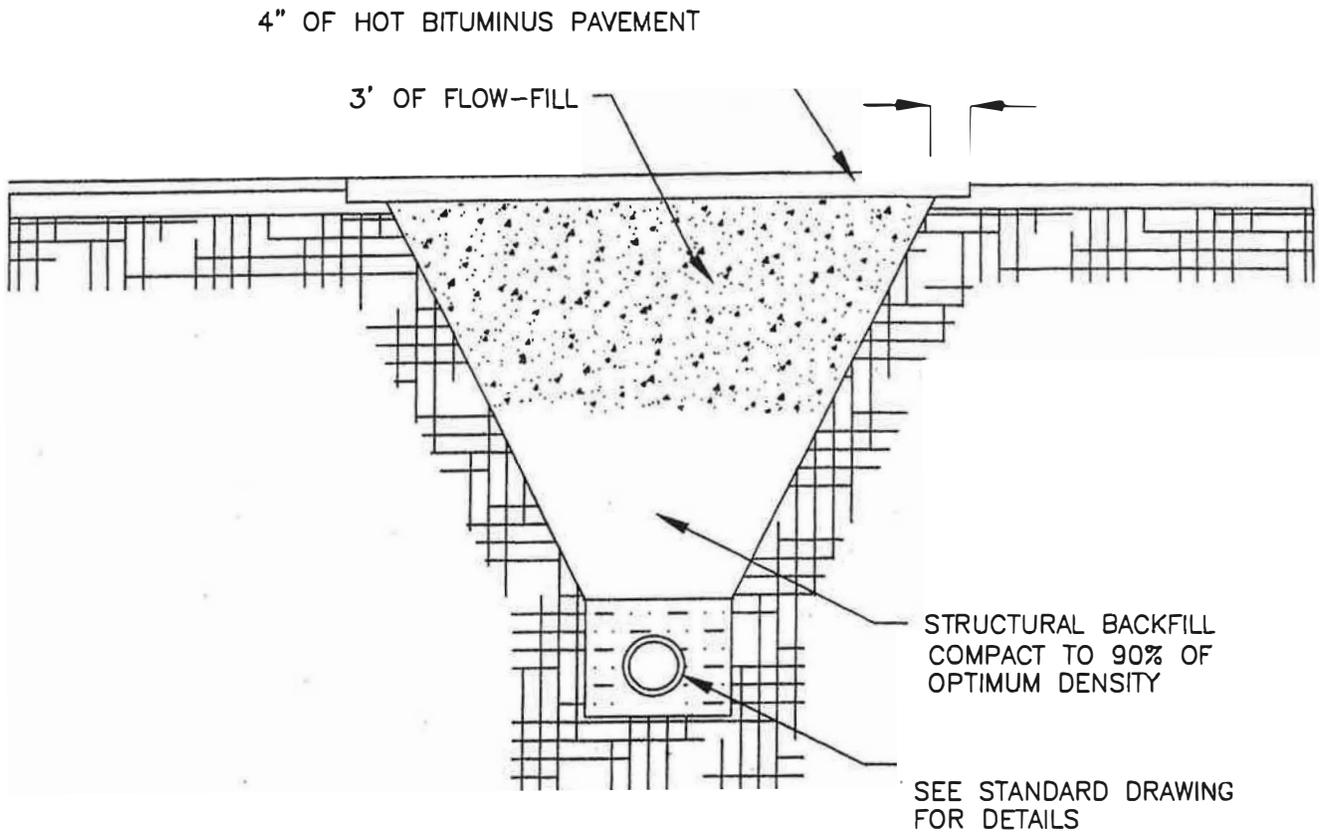
TRENCH WIDTH NOTES:

1. INSIDE DIAMETER PIPE < 33" ALLOW 8" MIN. EACH SIDE OF PIPE
2. INSIDE DIAMETER PIPE > 36" ALLOW 12" MIN. EACH SIDE OF PIPE
3. TRENCH WIDTHS SHALL NOT BE WIDENED BEYOND THESE LIMITS BELOW THE TOP OF THE PIPE.

PAVEMENT PATCHING NOTES:

1. EXISTING PAVEMENT TO BE CUT STRAIGHT 6" FROM THE EDGE OF THE TRENCH
2. IF THE ADJACENT PAVEMENT IS DISTURBED IT SHALL BE RECUT TO A NEAT LINE AND REPLACED.
3. MINIMUM PATCH THICKNESS IS 4" OR MATCHING EXISTING WHICHEVER IS GREATER.
4. MINIMUM PATCH THICKNESS ON U.S. HIGHWAY 50 IS 6"
5. PATCHING SHALL BE COMPLETED WITHIN 48 HOURS OF COMPLETION OF BACKFILL
6. IF HOT BITUMINOUS PAVEMENT IS NOT AVAILABLE COLD PATCH SHALL BE USED. COLD PATCH SHALL BE REPLACED WITH HOT BITUMINOUS PAVEMENT AS SOON AS IT IS AVAILABLE.

FLOW-FILL BACKFILL DRAWING



SEE STANDARD TRENCH DRAWING FOR TRENCH WIDTH AND PAVEMENT PATCHING REQUIREMENTS.

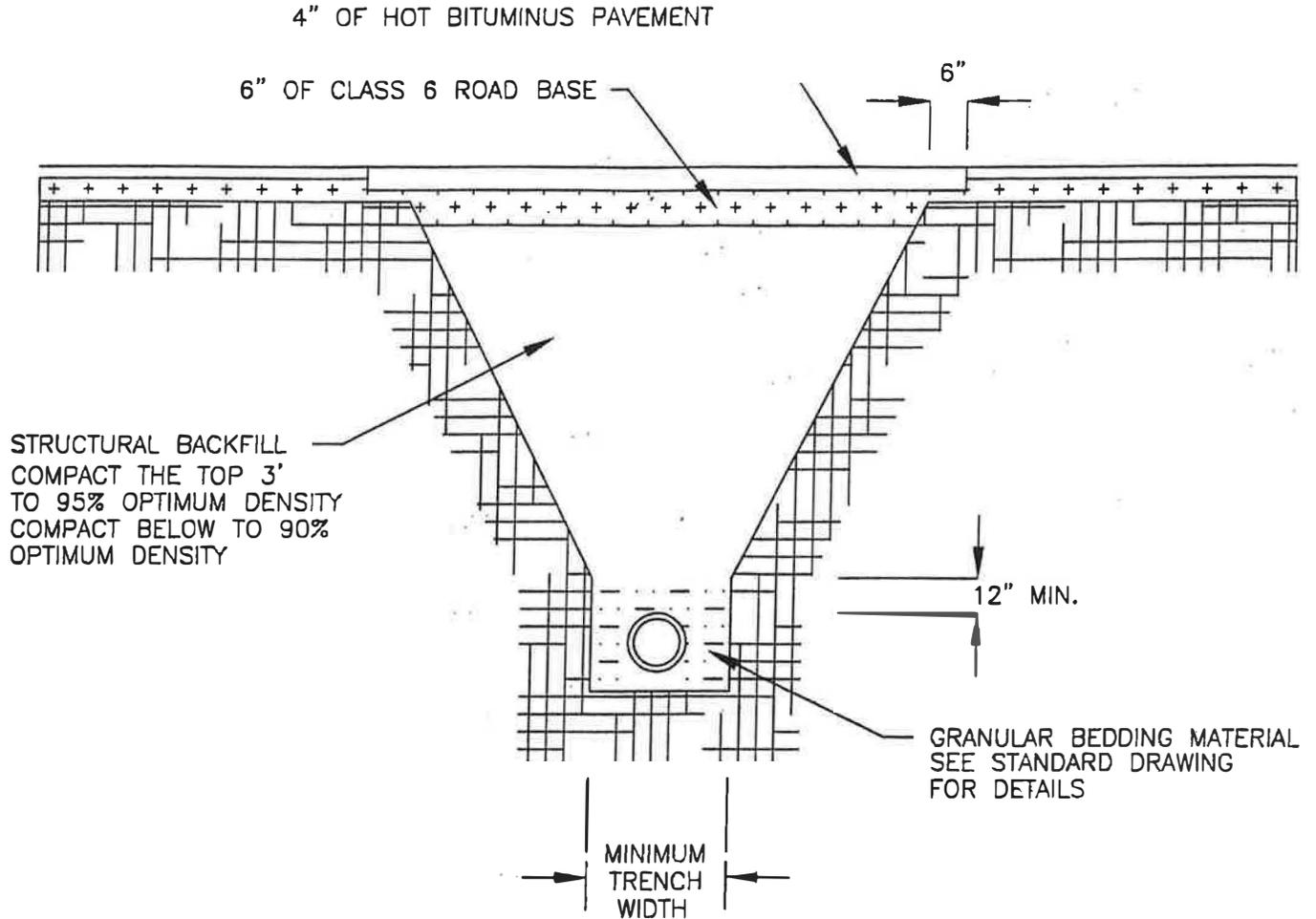
EXCEPT:

IF HOT BITUMINOUS PAVEMENT IS NOT AVAILABLE THE TRENCH MAY BE FILLED LEVEL TO THE ADJACENT PAVEMENT WITH FLOW-FILL. THE TOP 4" SHALL BE REPLACED WITH HOT BITUMINOUS PAVEMENT AS SOON AS IT IS AVAILABLE.

COMPACTION TESTING NOT REQUIRED WITH THIS DRAWING

DRAWING 200-2

STANDARD TRENCH DRAWING



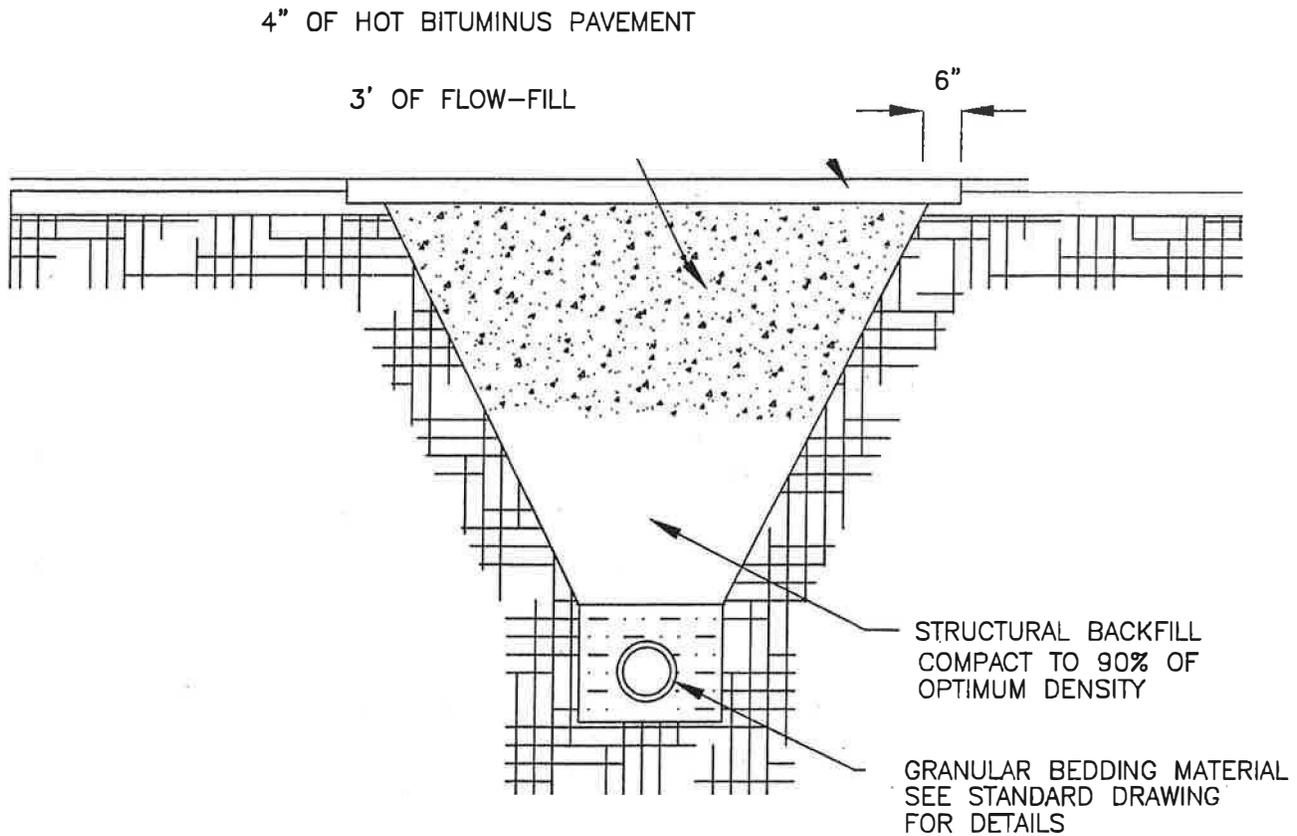
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1. EXISTING PAVEMENT TO BE CUT STRAIGHT 6" FROM THE EDGE OF THE TRENCH
2. IF THE ADJACENT PAVEMENT IS DISTURBED IT SHALL BE RECUT TO A NEAT LINE AND REPLACED.
3. MINIMUM PATCH THICKNESS IS 4" OR MATCHING EXISTING WHICHEVER IS GREATER.
4. MINIMUM PATCH THICKNESS ON U.S. HIGHWAY 50 IS 6"
5. PATCHING SHALL BE COMPLETED WITHIN 48 HOURS OF COMPLETION OF BACKFILL
6. IF HOT BITUMINOUS PAVEMENT IS NOT AVAILABLE COLD PATCH SHALL BE USED. COLD PATCH SHALL BE REPLACED WITH HOT BITUMINOUS PAVEMENT AS SOON AS IT IS AVAILABLE.

FLOW-FILL BACKFILL DRAWING



SEE STANDARD TRENCH DRAWING FOR TRENCH WIDTH AND PAVEMENT PATCHING REQUIREMENTS.

EXCEPT:

IF HOT BITUMINOUS PAVEMENT IS NOT AVAILABLE THE TRENCH MAY BE FILLED LEVEL TO THE ADJACENT PAVEMENT WITH FLOW-FILL. THE TOP 4" SHALL BE REPLACED WITH HOT BITUMINOUS PAVEMENT AS SOON AS IT IS AVAILABLE.

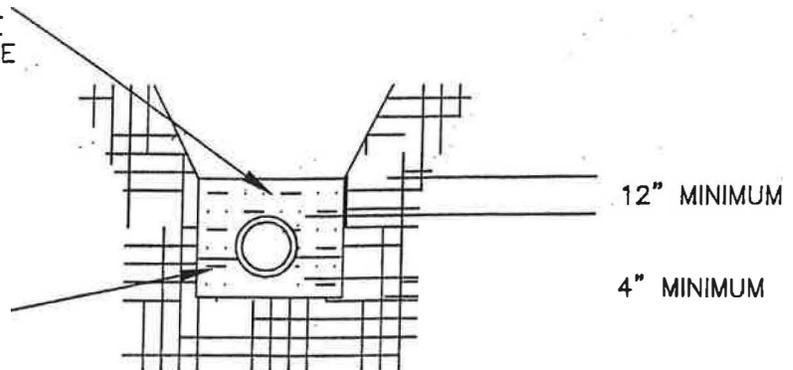
COMPACTION TESTING NOT REQUIRED WITH THIS DRAWING

DRAWING 200-2

PIPE EMBEDMENT DRAWING

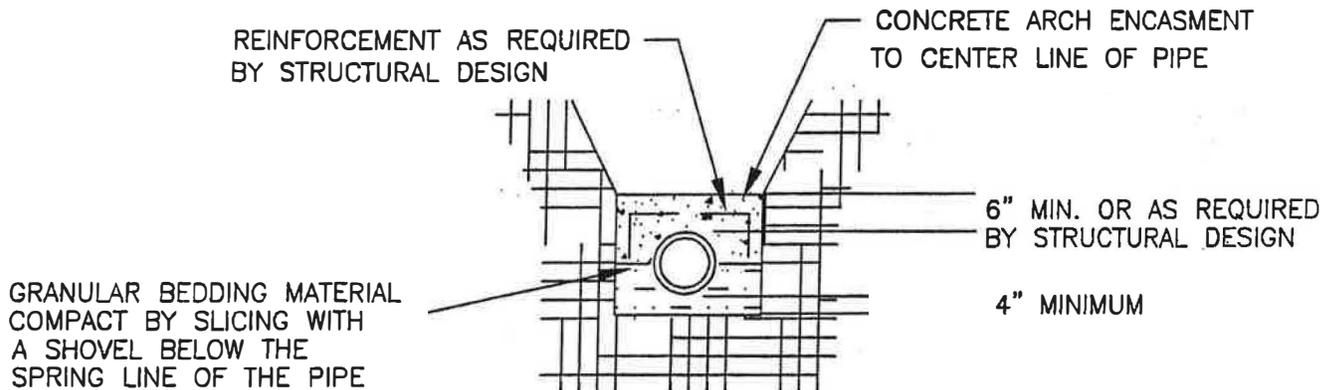
GRANULAR BEDDING MATERIAL
COMPACT BY SLICING OR
VIBRATORY COMPACTOR ABOVE
THE SPRING LINE OF THE PIPE

GRANULAR BEDDING MATERIAL
COMPACT BY SLICING WITH
A SHOVEL BELOW THE
SPRING LINE OF THE PIPE



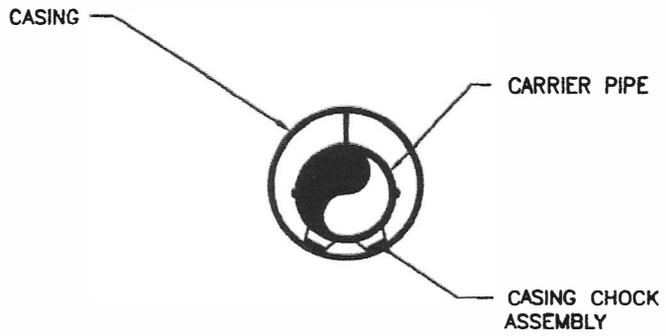
CLASS B EMBEDMENT DRAWING

GRANULAR BEDDING MATERIAL SHALL BE PLACED IN 6" MAX. LIFTS

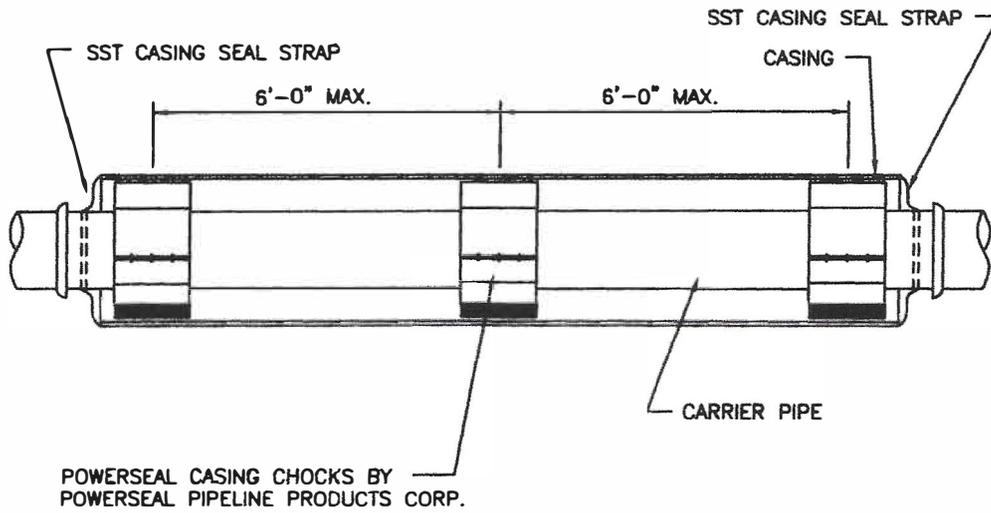


CLASS A EMBEDMENT DRAWING
CONCRETE ARCH ENCASUREMENT

DRAWING 200-3



END SECTION



PIPE CASING DETAIL

DRAWING 200-4

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GUNNISON COUNTY

SANITARY SEWER SPECIFICATIONS

SECTION 300

I. SCOPE:

The purpose of the Sanitary Sewer Specification is to set forth the criteria to be used in the construction of sanitary sewer mains and appurtenances for approval and acceptance by Gunnison County.

All sanitary sewer mains shall be constructed using a pipe with a minimum nominal inside diameter of eight (8) inches.

All excavation and backfill shall conform to the General Earthwork Specification and as shown on the Standard Details of this section.

II. MATERIALS:

1. Rigid Poly Vinyl Chloride Pipe (PVC) & Fittings:

General: All PVC pipe shall meet the requirements of ASTM Designation D3034 "Type PSM Poly Vinyl Chloride (PVC) Sewer Pipe and Fittings", latest revision. The maximum allowable length per section of pipe from bell to spigot shall not exceed 20 feet.

Wall Thickness: The wall thickness of all PVC pipe shall meet ASTM Designation D3034: SDR 35 or better.

Joints: Pipe joint assemblies shall be bell and spigot with an O-ring rubber gasket, for main line and service lines.

Acceptance: In addition to any deficiencies covered by ASTM D3034, PVC which has any of the following visual defects will not be accepted:

- A. Improperly formed pipe such that the pipe intended to be straight has an ordinate, measured from the concave side of the pipe, exceeding 1/16 inch per foot of length.
- B. Pipe which is sufficiently out-of-round to prohibit proper jointing.
- C. Improperly formed bell and spigot ends.

requirements of ASTM C-150, Type II. Fine aggregate shall consist of well graded, natural sand having clean, hard, durable, uncoated grains, free from organic matter, soft or flaky fragments or other deleterious substances. The fine aggregate shall be thoroughly washed and shall be uniformly graded from coarse to fine with a minimum of 95% passing a number 4 sieve and a maximum of 7% passing a number 100 sieve. All mortar shall be fresh for the work at hand. Mortar that has begun to set shall be thrown away.

- E. Cement: All cement used in concrete and mortar shall conform to ASTM Designation C-150, Type II.
 - F. Aggregate: Aggregate shall conform to Standard Specifications for Concrete Aggregates ASTM Designation C33.
3. Encasements: Concrete for encasements shall have a minimum cement content of 5 sacks per cubic yard and a maximum water content of 6 gallons per sack of cement and shall have a minimum compressive strength of 2500 psi in 28 days.

III. INSTALLATION:

1. Grade Stakes: The Developer's Engineer shall provide grade stakes for all sewer main installation. These stakes shall locate the main both horizontally and vertically. All manholes shall be staked for centers, line, and elevation.

Other methods of maintaining alignment, such as the use of laser beam equipment or surveying equipment are acceptable.

2. Pipe: Pipe shall be installed at the depths and location shown on the drawings and shall be a minimum of 6 feet from top of pipe to existing or proposed finish grade which ever is lower. No rocks larger than 2 inches in diameter will be permitted within 1 foot of the pipe. Sufficient handwork will be necessary around the bell so that the pipe will have a firm bearing from end to end. This will ensure that the weight of the pipe and backfill will be carried on the body of the pipe and not concentrated on the bell. All adjustments to line and grade must be made by scraping or filling under the body of the pipe. Wedging or blocking of the bell of the pipe will not be permitted. Bedding shall be as specified in the General Earthwork Section 200 of these specifications.

Sewer mains or service lines shall not be installed at less than six (6) foot below finished grade without the permission of the inspector. The type and

amount of insulation over the pipe shall be approved by the inspector.

The pipe shall be laid upgrade from structure to structure, with bell end upgrade. All main sewer pipe shall be pushed past the guide mark and to the shoulder of the bell (properly seated).

3. Manholes: Manholes shall be constructed at the locations and to the elevations indicated on the drawings. Manholes shall be so constructed so as to form a circle in a horizontal plane.

Bedding material shall be 1 1/2" washed rock for all manhole bases to a depth of one foot.

The internal diameter of 4 foot manhole barrels shall be maintained to a distance of not more than 4 feet below finished grade. From that point, the manhole barrel shall be tapered to the 24 inch internal diameter for 4 foot diameter manholes, as shown on the standard drawings for this section.

The internal diameter of 5 foot manhole barrels shall be maintained to a distance of not more than 5 feet below finished grade. From that point, the manhole barrel shall be tapered to the 24 inch internal diameter for 5 foot diameter manholes shown on the standard drawings for this section.

The internal diameter of 6 foot manhole barrels shall be maintained only a distance of 6 feet - 6 inches above the manhole base. Then reduce the barrel to an internal diameter of 5 feet to a distance not more than 5 feet below the finished grade. From that point, the manhole barrel shall be tapered to a 24 inch internal diameter. The manhole barrels shall be tight at all joints.

The cone section shall not extend closer than 8 inches and not more than 16 inches from the top of the manhole cover. Precast concrete adjustment rings shall be used on top of the cone to support and adjust the manhole frame to the required final grade.

The horizontal joints between precast manhole sections shall be sealed with preformed bitumastic material and plastered and troweled smooth, inside, with Portland Cement mortar. The mortar shall be not less than 5/8 of an inch in thickness over the joint and shall extend at least 4 inches either side of the joint. The joint between the manhole base and the lowest precast section shall be grouted, inside and outside.

Where the sewer main enters the manhole, necessary measures shall be taken to prevent any infiltration of groundwater into the system as shown on

the Standard Drawings of this section. Connections to precast manholes may be made with a continuous circular connector cast into the manhole wall. Connectors shall be acceptable to the inspector.

The horizontal joints between precast manhole sections shall be sealed with preformed bitumastic material and plastered and troweled smooth, inside, with Portland Cement mortar. The mortar shall be not less than 5/8 of an inch in thickness over the joint and shall extend at least 4 inches either side of the joint. The joint between the manhole base and the lowest precast section shall be grouted, inside and outside. For manholes in groundwater the exterior shall be water proofed in some fashion.

Where the sewer main enters the manhole, necessary measures shall be taken to prevent any infiltration of groundwater into the system as shown on the Standard Drawings of this section. Connections to precast manholes may be made with a continuous circular connector cast into the manhole wall. Connectors shall be acceptable to the inspector.

4. Precast Bases: The pipe shall not extend more than 1 inch inside the manhole wall.

Concrete inverts shall be placed in the bases conforming to the requirements of the cast-in-place manhole base requirements for changes in direction and size.

Prior to placing the precast base the subgrade shall be level and at the correct elevation for the connecting pipe. No wedging or blocking of the base will be allowed.

5. Connections to Existing Manholes: Sewer pipe connection to existing manholes where there is no existing pipe stubbed out shall be made in such a manner that the finished work will conform as nearly as practicable to the essential requirements specified for new manholes. The Contractor shall break out as small an opening in the existing manhole as necessary to insert the new sewer pipe. The existing concrete foundation bench shall be shaped to the cross-section of the new pipe in order to form a smooth continuous invert similar to what would be formed in a new concrete base. Cement grout shall be used as necessary to smoothly finish the new invert and to seal the new line so the junction is watertight.
6. Outside Drop Manholes: Whenever the elevation difference between the incoming sewer invert and the invert of the manhole is equal to or greater than 24 inches, an outside drop shall be indicated on the drawings and shall be constructed as shown.

The diameter of the drop shall not be less than the diameter of the sewer main. This specification for outside drops shall apply equally to any service line where it enters a manhole.

Construction of outside drops shall be in accordance with the Standard Drawings of this section.

7. Encasements: Prior to placing the concrete for cradles or encasements, temporary supports consisting of concrete blocks or bricks shall be used to support the pipe in place. Not more than 2 supports shall be used for each pipe length, one adjacent to the shoulder of the bell and the other near the spigot end.

No encasements shall be poured until the inspector has inspected and approved the pipe to be encased and its supports.

8. Relationships Between Water Lines and Sanitary Sewers: Lines shall mean all water or sewer lines including mains, laterals and service lines. When a water and sewer line are within 10 feet horizontally (centerline distance) of each other and the sewer line is above or less than 18 inches (clear distance) below the water line, the portion of the sewer line within that area shall:
 - A. Be constructed of approved waterline pipe and joints (Ductile Iron Cement mortar lined pipe conforming to AWWA C 151),
 - B. Be constructed of SDR 35 PVC sewer pipe with all joints and pipe within 10 feet of the water line encased in concrete that is a minimum of 6 inches thick centered on the crossing pipe or,
 - C. A designed protection system subject to the review and approval of the inspector.

In all cases, suitable backfill or other structural protection shall be provided to preclude the settling or failure of both pipes.

Crossings of sewer and water lines shall not be at an angle less than 45 degrees unless approved by the inspector.

See the Standard Drawings of this section.

9. Service Line Taps: Service taps into sewer mains shall use a factory flow wye referenced in Section II. If a saddle tap is used: Holes for the saddle tap connection shall be made by a mechanical hole cutter and shall be full diameter of the service line. Holes shall be de-burred and carefully beveled

to provide a smooth hole shaped to conform to the fitting.

See Section II. Materials of this section.

Service connections shall point to 10 o'clock or 2 o'clock and shall not be installed vertically to the main line and be in the top 1/4 of the main. Also the service line shall point either perpendicular to the direction of flow or in the direction of the main line flow.

Sewer mains or service lines shall not be installed at less than six (6) foot below finished grade without the written permission of the inspector. The type and amount of insulation over the pipe shall be approved by the inspector. All service lines shall have a tracer wire.

See the Standard Drawings of this section.

Any service line installation that crosses an irrigation ditch shall be isolated from the ditch so that flow from the ditch will not enter the sewer line trench and guarded from damage from ditch maintenance activities. The installation and materials shall be approved by the inspector.

Clean outs shall be installed at the property line and within 5' of building being served. If the distance from the building clean out to the county main line exceeds 100' then additional clean outs will need to be added so that the distance between any two clean outs is not greater than 100'. Minimum requirements include flow wye with flow direction toward Gunnison County's sewer main and a removable gasketed 4' sewer cap.

VI. SEWER PIPELINE TESTING:

1. Testing Pipelines: All pressure and leakage testing shall be performed by the Contractor under direct control of the Engineer or an approved independent laboratory.
2. Testing Sanitary Sewers: The testing of sanitary sewers for acceptability shall include the following tests:
 - A. Exfiltration of water or exfiltration of air under pressure - by Contractor.
 - B. Infiltration of water - by Utility Department Sewer Camera.
 - C. Deflection of thermoplastic pipe - by Contractor.
 - D. Lamping - by Contractor's Engineer.

3. Exfiltration Tests: An exfiltration or leakage test shall be performed on all newly constructed sanitary sewers. The Contractor will determine whether the test will be made with water or air pressure and shall furnish all labor, tools and equipment necessary to conduct the test.

The exfiltration test will not be considered valid without the presence of the Engineer or his representative throughout the test.

- A. Exfiltration of Water Test: The length of pipeline to be tested shall be limited so that the pressure on the lower end of the test section does not exceed 6 feet of water column. The test section shall be sealed off from the remaining pipeline with watertight plugs inserted in the pipes at the end manholes. The Contractor shall fill the pipe to the test level with potable water at least 24 hours prior to conducting the test. The test level shall be at least 18 inches above the top of the pipe opening in the upper manhole or 18 inches above the ground water table, whichever is higher.

Throughout the test period of at least 1 hour, the water level shall be maintained at the test level and all water added shall be accurately measured. If the exfiltration rate exceeds 0.15 gallon per inch of nominal pipe diameter per hour per 100 feet of pipe length, the leaks shall be located and repaired at the Contractor's expense, and the pipeline retested until the leakage is within the allowable limits.

- B. Air Leakage Test: If the Contractor chooses to test for exfiltration with air pressure, the testing shall be in accordance with ASTM C 828. The ends of the test section shall be sealed at the manholes with pneumatic plugs. One of the plugs provided shall have 2 taps. 1 tap will be used for introducing air into the pipeline through suitable valves and fittings so that the input air may be regulated. The second tap shall be fitted with valves and fittings to accept a pressure gauge to monitor the internal pressure of the sewer pipe.

The pressure gauge shall meet the following minimum specifications:

- Size. 4 1/2 inch diameter
- Pressure range. 0 - 15 psi
- Figure intervals 1 psi increments
- Smallest Intervals. 0.05 psi
- Pressure tube. Bourbon tube or diaphragm

Procedure: Connect the pressure gauge and air control equipment to the proper fittings and slowly apply air pressure. Pressurize the pipe line to 4.0 psig and throttle the air supply to maintain between 4.0

and 3.5 psig for at least 2 minutes in order to allow equilibrium between air temperature and pipe walls. During this time check all plugs for leakage. If plugs are found to leak, bleed off air; tighten plugs and repressurize the pipeline. After the temperature has stabilized, allow the pressure to decrease to 3.5 psig. At 3.5 psig begin timing to determine the time required for pressure to drop to 2.5 psig. The time, in seconds, for the air pressure to decrease from 3.5 psig to 2.5 psig should be greater than the minimum test time shown in the following table.

MINIMUM TEST TIME FOR VARIOUS PIPE SIZES

Nominal Pipe Size, in.	T (time) Min/100 ft.	Nominal Pipe Size, in.	T (time) Min/100 ft.
4	0.3	21	3.0
6	0.7	24	3.6
8	1.2	27	4.2
10	1.5	30	4.8
12	1.8	33	5.4
15	2.1	36	6.0
18	2.4	39	6.6
		42	7.3

If the air test fails to meet the above requirements, the leaks shall be located and repaired at the Contractor's expense and the pipeline retested until the leakage is within the allowable limits.

In areas where the ground water level is above the pipe, the hydrostatic pressure of the ground water above the pipeline shall be determined and added to all test pressures.

4. **Infiltration of Water:** If the sewer line is in an area where the water table is a minimum of 18" above the pipeline's highest point, the contractor may conduct an infiltration test. The infiltration of ground water will be measured with special made weirs which will be inserted in the pipeline at manholes where flow is present. The infiltration rate shall not exceed .15 gallons per inch pipe diameter per day per 100 foot of sewer line. If the infiltration exceeds this flow rate, the leaks shall be located and repaired at the Contractor's expense.

Infiltration tests shall be completed prior to placing new sewer lines in service.

5. Deflection Testing for Plastic Pipe:

All PVC sewer lines will be tested for excess deflection by the Contractor. The maximum allowable deflection of flexible pipe shall not exceed seven and one-half percent (7 1/2%) of the base inside diameter as established in ASTM D 3034. The following values from ASTM D 3034 shall apply:

Nominal Pipe Size, In.	Base Inside Diameter In.	Mandrel Diameter In.
6	5.4	5.31
8	7.665	7.09
10	9.563	8.84
12	11.361	10.51
15	13.898	12.86

The deflection test will be performed by pulling a mandrel up-grade through the pipe from manhole to manhole. Where deflection is found to be in excess of allowable testing limits, the Contractor shall excavate to the point of excess deflection and remove the deflection by recompacting around the pipe or other approved method. After backfilling, the line shall then be retested for deflection. If the line has failed to return to its original size (inside diameter) the deflected pipe shall be replaced by the Contractor at his expense.

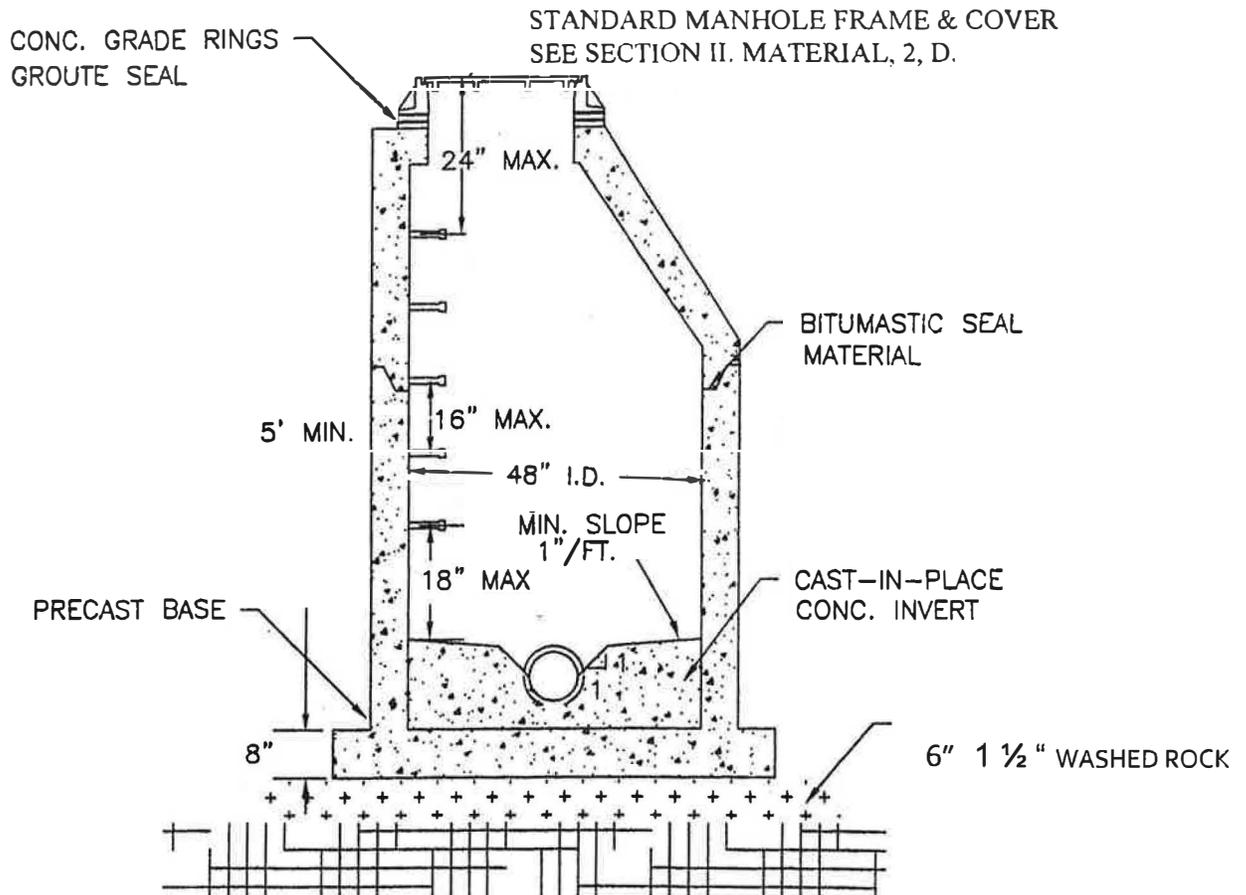
5. Lamping Test:

Lamping will be performed on all sanitary sewer pipes by an Engineer. In order to pass the lamping test, 3/4 of the pipe circle shall be observed both vertically and horizontally between manholes.

6. Sewer Camera Video Work:

Additions of main sewer lines to the current Gunnison County Collection System will require final sewer camera video before being accepted by Gunnison County. Any major defects will be subject to repair before being accepted by Gunnison County.

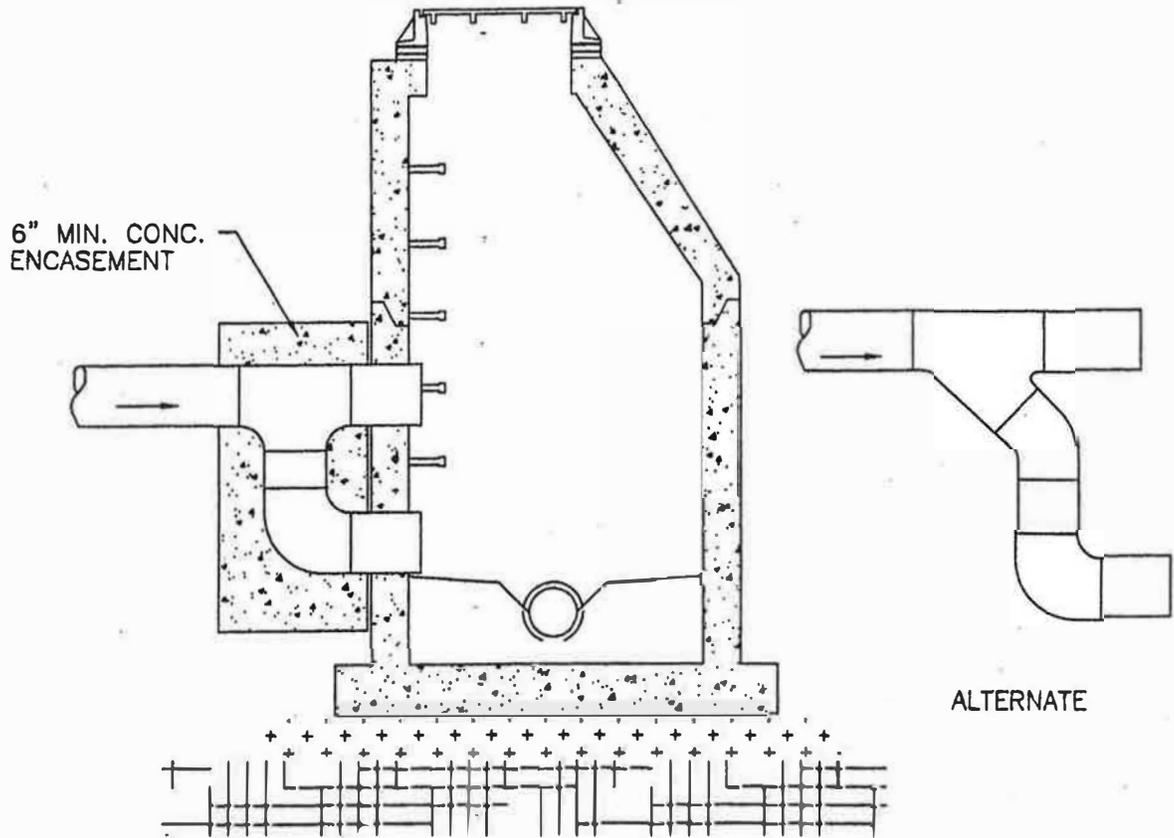
STANDARD MANHOLE DRAWING



MANHOLE NOTES

1. MANHOLE RISER BARREL PIPE , CONES, FLAT TOPS AND GRADE RINGS SHALL BE PRECAST CONCRETE CONFORMING TO ASTM C-478 OR AASHTO M-199.
2. ALL CEMENT USED IN MORTER, CONCRETE BASES, GRADE RINGS, BARREL SECTIONS, CONES, AND FLAT TOPS FOR SANITARY SEWERS SHALL BE TYPE IV OR MODIFIED TYPE II PORTLAND CEMENT WITH LESS THAN 5% TRICALCIUM ALUMINATE.
3. FOR PIPE SIZES GREATER THAN 24" DIAMETER 60" DIAMETER MANHOLE REQUIRED.
4. FOR CAST-IN-PLACE BASES INVERT AND BASE SHALL BE POURED MONOLITHIC. THE TOTAL THICKNESS AS MEASURED FROM THE PIPE INVERT SHALL BE 8" MIN.
5. A BITUMASTIC SEAL AND GROUTE ARE REQUIRED BETWEEN CAST-IN-PLACE BASES AND PRECAST BARREL SECTIONS.
6. MANHOLES LESS THE 5' DEEP SHALL HAVE FLAT TOPS.

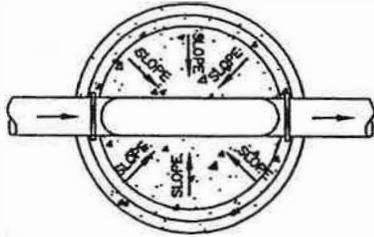
STANDARD DROP MANHOLE DRAWING



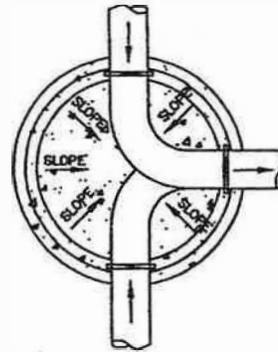
NOTES:

1. REFER TO STANDARD MANHOLE DRAWING FOR DIMENSIONS NOT SHOWN.
2. INCOMING SEWER SHALL NOT BE LOCATED WITHIN 1' OF THE MANHOLE STEPS.
3. DROP MANHOLES ARE REQUIRED WHEN THE SEWER ENTERS THE M.H. 2'-0" OR MORE ABOVE THE LOWEST INVERT OF THE MAN HOLE.

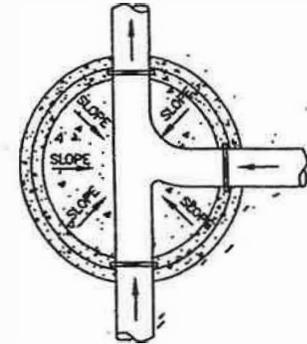
STANDARD MANHOLE INVERT DRAWING



CONTINUOUS PIPE



"Y" OR 90° JUNCTION



"T" JUNCTION

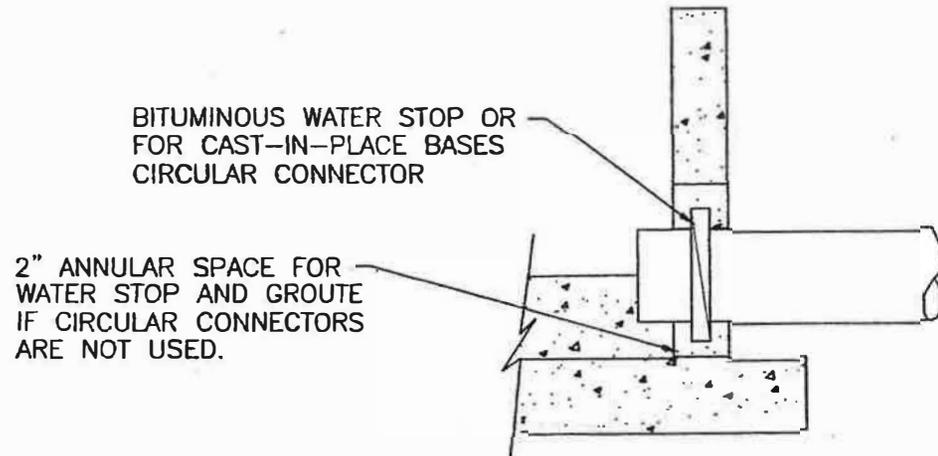
CAST-IN-PLACE BASE

1. WHERE NO CHANGE IN ALIGNMENT IS REQUIRED LAY PIPE THROUGH BASE.
2. AFTER POURING BASE REMOVE 3' +/- OF CROWN OF PIPE.

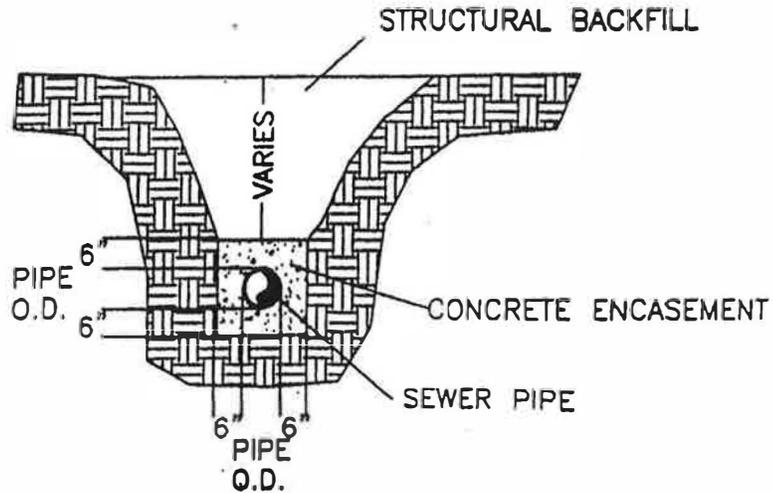
PRECAST BASE

1. EXTEND PIPE 1" +/- PAST FACE OF MANHOLE WALL.

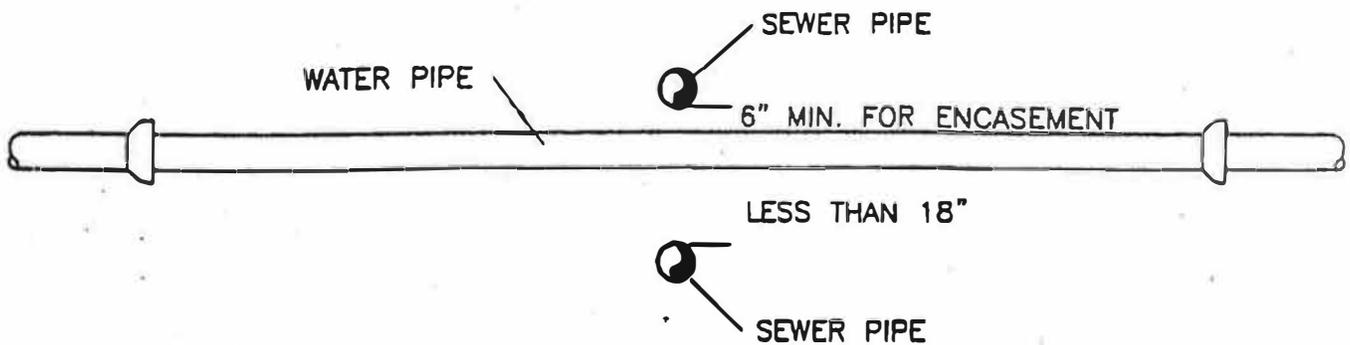
PIPE ENTRANCE



SANITARY SEWER – WATER PIPE CROSSING



CONCRETE ENCASEMENT



PIPE CROSSING

NOTE:
 IF THE SEWER PIPE IS ABOVE THE WATER PIPE
 OR IF THE SEWER PIPE IS LESS THAN 18" BELOW THE WATER PIPE
 THE SEWER PIPE MUST BE CONCRETE ENCASED TO PROTECT THE WATER PIPE.
 SEE SPECIFICATION SECTION 500 OR 600 FOR PROTECTION REQUIRED.
 PROTECTION MUST EXTEND A MINIMUM OF 10' EACH WAY FROM THE CROSSING.

GUNNISON COUNTY
WATER MAIN SPECIFICATIONS

SECTION 400

I. SCOPE:

The purpose of the Water Main Specification is to set forth the criteria to be used in the construction of water mains for approval and acceptance by Gunnison County.

All water mains shall be a minimum of 6 inches in diameter.

All excavation, embankment and backfill shall conform to the General Earthwork Specifications and as shown on the Standard Drawing of this section.

II. MATERIALS:

1. Pipe: Ductile iron pipe for water mains shall conform to the AWWA C-151, thickness class 52. Ductile iron pipe shall be cement lined per AWWA C-104.
2. Joints: Ductile iron pipe joints shall be mechanical, push on or restrained push-on joints conforming to AWWA C-111.

Gaskets shall be of neoprene or other synthetic rubber material.

Restrained push-on joints:

American "Lok-Fast" or "Lok-Ring",
CLOW "Super-Lock"
US Pipe "Lok-Tyton" or "Lok-Tyte"
Griffin "Snap-Lock".

Restrained Glands:

EBBA Iron model No. 1100 series

3. Fittings: Fittings shall be ductile-iron conforming to AWWA C153, pressure Class 350, mechanical joint conforming to AWWA C-111 with appropriate gaskets for the connected pipe.
4. Bonding Straps: Bonding straps shall be de-oxidized copper conforming to ASTM-B 152-58 D.H.P., a minimum of 1 1/4 inch wide by 1/8 inch thick and of sufficient length to attach to each pipe.

Bonding may be accomplished using Cad Weld method for ductile pipe with a minimum wire requirement of #4 BSD Copper.

5. Valves & Valve Boxes:
 - A. Gate Valves: Gate Valves shall be in accordance with AWWA Standard C509, equal to the class of pipe being used, with mechanical joint ends. All valves shall be equipped with a nonrising stem and standard 2 inch square wrench nut. Stems will provide "O" ring dirt seal and pressure seal packings. All zinc bolts shall be replaced with stainless steel bolts.
 - B. Butterfly Valves: Butterfly valves shall be Engineer approved and shall conform to AWWA Standard C504.
 - C. All valves shall open counter-clockwise (Open Left).
 - D. Valve Boxes: Valve boxes will be provided for each valve, such boxes to be buffalo-type, 2 or 3 piece with extension as required. Shafts will be not less than 6 inches in diameter and will be capped with a standard flush-type lid weighing not less than 10 pounds and marked "Water".
6. Fire Hydrants: Fire Hydrants shall be in accordance with AWWA Specification C-502 and shall be Waterous 51/4" Pacer Fire Hydrant or equivalent. All hydrants shall be installed with adjustable grade device.
7. Encasements & Thrust Blocks: Concrete for encasements or thrust blocks minimum compressive strength of 2500 psi in twenty-eight (28) days.
8. Appurtenances:
 - A. Pipe: Three (3) inch and larger shall conform to paragraph 1 of this Specification. Pipe 2 inch or smaller shall be Type K copper or HDPE (High Density Polyethylene). All service lines shall not be less than one inch.
 - B. Joints: Three (3) inch and larger shall conform to paragraph 2 of this Specification. Joints 2 inch and smaller shall be compression.
 - C. Fittings: Three (3) inch and larger shall conform to paragraph 3 of

this Specification. Fittings 2 inch and smaller shall be compression.

- D. All service lines shall be HDPE (high density polyethylene) with a minimum of 1" line size or copper with a minimum of 1" line size. The service line shall be bedded in 3/4" washed rock from the corporation stop and or curb valve to the foundation. All lines shall include a tracer wire.

9. Corporation Stops:

1 inch - Materials to be approved by Gunnison County.

Larger than one inch - Materials to be approved by Gunnison County.

- 10. Curb Valves & Stops: Material to be approved by Gunnison County.
- 11. Curb Boxes: Materials to be approved by Gunnison County.
- 12. Service Saddles: Mueller Ductile Iron, Service Saddles H105 Series double strap.

III. INSTALLATION:

- 1. Pipe: Pipe shall be installed a minimum of 6 foot from top of pipe to existing or proposed grade which ever is lower.

General: All pipe and fittings shall be carefully lowered into the trench by means of a hoist, ropes or other suitable tools or equipment in such a manner as to prevent damage to the water main materials and protective coatings and linings. Under no circumstances shall water main materials be dropped or dumped into the trench. All pipe and fittings shall be carefully examined for cracks or other defects immediately before installation in final position. Every precaution shall be taken to prevent foreign material from entering the pipe while it is being placed in the line. During laying operations, no debris, tools, clothing or other material shall be placed in the pipe. As each length of pipe is placed in the trench, the spigot end shall be centered in the bell and the pipe forced on and brought to correct line and grade. Precautions shall be taken to prevent dirt from entering the joint space.

At times when pipe laying is not in progress, the open ends of the pipe shall be closed by a watertight plug or other means approved by the inspector. If

water is in the trench, the plug shall remain in place until the trench is pumped completely dry.

Where pipe is laid on a grade of 10% or greater, the laying shall start at the bottom and shall proceed upward with the bell ends of the pipe up grade. The cutting of pipe for inserting valves, fittings or closure pieces shall be done in a neat and workmanlike manner without damage to the pipe and so as to leave a smooth end at right angles to the axis of the pipe. No pipe shall be laid when in the opinion of the inspector trench conditions are unsuitable.

2. Bonding Strap: A bonding strap shall be installed across each joint in the water line to provide metal to metal continuity. Bonding straps shall be attached at each end by means of magnesium weld or other approved method.
3. Valves: Valves shall be set and joined to pipe in the manner specified for cleaning, laying and joining pipe. Valves shall be installed where shown on the drawings. In instances where the valve is to be installed adjacent to the Tee or Cross Fitting, there shall be at least an 18 inch section of pipe but never more than a 36 inch section of pipe between the valve and the fitting. Valves shall have the interior cleaned of all foreign matter before installation. Valves shall be inspected in the open and closed positions to insure that all parts are in working condition.
4. Valve Boxes: Valve boxes shall be provided for all valves. Valves 10 inches and larger shall be provided with a bonnet. Valve boxes will be centered and plumb over the wrench nut of the valve with the box cover flush with the level of the finished grade or such level as may be directed by the Engineer. Upon completion of backfill around the valve box, a 4 x 4 inch timber shall be placed vertically next to each valve box, exposed portion of which shall be above finished grade of the subgrade.
5. Fire Hydrants: Fire Hydrants will be mounted at the grade elevation and location designated by the Utility Department. An appropriately sized Class 150 auxiliary valve with mechanical joint ends shall be required with each hydrant and installed at the location designated by the designing Engineer.

Hydrant drainage in pervious soil shall be provided at the base of the hydrant by placing coarse gravel or crushed stone from the bottom of the trench to at least 6 inches above the water opening (weep holes) in the hydrant and to a distance of 1 foot around the elbow.

Hydrant drainage in clay or other impervious soil shall be provided by a drainage pit 2 feet in diameter and 3 feet deep excavated below the hydrant and filled compactly with coarse gravel or crushed stone under and around the elbow of the hydrant and to a level of 6 inches above the water opening (weep holes).

6. Thrust Restraints: All plugs, tees, valves, bends and hydrants or a change in direction of 10 degrees or more shall be provided with Thrust Restraints.
 - A. Thrust Blocks: Concrete Thrust Blocks shall be placed between the solid ground of the trench wall and the fitting. The backing shall be so placed that the pipe and fitting joints will be accessible for repair. Plastic "cloth" shall be placed between the fitting and concrete. Unless a design is provided by a Registered Professional Engineer Thrust Blocks shall be as shown in Standard Drawings of this section.
 - B. Restrained Joint Pipe: Unless a design is provided by a Registered Professional Engineer pipe shall be Restrained each direction from a plug, tee, bend, hydrant or change of 10 degrees or more as shown in Standard Drawings of this section.
7. Encasements: Prior to placing the concrete for cradles or encasements, temporary supports consisting of concrete blocks or bricks shall be used to support the pipe in place. Not more than 2 supports shall be used for each pipe length, one adjacent to the shoulder of the bell and the other near the spigot end.

No encasements shall be poured until an inspector has inspected and approved the pipe to be encased and its supports.
8. Water Taps and Services: Water taps and services shall be a minimum of 6 feet from top of pipe to existing or proposed finish grade which ever is lower. A bonding strap shall be installed on all pipe 3 inches and larger.

Service lines and taps on the water main may be installed to the property line at the time of main construction.

1 inch service taps shall be direct taps.

For one inch service taps follow Muller's recommendation for minimum size water main for direct tapping.

No two inch taps allowed, must use three inch DIP, or larger.

Three inch and larger services shall use ductile iron pipe and fittings.

Each one inch and service line shall be machine tapped and connected to the water main through a brass corporation stop. The main shall be tapped at the spring line of the pipe, and the stop must be turned so that the T-handle will be on top.

9. Relationships Between Water Lines and Sanitary Sewers:

Lines shall mean all water or sewer lines including mains, laterals and service lines.

When a water and sewer line are within 10 feet horizontally (centerline distance) of each other and the sewer line is above or less than 18 inches (clear distance) below the water line, the portion of the sewer line within that area shall:

- A. Be constructed of approved waterline pipe and joints (Ductile Iron Cement mortar lined pipe conforming to AWWA C-151.
- B. Be constructed of SDR 35 PVC sewer pipe with all joints and pipe within 10 feet of the water line encased in concrete that is a minimum of 6 inches thick centered on the crossing pipe or,
- C. A designed protection system subject to the review and approval of the Gunnison County's Utility Department.

In all cases, suitable backfill or other structural protection shall be provided to preclude the settling or failure of both pipes.

Crossings of sewer and water lines shall not be at an angle less than 45 degrees unless approved by the inspector.

See the Standard Drawings of this section.

IV TESTING:

1. Testing Pressure Pipelines: Water mains shall be tested for pressure and leakage in accordance with these Specifications and AWWA Standard C-600.

The Contractor shall furnish all labor, equipment, tools, water and other incidental items required to conduct the tests. Test results will not be considered valid without the presence of an inspector throughout the test.

No pressure testing shall be performed until all thrust blocks have been placed and cured for at least 7 days, and the pipeline backfilled adequately to prevent any movement or lifting of the pipe. Pavement or other permanent surfaces shall not be placed until all pressure and leakage tests are satisfactorily completed.

2. Test Pressure: The test pressure for all pipes shall be double the maximum operating pressure as determined by the inspector at the lowest elevation of the test section, but shall be a minimum of 150 psi at any elevation in the test section.
3. Filling: The pipeline shall be filled with potable water at least 24 hours before being subjected to the hydrostatic pressure test. Each section of pipeline shall be filled slowly and all air expelled by means of taps at points of highest elevation.
4. Leakage:

The specified test pressure shall be applied by means of a pump connected to the pipe in a manner satisfactory to the inspector. No pipe installation will be accepted if the leakage for the section of line being tested is more than the rate calculated using the following formula:

$$L = \frac{ND\sqrt{P}}{7400}$$

Where: L = Allowable leakage in gallons per hour
 N = Number of joints in length pipeline tested
 D = Nominal diameter of pipe in inches
 P = Average test pressure in psi gauge

Leakage is defined as the quantity of water to be supplied to the section of

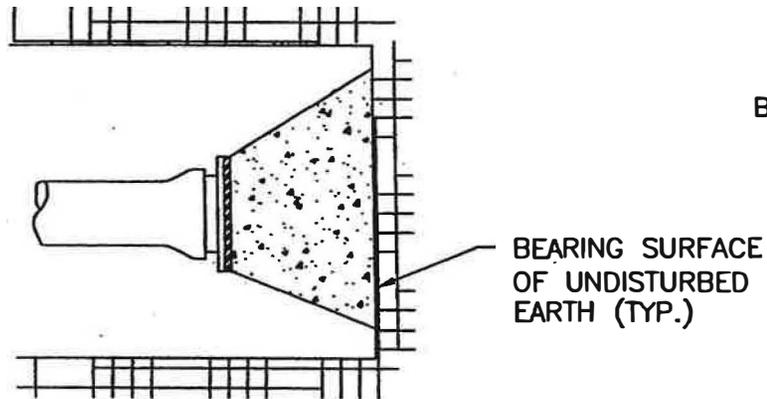
pipeline being tested, which is necessary to maintain the specified leakage test pressure after the pipe has been filled with water and the air expelled.

5. Disinfection of Waterlines: After completion of pressure testing and prior to being placed into service, all new water mains and repaired portions or extensions of existing mains shall be chlorinated by the Contractor in accordance with AWWA Standard C-601.
 - A. Preliminary Flushing: Sections of pipe to be disinfected shall first be flushed to remove any solids or contaminated material that may have entered the pipe. If a hydrant was not installed at the end of the main, then a 2 1/2 inch tap shall be installed in order to flush the line.
 - B. Form of Applied Chlorine: Chlorine shall be applied by one of the methods described in AWWA C-601, subject to approval by the Engineer. If AWWA C-601 section 5 is utilized - Tablet Method - then flushing will take place after chlorination.
 - C. Point of Application: The prepared point of application of the chlorinating agent is at the beginning of the pipeline extension or any valved section of it, and through a corporation stop inserted in the pipe. The water injector for delivering the chlorine-bearing water into the pipe should be supplied from a tap made on the pressure side of the gate valve controlling the flow into the pipeline extension. Alternate points of application may be used when approved or directed by the inspector.
 - D. Preventing Reverse Flow: Valves shall be manipulated so that the strong chlorine solution in the line being treated will not flow back into the line supplying the water. Check valves may be used if desired.
 - E. Retention Period: Treated water shall be retained in the pipe at least twenty-four (24) hours. After this period, the chlorine residual at pipe extremities and at other representative points shall be at least twenty-five (25) mg/l.
 - F. Chlorinating Valves and Hydrants: In the process of chlorinating newly laid pipe, all valves or other appurtenances shall be operated while the pipeline is filled with the chlorinating agent and under normal operating pressure.
6. Final Flushing and Testing: Following chlorination, all treated water shall be thoroughly flushed from the newly laid pipe at its extremity until the

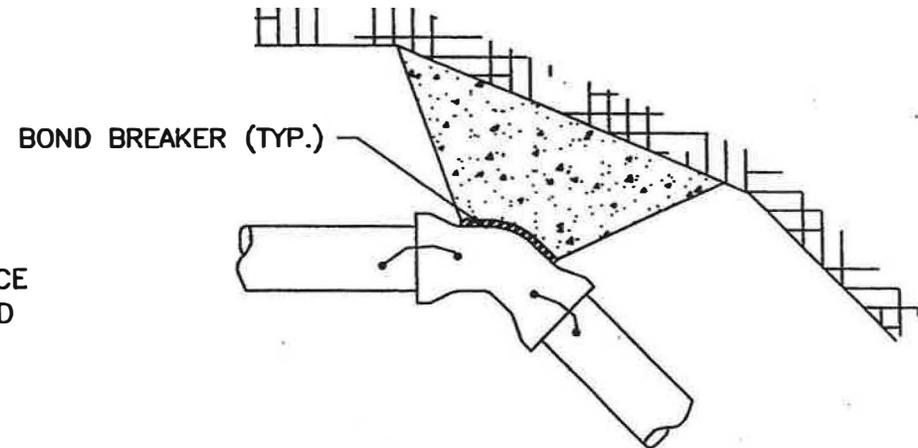
replacement water throughout its length shows upon test a chlorine residual of less than one (1) mg/1.

7. **Bacteriologic Tests:** After final flushing, and before the water main is placed in service, bacteriologic tests shall be performed in accordance with AWWA C-601.

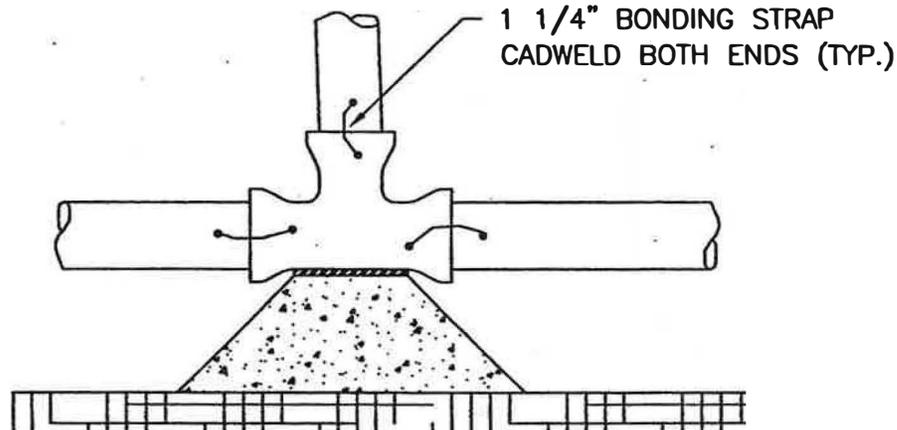
THRUST BLOCK DRAWING



DEAD END



11-1/4°, 22-1/2°, 45° OR 90° BENDS

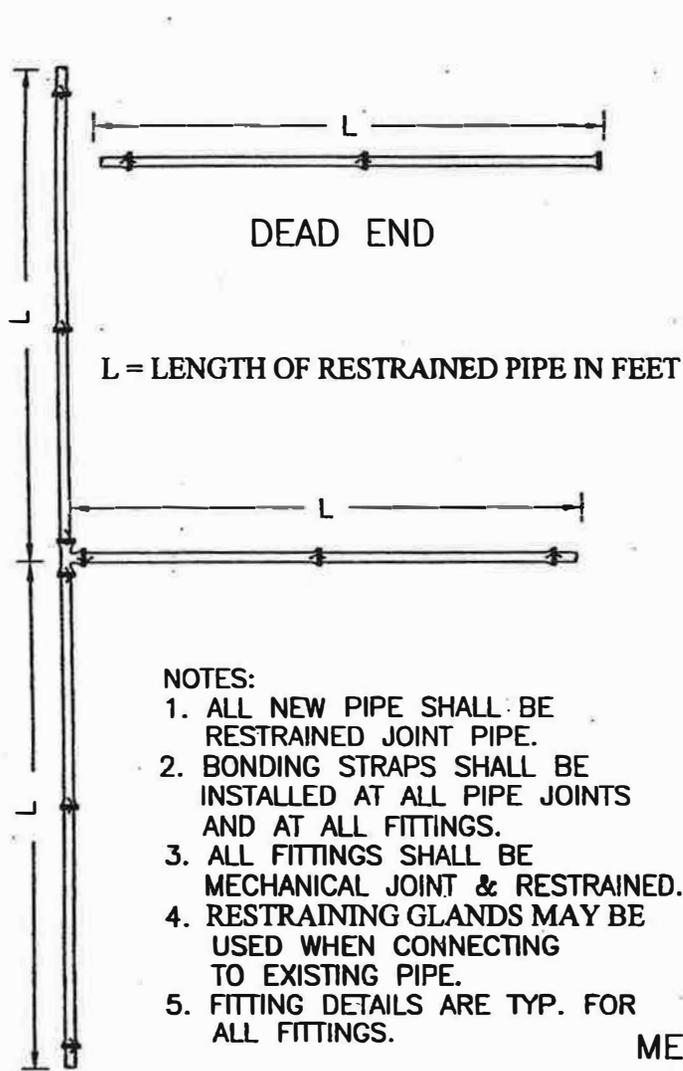


TEE & CROSS W/ DEAD END

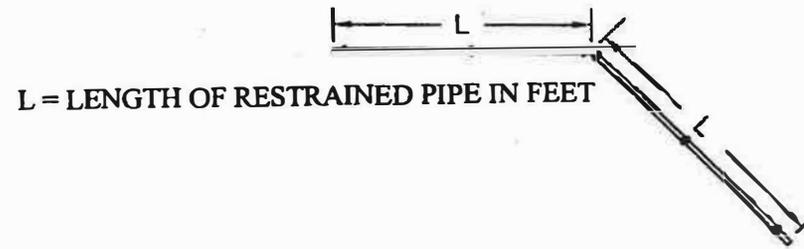
NOTES:

1. ALL FITTINGS REQUIRING THRUST BLOCKS SHALL BE WRAPPED IN POLYETHYLENE BOND BREAKER MATERIAL.
2. CONCRETE SHALL NOT BEAR ON BOLTS OF MECHANICAL JOINT FITTINGS.
3. PIPE AND FITTINGS MAY BE EITHER MECHANICAL JOINT OR PUSH ON JOINT.

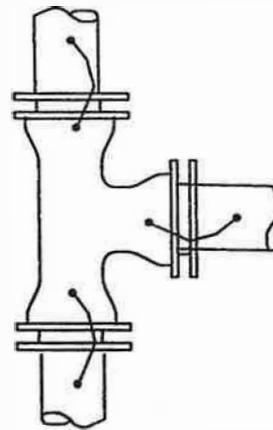
RESTRAINED PIPE DRAWING



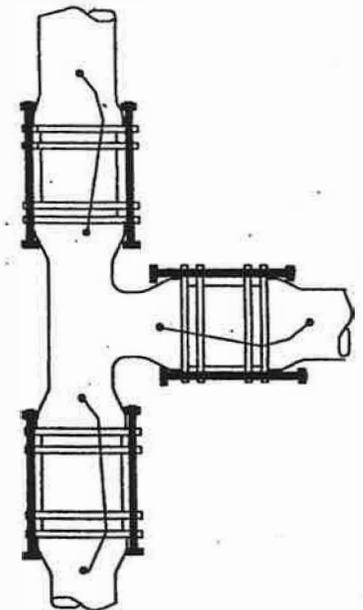
TEE & CROSS W/ DEAD END



11-1/4°, 22-1/2°, 45° OR 90° BENDS



MECHANICAL JOINT FITTING W/
RESTRAINING GLAND



MECHANICAL JOINT FITTING W/
TIE ROD RESTRAINT

TABLE FOR THRUST BLOCKING

BEARING AREAS (IN SQ. FT.)					
SIZE (IN.)	BENDS				TEES, DEAD ENDS, AND CROSS W DEAD END BRANCHES
	90°	45°	22-1/2°	11-1/4°	
3	1.0	0.6	0.3	-	0.7
4	1.8	1.0	0.5	-	1.3
6	4.0	2.2	1.1	0.5	2.8
8	7.1	3.8	2.0	1.0	5.0
10	11.1	6.0	3.0	1.5	7.8
12	16.0	8.6	4.4	2.2	11.3

AREAS GIVEN IN TABLE ARE BASED UPON INTERNAL STATIC PRESSURE OF 100 PSI AND A SOIL BEARING CAPACITY OF 1000 LBS/S.F.

LENGTHS FOR ANY PRESSURE AND SOIL BEARING CAPACITY MAY BE OBTAINED BY MULTIPLYING THE TABULATED VALUES BY A CORRECTION FACTOR "F"

$$F = \frac{\text{ACTUAL SPECIFIED TEST PRESSURE IN HUNDREDS OF LBS.}}{\text{ACTUAL TESTED SOIL CAPACITY IN THOUSANDS OF LBS.}}$$

TABLE FOR RESTRAINED PIPE

RESTRAINED LENGTH (IN FT.)					
SIZE (IN.)	BENDS				TEES, DEAD ENDS, AND CROSS W DEAD END BRANCHES
	90°	45°	22-1/2°	11-1/4°	
3	7	3	2	1	12
4	10	4	2	1	18
6	16	6	3	2	27
8	21	9	4	2	38
10	26	11	5	3	48
12	31	13	6	3	58

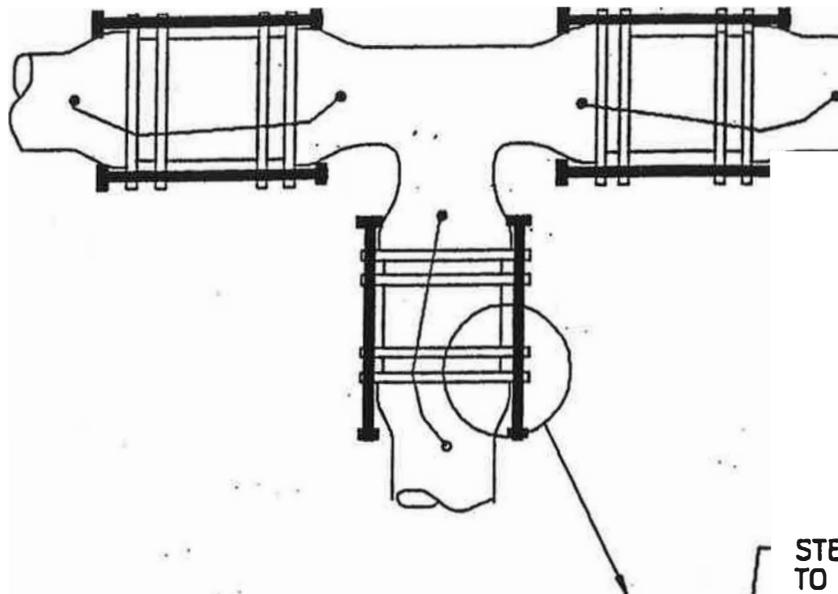
LENGTHS GIVEN IN TABLE ARE BASED UPON INTERNAL STATIC PRESSURE OF 100 PSI THE PIPE FULLY BEDDED AND THE TRENCH NOT BACKFILLED.

LENGTHS FOR ANY PRESSURE MAY BE OBTAINED BY MULTIPLYING THE TABULATED VALUES BY A CORRECTION FACTOR "F"

$$F = \frac{\text{ACTUAL SPECIFIED TEST PRESSURE IN PSI}}{100 \text{ PSI}}$$

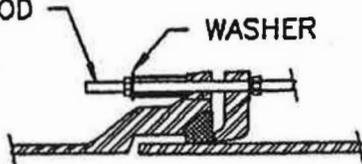
DRAWING 400-3

TABLE FOR TIE ROD RESTRAINT



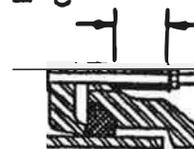
STEEL PIPE SPACER SHAPED TO FIT BACK OF FLANGE
SPACER SIZE = B

THREADED TIE ROD
SIZE = A



WASHER

SPACER LENGTH = C



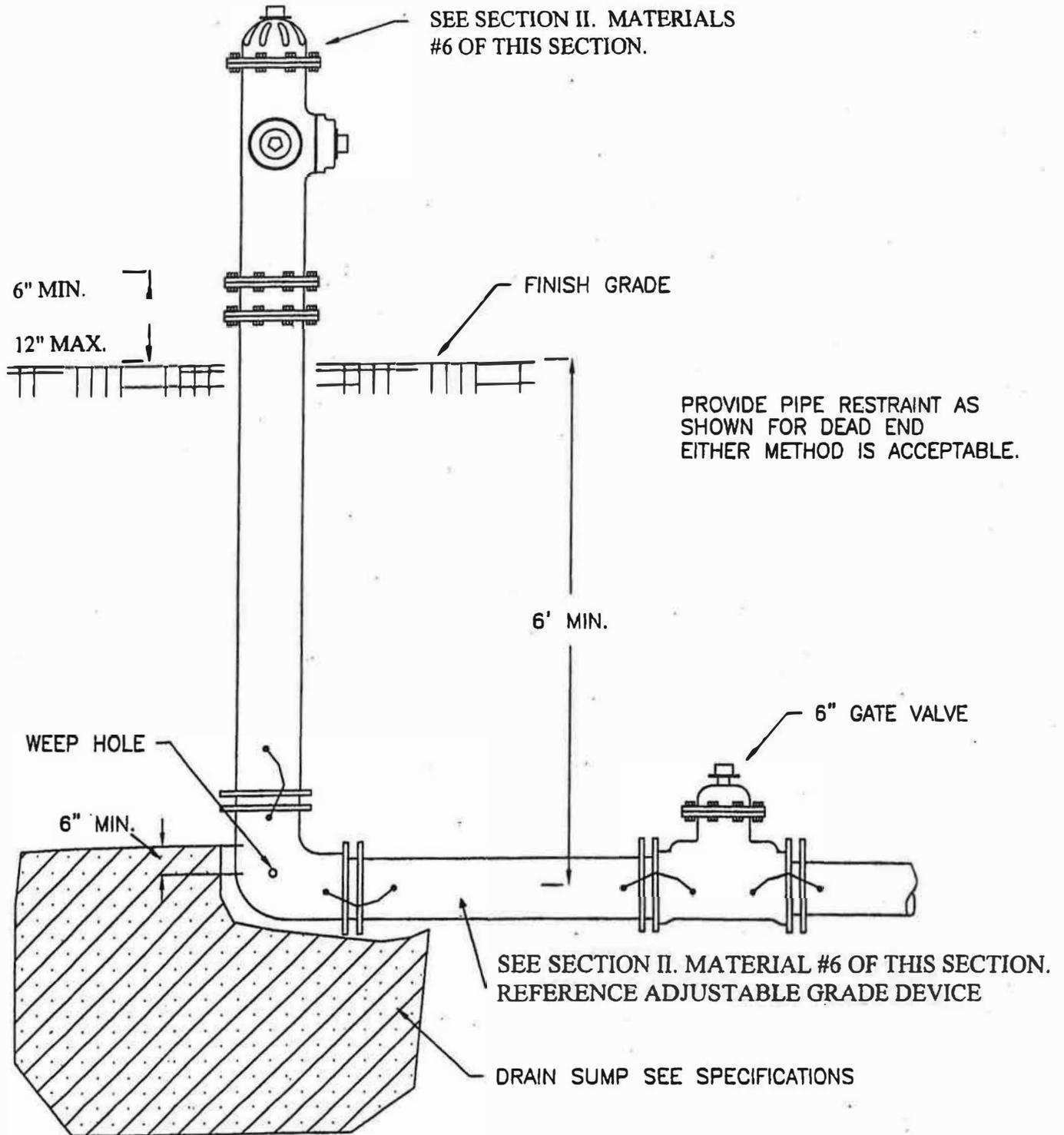
TIE ROD RESTRAINT

PIPE SIZE (IN.)	A TIE RODS DIA.	B SPACER NOM. SIZE	C SPACER LENGTH	NO. OF RODS REQ.
3	5/8"	3/4"	2.5"	2
4	5/8"	3/4"	2.5"	2
6	5/8"	3/4"	2.5"	2
8	5/8"	3/4"	2.5"	2
10	5/8"	3/4"	2.5"	4
12	5/8"	3/4"	2.5"	6

NOTES:

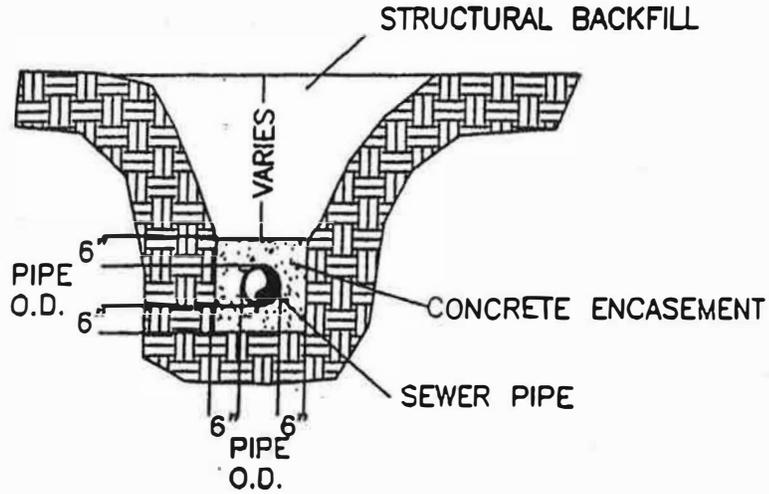
1. ALL TIE RODS, WASHERS AND SPACERS SHALL BE COATED WITH COAL TAR PAINT.
2. TABLE IS BASED ON 150 PSI TEST PRESSURE.
3. OTHER METHODS OF CONNECTING TIE RODS SHALL BE ACCEPTABLE TO THE ENGINEER.

STANDARD FIRE HYDRANT DRAWING

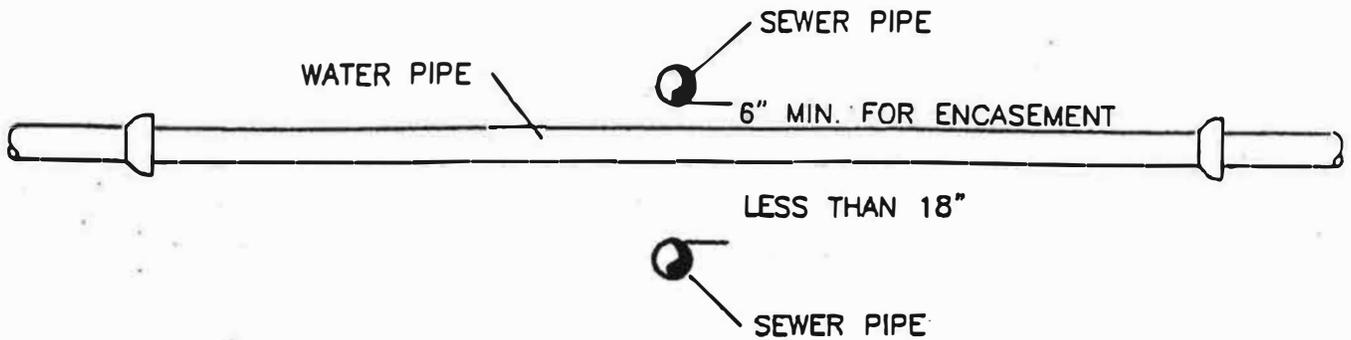


DRAWING 400-5

SANITARY SEWER — WATER PIPE CROSSING



CONCRETE ENCASEMENT



PIPE CROSSING

NOTE:
 IF THE SEWER PIPE IS ABOVE THE WATER PIPE
 OR IF THE SEWER PIPE IS LESS THAN 18" BELOW THE WATER PIPE
 THE SEWER PIPE MUST BE CONCRETE ENCASED TO PROTECT THE WATER PIPE.
 SEE SPECIFICATION SECTION 500 OR 600 FOR PROTECTION REQUIRED.
 PROTECTION MUST EXTEND A MINIMUM OF 10' EACH WAY FROM THE CROSSING.