

SECTION 54

DRAINAGE PIPE INSTALLATION

54.1 DESCRIPTION

A. General: This work consists of furnishing and installing culverts and drainage piping. Pipe culverts shall be in accordance with Section 11 except as modified by the provisions contained here within. Pipe materials and minimum sizes allowed for Public Works Construction are determined by the Engineer, adopted Infrastructure Design Criteria, and City policy.

B. Related Work:

Section 11	Utility Excavation and Backfill
Section 12	Roadway and Drainage Excavation and Embankment
Section 62	Drop Inlets
Section 63	Storm Sewer Junction Boxes and Manholes
Section 112	Select Granular Backfill
Section 117	Aggregates for Granular Bases and Surfacing
Section 120	Drainage Pipe Materials
Section 203	Submittals
Section 205	Televising

54.2 MATERIALS

A. Pipe Materials: Materials shall be per Section 120.

B. Bedding:

1. **Reinforced Concrete Pipe (RCP):** Bedding shall conform to Granular Material for Storm Sewer in Section 112.
2. **PVC Pipe:** Bedding for PVC drainage pipe shall be Type 1 bedding per Section 112.
3. **Dual Wall Polypropylene:** Dual wall polypropylene (PP) pipe shall be bed with Type 1 bedding per Section 112, or per detailed plans and specifications.

54.3 CONSTRUCTION REQUIREMENTS

A. General: Drainage piping shall be accurately laid to the lines, grades, stations, and elevations identified in plans. Equipment capable of gently lowering the sections of pipe into place shall be provided. Dropping the pipe into place will not be permitted.

- B. Reinforced Concrete Pipe (RCP) Culvert:** RCP pipe shall be laid with the groove or bell end upstream and inserting the tongue end into the downstream bell or groove.

All RCP flared end sections shall be tie bolted. A minimum of two joints past the flared end shall also be tie bolted, or as shown in the plans. Tie bolts shall be installed at the 10 o'clock and 2 o'clock position on the pipe. Pipes installed on slopes 4:1 and greater shall have all joints tie bolted.

Rubber gaskets at joints shall be installed according to the manufacturer's instructions when called for in the detailed plans and specifications. Joints whether gasketed or not shall comply with ASTM C443.

For pipes not utilizing gaskets each joint shall be effectively protected against infiltration of backfill soil by filling the joint space with an approved sealer, or by providing a circumferential wrap of drainage fabric on the outer exposed portion of the pipe joint above the cradle or bedding material. Drainage fabric shall be minimum 1-foot wide and centered on the joint. The Engineer shall require the use of construction adhesives if the Contractor's method of installation does not secure the drainage fabric over the center of the joint while placing backfill. A combination of sealer and drainage fabric materials will be allowed.

Lift holes shall not be permitted for round pipe 36-inch diameter and less. For pipe greater than 36 inches diameter, lift holes shall be plugged using a manufactured product intend for the purpose of plugging lift holes.

- C. Dual Wall Polypropylene (PP) Pipe:** PP pipe shall have water tight gaskets, and shall be installed per manufacturer's recommendations.
- D. PVC Pipe:** PVC drainage pipe shall be installed the same as sanitary sewer pipe per Section 11 of these specifications.
- E. Excavation:** Trenches shall be excavated to a width sufficient to allow for proper jointing of the pipe and thorough compaction of the bedding and backfill material under and around the pipe. Where soil type allows, trench walls shall be vertical to an elevation atop the pipe. Minimum trench width shall be per Section 11.

The trench foundation shall be adequate to furnish a uniform stable support. Removal of unstable material or rock below bedding grade shall be performed as set forth in Section 11.

F. Bedding:

- 1. RCP Pipe:** Bedding for RCP storm sewer pipes 72 inches and smaller shall be one of the following methods. Bedding for pipes larger than 72 inches in diameter shall be per detailed plans and specifications.
- a) Granular Bedding Method:** See detail 54-1, bedding thickness below the pipe in inches shall be the outer pipe diameter (OD) in inches divided by 24 (OD/24)

and no less than three (3) inches. Bedding beneath the pipe shall be in contact with the pipe for a distance no less than 1/3 the outer diameter (OD/3). The bedding shall extend the full width of the trench. Minimum trench widths for pipes 36 inches and less shall be per Section 11. Minimum trench widths for pipe larger than 36 inches shall extend a minimum of one (1) foot beyond the outer edge of the pipe on both sides. This is similar to the American Concrete Pipe Association's Type 3 installation, except the trench compaction above the bedding shall be per Section 11 of these specifications.

b) Undercut Method: Material shall be excavated from below the bottom of the pipe grade for a depth of one (1) foot and for a width equal to the external diameter of the pipe plus one (1) foot. The excavated area shall be backfilled with select bedding material as defined below. Backfilling shall occur in maximum six (6) inch compacted lifts. The material shall be thoroughly compacted to provide a firm uniform foundation. The foundation shall then be shaped as a "cradle" to fit the lower ten percent (10%) of the pipe's overall height. Over excavation to accommodate the bell end of the pipe is required. When the pipe foundation is entirely in new embankment, the twelve (12) inch undercut will be waived, provided select bedding material was used for the embankment one (1) foot beneath the pipe.

2. PVC and PP Pipe: Bedding shall be per water or sewer main specifications in Section 11, or detailed plans and specifications.

G. Backfill: Backfill and compaction shall be per Section 11.

1. Select Bedding Material: shall begin above the bedding (54.3.F.1.a) or trench bottom (54.3.F.1.b above) and extend to 12 inches above the top of pipe.

H. Pipe Culvert Connections: Prefabricated tee connections are required up to and including twenty four inch (24") x twenty four inch (24"). Connections larger than twenty four inches (24") can be made by field connections. Field Connections shall be made using M6 concrete minimum 2 feet wide and 6 inches thick and shall be reinforced with 6 inch x 6 inch W2.9 wire mesh. Inserta Tee™ or approved equal shall be allowed up to 18 inches.

I. Pipe Culvert and Storm Sewer Testing and Inspection:

1. General: A visual inspection and a TV inspection shall be performed as specified herein for all pipe culverts and storm sewers as a condition of acceptance by the City. All tests shall be performed after backfill is complete but prior to any surface restoration. When called for in the plans and detailed specifications the contractor may also be required to perform a leakage test.

2. Pre-Cleaning: Prior to testing newly installed pipe culverts and storm sewers, the Contractor shall remove all accumulated construction debris, rock, gravel, sand, silt, and other foreign matter from the pipe. The Contractor shall be responsible for

all work necessary to make the pipe culverts and storm sewers acceptable for final acceptance.

- 3. Inspection:** All newly installed pipe culverts and storm sewers sewer shall pass a visual inspection by the Engineer, and a television inspection. Straight alignment shall be checked during installation using a laser beam. The television inspection shall consist of viewing the inside of all pipe culverts and storm sewers installed to determine proper alignment, grade, joining, etc. The Contractor shall, at his own expense, correct any defects discovered during visual or television inspection of the pipe.

- a) City Provided Televising:** If the City will be providing television inspection of storm sewer, it shall be explicitly stated in the plans. The expense of the initial television inspection prior to surfacing and final inspection after surfacing will be borne entirely by the City. If defects in workmanship, material, or construction are noted, the Contractor shall, at no expense to the City, correct the deficiencies including necessary concrete or asphalt surfacing. The City will perform one (1) additional television inspection to review if the repairs were made properly and in accordance with the specifications. The expense of any additional television inspections beyond the initial, final, and follow-up inspections will be borne entirely by the Contractor. The City may take any actions necessary for items not completed or repaired in a timely manner and may charge the contractor one and a half (1½) times the costs incurred.

It is the Contractors responsibilities to notify the City Inspector once the pipe culverts and storm sewers are ready for inspection. The City will not be responsible for cleaning lines prior to televising the pipe culverts and storm sewers. In the event that the pipe is not acceptable for televising, due to the Contractor's operations, the Contractor will be notified. It will be the Contractor's responsibility to clean the pipe culverts and storm sewers and make them acceptable for the television inspection. If not cleaned in a timely manner, the City may take actions necessary and charge the Contractor one and a half (1½) times the cost incurred. Contractor shall allow at least two (2) weeks from the time they notify the engineer that the system is ready to the time actual television inspection. Contractor shall allow one (1) additional week after the inspection for the City's approval or request for corrections. Any surfacing started prior to televising is at the Contractors own risk.

- b) Contractor Provided Televising:** Per section 205. Unless otherwise specified in plans, television inspection of storm sewer shall be provided by the contractor.

- 4. Pipe Deflection Test, Corrugated Polyethylene Pipe, and PVC Pipe:** When called for in detailed plans and specifications, deflection testing will be performed by the Contractor. For pipe diameters up to and including 18 inches in diameter, deflection testing is to be performed using a mandrel with at least five points and shall be inspected by the Engineer. The mandrel shall be pulled through by hand without the use of excessive force. Pipe through which the mandrel does not pass

shall be examined more closely to determine the reason for non-passage. Deflection testing shall be performed no earlier than thirty (30) days after completion of final grades and surfacing. Pipe that is determined to be over deflected shall be removed and reinstalled if the pipe is not damaged, or replaced with acceptable pipe. All pipe exceeding 7.5 percent deflection within the two-year warranty period shall be reinstalled or replaced by the contractor at no additional cost to the City.

- 5. Leakage Tests:** If required by plans and detailed specifications, the Contractor shall conduct leakage testing of all newly constructed or reconstructed pipe culverts and storm sewers. The Contractor shall furnish all necessary equipment and shall be responsible for conducting the leakage test in the presence of the Engineer.

Refer to the detailed specifications or notes in the plans for specific testing methods and requirements. Pipeline segments between drop inlets or storm sewer manholes shall be tested separately. Mechanical or pneumatic plugs shall be placed in the line at opposing drop inlets or storm sewer manholes and each plug braced as a safety precaution.

54.4 METHOD OF MEASUREMENT

- A. Furnishing and Installing Pipe Culverts and Storm Sewer:** Will be measured up to the nearest even two (2) linear feet of the respective type, classes, and sizes of pipe furnished, installed, and accepted. The footage will be obtained by measuring from the inside wall of structure to the inside wall of structure, and shall not include flared ends or end treatments.
- B. Furnishing and Installing Bends, Tees, and End Sections:** For the respective type and sizes of pipe culverts will be measured by the number of complete bends, tees, and end sections installed and accepted, including tie bolts or bands.

54.5 BASIS OF PAYMENT

- A. Furnishing and Installing Pipe Culverts:** Will be paid for at the contract unit price per linear foot for the respective designated types, classes, and sizes installed.

Payment for this item will be full compensation for furnishing and installing the pipe, gaskets, connecting devices, tie bolts, coupling bands, and joint fabric, and lift hole plugs. It will also be full compensation for necessary bedding operations, cost of selecting and placing backfill, furnishing and installing required bedding materials, undercut, testing, and necessary excavation.

- B. Furnishing and Installing Bends, Tees, and Flared End Sections:** Will be paid for at the contract unit price per each for the respective type and size installed, including tie bolts or bands.

END OF SECTION