

# **TOWN OF CRESTED BUTTE**

## **PUBLIC WORKS CRITERIA**

### **FOR DESIGN AND CONSTRUCTION**

**June 2018**

**APPROVED FOR PUBLIC RELEASE; DISTRIBUTION UNLIMITED**

## FOREWORD

This is a living document that will be periodically reviewed, updated, and made available to users as part of the Town of Crested Butte, Colorado responsibility for providing technical criteria for design and construction projects in Crested Butte. Contractors should contact the Public Works Department for document interpretation and improvements.

Deviation from these criteria cannot be made without prior written approval of the Public Works Director.

This document is effective upon issuance, and can be found on the Town of Crested Butte Internet site, [www.crestedbutte-co.gov](http://www.crestedbutte-co.gov)

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**TOWN OF CRESTED BUTTE**  
**PUBLIC WORKS CRITERIA**  
**FOR DESIGN AND CONSTRUCTION**

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**TOWN OF CRESTED BUTTE**  
**GENERAL SPECIFICATIONS**

**SECTION 100**

**I. SCOPE**

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

These specifications are the minimum requirements for design, materials, and construction and may only be modified by written approval from the Town OF Crested Butte.

**II. DEFINITIONS AND ABBREVIATIONS**

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

**Town:** The Town of Crested Butte, Colorado.

**Town Code:** The official adopted Town Code Regulations of Crested Butte, Colorado.

**Engineer:** The Town Engineer, Town OF Crested Butte, Colorado, or an authorized representative acting on behalf of the Town.

**Traffic Control Officer:** An authorized representative acting on behalf of the Town OF Crested Butte, Colorado.

**Inspector:** An authorized representative of the Town at the site of the work.

**Utility:** The Water and Sewer Utilities Department of the Town OF Crested Butte, Colorado and all other utilities.

**Base Course:** The upper course of the granular base of the pavement or the lower course of an asphalt concrete pavement structure.

**Culvert:** Any structure not classified as a bridge, which provides an opening under or adjacent to the roadway.

**Pavement:** Any surfacing of streets, alleys, sidewalks, courts, driveways, or similar areas, consisting of material aggregate bound into a rigid or semi-rigid mass

by a suitable binder such as, but not limited to, Portland cement, or asphalt cement.

**Pavement Structure:** The combination of subbase, base course, and surface course placed on a subgrade to support the traffic load and distribute to the road bed.

**Private Street:** Any vehicular access serving residential properties where average daily traffic volume exceeds sixty (60) trips per day.

**Public Improvements:** Includes public facilities and shall refer to the construction or installation of streets, including curb and gutter, sidewalks, development or extension of the municipal water system, municipal sanitary sewer system, municipal storm sewer system, municipal irrigation system, and landscaping.

**Right-of-Way:** A general term denoting land, property or interest therein, usually in a strip, acquired for or devoted to a street, highway, or other public improvement.

**Road:** A general term denoting an open way for purposes of vehicular and pedestrian travel.

**Roadway:** The improved portion of the right-of-way intended primarily for vehicular traffic.

**Sanitary Sewer:** Conduits and related appurtenances employed to collect and carry off wastewater to a suitable point of final discharge.

**Shoulder:** That portion of the roadway contiguous with the traveled way for accommodation of stopped vehicles, for emergency use, and for lateral support of base and surface courses.

**Sidewalk:** That portion of the street primarily constructed for the use of pedestrians.

**Storm Sewer:** Any conduit and appurtenance intended for the reception and transfer of stormwater.

**Street:** The improved area of the right-of-way.

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

**Subbase:** The lower course of the base of a roadway, immediately above the subgrade.

**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 Engineer or Town Representative is intended. Similarly, the words "approved", "acceptable", and "satisfactory" shall refer to approval by the Engineer or Town Representative.

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

**ASA:** American Standards Association

**ASTM:** American Society for Testing and Materials

**AWWA:** American Water Works Association

**APWA:** American Public Works Association

**CDOT:** Colorado Department of Transportation

**CDOT-SSCRB:** CDOT Standard Specifications for Construction of Roads & Bridges

**DPW:** Department of Public Works, Crested Butte

**GCEA:** Gunnison County Electric Association

**MUTCD:** Manual of Uniform Traffic Control Devices

### **III. DESIGN CRITERIA**

#### **A. Streets**

1. Street Layout
  - a. Street layout shall be designed to conform to the standards described in Residential Streets, second edition, published by the American Society of Civil Engineers, National Association of Home Builders and the Urban Land Institute in 1990, or latest edition. Copies are available in the Planning Department. When there are Conflicts between the standards set forth herein and Residential Streets, the standards set forth herein shall prevail.
  - b. Street layout shall conform to the Master Street Plan in the Crested Butte Land Use Plan.

#### **B. Dry Wells**

1. Specifically designed for the flow required.
2. Native soil must consist of sandy gravel having a permeability in the range of 0.01 feet per minute
3. Seasonal high groundwater level must be at least 24-inches below the ground surface
4. Refer to dry well diameter schedule for allowable volumes pumped per hour
5. Dry well shall be cylindrical in shape and constructed with CMP, concrete pipe, plastic pipe, or precast manhole (with open bottom)
6. Dry well must be at least 4 feet into the ground with the top even with or up to 2-inches above the ground surface and graded so that the surface water does not flow into the dry well
7. The inlet to the dry well should be set at a depth of at least 12-inches above the seasonal high groundwater level but not shallower than 12 inches below the ground surface

8. Dry Well Diameter Schedule:

<b>Dry Well Diameter Schedule</b>	
<i>Total Sump Volume or Max. Volume Pumped During 1 Hour Period (Gallons)</i>	<i>Dry Well Pipe Diameter</i>
15	24"
20	30"
30	36"
40	48"

**C. Stormwater Permit and Plan**

1. For construction disturbing an area of one acre or more, a stormwater permit and plan must be obtained as required by the State of Colorado.

**D. Sanitary Sewer System**

1. General
  - a. All new construction of sanitary sewer mains, man holes, and lift stations must be designed by a Professional Engineer licensed in the State of Colorado and shall meet all Colorado state design and construction regulations.
  - b. Professional Engineer is responsible for all state compliance and associated fees with regards to new construction and/or repair and replacement of existing infrastructure. This includes, but is not limited to, site applications and/or amendments to existing site applications.
  - c. The Professional Engineer must provide the following information,
    - (a) Calculations relevant to the design flows at initial build and final build out. Including, but not limited to, peaking factors, per capita daily flows, commercial capacity allowances and inflow and infiltration allowances.
    - (b) Data that demonstrates the new construction design life.
  - d. Construction Drawings shall include pertinent project-specific notes to clarify or bring attention to construction requirements that effect the Town's sanitary sewer systems and those who work on these systems.

- e. The following shall be provided to the Town for review and approval as applicable and/or for record purposes.
  - (a) One hard copy and one electronic copy of shop drawings
  - (b) One hard copy and one electronic copy of complete "as built" drawings, upon completion of the construction work.
    - (i) Sanitary sewer service "as-builts" shall include measurements of the distance between the new service tap and the upstream and downstream manholes, route of sewer service, location of clean outs, etc.

2. Lift Stations

- a. Design calculations, signed by a Professional Engineer, must be submitted to the Town for review and shall contain the following computations: capacity at peak flow, system head, cycle time, buoyancy calculations, and storage volumes.
- b. Lift Stations shall be sized based upon the anticipated upstream flow that will be realized in a 20 year period of development. The amount of development in a basin is judgmental and will be determined by the Town.
- c. O&M Manual
  - (a) One hard copy and one electronic copy of the O & M manual. O & M manual must include,
    - (i) Detailed preventative maintenance schedules and procedures
    - (ii) Generator information if applicable
    - (iii) Electrical wiring diagram which depicts all breakers, relays, controls, switches, alarm system, etc.

3. Gravity Sanitary Sewer Mains
  - a. The design shall include a manhole at any sanitary sewer main change in direction or grade or at a maximum of 500 feet from adjacent manholes.
4. Sanitary Sewer Service Laterals
  - a. Single family and multi-family dwellings, containing 2 to 4 units, will generally require a sewer service for each dwelling. This will be considered by the Town on a case by case basis.

#### **IV. RESPONSIBILITY OF THE TOWN**

##### **A. Authority of the Engineer or Town Representative**

1. The Engineer/Town Representative shall have the authority on behalf of the Town to ascertain that all design and construction of facilities is equal to or better than the minimum requirements set forth in these specifications.
2. The Engineer/Town Representative shall have the additional authority to assign an inspector to check any and all work, including materials to be incorporated in the work, excavation, bedding, backfill, and all construction methods and practices.

##### **B. Authority of the Inspector**

1. 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 Engineer.

#### **V. RESPONSIBILITY OF THE CONTRACTOR**

##### **A. Notice Before Beginning Work**

1. The Contractor shall notify the Town Engineer/Town Representative at least five (5) working days before beginning any construction.
2. 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 Town Engineer/Town Representative at least twenty-four (24) hours prior to any resumption of work on the project.

3. If the Contractor intends to work extended shifts, double shifts, or hours other than the normal workday of Town personnel, he shall notify the Town Engineer/Town Representative 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.

**B. Traffic Control**

1. 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.
2. All signing shall conform to the Manual of Uniform Traffic Control Devices (MUTCD) and shall be subject to the approval of the Town Representative.
3. When specifically authorized by the Town Representative, 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 of such streets to a minimum.
4. It shall be the responsibility of the Contractor to notify the Fire Department, Marshal's Office and Ambulance Service twenty-four (24) hours prior to the closure of any street.
5. 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.

**C. Rejected Materials**

1. All materials installed shall be free of manufacturer defects. 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 Engineer/Town Representative may arrange for such removal at the expense of the Contractor.

**D. Familiarity of Specification**

1. 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.

## **E. Maintenance of Site**

1. 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.
2. 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.

## **F. Public Relations and Notifications**

1. 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. He 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.
2. 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.
3. Notifications may be verbal or in written form if the business manager or resident cannot be located. The Contractor is responsible for posting notice cards for interruption of domestic water service only.
4. 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 ten (10) calendar days prior to their removal.
  - a. The Contractor shall bid the project based on assuming responsibility for all removals.

- b. 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.
  - c. This notification requirement is intended as a positive public relations action.
5. All notifications described and required in this section are considered as incidental to the Work and will not be measured or paid for separately.

**G. Utilities: Service, Locating, Protecting, and Relocating**

1. For all construction projects where Town utilities are made available for the Contractor's use, the Town may require the Contractor to pay for Town utility service used (potable water, sewer, etc.).
2. The Contractor is responsible for calling in all underground utility locates prior to construction.
3. It is the responsibility of the Contractor to provide for the protection of all structures and utilities including pipes, fences, or similar items.
4. 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.
5. The Contractor shall be responsible for damage to any Town utility system resulting from construction operations. Any repair performed by the Contractor shall be inspected by the Town prior to backfilling.
6. The Contractor shall bear the entire expense of repairing or replacing any utilities or structures disturbed or damaged during construction.
7. 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.

**H. Safety and Protection**

1. 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:

- a. All employees on the Work and other persons who may be affected thereby;
  - b. All work and all materials or equipment to be incorporated therein in storage on or off site;
  - c. 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.
2. 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.
  3. The Contractor shall erect and maintain, as required by the conditions and progress of the work, all necessary safeguards for safety and protection.

**I. Cost of Testing**

1. The contractor shall bear all costs of testing unless otherwise specified or agreed to in writing by the Town.

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**TOWN OF CRESTED BUTTE**  
**GENERAL EARTHWORK SPECIFICATIONS**

**SECTION 200**

**I. SCOPE**

The purpose of this General 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 the Town of Crested Butte. Work shall include, but not be limited to, surface removals, excavation, dewatering, trench embankment, bedding, and backfill for all utilities, structures, and roads.

**II. MATERIALS**

**A. Fill Material**

1. 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 over eight (8) inches in greatest dimension. It shall have less than twenty percent (20%) by weight passing the No. 200 sieve and a liquid limit not greater than 35.
2. Pit Run (imported): Shall be well-graded eight (8) inch minus material. It shall have less than twenty percent (20%) by weight passing the No. 200 sieve and a liquid limit not greater than 35.
3. Other Materials: Other materials may be selected by the Contractor subject to the approval of the Engineer/Town Representative.
4. Granular Bedding Material: Granular bedding material shall be a well-graded, gravelly material meeting the requirements of *ASTM D448*, as follows:

<u>Sieve Size</u>	<u>Total Passing (Max % By Weight)</u>
1/2 "	100 %
3/8 "	80 %
No. 4	10 %
No. 200	5 %

5. Subbase, Course Aggregate: CDOT Class 2 Aggregate Base Course.
6. Base, Course Aggregate: CDOT Class 6 Aggregate Base Course.

7. Select Backfill Material may be either CDOT Class 6 Aggregate Base Course or Granular Bedding Material.
8. Sand Specifications: Refer to GCEA requirements for conduit installation.
9. Flow-Fill: Per CDOT standards, most recent edition.

**B. Concrete – Sidewalks**

1. SP-5 Section 601.02 – Classification (Concrete):
  - a. Mix design for concrete shall conform to Concrete Class D as specified in Table 601-1
  - b. The Town reserves the right to modify the concrete mix design after review of the final mix design submitted by the Contractor if an acceptable alternate mix can meet the following general concrete mix design criteria:
    - (a) Compressive Strength: 4,000 psi minimum at 28 days
      - (i) Minimum No. of Passing Cylinders: 90%
      - (ii) Minimum Acceptable Cylinder Strength: 3,800 psi
    - (b) Cement Content: minimum six (6) bags per cubic yard
    - (c) Maximum permissible water-cement ratio for 4,000 psi strength, air entrained, absolute ratio by weight 0.45
    - (d) Slump: maximum four (4) inch
    - (e) Air Content: 6% +/- 1% for all concrete

**C. Embankments**

1. All fill material shall be free from roots, organic material, trash, and frozen material.
2. Rocks, broken concrete, or other solid materials more than six (6) inches in greatest dimension shall not be placed in embankment areas less than one (1) foot deep as measured from the subgrade.

3. Materials up to one hundred fifty (150) pounds in weight may be placed at the base of fills over three (3) feet deep as measured from the subgrade.

### **III. INSTALLATION**

#### **A. Removal of Water**

1. When required by the Town, a construction dewatering permit, as required by the State of Colorado, shall be obtained by the Contractor.
2. Dewatering of ground water on excavation
  - a. Water shall be disposed of in a suitable manner without damage to adjacent property and without being a menace to public health and convenience.
  - b. Shall be done in a manner so as not to allow pollutants or silt to collect on Town rights-of-way, stream courses, or storm sewers.
3. Dewatering onto the Town rights-of-way or storm sewers must be pre-approved.
4. Trenches shall be kept free of water during pipe laying operations by draining, pumping, or other approved methods.
  - a. The water level shall be maintained below the trench bottom throughout the placement of bedding, pipe laying, joining, and backfilling operations.
  - b. The dewatering shall be carried out so that it does not destroy or weaken the strength of the soil under or alongside the trench.
  - c. Under no circumstances shall trench water be discharged into sanitary sewers.
  - d. Construction dewatering into the Town's sanitary sewer system is not permitted. Discharge of hydro-test water, dechlorinated water from pipe line disinfection or flush water from storm drain cleaning is not permitted into the Town's wastewater collection system.

5. The method of disposal of trench water shall be approved by the Engineer/Town Representative.

**B. Clearing, Grubbing, and Stripping**

1. Clearing

- a. 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.

2. Grubbing

- a. 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 minimum depth of three (3) inches.
  - (a) All such materials shall be wasted or spread outside the construction area or disposed of as directed by the Engineer/Town Representative.
  - (b) In no case shall such objectionable material be allowed in or under embankment. 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.

3. Stripping

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

4. Noxious Weed Management

- a. Contractors shall conform to the standards described by the *Town of Crested Butte Noxious Weed Management Plan*, as required by the *Colorado Noxious Weed Act of 2008*.

### **C. Excavation**

1. After all clearing, grubbing, and stripping has been completed, 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.
2. Variation from the subgrade plane shall not be more than one (1) inch of soil.
3. 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 one (1) foot outside the proposed edge of paving slab or curb.
4. The Contractor shall not excavate beyond the dimensions and elevations established and material shall not be removed prior to the staking.
5. If excavation to the finished graded section encounters a subgrade or slopes of spongy material, vegetable matter, or trash pockets, the Engineer/Town Representative may require the Contractor to remove the unsuitable materials and backfill to the finished graded section with suitable material.
  - a. The Engineer/Town Representative may designate as unsuitable those soils or materials that are in his judgement detrimental to the finished roadway. All unsuitable materials shall be disposed of outside the construction area.
6. Where the excavation is carried beyond or below the lines and grades staked or shown on the plans, the Contractor shall, at his own expense, refill and compact all such excavated space with suitable granular material.

### **D. Roadway Excavation and Grading**

1. 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 Engineer/Town Representative.
2. The excavation and embankments for roadway and ditches shall be finished to reasonably smooth and uniform surfaces.

3. Unauthorized Pavement Removal: Unless authorized by the Engineer/Town Representative, all removed pavement and excavations made beyond the lines and grades shown on the approved Construction Drawings or described in the Construction Specifications shall be replaced at the Contractor's expense.

**E. Shouldering and Miscellaneous Work**

1. 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. In case excavation is necessary to accomplish the above purpose, the Contractor shall make such necessary excavation, and shall leave the area so filled or excavated free from all trash and debris.
2. The Contractor shall set all manholes, water boxes, or other service boxes, to the proper finished grade of the pavement or of the fill back of the curb. This work will be considered as part of the grading.

**F. Embankments**

1. 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 as specified in *Part II – Materials*, above.
2. Free running water shall be drained from the material before the material is placed.
3. When an embankment is to be placed and compacted on hillsides, 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.
  - a. Benching shall be well-keyed and, where practical, a minimum of eight (8) feet wide. Each horizontal cut shall begin at the

intersection of the original ground and the vertical sides of the previous cuts.

- b. Material thus cut out shall be recompacted along with the new embankment material at the Contractor's expense.
4. Embankment material shall be placed in horizontal layers not to exceed eight (8) inches in loose depth and compacted prior to placing each following layer.
5. 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 pipe to be installed, prior to trenching and installation of the pipe.
6. The Contractor shall add moisture to, or dry by aeration, each layer as may be necessary to meet the requirements for compaction.
7. Moisture content range (material dependent)
  - a. Not more than 3% above optimum moisture content
  - b. Not less than 5% below optimum moisture content
8. Under roadways and extending one (1) foot beyond proposed curb line as measured perpendicular from the centerline, embankments shall be compacted for the entire depth of the fill.
9. Compaction Requirements
  - a. Top three (3) feet: Minimum of ninety five percent (95%) maximum density as defined by *ASTM D698 / AASHTO T-99*.
  - b. Excluding top three (3) feet: Not less than ninety percent (90%) maximum density

## **G. Trench Excavation**

1. Surface Removal and Topsoil Preservation
  - a. 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.

- b. Where excavation is required under paved areas, the pavement shall be cut in such a manner as to affect a smooth, straight-cut edge, and as a vertical face, six (6) inches minimum beyond the trench wall.
- c. Clean topsoil suitable for final grading shall be stripped, stockpiled separately in approved location, and restored to the surface after the trench is backfilled.
  - (a) Where excavation is in a lawn-covered area, the sod shall be cut, removed, and replaced after trench filling so as to promote regrowth. Where sod is disturbed, the Contractor shall re-sod with like grass at his own expense.

## 2. Stockpiling Excavated Material

- a. Excavated material shall be piled in locations that will not endanger the work, create traffic hazards, or obstruct sidewalks and driveways.
- b. 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.
- c. 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

- a. 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.
- b. Where conduit is to be installed outside of existing pavement and pipes have an inside diameter of thirty-three (33) inches or less, the trench shall be excavated at pipe level a minimum of sixteen (16) inches wider than the outside diameter of the pipe so that a clear space of not less than eight (8) inches is provided on each side of the pipe.
- c. For pipes having an inside diameter of thirty-six (36) inches or greater, the trench shall be excavated at pipe level a

minimum of twenty-four (24) inches wider than the outside diameter of the pipe so that a clear space of not less than twelve (12) inches is provided on each side of the pipe.

- (a) Wherever it is necessary to exceed these limits, approval of the Engineer/Town Representative shall be obtained and provisions made for the additional load imposed on the pipe.
- (b) When sheeting is used, the widths indicated above shall be measured to the inside dimension between the sheeting.

#### 4. Bracing and Sheeting of Trenches

- a. 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 Administration (OSHA) Standards for Construction*.
- b. A sand box or trench shield may be used in lieu of sheeting and bracing as permitted by OSHA. 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.

#### 5. Trenches with Sloping Sides

- a. In traveled streets, alleys, or narrow easements, only vertical trenches with proper bracing will be allowed.
- b. Where working conditions and right-of-way width permit (as determined by the Engineer/Town Representative), trenches may be excavated with sloping sides in accordance with OSHA requirements. Sloping sides will not be allowed when it requires excavation beyond the limits shown on the approved Construction Drawings.
- c. Where trenches with sloping sides are permitted, the slopes shall not extend below a point twelve (12) inches above the top of pipe. The trench shall be excavated with the vertical sides below this point with widths not exceeding those specified on *Drawing No. 1 – Standard Trench Detail*.

6. Over-Excavating for Rock

- a. When bedrock, boulders, or loose/stony soil are encountered in the trench bottom so that there is the possibility of pipe being subjected to "point" contacts, the trench shall be over-excavated a minimum of six (6) inches. The over-excavated material shall be replaced with Engineer/Town Representative-approved material and compacted.
- b. 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

- a. Where the excavation is found to consist of organic matter, or any other material that the Engineer/Town Representative determines to be unsuitable for supporting the pipe, the trench shall be excavated to an additional depth as directed by the Engineer/Town Representative and replaced with an approved granular stabilization material.
- b. Suitable materials will be determined by the Town/Town Representative shall determine suitability of materials to be used.

8. Trench Bedding

- a. All trenches shall be excavated to at least four (4) inches below the pipe grade and backfilled to grade with approved granular bedding material.
- b. The bedding material shall be hand-shaped and graded until the trench bottom is uniform and free from rocks, bumps, and depressions.
- c. 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 two (2) inches between the coupling and the trench bottom.
- d. If, in the opinion of the Engineer/Town Representative, the pipe is subjected to unusual loading, Class A – Concrete Arch bedding may be required.

- (a) The Contractor shall provide an analysis of the load conditions and the bedding required if directed by the Engineer/Town Representative. Refer to *Drawing No. 3 – Pipe Embedment Detail*.

9. Backfilling Pipes and Structures

- a. During initial backfilling, the Contractor shall take all necessary precautions to prevent movement or distortion of the pipe or structure being backfilled.
- b. Pipe bedding material shall be placed and compacted in even lifts on both sides of the conduit to six (6) inches above the top of the pipe.
- c. Above the bedding material, earth backfill material shall be placed full-width in uniform layers not more than twelve (12) inches thick.
- d. Each layer shall be compacted to the required density with approved mechanical or hand tamping equipment.
- e. Unless otherwise specified or approved by the Engineer/Town Representative, all backfill material shall be placed with moisture-density control in accordance with *Drawing No. 1 – Standard Trench Detail*.
  - (a) Moisture content range
    - (i) Two percent above (+2%) the optimum moisture content
    - (ii) Four percent below (-4%) the optimum moisture
- f. Jetting or water soaking trenches to achieve compaction of the backfill will not be permitted except when:
  - (a) Soil sample tests show that the backfill and excavated trench materials consist of gravel or other granular material having less than fifteen percent (15%) by weight passing on No. 200 sieve.
  - (b) The Engineer/Town Representative has given written approval prior to water soaking.



**I. Sidewalks**

1. The Town utilizes Standard Specifications for Roadway and Concrete Construction which are based upon *CDOT Standard Specifications for Road and Bridge Construction, 2011*, or latest revision.

**J. Storm Water**

1. All pollution control devices and best management practices (BMPs) shall be provided and placed so that all potential pollutants will be contained.
2. All access points must be controlled to minimize the tracking of debris on to Town right of away.

**IV. INSPECTION AND TESTING**

**A. Embankments**

1. In-Place Density: One test for every six-thousand (6,000) square feet per lift

**B. Trenches**

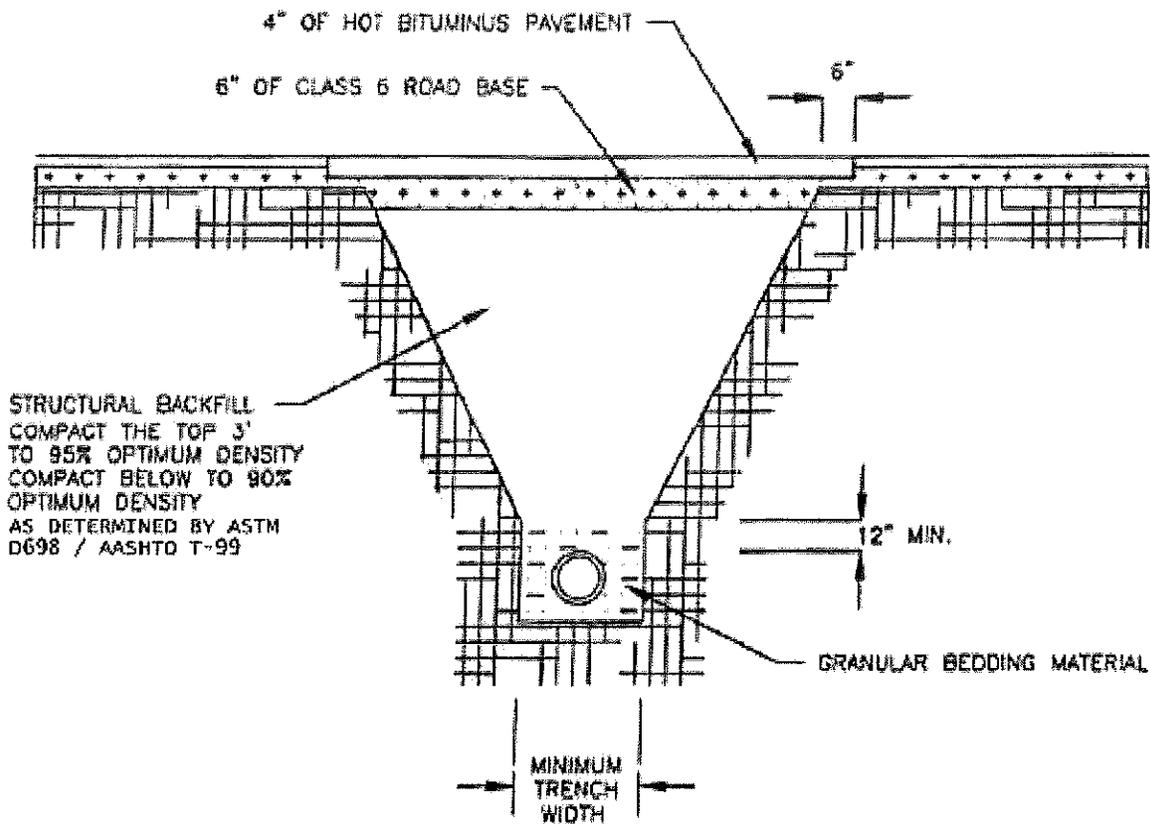
1. For every four-hundred (400) lineal feet of trench and each branch or section of trench less than four-hundred (400) feet in length, at least one compaction test shall be performed for each two (2) foot vertical lift of backfill material placed.
2. The first test shall be taken approximately two (2) feet above the top of pipe, and the last test shall be at the pavement subgrade or six (6) inches below the ground surface in unpaved areas.
3. Compaction tests shall be taken at random locations along the trench and wherever poor compaction is suspected. If any portion of the backfill placed fails to meet the minimum density specified, the area shall be defined by additional tests as necessary and the material in the designated area shall be removed and replaced to the required density at the Contractor's expense.

**C. Acceptance**

1. All compaction testing shall be performed by an independent soil testing laboratory acceptable to the Town.

2. It shall be the Contractor's responsibility to make necessary excavations in order to accommodate compaction tests or retests at all locations designated.
3. A summary report of all compaction tests shall be submitted to the office of the Engineer/Town Representative. The test results are required as a basis of acceptance of facilities by the Town.

## DRAWING NO. 1: STANDARD TRENCH DETAIL



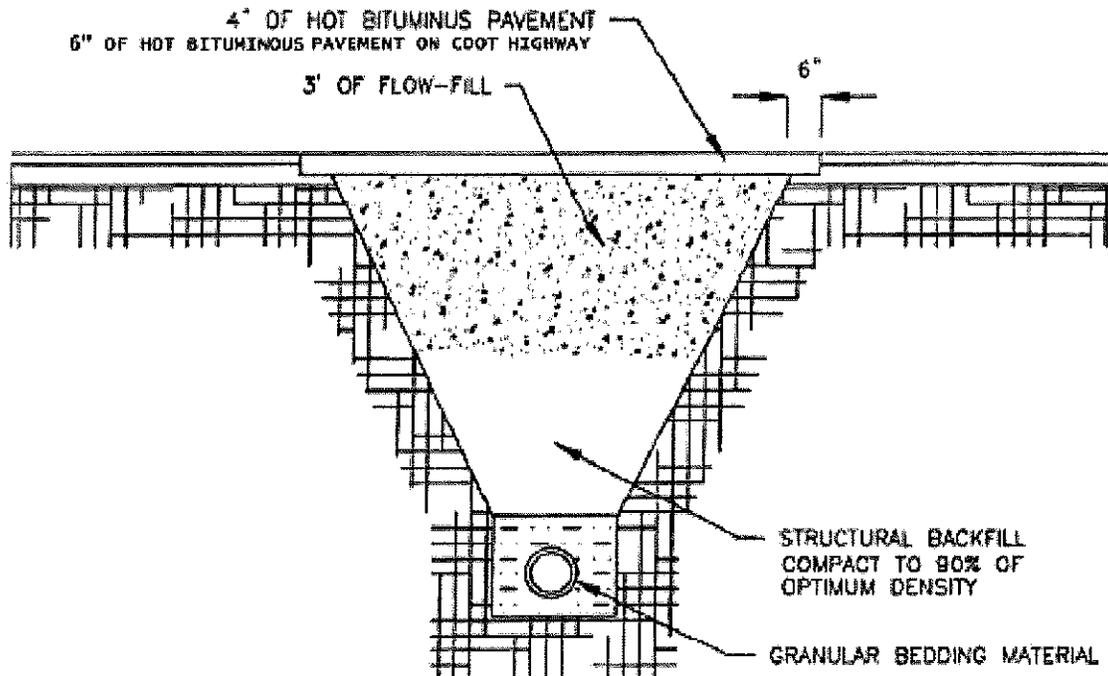
### TRENCH WIDTH NOTES:

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 12" OVER 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 CDOT HIGHWAY 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.

## DRAWING NO. 2: FLOW-FILL BACKFILL DETAIL



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

EXCEPT:

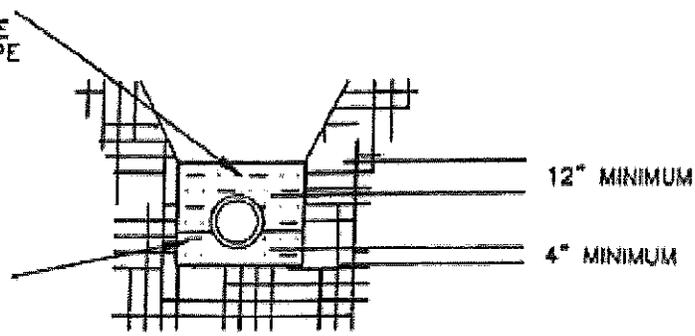
IF HOT BITUMINOUS PAVEMENT IS NOT AVAILABLE THE TRENCH MAY BE FILLED LEVEL TO THE ADJACENT PAVEMENT WITH FLOW-FILL. THE TOP 4" SHALL BE REPLACED WITH HOT BITUMINOUS PAVEMENT AS SOON AS IT IS AVAILABLE.

COMPACTION TESTING NOT REQUIRED ON FLOW-FILL.

### DRAWING NO. 3: PIPE EMBEDMENT DETAIL

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

REINFORCEMENT AS REQUIRED  
BY STRUCTURAL DESIGN

CONCRETE ARCH ENCASMENT  
TO CENTER LINE OF PIPE

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

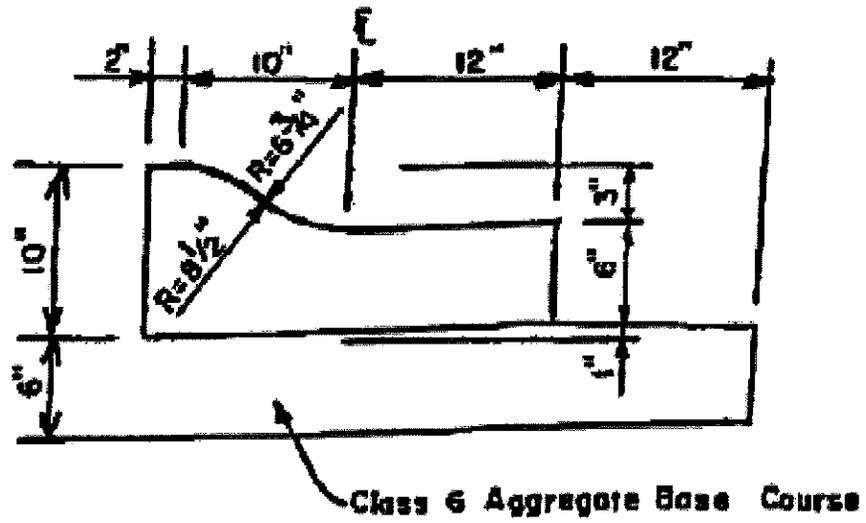
6" MIN. OR AS REQUIRED  
BY STRUCTURAL DESIGN

4" MINIMUM

CLASS A EMBEDMENT DRAWING  
CONCRETE ARCH ENCASMENT

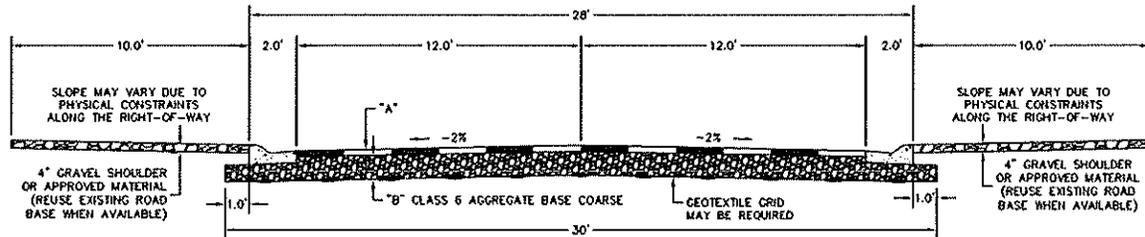
**DRAWING NO. 4: CURB AND GUTTER DETAIL**

DETAIL.



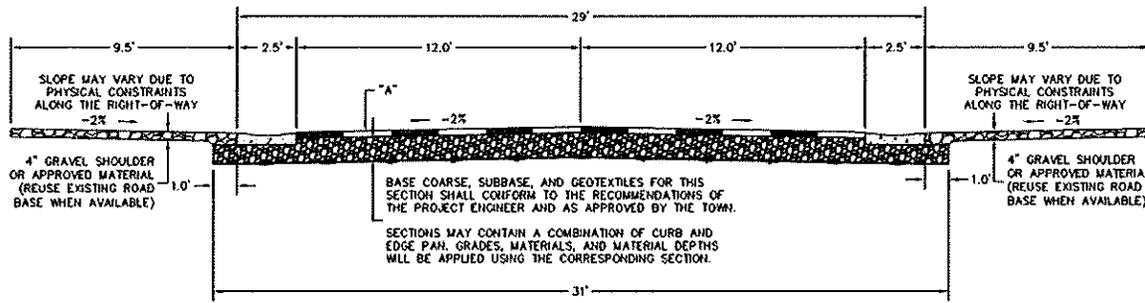


## DRAWING NO. 6: STREET STANDARDS (PAGE 1)



TYPICAL ROADWAY - RS2

SCALE 1"=4'

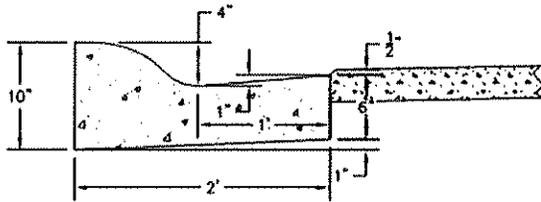


TYPICAL ROADWAY - WITH EDGE PAN

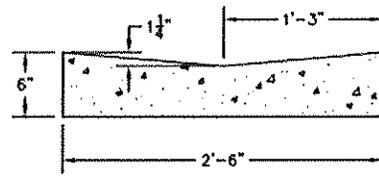
SCALE 1"=4'

<p>ASPHALT WIDTH</p> <p>MINIMUM ASPHALT THICKNESS</p> <p>MINIMUM BASE</p> <p>MINIMUM STRUCTURAL NUMBER</p> <p>ROADWAY CROWN</p> <p>MAXIMUM GRADE</p> <p>MINIMUM GRADE</p>	<p>24 FEET</p> <p>3 INCHES</p> <p>6 INCHES</p> <p>2.1</p> <p>2.0 %</p> <p>6.0 %</p> <p>0.6 %</p>	<p>ASPHSPHALT SHALL BE A MINIMUM OF 1/2 INCH ABOVE THE LIP OF THE GUTTER OF A CATCH CURB AND GUTTER AND PANS.</p> <p>ASPHALT SHALL BE EVEN WITH THE LIP OF THE GUTTER OF A SPILL CURB AND GUTTER.</p>
<p>CURB RETURN RADIUS (BACK OF CURB)</p>	<p>15 FEET</p>	

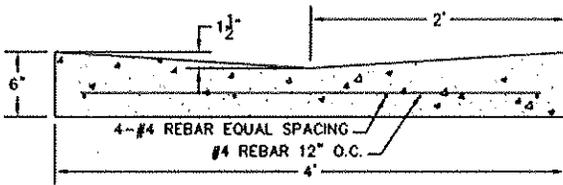
**DRAWING NO. 7: STREET STANDARDS (PAGE 2)**



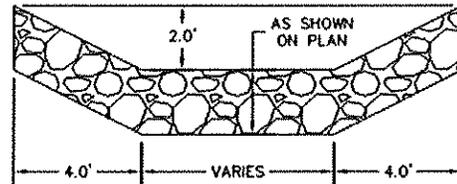
TYPICAL CURB AND GUTTER



TYPICAL EDGEPAN



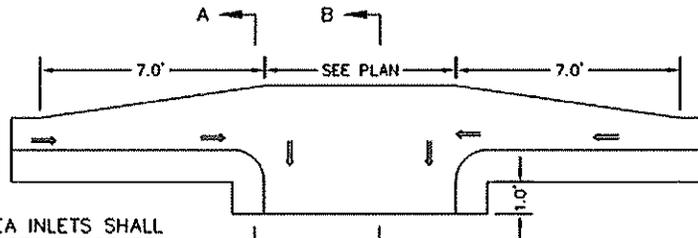
TYPICAL CROSSPAN



ANGULAR - 12" AVERAGE DIAMETER  
ROUNDED - 15" AVERAGE DIAMETER

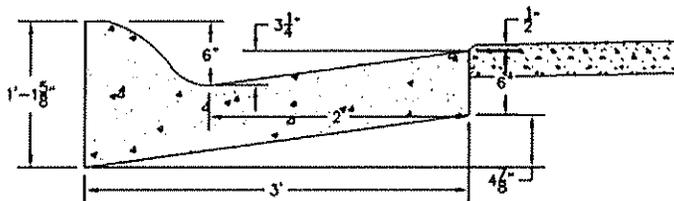
TYPICAL RIP-RAP

NOTE: #4 REBAR SHALL BE PLACED AT 12" O.C. E.W. IN CURB RETURN PANS.

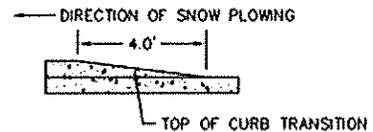


CURB OPENING

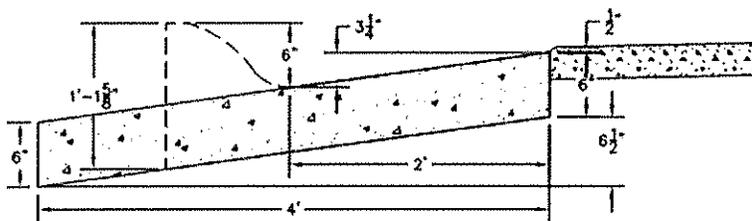
NOTE: CURB AND AREA INLETS SHALL CONFORM TO C.D.O.T. STANDARDS OR AS APPROVED BY THE TOWN.



SECTION A-A



TYPICAL CURB TRANSITION



SECTION B-B

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**TOWN OF CRESTED BUTTE**  
**WATER DISTRIBUTION SYSTEM SPECIFICATIONS**  
**SECTION 300**

**I. SCOPE**

- A. The purpose of this Water Distribution System Specification is to set forth the criteria to be used for in the construction of water mains and service lines for approval and acceptance by the Town of Crested Butte.
- B. All excavation and backfilling shall be performed in accordance with *Section 200 – General Earthwork Specifications*.

**II. MATERIALS:**

**A. Pipe Larger than Two (2) Inches**

- 1. All water mains shall be a minimum of eight (8) inches in diameter unless approved by the Town.
- 2. Polyvinyl Chloride (PVC) Pipe
  - a. PVC C900, DR 18 unless otherwise approved by the Town.
- 3. Ductile Iron Pipe (DIP)
  - a. DIP for water mains shall conform to *AWWA C151*, Class 52. DIP shall be cement-lined in accordance with *AWWA C104*.

**B. Pipe Two (2) Inches and Smaller (Services)**

- 1. Service lines shall be constructed with high-density polyethylene (HDPE) pipe or copper pipe and conform to *AWWA C901*, or other if approved by the Town. Refer to *Item N – Service Lines* for further detail.

**C. Joints**

- 1. DIP joints shall be mechanical, push-on, or restrained push-on joints conforming to *AWWA C111*.
- 2. Joints used for PVC pipe shall be mechanical, push-on, or restrained push-on joints conforming to *ASTM D3139*.

- a. Push-on joints shall conform to *ASTM F477*.
  - b. Restrained push-on joints shall conform to *ASTM A536*.
  - c. Mechanical joint restraints shall conform to *AWWA C110*.
    - (a) EBAA Iron "MEGALUG"
3. Two (2) inch and smaller shall be compression type

**D. Gaskets**

1. Gaskets shall be of neoprene or other synthetic rubber material.

**E. Restrained Push-On Joints**

1. American "Lok-Fast" or "Lok-Ring"
2. CLOW "Super-Lock"
3. US Pipe "Lok-Tyton" or "Lok-Tyte"
4. Griffin "Snap-Lock"
5. Pacific States "Thrust-Lock"

**F. Restrained Glands**

1. EBAA Iron Model No. 1100 series

**G. Fittings**

1. Fittings shall be ductile-iron conforming to *AWWA C152*, Class 350, and mechanical joints conforming to *AWWA C111* with appropriate gaskets for the connected pipe.
2. Smaller than two (2) inch shall be compression type.

**H. Bonding Straps**

1. Bonding straps shall be deoxidized 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.
2. Bonding may be accomplished using Cad Weld method for DIP with a minimum wire requirement of No. 4 BSD Copper.

**I. Tracer Wire**

1. Provide tracer wire for all PVC and HDPE pipe
2. All tracer wire shall be 12 AWG solid copper wire coated with 45 mil Type HMW - PE blue insulation compliant with *ASTM D1351* specifically designed for direct burial in corrosive soil or water
3. UL listed

**J. Tracer Wire Test Stations**

1. Four (4) inch with locking lid
2. Manufacturers:
  - a. CP Test Services
  - b. Glenn Series "Glenn-4"
  - c. Or accepted substitution

**K. Valves and Valve Boxes**

1. General
  - a. Valve boxes shall be provided for each valve.
  - b. All valves shall open counter clockwise (open left).
  - c. All valves shall be equipped with a non-rising stem and standard two (2) inch square wrench nut.
  - d. Stems shall provide "o" ring dirt seal and pressure seal packing.
  - e. Valve boxes shall be 2 or 3 piece, buffalo-type, with extension as required.
  - f. Valves twelve (12) inches and larger shall be provided with a bonnet.
  - g. Shafts shall be not less than six (6) inches in diameter and will be capped with a standard flush-type lid weighing not less than ten (10) pounds and marked "WATER".

2. Gate Valves
  - a. Gate valves shall be in accordance with *AWWA C509*, equal to the class of pipe being used, with mechanical joint ends.
3. Butterfly Valves
  - a. Butterfly valves shall be Town approved and shall conform to *AWWA C504*.

**L. Fire Hydrants**

1. Fire hydrants shall be in accordance with *AWWA C502*.
2. Guardian Model K81A as manufactured by ITT Kennedy Valve.
3. Adjustable grade device (as required by Town): Gradelok or equivalent.

**M. Encasements & Thrust Blocks**

1. Concrete used for encasements or thrust blocks shall have a minimum compressive strength of two-thousand five-hundred (2,500) psi in twenty-eight (28) days.

**N. Service Lines**

1. Service lines shall be a minimum of one (1) inch in diameter.
2. All service lines shall be installed with insulated pipe foam from the water main to the water meter.
3. All HDPE pipe shall have coated, solid locating wire attached and accessible at the ground surface.
4. All service lines shall have curb valves placed at property line. Below grade and accessible.

**O. Corporation Stops**

1. Size: one (1) inch to two (2) inch
2. Style: ball-style
3. Rating: three-hundred (300) psi
4. Materials shall be approved by the Town prior to installation

**P. Curb Valves/Stops**

1. All curb valves/stops shall be one (1) inch to two (2) inch ball-style curb valves/stops. Materials shall be approved by the Town prior to installation.

**Q. Curb Boxes**

1. Materials shall be approved by the Town prior to installation.

**R. Service Saddles**

1. Materials shall be approved by the Town prior to installation.

**III. INSTALLATION**

**A. Depth**

1. Pipe shall be installed a minimum of seven (7) feet from top of pipe to proposed grade, whichever is lower.

**B. General**

1. No pipe shall be laid when, in the opinion of the Town or their representative, trench conditions are unsuitable.
2. 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 materials, protective coatings, and linings.
3. Under no circumstances shall water main materials be dropped or dumped into the trench.
4. All pipe and fittings shall be carefully examined for cracks or other defects immediately before installation in final position.
5. Every precaution shall be taken to prevent foreign material from entering the pipe while it is being installed.
6. During laying operations, no debris, tools, clothing, or other material shall be placed in the pipe.
7. 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 Town. If water is in the trench, the plug shall remain in place until the trench is pumped completely dry.

8. 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.
9. Where pipe is laid on a grade of ten percent (10%) or greater, the laying shall start at the bottom and shall proceed upward with the bell ends of the pipe up grade.
10. 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.
11. Wedging or blocking of the bell or pipe is not permitted for achieving slope before backfilling.

**C. Bonding Strap**

1. For ductile iron pipe installation, a bonding strap shall be installed across each joint to provide metal to metal continuity. Bonding straps shall be attached at each end by means of magnesium weld or other approved method.

**D. Valves**

1. Valves shall have the interior cleaned of all foreign matter before installation.
2. Valves shall be inspected in the open and closed positions to ensure that all parts are in working condition.
3. Valves shall be set and joined to pipe/fittings in the manner specified for cleaning, laying, and joining pipe and fittings.

**E. Valve Boxes**

1. Valve boxes shall be centered and plumb over the wrench nut of the valve with the box cover flush with the level of the finished grade for paved surfaces and slightly below grade for dirt installation. Or at such level as may be directed by the Town.
2. Upon completion of backfill around the valve box, a standard 4 x 4 timber shall be placed vertically next to each valve box, the exposed portion of which shall be at least four (4) feet above finished grade for new construction, where applicable.

## **F. Fire Hydrants**

1. Fire hydrants shall be installed to finished grade elevation. An appropriately sized class 150 valve shall be required with each hydrant, and both shall be installed at the location designated by the Town.
2. Hydrant drainage
  - a. Pervious soil – Provided at the base of the hydrant by placing coarse gravel or crushed stone from the bottom of the trench to at least six (6) inches above the water openings (weep holes) in the hydrant and to a distance of one (1) foot around the elbow.
  - b. Clay or other impervious soils – Provided by a drainage pit two (2) feet in diameter and three (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 six (6) inches above the water openings (weep holes).

## **G. Thrust Protection**

1. All plugs, tees, valves, bends, and hydrants or a change in direction of ten (10) degrees or more shall be mechanically restrained to provide 100% thrust protection.
2. Restrained Joint Pipe
  - a. Pipe shall be restrained in each direction from a plug, tee, bend, hydrant, or change of ten (10) degrees or more as shown on *Drawing No. 9 – Restrained Pipe Detail*, unless a design is provided by a Registered Professional Engineer and approved by the Town,
3. Thrust Blocks
  - a. Concrete thrust blocks shall be placed between the solid ground of the trench wall and the fitting.
  - b. The backing shall be so placed that the pipe and fitting joints will be accessible for repair.
  - c. Plastic "cloth" shall be placed between fitting and concrete. Unless a design is provided by a Registered Professional

Engineer and approved by the Town, thrust blocks shall be as shown on *Drawing No. 8 – Thrust Block Detail*.

#### **H. Encasements**

1. 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.
2. Not more than two (2) supports shall be used for each pipe length, one adjacent to the shoulder of the bell and the other near the spigot end.
3. No encasements shall be poured until the Town has inspected and approved the pipe and supports to be encased.

#### **I. Water Taps and Services**

1. Water taps and services shall be a minimum of seven (7) feet from top of pipe to proposed finished grade.
2. A bonding strap shall be installed on all DIP.
3. Installation of service lines and taps on the water main shall be installed to the property line at the time of water main construction.
4. Install curb valve at the property line with tracer wire accessible at the curb valve location.
5. For all service taps, follow manufacturer recommendations for minimum water main size for direct tapping.
6. Water taps larger than one (1) inch on existing cast iron and ductile iron pipe shall be installed using tees. Saddles will not be acceptable unless approved by the Town.
7. Each two (2) inch and smaller service line that is machine tapped shall be connected to the water main through a brass ball-style corporation stop. The main shall be tapped at twenty-two (22) degrees from the horizontal centerline of the pipe, and the stop must be turned so that the T-handle will be on the side.
8. All copper water service lines shall be installed with a frost loop. See *Drawing No. 12 – Service Connections Detail*.

9. Any water service line installation that crosses an irrigation ditch requires the installation of culvert pipe in the irrigation ditch. Installation and materials shall be approved by the Town.

**J. Relationships Between Water System Piping and Sanitary Sewer System Piping**

1. "Lines" shall mean all water or sewer mains.
2. When water and sewer lines are within ten (10) feet horizontally of each other and the sewer line is above or less than eighteen (18) inches below the water line, the portion of the sewer line within that area shall
  - a. Be construction of approved waterline pipe and joints (PVC C900);
  - OR
  - b. Be constructed of SDR 35 PVC sewer pipe with all joints and pipe within ten (10) feet of the water line encased in concrete that is a minimum of six (6) inches thick centered on the crossing pipe.
3. In all cases, suitable backfill or other structural protection shall be provided to preclude the settling or failure of both pipes.
4. Crossings of sewer and water lines shall not be at an angle less than forty-five (45) degrees, unless approved by the Town.
5. See *Drawing No. 11 – Sanitary Sewer – Water Pipe Crossing Detail*.

**IV. INSPECTION AND TESTING**

The Contractor shall furnish all labor, equipment, tools, water, and other incidental items required to conduct the tests. Test results are not considered valid without the presence of the Engineer/Town Representative throughout the test.

**A. Water Main Pressure Testing**

1. Water mains shall be tested for pressure and leakage in accordance with *AWWA C600* and as specified herein.
2. No pressure testing shall be performed until all thrust blocks have been placed and cured, and the pipeline backfilled adequately to prevent any movement or lifting of the pipe. Pavement or other

permanent structures shall not be placed until all testing are satisfactorily completed.

3. Test Pressure

- a. The test pressure for all pipes shall be fifty percent (50%) more than the maximum operating pressure, as determined by the Town, at the lowest elevation of the test section, but shall be a minimum of one-hundred fifty (150) psi at any elevation in the test section.

4. Filling

- a. The pipeline shall be filled with potable water at least twenty-four (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.

5. Leakage

- a. The specified test pressure shall be applied by means of a pump connected to the pipe in a manner satisfactory to the Town. The leakage test shall be performed for a minimum of two (2) hours. No pipe installation will be accepted if the leakage for the section of line being tested is more than the rate calculated using a standard formula.

$$L = \frac{ND\sqrt{P}}{7,400}$$

where:

- L = testing allowance, gallons per hour
- N = number of joints in the tested line
- D = nominal pipe diameter, inches
- P = average test pressure, psi

Table 2620-1 Hydrostatic Testing Allowance per 1000 ft. of Pipeline (gph)

Avg. Test Pressure (psi)	Nominal Pipe Diameter (in.)												
	3	4	6	8	10	12	14	16	18	20	24	30	36
450	0.48	0.64	0.96	1.27	1.59	1.91	2.23	2.55	2.87	3.19	3.82	4.78	5.73
400	0.45	0.60	0.90	1.20	1.50	1.80	2.10	2.40	2.70	3.00	3.60	4.50	5.41
350	0.42	0.56	0.84	1.12	1.40	1.69	1.97	2.25	2.53	2.81	3.37	4.21	5.06
300	0.39	0.52	0.78	1.04	1.30	1.56	1.82	2.08	2.34	2.60	3.12	3.90	4.68
275	0.37	0.50	0.75	1.00	1.24	1.49	1.74	1.99	2.24	2.49	2.99	3.73	4.48
250	0.36	0.47	0.71	0.95	1.19	1.42	1.66	1.90	2.14	2.37	2.85	3.56	4.27
225	0.34	0.45	0.68	0.90	1.13	1.35	1.58	1.80	2.03	2.25	2.70	3.38	4.05
200	0.32	0.42	0.64	0.85	1.06	1.27	1.49	1.70	1.91	2.12	2.55	3.19	3.82
175	0.30	0.40	0.60	0.79	0.99	1.19	1.39	1.59	1.79	1.99	2.38	2.98	3.58
150	0.28	0.37	0.55	0.74	0.92	1.10	1.29	1.47	1.66	1.84	2.21	2.76	3.31
125	0.25	0.34	0.50	0.67	0.84	1.01	1.18	1.34	1.51	1.68	2.01	2.52	3.02
100	0.23	0.30	0.45	0.60	0.75	0.90	1.05	1.20	1.35	1.50	1.80	2.25	2.70

6. 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.

## B. Water Main Disinfection

1. 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 C651*.
2. Disinfection can be completed simultaneously with pressure test if approved by the Town.
3. 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.
4. Preliminary Flushing
  - a. Sections of pipe to be disinfected shall first be flushed to remove any solids or contaminated material that may have entered the pipe.
  - b. 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.

- c. Preliminary flushing can be eliminated if approved by the Town.
- 5. Form of Applied Chlorine
  - a. Chlorine shall be applied by one of the methods described in *AWWA C651*, subject to approval by the Town.
  - b. Per *AWWA C651*, tablet chlorination is only acceptable if installed pipe is clean and free of debris and groundwater during installation.
  - c. If the "tablet method" is utilized, then flushing shall take place after chlorination.
- 6. Point of Application
  - a. The prepared point of application of the chlorinating agent is at the beginning of the pipeline extension or any isolated section of it, and through a corporation stop inserted in the pipe.
  - b. The water injector for delivering the chlorinated water into the pipe shall be supplied from a tap made on the pressure side of the gate valve controlling the flow into the pipeline extension.
  - c. Alternate points of application may be used when approved or directed by the Town.
- 7. Retention Period
  - a. Treated water shall be retained in the pipe for at least twenty-four (24) hours.
  - b. After the retention period, the chlorine residual at pipe extremities and at other representative points shall be at least twenty-five (25) mg/L.
- 8. Final Flushing, Neutralization, and Testing
  - a. All chlorinated water shall be neutralized to a chlorine residual of no greater than one (1.0) ppm before discharge as approved or directed by the Town.
  - b. 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 testing a chlorine residual of less than one (1) mg/L.

**C. Chlorinating Valves and Hydrants**

1. In the process of chlorinating newly laid pipe, all valves and other appurtenances shall be operated while the pipeline is filled with the chlorinating agent and under normal operating pressure.
2. After final flushing, and before the water main is placed in service, bacteriologic tests shall be performed in accordance with *AWWA C651*.

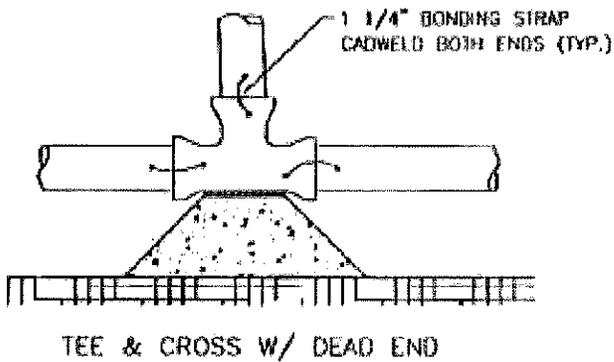
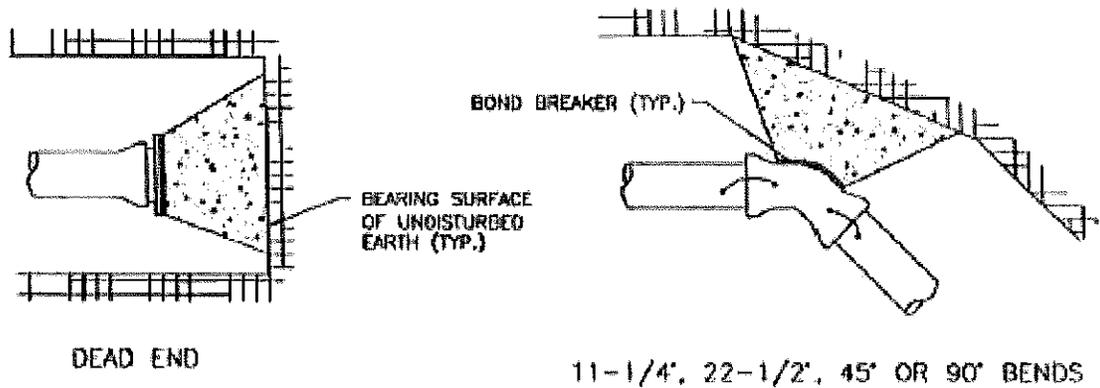
**D. PVC Water Pipe Continuity Testing**

1. Notify Town 24 hours in advance to schedule testing
2. Test tracer wire for continuity, in the presence of Owner and Engineer, after backfill is complete and before Substantial Completion
3. Continuity test to consist of locating the PVC water pipe with an electronic-type pipe locator
4. If test is negative for continuity, repair or replace as necessary to achieve continuity

**E. Trench Backfill Compaction Testing**

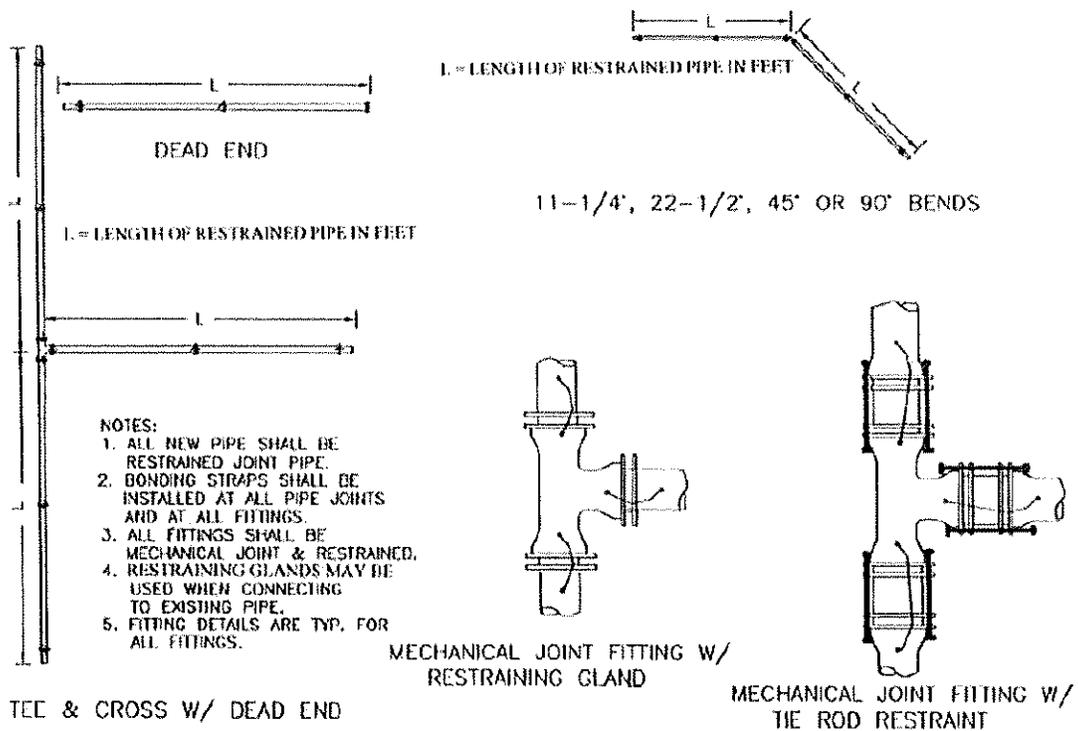
1. Testing shall be performed according to *Section 200 – General Earthwork Specifications, Part IV – Inspection and Testing*.

**DRAWING NO. 8: THRUST BLOCK DETAIL**

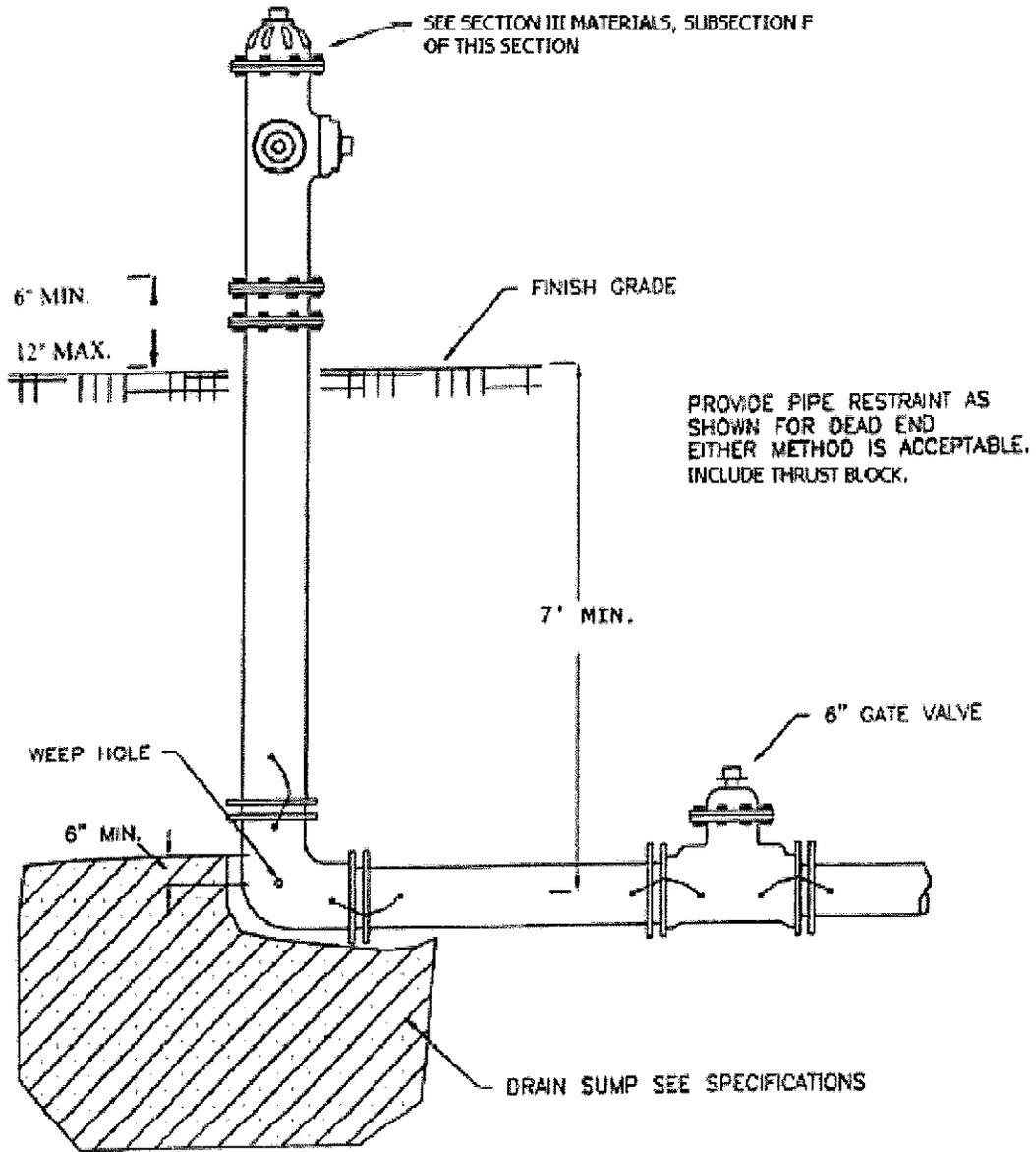


- NOTES:
1. ALL FITTINGS REQUIRING THRUST BLOCKS SHALL BE WRAPPED IN POLYETHYLENE BOND BREAKER MATERIAL.
  2. CONCRETE SHALL NOT BEAR ON BOLTS OF MECHANICAL JOINT FITTINGS.
  3. PIPE AND FITTINGS MAY BE EITHER MECHANICAL JOINT OR PUSH ON JOINT.

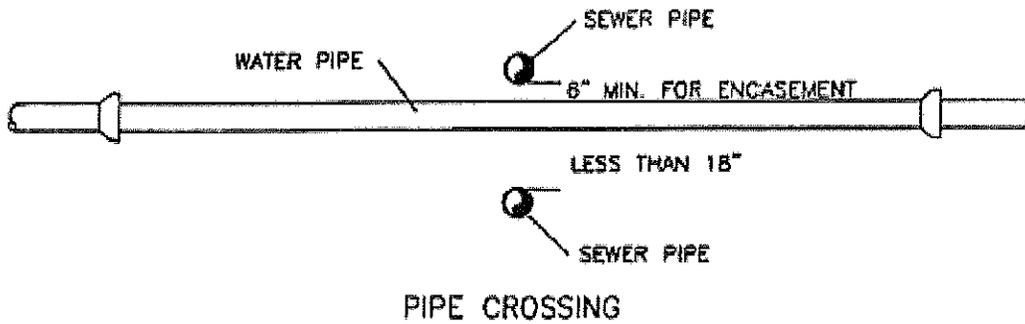
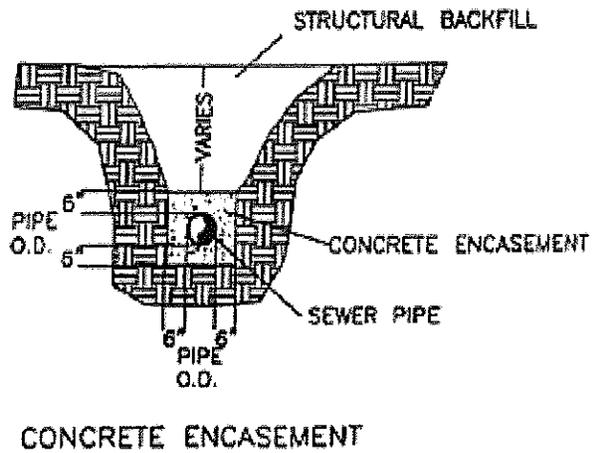
## DRAWING NO. 9: RESTRAINED PIPE DETAIL



# DRAWING NO. 10: STANDARD FIRE HYDRANT DETAIL

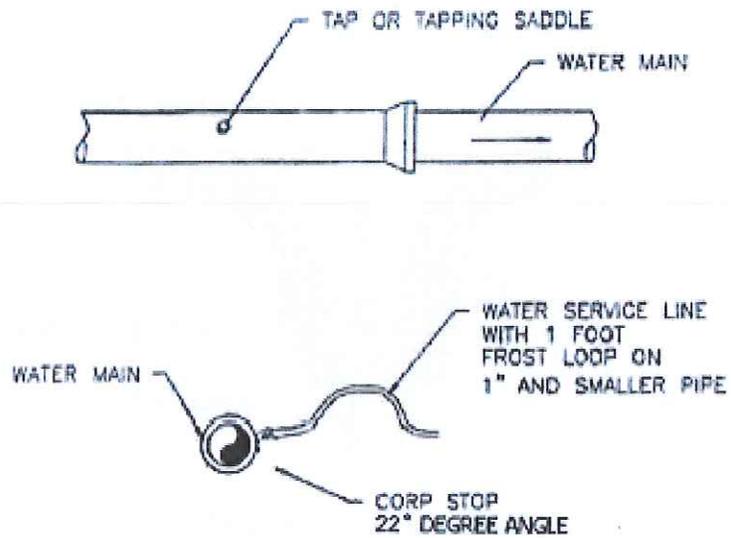


**DRAWING NO. 11: SANITARY SEWER – WATER PIPE CROSSING DETAIL**

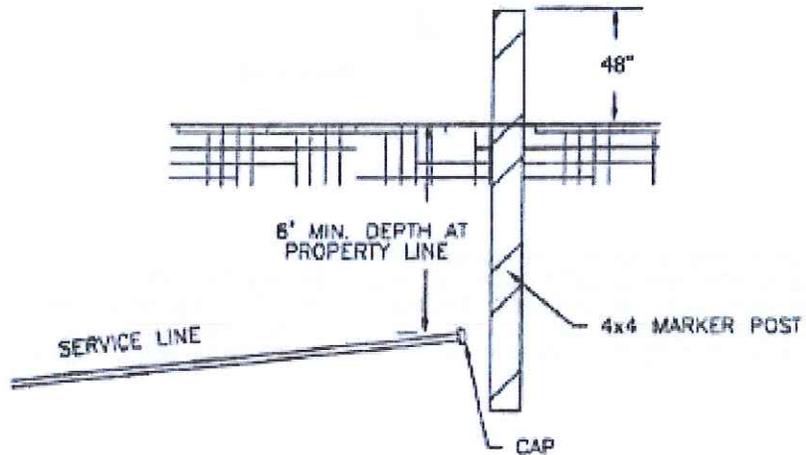


**NOTE:**  
 IF THE SEWER PIPE IS ABOVE THE WATER PIPE  
 OR IF THE SEWER PIPE IS LESS THAN 18" BELOW THE WATER PIPE  
 THE SEWER PIPE MUST BE CONCRETE ENCASED TO PROTECT THE WATER PIPE.  
 SEE SPECIFICATION SECTION 500 OR 600 FOR PROTECTION REQUIRED.  
 PROTECTION MUST EXTEND A MINIMUM OF 10' EACH WAY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

**DRAWING NO. 12: SERVICE CONNECTIONS DETAIL**



**DRAWING NO. 13: WATER SERVICE MARKER DETAIL**



**TOWN OF CRESTED BUTTE**  
**SANITARY SEWER SYSTEM SPECIFICATIONS**  
**SECTION 400**

**I. SCOPE**

The purpose of the Sanitary Sewer System Specification is to set forth the criteria to be used in the construction of sanitary sewer mains, services, manholes, and lift stations for approval and acceptance by the Town of Crested Butte.

All requests for information on the Town's wastewater system shall be made via Wastewater System Division. The Town makes no representation that released documents and files (e.g. record drawings, maps, reports, studies, etc.), hard copy or otherwise, or the information they contain, are accurate, current, or complete.

**II. MATERIALS**

**A. Gravity Sanitary Sewer Main**

1. All sanitary sewer mains shall be constructed with SDR 35 PVC, C900 PVC, or other as approved by the Town.

**B. Sanitary Sewer Pressure Main**

1. Four (4) inch minimum inner diameter
2. Ductile iron with 316 stainless steel nuts and bolts unless otherwise approved by the Wastewater Division
  - a. Provide cathodic protection or polyethylene encasement.
3. High-Density Polyethylene (HDPE): may be permitted provided thermal expansion factors are considered. Approval from Town required for installation.
  - a. Provide tracer wire.

**C. Fittings**

1. PVC Sewer Pipe: Double-gasket push-on joints, for sanitary use
  - a. "Mission" (rubber) couplings are only to be used upon Town approval.

- b. Push on type plastic or PVC fittings without sanitary sewer sweeps shall not be permitted.
- 2. PVC C900
  - a. Inside diameter shall correspond with inside diameter of the C900 PVC pipe installed.
    - (a) "Lips" at improperly specified fitting can snag solids resulting in hydraulic flow constrictions.
- 3. No-hub cast iron pipe
  - a. Town approved cast iron or stainless steel fittings required

**D. Manholes**

- 1. Size: Four (4) foot diameter with two (2) foot cones
- 2. Manholes shall be pre-cast reinforced concrete. Cast-in-place reinforced manholes may be used upon approval from the Town.
- 3. Rubber boots shall be used on all manhole penetrations. Grouting the inside of the penetration shall also be performed.
- 4. Manholes shall have a protective inside coating.
- 5. Manholes shall be provided without rungs.
- 6. Over lapping joints and rub'r-nek gaskets, or similar product, shall be used at all barrel section joints.
- 7. Standard-sized frames and covers shall be specified as depicted in standard details on approved Construction Drawings.
- 8. Coatings
  - a. Interior: Tnemec or Sherwin Williams as specified below,
    - (a) Filler – Tnemec Series 218 as needed to fill voids and bugholes
    - (b) First coat – Tnemec Series 66HS, thinned 10%, @ 100 sfpg
    - (c) Second coat – Tnemec Series 66HS @ 160 sfpg

(d) Third coat – Tnemec Series 66HS @ 160 sfpg

OR

(e) Filler – Sherwin Williams Dura-Plate 2300 as needed to fill voids and bugholes

(f) First coat – Sherwin Williams Dura-Plate 235, thinned 10%, @ 100 sfpg

(g) Second coat – Sherwin Williams Dura-Plate 235 @ 160 sfpg

(h) Third coat – Sherwin Williams Dura-Plate 235 @ 160 sfpg

b. Exterior (as required by Town)

(a) Bituminous Dampproofing Exterior Coating

c. Manufacturers:

(a) Tnemec

(b) Sherwin Williams

(c) Or approved equal

**E. Service Lines and Connections**

1. Four (4) inch minimum inner diameter unless otherwise approved by the Town
2. SDR 35 PVC, C900 PVC, or SCH 40 PVC
3. Service taps into sewer mains shall use a factory tee or wye, gasket saddle wye or gasket fitting in conjunction with a repair sleeve coupling. If a new sewer main is installed with pre-taps, a factory tee or wye is recommended.
4. A saddle wye must be gasketed with all stainless steel clamps.

**F. Lift Stations**

1. 3-phase, 480V, 4-wire, if available

2. Backup power supply required. This can be in the form of external connections and a transfer switch to accommodate a portable generator.
3. Davit crane: Thern Commander 5PT10G with Pedestal Base.
4. Wet Well Internal Coating: protective coating consistent with *Item D.8 – Coatings*, above, or as approved by the Town.
5. Materials and Equipment Within Wet Well
  - a. Mechanical and Electrical: Explosion Proof.
  - b. Hardware: Stainless Steel
6. Horizontal Well Coverings: Open fully (minimum 90 degrees), and equipped with a device to prevent accidental closure.
7. Provide a concrete pad around the wet well hatch with a minimum diameter of ten (10) feet.
8. Emergency Bypass Hose Connection Assembly
  - a. Connection assembly to the pressure main exiting the lift station to allow a station lift bypass with a portable pump
  - b. The hose connection assembly shall be equipped with a plug valve in the closed position and a four (4) inch coupling type cam-lock connectors (female) with a protective cam-lock (male).
9. Isolation valves: Plug type.
10. Pumps: Submersible wastewater pumps. Pump type shall be approved by Town.
  - a. Minimum four (4) inch suction and discharge
  - b. Quantity: Two (2) Installed; One (1) Shelf Spare
  - c. Grinder Pumps shall not be permitted.
  - d. Removable without entering the wet well.
  - e. Each pump shall have an hour meter installed at the control panel.

11. Any special tools required for such work as operation, calibration, adjustment, or service maintenance must be provided to the Town and listed in the O & M manual.
12. Electrical Control System
  - a. Control system brand, type, and configuration shall be approved by the Town.
  - b. Control circuitry must be configured so that failure of any single component does not disable both pumps.
  - c. Control boxes must be designed to operate in -40 to 100 degree F ambient temperature and meet NEMA standards.
  - d. Provide a convenience receptacle on its own circuit located near the electrical control system.
  - e. Wet well must be equipped with an ultrasonic level sensor with a float back up. Type of sensor must be approved by Town.
  - f. Lift station alarms
    - (a) Red alarm light (visible from the nearest road) and audible alarm (audible from 100 feet) to indicate a high level situation.
    - (b) Red or yellow light visible from the nearest road indicating pump motor seal failure and overheat conditions
    - (c) Alarm dial out capability with a twenty-four (24) hour back up. The dialer must call out when the high level alarm signals and/ or in the event of a power failure.

**G. Air Release/ Vacuum Relief Valves**

1. Designed specifically for sewage applications
2. All interior mechanical components shall be fabricated of stainless steel. Valves with plastic components are not acceptable.
3. Air release/vacuum relief valves are required on all force mains and shall be equipped with fittings to allow for back flushing

## **H. Pressure Cleanouts**

1. Constructed with viton-gasket stainless steel pressure blank covers, or approved equal.

## **III. INSTALLATION**

### **A. General**

1. The Contractor shall be responsible for providing and maintaining temporary power as necessary to maintain normal system operations.
2. Spills
  - a. The Contractor is responsible for any costs associated with sewage spills resulting from construction operations, which may include, but are not limited to, clean-up, regulatory fines, and/or penalties that may be imposed by environmental regulatory agencies (EPA and/or CDPHE).
  - b. The Contractor shall reimburse the Town for any emergency response effort that may be required by Government forces to mitigate the adverse effects of any sewage overflow or spill resulting from the Contractor's operations.
3. For any new concrete surface that will be exposed to sewage flow, the Contractor shall maintain sewage bypass/diversion operations for the duration of the specified cure time for the concrete.
4. Connection strategies to existing asbestos cement sanitary sewer mains require Town approval
5. Abandoning
  - a. Prior to the abandonment of any sanitary sewer main, the Contractor shall fill the pipe with flowable fill.
  - b. Manholes to be abandoned shall have its cone section removed and disposed of, pipe penetrations plugged with class "c" concrete and the remaining riser structure backfilled and compacted to finished grade.

### **B. Bypass Pumping**

1. To the maximum extent practical sewage flow shall not be interrupted.

2. The Contractor is responsible for diverting sewage as necessary for performance of work.
3. The Town shall not perform sewage diversion operations on behalf of the Contractor. The Contractor shall supply all labor and equipment necessary to completely perform the work.
  - a. This may include, but is not limited to, bypass pumps, tank trucks, temporary piping/hoses, etc.

### **C. Sanitary Sewer Mains**

1. General
  - a. The Contractor is required to properly protect and cover PVC pipe staged at the job site from ultraviolet radiation.
  - b. Install sanitary sewer mains in the Town right-of-way.
  - c. Structures (including but not limited to buildings, backflow preventers, transformer pads, mechanical equipment, and anchor walls) shall not be built over new or existing sewer lines.
  - d. As a general rule-of-thumb, consider a 1:1 depth to width sewer line excavation clearance. For structures that can transmit live loads to the foundation (e.g. flag poles, utility poles), a structural or soils engineer should establish the appropriate horizontal setback distance, but in no instance, shall any structure be located closer than three (3) feet from any sewer line.
  - e. Minimum pipe cover shall be six (6) feet.
  - f. All sewer lines must be identified with metallic buried warning and identification tape.
  - g. Separation for potable water mains shall be per *Section 300 – Water Distribution System Specifications, Part III – Installation, Item J – Relationships Between Water System Piping and Sanitary Sewer System Piping*, and *Drawing No. 11 – Sanitary Sewer – Water Pipe Crossing Detail*.
  - h. Trees shall not be planted closer than twenty (20) feet, and shrubs/hedges not closer than five (5) feet from a new or existing sewer line. Also, in the event that excavation for

future repairs to the underground utility lines become necessary, the Town shall not fund for removal, relocation, disposal, or replacement of any affected planting.

- i. Wedging or blocking of the bell or pipe is not permitted for achieving slope before backfilling.
  - j. Pipe shall be laid upgrade from structure to structure, with bell end upgrade unless otherwise directed or permitted by the Engineer.
2. Pressure Mains
- a. Appropriate air release provisions shall be installed at all high points in the pressure main where air can accumulate.
  - b. If isolation valves are installed in a pressure main, install pressure cleanouts immediately downstream of the isolation valve.
  - c. The blank cover for the valve shall be installed such that the cleanout flange face is parallel to the finished grade, twelve (12) inches below grade, and within a manhole structure.
  - d. Sewer force main shall be marked with detectable warning tape to identify the pipe as a sewer force main to prevent accidental water service taps.

#### **D. Manholes**

1. Location
  - a. Install outside of drainageways, including but not limited to, valley pans, curb and gutter lines, sump depressions, or drainage swales where rainfall or snow melt runoff can accumulate.
  - b. Manholes and valve structures shall be located in roadway areas or in serviceable vehicle corridors.
  - c. Install so as to ensure that maintenance vehicles are not forced to drive over grassed lawns or landscaped areas.
  - d. Adequate clearance between the edge of a building (wall and roof line) and other structures shall be provided to enable repair of the lines by use of heavy equipment.

2. A manhole is required at the commencement of a sewer main.
3. A stub out in a manhole may be required if deemed necessary by the Town for future expansion.
4. Drop manholes are to be avoided to the maximum extent practical.
  - a. Only inside drop manholes will be permitted.
5. Changes in direction of flow through the manhole shall be made with a smooth, curved channel having as large a radius as possible.
  - a. The change in size of channels shall be made gradually and evenly and shall be formed directly in the concrete.
  - b. The floor of the manhole outside of the channel shall be finished to a smooth surface and shall slope to the channel.
  - c. The minimum thickness of the base shall not be less than eight (8) inches under the invert of the manhole channel.
6. No sanitary sewer services shall be tied directly into any manhole structure, unless authorized by the Wastewater Division.
7. Connections to manholes
  - a. Influent pipe connections to manholes shall be made at the properly channelized invert of the manhole, whether it is a direct connection or a drop connection.
  - b. "Waterfall" type connections are not permitted.
  - c. All pipe penetrations shall be made perpendicular to the circumference of the manhole. Angled deflections at existing flow channels are not be permitted.
  - d. Pipe penetrations into manholes shall not extend more than one inch past the manhole wall.
  - e. 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 to the maximum extent practical to the essential requirements specified for new manholes.
    - (a) The Contractor shall core an opening in the existing manhole to insert the pipe.

- (b) A rubber gasket and grout shall be used to seal the penetration.
  - (c) Existing concrete foundation bench shall be shaped to the cross-section of the new pipe in order to form a smooth continuous invert.
  - (d) Cement grout shall be used as necessary to smoothly finish the new invert.
8. Manhole frames shall be firmly (structurally) affixed to the top of manhole cone and grouted around the ring of the frame.
  9. All manhole frames and covers shall be adjusted to new finished grade.

**E. Service Lines and Connections**

1. Approval from the Wastewater Division is required before tapping any sanitary sewer main.
  - a. The Contractor shall provide the Town with at least three (3) days notice prior to tapping any sanitary sewer main.
  - b. This includes approval of the date and time of the tap.
  - c. No sewer main shall be tapped without a representative from the Town present.
2. Minimum pipe cover for sewer services is five (5) feet.
3. Service connections shall be made in the top quarter of the main.
4. Contractor shall identify the material of the main and have the proper saddle.
5. Holes for saddle connections shall be made by mechanical hole cutters and shall be the full diameter of the service line.
  - a. Holes shall be de-burred and carefully beveled to provide a smooth hole shaped to conform to the fitting.
6. For all building sewers, including housing units, a sanitary cleanout shall be installed within five (5) feet from the building line.
  - a. Additional building sewer cleanouts shall be installed at intervals not to exceed one-hundred (100) feet in straight

runs and at each horizontal change in direction in a sanitary sewer service.

#### **F. Lift Stations**

1. Check valves, isolation valves, and emergency bypass attachments must be installed in a valve box outside of the wet well.
2. The lift station must be accessible to maintenance vehicles.
3. The area within twenty (20) feet diameter of the lift station must maintain the same grade as the wet well hatch. The area within 20 feet diameter of the lift station as well as along the access way to the lift station must have twenty (20) feet of vertical clearance.
4. Service Connections to Lift Stations
  - a. No sewer services may be connected to the lift station wet well without prior authorization from the Wastewater Division.
  - b. No services may be connected to the influent line of the lift station until final approval is obtained.
5. Contractor shall post laminated copy of electrical wiring diagram which depicts all breakers, relays, controls, switches, alarm system, etc. at the lift station

### **IV. INSPECTION AND TESTING**

#### **A. General**

1. Testing shall not occur unless a representative from the Town or its agent is present.
2. All pressure and leakage testing shall be performed by the contractor under direct control of the Engineer or an approved representative.
3. The final testing and approval shall only occur after backfilling and compaction. The Contractor may request that a preliminary test be performed prior to backfilling.
4. A visual inspection by the Town is required before any sewer line or manhole is covered.
5. The Town may require secondary testing if further construction if performed on the line or adjacent lines that is judged to have weakened the integrity of the tested line.

6. In the event that service taps are pre-tapped, all testing and inspection shall be performed after the last pre-tap has been made.
7. Notification
  - a. Provide Town staff with a minimum of three (3) working days for final acceptance inspection of the new sanitary sewer main construction and sanitary sewer service tap and construction.

**B. Backfill and Compaction Testing**

1. Trench backfill compaction testing shall be performed according to *Section 200 – General Earthwork Specifications*.

**C. Gravity Sanitary Sewer Main Pressure Testing – Air**

1. On all sanitary sewer mains, the Contractor shall conduct pressure testing using low-pressure air testing.
2. Contractor shall provide all labor, equipment, and any additional items necessary to perform the air test.
3. For sanitary sewer mains installed above the ground water table, the following procedure shall be followed:
  - a. Plugging
    - (a) Isolate section of sanitary sewer main to test using inflatable stoppers or other suitable test plugs.
    - (b) Plug and cap ends of all branches, laterals, wyes, tees (including factory tees), etc., that are included in the test section.
    - (c) Securely brace all plugs or caps to prevent blow-out.
    - (d) One of the end plug caps shall include an inlet tap to connect portable air source.
  - b. Connect air hose to the inlet tap.
  - c. Add air solely to the test section until pressure reaches four (4) psig
  - d. Allow pressure to stabilize such that a pressure between four (4) psig and three point five (3.5) psig is maintained for at least two (2) minutes.

- e. Disconnect air supply and decrease the pressure to three point five (3.5) psig before starting test.
- f. Use the Time-Pressure Drop Method to determine if the segment of pipe is "acceptable".
- a. Minimum specified time required for a one (1.0) psig pressure drop based on size and length of pipe is included in the following table:

Pipe Diameter (inches)	Specification Time for Length Shown (Minutes : Seconds)							
	100ft	150ft	200ft	250ft	300ft	350ft	400ft	450ft
8	7:34	7:34	7:34	7:34	7:36	8:52	10:08	11:24
10	9:26	9:26	9:26	9:53	11:52	13:51	15:49	17:48
12	11:20	11:20	11:24	14:15	17:05	19:56	22:47	25:38
15	14:10	14:10	17:48	22:15	26:42	31:09	35:35	40:04
18	17:00	19:13	25:38	32:03	38:27	44:52	51:16	57:41
21	19:50	26:10	34:54	43:37	52:21	61:00	69:48	87:31

**D. Pressurized Sanitary Sewer Main Pressure Testing (Force Mains)**

- 1. Test all sanitary sewer force mains in accordance with the Hydrostatic Testing Requirements of *AWWA C600*.
  - a. All force mains shall be given a hydrostatic test of at least one point five (1.5) times the shutoff head of the connected pumps or one-hundred fifty (150) psi, whichever is greater.
  - b. Labor, equipment, and supplies required for the test shall be furnished by the Contractor.
    - (a) The test pressure shall not exceed the rated pressure of the valves in the pipeline.
  - c. Loss of water pressure during test shall not exceed five (5) psi in a two (2) hour period.
  - d. Where practicable, test between line valves or plugs in lengths of not more than one-thousand five-hundred (1,500) feet.
  - e. Procedure
    - (a) Slowly fill pipe with water; the specified test pressure shall be applied by means of a pump connected to the pipe.

- (b) The pump, pipe connection, pressure gauges, and all necessary apparatus except the gauges, shall be provided by the Contractor.
  - (c) Prior to applying the specified test pressure, all air shall be expelled from the pipe.
    - (i) If permanent air vents are not located at all high points, the Contractor shall install corporation cocks at such points so the air can be expelled as the line is filled with water.
  - (d) After all the air is expelled, the corporation cocks shall be closed and the test pressure applied.
- f. Minimum test duration is two (2) hours.
  - g. Where leaks are visible at exposed joints and/or evident on the surface where joints are covered, the Contractor shall repair the joints, retighten the bolts, relay the pipe, or replace the pipe until the leak is eliminated, regardless of total leakage as shown by the hydrostatic test.
  - h. Polyethylene encasement damaged from repairs must also be properly repaired or replaced to the satisfaction of the Town.
  - i. All pipe, fittings, and other materials found to be defective under test shall be removed and replaced at the Contractor's expense.
  - j. Lines that fail to meet test requirements shall be repaired and retested, as necessary, until test requirements are met.
  - k. The Contractor shall not operate any valves on existing water mains. This shall be done by the Town.
  - l. No pipe installation will be accepted if the leakage is greater than that determined by the formula and table included in *Section 300 – Water Distribution System Specifications, Part VI – Inspection and Testing, Item A.5 – Leakage*.

#### **E. Manhole Water Exfiltration Testing**

1. All new manholes shall be hydraulically tested. Labor, equipment, and supplies required for the test shall be furnished by the Contractor.

2. Manholes shall be tested after installation with all connections in place.
  - a. Lift holes, if any, shall be plugged with an approved, non-shrinkable grout prior to testing.
  - b. Drop connections (if approved) shall be installed prior to testing.
  - c. The water exfiltration test shall include testing of the seal between the cast iron frame and the concrete cone, slab, or grade rings.
  - d. The manholes shall be backfilled and finished to design grade prior to testing.
  - e. If a coating or lining is to be applied to the interior of the manhole, the water exfiltration test shall not be performed until the coating or lining has cured according to the manufacturer's recommendations.
  
3. Procedure
  - a. The maximum leakage allowance for all manholes shall be 0.025 gallons per foot diameter per foot of depth, and maintained for at least one (1) hour.
  - b. The inlet and outlet of the manhole being tested shall be sealed with watertight plugs or bulkheads, and the manhole shall be filled with water until the elevation of the water is above the interface of the concrete and the casting.
  - c. The test level shall be clearly marked in the manhole.
  - d. The manhole shall be filled and maintained full of water for a period of at least twenty-four (24) hours prior to the start of the test.
  - e. If the water level in the manhole drops during this twenty-four (24) hour period, the level shall be raised to the test level mark prior to start of the test.
  - f. All vent holes in the lid shall be plugged and the lid shall be installed prior to start of the test.

- g. The test shall last a minimum of one (1) hour. Once the test begins, the manhole lid shall only be removed in the presence of the Town or Town's representative.
  - h. Exfiltration shall be determined by measuring the amount of water required to raise the water level back to the marked level at the end of the test period.
  - i. The manhole shall be considered to pass the water exfiltration test if the measured exfiltration is less than or equal to the allowable leakage specified in *Item E.3.a – Procedure*, above.
- 4. If a manhole fails the water exfiltration test, the manhole shall be repaired with a non- shrinkable grout or other material approved by the Town. The water exfiltration test shall then be repeated until a satisfactory test is obtained.
  - 5. All observed leaks shall be corrected even if exfiltration is within the allowable limits.
  - 6. All temporary plugs shall be removed after each test.

**F. Deflection Testing**

- 1. All new sanitary sewer lines shall be deflection tested.
- 2. Maximum deflection for pipe joints shall be limited to eighty percent (80%) of the deflection recommended by the manufacturer.

**G. Televising**

- 1. On contracts that involve the construction of new sanitary sewer mains (manhole-to-manhole), the replacement of sanitary sewer main pipe with new sewer pipe (manhole-to-manhole), or for projects where subsequent heavy grade compaction is performed after the laying of sanitary sewer mains, the Contractor shall provide a digital video inspection of the interior of the constructed sewer main.
- 2. The video shall include a progressive video recording of the main section using standard pipeline video equipment.
- 3. The equipment used to video-document the interior of the main shall either be equipped with an inclinometer indicator that portrays the slope of the main on the video recording, or the video shall be recorded with partial flow in the main (or with a fully wetted invert)

such that an assessment can be made of the trueness of grade (workmanship).

4. The video shall clearly depict all pipe joint sections and service taps along the entire length of pipe in a continuous recording sequence with included linear distance measurements to each service.
5. An inspection report shall be provided to the Wastewater Division with digital videos (CD or USB format) for review and approval. Report shall include:
  - a. Length of pipe between manholes
  - b. Pipe material and diameter
  - c. Slope of pipe
  - d. Distance from starting manhole to service laterals
6. The Town shall have fourteen (14) working days after receiving the video inspection and report to review and approve.

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