

UPDATE LOG FOR SECTION 02762		
Date	Item Changed	Page #
11/09/07	<p><u>PART 1 – GENERAL</u></p> <p>1.01 DESCRIPTION (4th paragraph)</p> <p>PVC pipe 12" diameter and larger may be used for curved sewers with the verification from the pipe manufacturer that the deflection to achieve the curvature shown on the plans does not exceed the manufacturers recommendation. Plastic pipe shall not be used for curved sewers which are 12" diameter or larger. Plastic pipe shall not be used for sewers serving industrial areas, or areas that, in the opinion of the District, are likely to be rezoned to industrial zones.</p>	1
12/04/07	<p>The change made on 11/09/07 is being retracted and being revised back as follows:</p> <p><u>PART 1 – GENERAL</u></p> <p>1.01 DESCRIPTION (4th paragraph)</p> <p>PVC pipe 12" diameter and larger may be used for curved sewers with the verification from the pipe manufacturer that the deflection to achieve the curvature shown on the plans does not exceed the manufacturers recommendation. Plastic pipe shall not be used for curved sewers which are 12" diameter or larger. Plastic pipe shall not be used for sewers serving industrial areas, or areas that, in the opinion of the District, are likely to be rezoned to industrial zones.</p>	1

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SPECIFICATIONS - DETAILED PROVISIONS
Section 02762 - Furnish & Install Plastic Sewer System

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**SECTION 02762
FURNISH & INSTALL PLASTIC SEWER SYSTEM**

PART 1 - GENERAL

1.01 DESCRIPTION

The Contractor shall furnish all labor, material, tools, and equipment required for the complete construction of pipelines, manholes, clean-outs, and other allied structures and appurtenances as stated on the Bidding Sheets, shown on the Contract Drawings, and specified herein, all within the time as stated in the Contract Documents.

These provisions establish the requirements for the use of plastic pipe (i.e., ABS, PVC, and ABS and PVC Composite pipe) for house lateral and main line sewer construction. Use is limited to those projects which specify or indicate plastic sewer pipe as an alternate.

Plastic pipe may only be used where indicated on plans approved by the District. Where plastic pipe is used, one type shall be used between consecutive manholes and shall include the house laterals in that system. When pipe and fittings are fabricated by the same manufacturer, contractor will not be allowed to use fittings from other manufacturers. ABS solid wall pipe shall be used for laterals with ABS and PVC Composite pipe systems. Plastic laterals may be used with clay pipe main except those mains subject to industrial flows, as determined by the Engineer.

Plastic pipe shall not be used for curved sewers which are 12" diameter or larger. Plastic pipe shall not be used for sewers serving industrial areas, or areas that, in the opinion of the District, are likely to be rezoned to industrial zones.

1.02 RECORDS

A true and accurate record of the location of all wye or tee branches, laterals, clean-outs, and other connections and appurtenances shall be kept by the Contractor, and such record shall be furnished to the Engineer prior to, or immediately upon, completion of the work. The location of the end of all laterals and main stub-outs shall be shown at ground surface by a marker approved by the Engineer.

1.03 CARE & HANDLING

Pipe shall be stored at the jobsite in unit packages provided by the manufacturer. Caution shall be exercised to avoid compression, damage or deformation to bell ends of the pipe. If pipe is to be exposed to direct sunlight for more than 14 days, pipe must be covered with an opaque material while permitting adequate air circulation above and around the pipe to prevent excessive heat accumulation.

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If pipe is strung along trench prior to installation, string only pipe to be used within a 24-hour period; all pipe is to be laid on a flat surface. The interior as well as all sealing surfaces of pipe, fittings, and other accessories shall be kept free from dirt and foreign matter. Gaskets shall be protected from excessive exposure to heat, direct sunlight, ozone, oil and grease. Solvent cement when used shall be stored in tightly sealed containers away from excessive heat.

1.04 JOB CONDITIONS

The Contractor shall familiarize himself and comply with all applicable state, county and municipal rules and regulations pertaining to sanitation, fire protection and safety, and all provisions of the Contract Documents.

1.05 PAYMENT

- A. Measurement For Payment. Quantities for installation of sewer pipe, manholes, and other appurtenances on District-administered contracts shall be measured for payment as specified herein:
1. Main Sewer Lines will be measured in place along the horizontal centerline of the pipe by the linear foot. The measurement will be continuous through all wye branches, fittings, and manholes, except that said measurement will be taken to the center only of manholes where sewer lines terminate.
 2. Laterals will be measured in place along the horizontal centerline of the pipe by the linear foot from the centerline of the main line sewer to the end of the lateral as shown on the construction drawings.
 3. Clean-outs will be measured on the basis of each clean-out installed, including wye branch, riser, screw plug, and box with cover.
 4. Manholes will be measured on the basis of each manhole completely installed, including required stub-outs.
 5. Special Bedding will be measured on the basis of the cubic yards of special bedding required to bring the bedding up to grade for the trench size excavated up to the maximum size of trench allowable under these specifications. No allowance will be made for over-excavation except as directed by the Engineer.
 6. Bore Casing will be measured on the basis of horizontal centerline distance and shall include all excavation, furnishing and placement of casing, furnishing and placement of all required backpacking and grouting around casing, backfilling within casing, pipe bracing, restoration of surfaces, and all labor and material for a finished job. Furnishing and installation of pipe within casing shall be included in pipeline measurement.

7. Paving will be measured as a part of project causing removal and/or replacement of paving, except as otherwise specified on the Bidding Sheets.

B. Payment. Payment for quantities of sewer pipe and manholes will be paid in the manner described herein below. No additional compensation will be paid above the unit bid price for changes in quantities.

Requests for partial payments will not be approved if the record drawings and revised Construction Progress Schedule and bar chart are not kept current, an request for final payment will not be approved until the completed record drawings, showing all variations between the work "as-constructed" and as originally shown on the contract drawings or other contract documents, has been delivered to the District.

1. Sewer Pipe. Quantities of main sewer pipe and laterals measured as stated above and accepted, will be paid for at the respective unit bid prices per horizontal linear foot for the several kinds and sizes of pipe, which prices and payments shall constitute full compensation for furnishing all labor, materials, tools, and equipment necessary to complete the work in place, including pipe, wye branches, fittings, clean-outs, appurtenances, excavation, backfill, imported select granular backfill, special bedding, cradles or encasements, laterals where required, testing, removal and restoration of pavements, curbs, gutters and sidewalks, and disposal of surplus earth and rock spoil. Payment for pipe in place shall be further broken down based upon the Contractor's submittal under Section F-10 of these specifications, as concurred by the Engineer, but not to exceed in the ordinary project the following percentages of the linear foot price stated on the Bidding Sheet:

Trench excavation	10%
Pipe laid in place and shaded.....	65%
Trench backfilled and backfill compacted	20%
Testing and clean-up, exclusive of pavement replacement	5%

2. Wye or Tee Branches. Payment for quantities of wye or tee branches and 1/8 bends shall be included in the payment for the unit bid prices for sewer pipe, which prices and payments shall constitute full compensation for furnishing all labor, materials, tools, and equipment necessary to complete the work in place, including wye branches only or wye branches plus 1/8 bends or short pipe sections as applicable, and no additional payment shall be made therefore.

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3. Clean-outs. Payment for quantities of clean-outs measured as stated above and accepted will be paid for at the unit bid price stated on the Bidding Sheets, which prices and payments shall constitute full compensation for furnishing all labor, materials, tools and equipment necessary to complete the work in place, including wye branch, riser, screw plug, and box with cover, and no additional payments will be made therefore.
4. Manholes. Quantities of manholes measured as stated above and accepted, will be paid for at the respective unit bid prices for the sizes of manholes stated on the Bidding Sheets, which prices and payments shall constitute full compensation for furnishing all labor, materials, tools and equipment necessary to complete the work in place, including concrete base, manhole rings and tops, drop manhole inlets and supports, mortar, manhole frames and covers, stubs, earthwork, testing, removal and restoration of pavement, and disposal of surplus earth.
5. Special Bedding. Quantities of special bedding measured as stated above and accepted, will be paid for at the stipulated cost price, or the respective unit bid price for the quantities as stated on the Bidding Sheets, which price shall constitute full compensation for all labor, materials, and equipment necessary to complete the work in place, including the special bedding material.
6. Bore Casing. Payment for bore casing in place measured as stated above shall be made as specified on the Bidding Sheets.
7. Paving. Payment for quantities of paving measured as stated above and accepted shall be included in the unit bid price for pipeline. Work includes removal and/or restoration of paving and all earthwork, and no additional compensation will be made therefore, except as otherwise provided on the Bidding Sheets.

1.06 GUARANTEE

All work, materials, and equipment shall be guaranteed for the periods of time set forth elsewhere in the Contract Documents for general guaranty or warranty.

PART 2 - PRODUCTS & MATERIALS

2.01 MATERIALS FURNISHED BY CONTRACTOR

- A. Acrylonitrile-Butadiene-Styrene (ABS) solid wall pipe shall meet the requirements of ASTM designation D-2751, SDR 23.5 or 35.

- B. Polyvinyl Chloride (PVC) Plastic Pipe. PVC solid wall pipe shall meet the requirements of ASTM designation D-3034, SDR 35.
- C. Pipe Jointing for the various types of plastic shall be as follows:
1. PVC Pipe Gasketed Joint Assembly. The assembly of the gasketed joint should be performed as recommended by the pipe manufacturer. The elastomeric gaskets may be supplied separately in cartons or prepositioned in the bell joint or coupling at the factory. When gaskets are color coded, be sure to consult the pipe manufacturer or his literature for the significance. In all cases, clean the gaskets, the bell or coupling interior, especially the groove area (except when gasket is permanently installed) and the spigot area with a rag, brush or paper towel to remove any dirt or foreign material before the assembling. Inspect the gasket, pipe spigot bevel, gasket groove, and sealing surfaces for damage or deformation. When gaskets are separate, use only gaskets which are designed for and supplied with the pipe. Insert them as recommended by the manufacturer.

Lubricant should be applied as specified by the pipe manufacturer. Bacterial growth, damage to the gaskets or the pipe, may be promoted by use of nonapproved lubricants. Use only lubricant supplied by the pipe manufacturer. After lubrication, the pipe is ready to be joined. Good alignment of the pipe is essential for ease of assembly. Align the spigot to the bell and insert the spigot into the bell until it contacts the gasket uniformly. Do not swing or "stab" the joint; that is, do not suspend the pipe and swing into the bell. When field-cut is necessary, a square cut is required. Use a factory-finished beveled end as guide for proper bevel angle and depth of bevel plus distance to the insertion reference mark.
 2. PVC Solvent-Cemented Joint Assembly. Solvent-cemented joints should be made in accordance with manufacturer's recommendations or in accordance with ASTM D-2855, Standard Recommended Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.
 3. ABS Pipe Joint Assembly. Solvent-welded jointing of ABS pipe shall be in accordance with the manufacturer's printed instructions which shall be furnished to the Engineer. Joint solvent cement shall be an ABS cement conforming to ASTM D-2235. The ends of ABS Composite Pipe shall be thoroughly coated with solvent cement. All safety precautions prescribed by the manufacturer in use of solvent cement are to be observed. Gaskets observed shall conform to the requirements of the manufacturer's pipe supplied.

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- D. Portland Cement Concrete. All concrete shall meet the requirements of the Detailed Provisions of the District standard specifications, except that only Type V or Type II Portland Cement shall be used.
- E. Portland Cement Mortar. All cement mortar used for construction purposes shall consist of one (1) part Portland Cement (Type V or Type II) to two (2) parts of silica sand by volume and moistened with sufficient water to permit placing, buttering, caulking or coating without crumbling, unless otherwise approved by the Engineer.
- F. Manholes. All manholes, covers, frames and steps shall meet the requirements of the Detailed Provisions of the District standard specifications, and of the District standard drawings. One-piece cone and shaft will not be accepted.

Manhole stub-outs shall be included in manhole installations, and shall be of clay pipe of the size designated on the drawings. All stub-outs shall be plugged for future connection, with neoprene stoppers or approved equal.

Manhole frames and covers will be furnished by the Contractor upon prior approval by the District of shop drawings. Such prior approval by the District shall in no way nullify the District's right to accept or reject any individual unit as furnished or as installed.

- G. Manhole Connections. Connections of plastic sewer pipe to a manhole shall be watertight. Concrete manhole connections shall be "O" ring type produced from elastomeric compound or prefabricated manhole waterstop, grouted or locked into the manhole wall, the type to be approved by the Engineer. Additional requirements may be imposed by District for manhole connections in projects constructed in areas of high or potentially high ground water.

PART 3 - EXECUTION

3.01 INSTALLATION OF PIPE

Installation of pipe shall start at the low end of each section and proceed upgrade. All bell and spigot pipe shall be laid with the bell end upgrade. Assembly of all types of pipe shall be done in strict conformance with the requirements of the pipe manufacturer. Curved sewers shall not be constructed of plastic pipe.

Pipe shall be accurately laid to alignment and grade shown on the drawings or established by the Engineer. Where grade stakes are provided with which to establish the proper pipeline grade, pipe shall be laid to grade within a tolerance of 0.02', or 0.05' cumulative deviation from elevations set at 100' stations.

Sags, or standing water in pipe, shall meet the following criteria:

Complies with Specification	Does not Comply with Specifications Resulting in No Payment	Does not Comply with Specifications and Reconstruction is Required
1/2" or less sag	greater than 1/2" sag	greater than 1" sag

If standing water depth in the sag exceeds the value listed under "No Payment", then to compensate for anticipated higher than average pipeline operation and maintenance cost, no payment will be made for construction. The nonpayment amount will include all construction costs including such items as excavation, pipe installation, backfilling, resurfacing, etc., for the length of standing water that exceeds the value for "No Payment".

Due to unacceptably high operation and maintenance costs and poor system reliability, pipelines with sag depths exceeding those listed for "Reconstruction is Required" will be rejected. Reconstruction of the entire length of standing water plus 20 feet on each side of the standing water will be required. Damaged pipe must be removed and not reused.

- A. **Bedding.** All pipes shall be laid in a bed prepared by hand work, dug true to line and grade, to furnish a true and firm bearing for the pipe throughout its entire length. Adjustment of pipes to lines and grade shall be made by scraping away or filling in and tamping material under the body of the pipe throughout its entire length, and not by blocking or wedging. Where a hand-shaped trench bottom conforming to barrel of pipe is not available or practical, Class "C" bedding shall be utilized below the pipe to a depth of one-eighth (1/8) the outside diameter of the pipe, but not less than 4".

The flexibility of plastic pipe may cause a possible problem in maintaining line and grade. Therefore, special care must be taken in the preparation of the subgrade and in the placement of bedding to ensure that the pipe is laid true to line and grade as required in this specification.

Plastic pipe shall be bedded as shown in the following table:

Type of Pipe	Depth of Cover	Bedding Required
Solid Wall (ABS & PVC) 4" to 15" size	0' to 20'	Crushed rock envelope Per SB-157, Class "BB"
	greater than 20'	Special Design
ABS & PVC Composite 8" to 15" size	less than 4'	Encasement per SB-157 No. 2

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Type of Pipe	Depth of Cover	Bedding Required
or ABS Solid Wall SDR 23.5, 4"	4' to 9'	SB 157, Class "D"
to 6" diameter	9' to 20'	Crushed rock bedding to spring line per SB-157, Class "B"
	20' to 30'	Encasement per SB-157 No. 2
	greater than 30'	Special Design

- B. Bell Holes shall be provided at the ends of each pipe length, of sufficient size to permit making up the particular type of joint being used.
- C. Alignment. Pipes shall be laid in accurate conformity with the prescribed lines and grades, which alignment shall be obtained by plumbing and measuring from a tightly stretched wire or line running parallel with the flow line grade and supported over the centerline of the sewer by batterboards or bars accurately placed and firmly fastened in place across the trench; or by some other comparable method acceptable to the Engineer.

Alternate use of commercial LASER grade setting systems in lieu of string lines specified herein is acceptable when the following requirements and conditions are met:

1. The Contractor shall have the responsibility of providing an instrument operator who is qualified and trained in the operation of the LASER and said operator must adhere to the provisions of the State of California Construction Safety Orders issued by the Division of Industrial Safety. Attention is particularly directed to Section 1516, and 1800 through 1901, of said Orders for applicable requirements.
2. All LASER control points shall be established bench marks or construction off-set stakes identified on cut sheets and set in the field for the work. LASER set up points shall be on these control points or on points set directly from them by instrument.
3. Pipe alignment shall not deviate from that shown on the plans by more than 3/4 pipe diameter, nor shall it change in alignment more than 2 inches in 20 feet.
4. After each length of pipe has been laid to line and grade, it shall be jointed to the preceding section as hereinafter specified, and after said jointing procedure has commenced, there shall be no movement of the pipe whatsoever in subsequent operations.

- D. Pipe Cleaning. Before each new length of pipe is placed, the interior of the preceding pipe shall be carefully cleaned of all dirt and debris. At all times when the work of installing pipe is not in progress, all openings into the pipe and the ends of the pipe in the trench shall be tightly closed to prevent entrance of animals and foreign materials.

The Contractor shall take all necessary precautions to prevent the pipe from floating due to water entering the trench from any source, shall assume full responsibility for any damage due to this cause and shall at his own expense restore and replace the pipe to its specified condition and grade if it is displaced due to floating.

- E. Laterals and Clean-outs shall be constructed at the points indicated on the plans, and in accordance with the standard drawings. Connections of house laterals to sewer mains shall be made with factory-molded wye or tee connections as shown on EMWD standard drawings, except that only one type shall be used universally throughout the project.

Wye or tee branches shall be laid with the axis of the "Y" or "T" entering the main sewer at an angle above the horizontal axis of said main, unless specifically called out otherwise on the plans or in the Special Conditions, but, unless specifically called out otherwise, this angle shall not exceed 45°.

Whenever any service connection is to be temporarily blanked off, it shall be plugged with a cover or plug recommended by the manufacturer of the pipe.

Lateral connections to existing mains shall be made pursuant to the provisions of the appropriate standard drawing for saddle connection to the existing main pipe material. All sewers of this project are new sewers. Accordingly, laterals installed by saddle connections as shown on Std. Dwg. SB-176 and will be allowed only where unanticipated laterals are added after the sewer main is laid past the point of connection. In such case the already laid sewer main is shown on the standard drawing as "existing sewer main."

- F. New Sewer Laterals on Existing Plastic Main. The required excavation and cleaning of main surfaces for a tap and saddle shall be performed by the Contractor and when such taps are installed by District forces, the Contractor shall have the additional materials and equipment at the jobsite as follows: barricades; proper pipe; standard bedding material as specified in these specifications; and a ladder long enough to extend two-and-one-half (2-1/2) feet above the top of the excavation. The excavation shall provide a minimum clearance of 3" under and 6" on each side of the main sewer for a distance of 12" each way along the main from the point of connection. The outer surface of the main in this exposed area shall be thoroughly cleaned.

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New sewer laterals on existing vitrified clay pipe mains subject to commercial or industrial flows shall be constructed of vitrified clay pipe in accordance with the requirements for vitrified clay pipe.

The excavation above the main, for the tap working area, shall be a minimum of 2' in width without under-cut sides and shall be properly shored. Before the tap is made, the Contractor shall have sufficient standard bedding material at the site of the work to adequately backfill under the saddle to support it. No backfill shall be placed on the saddle fitting within one-half (1/2) hour after the completion of the work by District forces. If the Contractor breaks or otherwise damages the main while excavating for the tap, he shall notify the District and the District shall make repairs as necessary at the expense of the Contractor.

3.02 MANHOLES

Manholes shall be constructed in the locations and to the dimensions as shown on the drawings. Cast-in-place concrete shall conform to the requirements set forth in Section "Portland Cement Concrete" in these specifications. Pre-cast units shall be assembled accurately with full-bed mortar joints.

Unless otherwise shown on the drawings, the sewer pipe shall be laid continuously through the location of the manhole. After the manhole has been constructed, the open channel shall be formed by cutting the pipe and removing the top half. If the open channel cannot be formed in this manner, it shall be formed of concrete with the depth equal to the diameter of the sewer pipe. The floor of the manhole shall slope at least 2" from the sides of the manhole to the open channel.

When completed, the top of the manhole cover shall be accurately brought to the elevation called for on the drawings, or if no elevation is indicated, it shall be brought flush with the surface of the surrounding ground or pavement. The manholes shall be constructed so that there is not more than 19" of throat section between the top of the cone and the top of the frame.

When located in roadway subgrades, manholes shall be constructed up to the proper elevation preparatory to street paving, and temporarily covered with planks or steel plates. After paving operations have been completed the temporary covers shall be removed and the frames and covers installed flush with pavement grade.

3.03 CLEANING SEWER LINES

All sanitary sewer mains and laterals shall be flushed with water and "balled" or cleaned by acceptable method prior to testing to ensure that all dirt, debris, and obstructions are removed. This work must be performed in the presence of and to the satisfaction of the Engineer, and the Contractor shall notify the Engineer at least one (1) working day in advance of starting the cleaning work.

The Contractor shall, following backfill compaction and line cleaning provide:

- A. 3/8" minimum pull ropes from manhole to manhole.
- B. Equipment and traffic control to assist in the T.V. inspection performed by District's sub-contractor.

3.04 MANDREL TEST OF ABS & PVC PIPE

Following the placement and densification of backfill and prior to the placing of permanent pavement, all main line pipe shall be cleaned and then mandrelled to measure for obstructions (deflections, joint offsets and lateral pipe intrusions). A rigid mandrel, approved by the Engineer, with a circular cross section having a diameter of at least 95% of the specified average inside diameter, shall be pulled through the pipe by hand.

Ninety-five percent (95%) of the specified average inside diameter for flexible plastic pipe taken from the appropriate ASTM requirements are as follows:

Pipe Nominal Dia.	ABS Solid Wall (ASTM D-2751) SDR		PVC Solid Wall (ASTM D-3034) SDR
	23.5	35	35
4"	3.65"	3.77"	3.77"
6"	5.45"	5.61"	5.61"
8"	---	---	7.51"
10"	---	---	9.39"
12"	---	---	11.17"
15"	---	---	13.68"

Ninety-six percent (96%) of the specified average inside diameter for semirigid plastic pipe taken from ASTM D-2680:

Pipe Nominal Dia.	ABS & PVC Composite Wall (ASTM D-2680)
8"	7.44"
10"	9.36"
12"	11.28"
15"	14.16"

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Mandrel testing shall be performed 30 days or longer after installation and backfill compaction. In the event permanent pavement is placed prior to that time, mandrel-testing shall be required prior to pavement placement and a second mandrel test 30 days or longer after compaction of backfill.

The backfill shall be removed and recompactd for any section of pipe that fails the mandrel test.

Re-rounders shall not be used to correct excessive pipe deformation.

3.05 LEAKAGE TESTS

All sanitary sewers shall be tested for tightness after they and all appurtenances have been completed, backfilled (except for test tees) and compacted, and are ready for service. Tests shall be made on each section, including manholes, from one manhole or test tee to the next, unless grades are flat enough to permit testing two or more sections at one time.

The method of required test (water test or air test) shall be determined by the Inspector.

- A. Preparation for Tests. Each section of sewer, including house laterals, between successive manholes shall be tested by closing the lower end of the section to be tested, the inlet sewer of the upper manhole, and the ends of house laterals with stoppers, and filling the pipe and manhole with water to a level of 4' above the invert of the open sewer in the upper terminal. After the section has been filled, it shall be allowed to stand for a sufficient length of time to allow the manhole to absorb what water it will, prior to making the leakage test described in the following paragraphs (Water Test and Air Test). This period of time for absorption of water shall not be less than 30 minutes nor greater than 24 hours.
- B. Test Procedure and Allowable Leakage.
 - 1. Water Test. The leakage test shall consist of measuring the quantity of water required to maintain the water level at the elevation prescribed in the above paragraph for a period of one (1) hour. The water used in the test shall be measured through a meter or by other means satisfactory to the Engineer. The allowable leakage shall be computed from the following formula:

$$E = 0.0012 LD / H$$

Where E = allowable leakage in gallons

L = length of the sewer and house connections tested in feet

D = inside diameter of the pipe in inches

H = difference in the elevation (in feet) between water surface in the upper manhole and the invert of the pipe at the lower manhole.

If the leakage during the test period exceeds the allowable leakage, the sewer line shall be overhauled and, if necessary, relaid until the joints hold satisfactorily under the test.

2. Air Test. Installed pipeline shall be field tested in accordance with the air test required for vitrified clay pipe specified in the National Clay Pipe Institute 1967 Supplement to Engineering Manual, and its supplementary tables contained in the NCPI publication entitled "Low Pressure Air Test for Sanitary Sewers (Procedures and Tables)."

Isolation of defects by air test shall be the Contractor's responsibility to perform; however, if performed by the District or its agent, they shall be performed at the Contractor's expense.

- C. Alternate Infiltration Test. If excessive groundwater is encountered in the construction of a section of the sewer, the test for leakage previously described shall not be used. The end of the sewer at the upper structure shall be closed sufficiently to prevent the entrance of water and pumping of groundwater shall be discontinued for at least three (3) days, after which the section shall be tested for infiltration. The allowable infiltration for any portion of the sewer system should not exceed 100 gallons per inch of internal pipe diameter per mile per day (4.6 l/mm/km/day), including manholes. Infiltration in excess of this amount shall be reduced to a quantity within the specified amount before the sewer will be accepted. In any case, the Contractor shall stop any individual leaks that may be observed.

Unless otherwise specified, infiltration will be measured through a meter or by other means satisfactory to the Engineer.

- D. Manhole Leakage. Should an initial test show excessive leakage in a section of line, it is permissible to draw off the water of a water test and test the manhole that contained water. This test shall be made by plugging all openings in the manhole, filling same with water to the same elevation as used for the initial test, and checking the loss in a one hour period. The leakage so determined may be deducted from the total leakage in the section of pipe initially tested.

If, in the opinion of the Engineer, the manhole leakage thus determined is excessive, the Contractor shall waterproof the interior of the manhole by applying a coating of grout or an approved waterproofing material. Excessive leakage is defined to be 50 gallons per hour when filled to the top of the barrel sections (not including cone or grade rings). Shallow rectangular manholes shall be filled to the top of the manhole sections (not including grade rings), with 50 gallons per hour leakage allowed.

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3.06 SEWER PIPE REPAIRS

Sewer pipe leakage in excess of the allowable maximum shall be corrected by repairs acceptable to the Engineer, and retesting as required.

The section of damaged pipe will be cut out and the ends of the remaining pipe and replacement pipe will be prepared per Article 2.01 C.1. The closure will be made with a "closure coupling" as supplied by the manufacturer of type pipe used.

3.07 LATERAL MARKERS

It shall be required of the Contractor to place the required markers at the end of each lateral and to also return after curb construction to place the required mark in the face of the curb. An "L" may be used in place of the required "S" mark in the curb face. Unless waived by the Engineer, 2" wide metallic detectable locator tape shall be placed with each lateral, approximately 6" above the pipe.

END OF SECTION 02762