STORM DRAINS

DESCRIPTION

2201.1 Storm Drain pipe of the specified size, class and type shall be placed to line and grade given by the City Engineer and in accordance with the design shown on the plans.

MATERIALS

2202.1 Pipe: Non-reinforced concrete pipe up to and including twenty-four inches (24") in diameter shall be heavywall non-reinforced concrete pipe and conform to ASTM Designation C14, latest revision, with the class as specified below:

Pipe Class	Depth of cover in feet
2 [(a)]	12 or less
3 [(b)]	Greater than 12 and up to 15

A. Except for twenty-one and twenty-four inch diameter (21" and 24") which shall be Class 3 for less than 3 feet of cover.

B. Except for 12-inch diameter shall be reinforced concrete pipe.

2202.2 All pipes greater than 24-inch diameter shall be reinforced concrete pipe. Pipe smaller than 12-inch diameter shall not be allowed.

2202.3 Reinforced concrete pipe shall conform to ASTM Designation C76, latest revision, with the class as specified below:

Pipe Class	Depth of Cover In Feet
III	3 or less
II	Greater than 3 and up to 9
III	Greater than 9 and up to 14
IV	Greater than 14 and up to 20
V	Greater than 20 and up to 30

2202.4 Class of pipe shall not change between manholes and shall be the highest class required between manholes.

2202.5 Any pipe with less than two feet (2') of cover shall be encased in concrete.

2202.6 Joints: Joints shall be rubber gasket as directed by the Engineer.

2202.7 Rubber gaskets shall conform to ASTM Designation C443, latest revision.

2202.8 Plugs: Plugs for future extensions shall be commercially fabricated concrete plugs of the same material as the pipe and designed to withstand the loads to which they are subjected and for easy removal at the time extensions are made.

CONSTRUCTION PROCEDURE

2203.1 Excavation: The contractor shall perform all excavation necessary or required to construct all pipelines and structures covered by these Plans and Specifications.

2203.2 Heavy-duty machinery for cutting and breaking pavement shall be used only when permitted by the Engineer.

2203.3 Street surfaces along the edge of the trench shall be cut to a neat line with a cutting device. All street surfacing, within the limits of the trench excavation shall be removed and disposed of as excess material before excavating the trench. None of this material will be allowed in the backfill.

2203.4 Excavation for pipe shall be open cut and the width of the trench at a depth of twelve inches (12") above the top of pipe shall not exceed the external diameter of the pipe plus eighteen inches (18").

2203.5 Bracing and Shoring: The Contractor shall do all bracing, shoring and sheathing necessary to perform and protect all excavations as required for safety, and to conform to the governing laws, or as directed by the Engineer.

2203.6 Bedding: The surface upon which the pipeline is to be constructed shall be firm and true to grade. Maximum deviation from the established line and grade shall be three-hundredths (0.03) foot at each joint. After the joints have been made, walking on, moving or otherwise injuring the pipeline in any manner will not be permitted. The subgrade for the pipe shall be so prepared that the entire length of each pipe section shall have a firm and uniform bearing. Where the bottom of the trench when excavated to proper depth does not provide suitable foundation for the pipe, all such unsuitable material under the pipe shall be removed and the space backfilled with suitable material properly compacted to provide adequate support for the pipe.

2203.7 Pipe Laying: Pipe and fittings shall be carefully inspected in the field before and after laying. If any cause for rejection is discovered in a pipe after it has been laid, it shall be subject to rejection. The Engineer shall approve any corrective work and no additional compensation will be allowed for such corrective work.

2203.8 Storm Drain pipe and fittings shall be laid to true line and grade, and jointed in compliance with the manufacturer's recommendation and shall be carefully adjusted to grade by scraping away or filling and tamping the trench bottom to eliminate any possible sag or high point in the pipe. Occasional variations as follows will be permitted:

above grade, ¼ inch; below grade, not to exceed ½ inch; alignment not to exceed 2 inches if gradual over a distance of 20 feet. Use of blocks to support the pipe is prohibited. Each joint of pipe must be fully pressed into place so that there will be no unevenness or settlement of one length of pipe with the other at the joint.

Suitable excavations shall be made to receive the bell collar to prevent any possibility of bells resting on original trench bottom.

A. All pipe shall be laid upgrade with bell end upgrade.
B. The interior of the pipe shall be kept free from dirt and other foreign materials as the pipe laying progresses. The open ends of all pipelines shall be tightly plugged whenever the work is stopped for any reason.
C. **Existing storm drainage flow:** When the pipe laying interferes with the existing flow of storm drainage, the Contractor shall provide satisfactory by-pass facilities at the Contractor's expense.

2203.10 Rubber Gasket Joints: In advance of joining sections of pipe, the rubber gaskets shall be properly lubricated with a suitable vegetable compound soap or rubber lubricant.

2203.11 After the pipe has been laid, the outer and inner annular space between pipe sections shall be completely filled with cement mortar except that no mortar shall be required if the space is 3/16 inch or less in width. Where reinforced concrete collars or bells with rubber gaskets are used at the pipe joints, mortar will not be required in the outer annular space and will also not be required in the inner annular space between pipe sections if the space is 3/8 inch or less in width. Where pipes are used with exposed metal surfaces at the joint, both the inner and outer annular joint spaces between pipe sections must be completely filled with cement mortar. The rubber gasket shall be the sole element depended upon to make the joint watertight.

2203.12 Detector Wire: All storm drain lines and laterals constructed shall have a No. 10 coated solid copper detector wire placed over the pipeline prior to any backfilling. The detector wire shall be brought up to the manhole frames and at each end of the pipe or lateral. Lateral wires shall also be brought up to the top of drop inlets.

2203.13 Bends and Curves: changes in direction of concrete pipe storm drain are most commonly effected at manhole structures. This is accomplished by proper location of the inlet and outlet openings and finishing of the invert in the structure to reflect the desired angular change of direction.

2203.14 Deflected Straight Pipe: Starting from a home position any joint may be opened up to a maximum permissible joint opening on one side while the other side remains in the set position. The maximum permissible opening retains some margin between it and the limit for satisfactory function of the joint. It varies for different joint configurations and is best obtained from the pipe manufacturer.

2203.15 Opening a joint in this manner effects an angular deflection of the axis of the pipe, which, for any given pull is a function of the pipe diameter. Thus, given the values of

any two of the three factors; pull, pipe diameter, and deflection angle, the remaining factor may be readily calculated.

2203.16 Radius of Curvature: The radius of curvature is a function of the deflection angle per joint and the length of the pipe sections. Thus, longer lengths of pipe will provide a longer radius for the same pull than would be obtained with shorter lengths. The radius of curvature is computed by the equation:

Where:

$$R = \frac{L}{2(\tan \frac{1}{2} \times \Delta/N)}$$

R = Radius of curvature, feet
L = Average laid length of pipe sections along the CL, feet
Δ = Total deflection angle of curve, degrees
N = Number of pipe with pulled joints
Δ/N = Total deflection of each pipe, degrees

2203.17 Radius Pipe: Sharper curvature with correspondingly shorter radii can be accommodated with radius pipe than with deflected straight pipe. The pipe is manufactured longer on one side than the other and the deflection angle is built in at the joint. Also referred to as beveled or mitered pipe is an allowable alternate to straight pipe.

2203.18 Abandoned Pipes: Plug all ends of pipelines to be abandoned in place with Class "A" concrete.

2203.19 Order of Work: The contractor shall submit his schedule of work for approval by the City Engineer prior to commencing work.

MEASUREMENT AND PAYMENT

2204.1 Payment will be made at the contract unit price per linear foot of storm drain pipe laid in accordance with the provisions of Article 901.1, General Provisions.

2204.2 Measurement: The work performed under *"Storm Drains,"* and paid for by contract items will be measured by the linear foot, or by other methods specified on the Plans or in the Special Provisions.

2204.3 The above prices and payments shall include full compensation for furnishing all labor, materials, tools, equipment and incidentals and for doing all the work involved in installation of storm drain mains or fittings, or other items being installed as specified in these specifications and the Special Provisions and as directed by the Engineer.