

**STANDARD SPECIFICATIONS
FOR THE
FURNISHING OF MATERIALS
AND THE
CONSTRUCTION
OF
SANITARY SEWERS**

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SECTION I

GENERAL REQUIREMENTS

1-01 DEFINITIONS

The word "District" shall mean the East Valley Water District.

The word "Board" or words "Board of Directors" shall mean the Board of Directors of the East Valley Water District.

The words "District Engineer" shall mean a civil Engineer registered as such in the State of California and appointed by the Board acting either directly or through its properly authorized agents, assistants, inspectors and superintendents.

The word "Contractor" shall mean the person, person's partnership or corporation duly licensed as such in the State of California to enter into a contract for the performance of the work required.

The word "Plates" shall mean collectively all of the Plates accompanying these specifications and made a part hereof.

1-02 CONDITIONS

On all questions relating to the acceptability of the material, machinery or plant equipment, classification of material or work, the proper execution, progress or sequence of the work, quantities and interpretation of the specifications or drawings, the decision of the District Engineer shall be final and binding.

The Contractor shall obtain copies of and comply with all applicable current statutes, laws, ordinances, rules, regulations and specifications of the

United State Government, the State of California, the County of San Bernardino, the City of San Bernardino, the City of Highland and any other governmental agencies having jurisdiction and shall make application for all required permits and bear the cost of same.

The Contractor shall furnish to the District, copies of all required permits and licenses prior to initiation of the work. Upon completion of the work, the Contractor shall supply to the District a letter of approval from the governing body having jurisdiction that the Contractor has met the requirements and conditions of the permits or licenses.

1-03 SUPERVISION AND INSPECTION

The District Engineer shall decide within the provisions of the specifications all questions which may arise concerning the quality or acceptance of materials furnished and work performed. The Contractor shall be solely and completely responsible for conditions on the job site, including safety to all persons and property during performance of the work. This requirement shall apply continuously and completely and not be limited to normal working hours.

1-04 DEFECTIVE WORK OR MATERIALS

No work which is defective in its construction or deficient in any of the requirements of these specifications will be considered as accepted as a result of the failure of any inspector connected with the work to point out said defects or deficiency during construction. The contractor shall correct any imperfect work, without compensations from the District, before final acceptance of the work by the District.

All materials not conforming to the requirements of these specifications shall be considered as defective. They shall be rejected, whether in place or not, and shall be removed immediately from the site of the work by the Contractor at his expense. No rejected material, the defects of which have been subsequently

corrected, shall be used until approval in writing has been given by the District Engineer.

1-05 MAINTENANCE OF EXISTING IMPROVEMENTS

Unless otherwise indicated on the plans or in these specifications, or unless otherwise cared for by the owner of a public utility or franchise, all water, gas, oil, irrigation lines, lighting, power, telephone conduits, wires, sewer lines, structures or house laterals in place, and other surface or sub-surface structures or lines, shall be maintained by the Contractor and shall not be disturbed, disconnected or damaged by him during the progress of the work; provided, that should the Contractor in the performance of the work disturb, disconnect or damage any of the above, all expenses, of whatever nature arising from such disturbance or in the replacement or repair thereof shall be borne by the Contractor.

1-06 PROXIMITY TO WELLS AND WATER LINES

Where sanitary sewers and house connections are to be constructed within a 100-foot radius of a water well, types of pipe and joints shall be reviewed with the State Department of Health Services for their recommendation and approval. If the horizontal separation between parallel sewer and water lines must be less than 10 feet or if the sewer crosses shallower than one foot below the water main, special construction is required by the State Department of Health Services and must be approved by the District.

1-07 AS-BUILT DRAWINGS

The Contractor shall keep a separate set of construction plans upon which he shall designate in appropriate markings, as-built conditions using sufficient sketches to properly delineate locations of manholes, laterals and other pertinent items. Wyes and tees shall be referenced by distance from the nearest downstream manhole. Lateral ends shall be referenced the same plus an offset distance from the main. All measurements shall be accurate within one foot.

Prior to filing of the Notice of Completion, the Contractor shall certify as to the as-built conditions in a letter transmitting the plans and sketches to the District.

SECTION 2 MATERIALS

2-01 GENERAL

All materials shall be new and unused. Vitrified clay pipe, polyvinyl chloride pipe (PVC), acrylonitrile butadiene styrene (ABS) composite pipe or PVC composite pipe shall be used for sewer mains, except where ductile iron pipe is required for special conditions.

Vitrified clay pipe, polyvinyl chloride pipe or ABS solid wall pipe shall be used for house connections.

Manholes shall be constructed of poured in place concrete bases and pre-cast reinforced concrete sections. Pre-cast concrete manholes' bases will be considered on a case by case basis upon submittal of request and data.

The reference to specifications for the various materials shall include, in addition to the basic specifications referred to, all applicable amendments to the specifications and all emergency alternate specifications which have been promulgated and are in effect. Whenever a material, article, or piece of equipment is identified on the plans or in the specifications by reference to manufacturers' or vendors' names, trade names, catalogue numbers, etc., it is intended generally to establish a standard; and, any material, article, or equipment of other manufacturers and vendors which will perform adequately the duties imposed by the general design will be considered equally acceptable provided the material, article, or equipment so proposed, is in the opinion of the District, of equal substance and function. It shall not be purchased or installed without the District's written approval.

2-02 VITRIFIED CLAY PIPE (VCP)

Pipe shall conform to American Society for Testing and Materials (ASTM) Standard C 700, latest Revision entitled, "Vitrified Clay Pipe, Extra Strength, Standard Strength and Perforated," for either plain-end or bell and spigot type extra strength vitrified clay pipe. Only EXTRA STRENGTH vitrified clay pipe shall be used.

Jointing of vitrified clay pipe shall conform to ASTM C 425, latest revision, entitle "Compression Joints for Vitrified Clay Pipe and Fittings," with the following exceptions:

Band and fasteners for attached rubber coupling and tensioning mechanism shall be fabricated from stainless steel.

For pipe 8 inches in diameter and larger corrosion resistant shear rings are required on Banded Rubber Couplings.

2-03 POLYVINYL CHLORIDE (PVC) SEWER PIPE

Polyvinyl chloride pipe shall comply with ASTM D 3034, latest revision entitled "Type PSM Polyvinyl Chloride (PVC) Sewer Pipe and Fittings," or ASTM F 679 entitled "Polyvinyl Chloride (PVC) Large Diameter Plastic Gravity Sewer Pipe and Fittings." Four through fifteen inches shall have a maximum standard dimension rating (SDR) of thirty-five (35). Large diameter pipe shall have a minimum wall thickness of "T-1."

PVC plastic pipe and fittings shall be made of PVC plastic having a cell classification of 12454-B, 12454-C or 13364-B as defined in ASTM D 1784.

Elastomeric gasket joints shall be used for joining PVC Sewer Pipe, except house connection sewers. The critical sealing dimensions of the bell, spigot and gasket shall be in accordance with the manufacturer's standard dimensions and tolerances. The elastomeric compound shall comply with the

physical properties specified in ASTM D 1869. The gasket shall provide an adequate compressive force against the sealing surfaces of the bell and spigot so as to affect a positive seal under all combinations of the joint tolerances. The gasket shall be the only element dependent upon to make the joint flexible and watertight.

Whenever possible, the manufacturer's maximum standard length of pipe shall be used.

Solvent cement joints shall be allowed only on house connection sewers and when installing saddles on sewer mains. The solvent cement shall be in accordance with ASTM D 2564.

All fittings and accessories shall be as manufactured by the pipe supplier and be of equal material of the pipe supplied and have bell and spigot configurations identical to that of the pipe.

2-04 ACRYLONITRILE BUTADIENE STYRENE (ABS) SOLID WALL PIPE

Pipes smaller than eight inches in diameter shall be solid-wall pipe. The pipes, fittings and joints shall be manufactured in conformance with ASTM D 2751. Minimum wall thickness shall correspond with SDR 35.

Chemically welded joints shall be made in conformance with the pipe manufacturer's recommendations. Both a primer and a cement shall be used when recommended by the manufacturer. Joint solvent shall be an ABS cement conforming to ASTM D 2235.

2-05 ABS OR PVC COMPOSITE PIPE

ABS or PVC composite pipe, fittings and joints shall comply with ASTM D 2680. The pipe shall consist of two concentric extended thermoplastic tubes integrally connected by webs to form a circular truss. The longitudinal void

spaces shall be filled with inert material. The maximum average ID of the pipe, as determined by ASTM D 2122, shall be:

Nominal Size	Maximum Average ID
<u>Inches</u>	<u>Inches</u>
8	7.90
10	9.88
12	11.83
15	14.80

ABS and PVC resins and joint cement shall conform to the respective materials specified above for ABS solid wall and PVC plastic sewer pipe.

Pipe which is not installed within 120 days of the lot tests shall not be used without prior approval of the District Engineer.

2-06 DUCTILE IRON (DI) PIPE

Ductile iron pipe and fittings shall be cement mortar lined. Pipe joints shall be mechanical joint or push-on type. Applicable sections of the following standards apply:

<u>STANDARD</u>	<u>ITEM</u>
AWWA C 151	Ductile Iron Pipe
AWWA C 104	Cement Mortar Lining
AWWA C 110	Fittings
AWWA C 111	Rubber Gasket Joints

2-07 WYES AND TEES

Wyes and tees for house connections or future connections shall be as manufactured by the pipe supplier and be of a material of the pipe supplies. Where necessary to cut-in wyes or tees on existing mains, the mains may be

saddled. Sewer saddles shall be properly designed for the types of main. Each saddle shall be clearly marked with the size and type main to which it is to be applied.

The cast iron saddles for VCP and DI pipe shall be provided with a groove to accommodate a rubber O-ring gasket cemented in place so as to be an integral part of the saddle. The saddle shall be provided with a stainless steel band and non-corrosive hardware for firmly attaching to sewer main.

ABS or PVC saddles may be chemically welded or solvent cemented to like sewer mains, however they shall also be secured with two stainless steel straps.

2-08 STEEL CASING FOR BORED CROSSINGS

Steel pipes shall be a minimum one-quarter (1/4) inch thick wall for 12 inch to 20 inch nominal diameters and a minimum three eighths (3/8) inch thick wall for pipe sizes up to 36 inch nominal diameter or in accordance with the requirements of the governing agency which ever is greater, and shall be manufactured in accordance with American Water Works Association (AWWA), Standard C200, latest revision entitled "AWWA" Standard for Steel Water Pipe 6 Inches and Larger." The casing shall be round and straight, free from protruding bolts, rivets or welds, and shall have an inside diameter of not less than the maximum diameter of the sewer plus six (6) inches. The ends of the Steel Casing Pipe to be jacked or bored into place shall be prepared to withstand pressures created by jacking the pipe into place.

2-09 CONCRETE

a. **Portland Cement** shall conform to ASTM C 150, latest revision, entitled "Portland Cement," and shall be Type I or II. Cement in containers that have been broken in shipment or handling may be used only if approved by the District Engineer.

b. **Sand** shall be consist of well-graded, natural or artificially washed that has clean, hard, strong matter. Sand shall not contain over three (3) percent clay or silt by weight.

c. **Coarse Aggregate** shall consist of gravel, or a combination of gravel and crush rock, having clean, hard, tough, durable and uncoated pieces free from injurious amounts of soft, friable, thin, elongated pieces, alkali, oil, organic or other deleterious substances. Aggregate shall be properly graded, from 1/4 inch to 1-1/2 inch in size, to secure the required compressive strength concrete.

d. **Water** shall be clean, free from injurious amounts of oil, acids, organic matter or other injurious substance.

Only sufficient water shall be used to produce a concrete with a slump of not to exceed 4 inches, as determined by ASTM C 143, latest revision. The total volume of sand and coarse aggregate measured separately shall not exceed 6 cubic feet per sack of cement. Concrete shall be placed within 30 minutes of mixing and not retempering will be permitted. Batch slips shall be furnished by the Contractor when requested by the District Engineer, if transit mix concrete is supplied. Unless otherwise specified all concrete shall have a 28-day compressive strength of 2500 psi minimum and shall contain 5.5 sacks of cement per cubic yard of concrete.

2-10 CASTINGS

Manhole frames and covers for District sewers shall be furnished in accordance with Plate V, and shall be furnished with a 32-inch diameter over-all base, a 24-inch clear opening, a 5-inch frame height, a diamond pattern cover with letter designations "SEWER" and "EVWD", weighing no less than 385 pounds in place and shall be of traffic strength. The seat shall be beveled of the non-rocking type with covers and frames machined and matched to fit snugly. The frames and covers shall be painted with one coat of bituminous paint.

Covers and frames shall be Alhambra Foundry No. A-1590, or approved equal, subject to the above specifications, the Plate and the approval of the District.

2-11 MANHOLES, PRECAST

Precast manholes shall be of reinforced concrete manufactured to meet ASTM C 478 latest Revision entitled "Precast Reinforced Concrete Manhole Sections" and shall be 48 inches in diameter unless otherwise specified (See Plate II).

2-12 CRUSHED ROCK BEDDING

Crushed rock bedding at locations designated by the District Engineer and required by the Contractor shall be sound, crushed aggregate of good stability, free from lumps or balls of clay, with 100% passing through a 3/4 inch U.S. Standard Series sieve and 0 to 20% passing a No. 4 mesh sieve. All crushed rock shall be approved by the District Engineer.

2-13 FLEXIBLE PLASTIC GASKET

The flexible plastic gasket shall meet or exceed all requirements of Federal Specifications SS-S-210A, "Sealing Compound, Preformed Plastic for Pipe Joints," Type 1, Rope Form. The flexible plastic gasket shall be RAM-NEK as manufactured by Henry Company or approved equal and shall meet the following requirements:

- The Seal Compound shall prevent the joints from leaking while being tested at 10 PSI for a period of 24 hours;
- No sagging of the gasket shall be detected for overhead or vertical joints up to 1-inch wide.

The flexible plastic gasket shall be produced from blends of refined hydrocarbon resins and plasticizing compounds reinforced with inert mineral filler,

and shall contain no solvents, irritating fumes or obnoxious odors. The compound shall not depend on oxidizing, evaporating, or chemical action for its adhesive or cohesive strength. It shall be supplied in extruded rope-form of suitable cross-section and of such sizes as to fill the joint space when the pipes are laid. (added 9/15/99)

SECTION 3

METHODS OF CONSTRUCTION

3-01 EXCAVATION, TRENCHING AND BACKFILL

a. General

The work covered by this portion of the specifications consist of the furnishing of all plant, labor, equipment, appliances and materials and the performance of all operations in connection with the excavation, trenching and backfilling for sanitary sewers and appurtenant structures, in strict accordance with the specifications and the applicable drawings.

In case of conflict in requirements for excavation, trenching and backfilling between these specifications and any statutes, laws, ordinances, rules, regulations and specifications of any political subdivision or agency having jurisdiction, it shall be understood that the more exacting requirement shall govern. In general, these specifications will apply in District right-of ways and easements and the aforementioned statutes, laws, ordinances, rules, regulations and specifications of any political subdivision or agency having jurisdiction will apply within the political boundaries or public right-of-ways to which they apply.

The Contractor shall perform all excavation of every description and of whatever substances encountered, to the depths and alignment indicated on the construction drawings or as otherwise specified. During Excavation, material suitable for backfilling shall be piled in an orderly manner, a sufficient distance from the banks of the trench to avoid overloading and to prevent slides or cave-ins. All excavated materials not required or suitable for backfill shall be removed and wasted by the Contractor at the direction of the District Engineer.

Such grading shall be done as may be necessary to prevent surface water from flowing into trenches or other excavations. The Contractor shall remove, by

pumping or other means approved by the District, any water accumulated in the trench from any source.

Suitable shoring, timbering or sheeting shall be provided by the Contractor where necessary to support the sides of the trench prior to and during the installation of the pipe. The shoring methods and procedure shall be consistent with safety and shall be removed as the trench is being backfilled.

Unless otherwise indicated, excavation shall be by open cut except that short sections of a trench may be tunneled if, in the opinion of the District Engineer, the pipe can be safely and properly installed and backfill can be properly tamped in such tunnel sections.

All spoil may be thrown on one side of the trench only to facilitate distribution and installation of pipe in such a manner that it will not endanger the work and will avoid obstructing roads and driveways. Adequate provisions shall be made for maintaining the flow of water courses, drains, sewers or ditches crossing the trench, and upon completion of the work, they shall be restored to their original condition.

The use of trench digging machinery will be permitted except where its operations will cause damage to trees, buildings or existing structures above or below the ground. At such locations, hand methods shall be employed to avoid such damage. Trees, fences, poles and other property shall be protected unless their removal is authorized. Any property damage shall be satisfactorily restored by the Contractor.

The Contractor shall provide his own access and proper clearance for installation of pipe in easements. Removal and disposal of all trees, stumps, roots, brush and other objectionable material shall be provided by the Contractor all in accordance with the approval of the District.

b. Trench Excavations

The width of the trench at and below the top of the pipe shall be such that the clear space between the barrel of the pipe and trench wall shall not be less than six (6) inches nor exceed eight (8) inches on either side of the pipe. The width of the trench above that level may be as wide as necessary for sheeting and bracing and the proper performance of the work. The bottom of the trench shall be graded and shaped so that the pipe shall rest firmly on undisturbed soil for the full length of the barrel except where it is necessary to excavate for bell holes and proper jointing operations. This part of the excavation shall be made manually, only a few feet in advance of the pipe laying, by men skilled in this type of work. Bell holes and depressions for joints shall be dug after the trench bottom has been graded and shall be only of such length, depth and width as necessary for properly making the particular type of joint. Except where rock or unsuitable materials is encountered, care shall be taken not to excavate below the depths indicated on the construction drawings.

Where the bottom of the trench is in rock or hard materials, the trench shall be excavated six (6) inches below grade as directed by the District Engineer or where the trench has been over excavated, the trench shall be refilled to the proper trench grade with crushed rock bedding as directed by the District Engineer.

Where the trench bottom requires the use of imported material under the pipe because of soft, wet, spongy or unstable conditions in the trench, a minimum thickness of twelve (12) inches of crushed rock bedding shall be placed below grade of pipe invert for the full width of the trench.

c. Excavation for Appurtenances

Excavation for manholes and similar structures shall be sufficient to leave at least twelve (12) inches clear between their outer surfaces and embankment or timber which may be used to hold and protect the banks. Excavations for

other structures shall be made to the grades shown on the construction drawings and all work shall be done in a workmanlike manner.

d. Backfill

1. General - Backfilling of the trench around the pipe and excavation around appurtenances shall follow the installation as closely as possible. Backfill shall be accomplished in two stages: (1) Initial backfill from property trench grade to twelve (12) inches over the pipe; (2) Final backfill from twelve (12) inches over the pipe to the surface.

2. Initial Backfill - Vitrified Clay Pipe and PVC or ABS Composite Pipe. Initial backfill should be accomplished as soon as possible after the pipe has been laid. The backfill material shall be approved by the District Engineer and shall contain no particles larger than one and one-half (1 1/2) inch for VCP or three-quarter (3/4) inch for composite pipe. The material shall be sufficiently damp to permit thorough compaction on all sides of the pipe free from voids. Initial backfill shall consist of placing the backfill from proper trench grade to an elevation of twelve (12) inches over the top of pipe by the following procedure:

The first lift of material shall be uniformly placed on both sides of the pipeline for the full width of the trench and have a maximum loose depth of not more than six (6) inches as measured from the trench bottom. This material shall then be tamped under and around the pipe and joints until all voids underneath and around the pipe and joints have been filled.

After the voids beneath the pipe have been filled, the material between the trench walls and the pipe shall be compacted, with each layer firmly compacted prior to placing the subsequent material, until the material has reached a minimum depth of the horizontal centerline of the pipe line. From the horizontal centerline of the pipe line to a depth of twelve (12) inches over the pipe lines, the

backfill material shall be placed in horizontal layers not exceeding eight (8) inches in depth and properly compacted by tamping.

Flooding of the initial backfill may be permitted with prior approval of the District Engineer. Flooding of the initial backfill will be permitted when the material contains no rocks larger than one (1) inch and has a sand equivalent value of not less than 30 as determined by Test Method No. 217 of the California Division of Highways.

Alternate - Initial backfill shall consist of placing saturated sand as approved the District Engineer, from either on-site or off-site sources, from proper trench grade to a compacted elevation of twelve (12) inches above the top of the pipe. The sand shall be properly saturated before placement in the trench. This material may be placed in one lift provided adequate rodding or vibrating during placement is performed to assure filling of all voids under and around the pipe. Care should be taken to avoid floating of pipe in all cases. This method of initial backfill shall be used only when the native material in the trench permits adequate drainage and is suitable in the opinion of the District Engineer. There shall be no free water standing on the surface of the initial backfill at the time final backfill is placed.

3. Initial Backfill - PVC and ABS Solid Wall Pipe.

The embedment practices and procedures for PVC and ABS solid wall pipe shall be in accordance with ASTM D 2321, latest revision, entitled, "Standard Thermoplastic Sewer Pipe", using Class I, II or III embedment materials for depths up to ten (10) feet. Where the depth of cover is in excess of ten (10) feet, only Class I or II embedment materials shall be used.

The same class of embedment material shall be used for the bedding haunching and initial backfill. The bedding material shall have a minimum thickness of four (4) inches.

4. Final Backfill - The balance of backfill shall contain no particles larger than six (6) inches in its greatest dimension or such smaller dimensions as specified by the governing body having jurisdiction and shall be free from brush or any other perishable or objectionable matter that would prevent proper compaction, consolidation or that might cause subsequent settlement. All of the backfill placed shall be compacted to a minimum density of ninety (90) percent of its maximum density as determined in accordance with ASTM D 1557.

Flooding and/or jetting of the material to accomplish compaction will not be permitted without prior authorization by the District. For trenches eight (8) feet in depth or less, the final backfill may be placed in compacted lifts of twenty-four (24) inches, or one-half (1/2) of the trench depth, whichever is the greater depth. For trenches greater than eight (8) feet in depth, the material shall be placed in maximum compacted lifts of four (4) feet. The depth of fill lifts in trenches on slopes may be reduced by the District to facilitate compaction.

Any deficiency in the quantity of material for backfilling the trenches or for filling depressions caused by settlement shall be supplied by the Contractor. Surplus spoil shall be crowned over the trench, spread or hauled away as directed by the District Engineer.

Backfill within traveled streets or highways, existing or proposed, shall meet the standards and approval of the agency or proper authority having jurisdiction over same.

Trenches improperly backfilled, or where settlement occurs, shall be re-opened to the depth required for proper compaction, then backfilled and compacted, with the surface restored to the required grade.

Where flooding and/or jetting has been approved by the District Engineer, backfill shall be thoroughly consolidated by use of water jets. The Contractor

shall use water jets of at least one and one-quarter (1-1/4) inches in diameter and of sufficient length to extend to within one foot of the top of the pipe.

Where water is not readily available in sufficient quantity and pressure, the backfill may be flooded by the following method. The water shall be allowed to flow slowly into the trench from the upper end, and shall be worked down to the bottom of the trench by "poling". Care shall be taken to insure that water does not flow through the trench before it has penetrated down to the pipe line.

e. Pavement Replacement

When it is necessary to break pavement to order to lay the pipe lines shown on the construction drawings, the existing pavement shall be cut vertically as nearly as possible to a straight line by an approved method. The pavement so removed shall be hauled away as directed by the District and shall be replaced with like material. All pavement removal and replacement shall conform to the standards and specifications of the governing body having jurisdiction and shall meet with their approval. The Contractor shall be responsible for replacing all necessary pavement.

3-02 PIPE LAYING

All foreign matter and dirt shall be removed from the interior of the pipe prior to its installation. Before lowering, the pipe shall be inspected for defects. Any defective, damaged or unsound pipe shall be rejected. The entire joint including coupling, ends of the pipe and the rubber gasket or ring shall be thoroughly cleaned at the time the joint is made. The entire procedure and method of installation of the pipe and making joints shall be done in a workmanlike manner and shall be in strict accordance with the pipe manufacturers direction and recommendations.

The bottom of the trench shall be shaped to give substantially uniform support to each pipe. Pipe laying shall proceed upgrade with the spigot ends of bell-and-spigot pipe pointing in the direction of the flow.

All pipe shall be laid according to the size, class, location and grade shown on the Plans. The faces of all spigot ends and all shoulders in the hubs or sockets must be true and brought into firm contact. Rubber ring locations shall be checked with suitable gauges to insure that they are located in the proper position relative to the pipe ends.

Each pipe shall be laid true to line and grade in such manner as to form a close concentric joint with the adjoining pipe and to prevent sudden offsets of the flow line. As the work progresses, the interior of the sewer shall be cleared of all dirt and superfluous materials of every description.

Where cleaning after laying is difficult because of small pipe size, a suitable swab or drag shall be kept in the pipe and pulled forward past each joint immediately after the jointing has been completed. If the maximum width of the trench at the top of the pipe, specified in EXCAVATION, TRENCHING AND BACKFILLING, is exceeded for any other reason than by order of the District Engineer, the Contractor shall install, at his own expense, such concrete, cradling, pipe encasement, or other bedding as may be required by the District Engineer to support the added load the backfill. Trenches shall be kept free from water until the pipe jointing has been completed, and pipe shall not be laid when the condition of the trench or the weather is unsuitable for such work. The Contractor shall take all necessary care and precautions to prevent the pipe from floating due to water entering the trench from any source. The Contractor shall be responsible for damage caused by floating pipe, and shall, at his sole expense, restore and replace the pipe to its proper condition, alignment and grade.

At times when work is not in progress, unfinished ends of pipe and fittings shall be securely closed to the satisfaction of the District Engineer so that no trench water, earth or other substance will enter the pipe or fittings.

Where pipe is laid on a curve or at horizontal or vertical angles in the trench, the maximum deflection at the joint shall not exceed sixty (60) percent of the limitations specified by the pipe manufacturer and each joint shall be adequately blocked to take the thrust until properly backfilled.

Whenever pipe is required to be cut, it shall be done in a neat and workmanlike manner and the cut shall be made at a right angle to the longitudinal axis of the pipe. All burrs shall be removed prior to the assembly of the pipe.

Connections to manholes or other rigid structures shall be accomplished by a flexible joint at or within six (6) inches of the structure.

3-03 PIPE JOINTING

a. Vitrified Clay Pipe

Joints in the bell-and-spigot pipe shall be made by lubricating the resilient material on both the bell-and-spigot ends with a soap solution approved the manufacturer. Position the spigot inside the bell of the next length and properly align the two sections in the trench. Put the joint home by hand or by means of a bar lever, with wooden blocking to protect the bell end from damage, until the joint is obtained.

Joints in plain-end pipe shall consist of three parts; a circular rubber sleeve, stainless steel compression bands with a bolt and nut mechanism for tensioning bands, and a sheer ring to insure proper alignment of the pipe joints. The bolt and nut mechanism to tension bands shall be tightened by a torque wrench, furnished by and preset to the manufacturer's specifications. Prior to

tensioning, a lubricant approved by the manufacturer shall be applied to the rubber under the area of the bands.

b. Solvent Welded Plastic Sewer Pipe

Solvent welded plastic pipe and socket type fittings and couplings shall be joined as follows:

1. Cut the pipe square using a hack saw or band saw with a miter box or power saw with relatively slow feed or tube cutter with special wheel for cutting plastics.
2. Remove burrs with sandpaper or knife.
3. After pipe and fittings have been exposed to the same temperature for a reasonable length of time, they should be tested for tight or loose fit before cement is applied for the pipe to enter the socket easily for a distance of 1/4 to 3/4 of the socket depth.
4. Clean the pipe and fitting socket. Wipe away dust and moisture. Remove grease and oil with clean gasoline.
5. Let the gasoline evaporate before applying the cement.
6. Brush cement uniformly on the inside of the socket by means of non-synthetic paint brush. Avoid puddling in the socket which would form a bead on the inside of the fitting when the pipe is inserted.
7. Brush cement generously on the outside of the pipe to the depths of the fitting socket. On composite pipe, seal the ends with a generous coating of solvent cement.
8. After cement is applied, inset the pipe to the bottom of the socket using a slight twisting motion, and hold the pipe and fitting in place for a few seconds until the cement sets. This will keep the pipe from backing out slightly when pressure is released.
9. The joint may be handled immediately with care. Avoid rough handling for one hour. The joint may be tested at 1/3 of the rated working pressure after four hours. Avoid full-rated working pressure for 24 hours.

10. Keep the can, containing the cement, covered between operations to avoid moisture absorption.

c. Polyvinyl Chloride (PVC) Pipe

Joints in PVC elastomeric joints shall be made by making certain the bell and rubber rings are clean with no foreign material that could interfere with the proper assembly of the joint. Wipe the spigot end of the pipe with a clean, dry cloth around the entire circumference from the end to one inch beyond the reference mark. Lubricate the spigot end of the pipe, using only lubricant recommended or supplied by the pipe manufacturer. The lubricant shall be applied to a consistency and manner in accordance with the pipe manufacturers recommendation. The spigot end of the pipe is then inserted into the bell so that it is in contact with the rubber ring, keeping the pipe lengths in proper alignment. Brace the bell while the spigot end is pushed in under the rubber ring, so that previously completed joints will not be closed up. Push the spigot end in until the reference mark on the spigot end is flush with the end of the bell. This pipe shall be assembled by hand and/or bar and block and shall not be stabbed.

d. Ductile Iron Pipe

1. **Bell-and-Spigot** - Before jointing, the outside of the spigot and the inside of the bell shall be free from lumps, blisters, oil, grease and excess coating material, and shall be wire brushed and wiped clean and dry. Join as described above for PVC pipe.

2. **Mechanical** - Before jointing, the socket and plain end of the pipe shall be brushed and wiped clean of dirt, oil, grease and scale. The socket and end shall be washed with soapy water, then after the gland and gasket have been slipped on, the gasket shall be painted with soapy water. The gasket shall then be pushed into position and seated with the fingers after which the gland shall be positioned and all bolts tightened by hand before using the wrench.

3-04 SEPARATE WYES

Commercially manufactured wyes shall be installed where indicated on the plans and/or at such other locations required by the District Engineer. Where conditions are such that the house connection cannot be adequately supported on undisturbed earth or tamped backfill, the house connection pipe shall be encased in concrete and supported on a concrete cradle as directed by the District Engineer. Concrete shall be installed at the Contractor's expense. All wye branches not joined to house connections shall be installed with a suitable stopper of the size of the wye branch. The wye branches, unless otherwise specified, shall be inclined upward at an angle not greater than 45 degrees from a horizontal line. No wye branch shall be placed closer than five (5) feet to the centerline of any structure. The use of double wyes will not be permitted except as specified or required for chimneys.

3-05 CHIMNEY PIPES

Chimney pipes shall be constructed as shown on Plate VIII and at locations designed on the plans. Chimney pipes shall be installed where the depth of the sewer main is twelve (12) feet or more, or as designated by the District.

3-06 HOUSE CONNECTIONS

The term "house connection" as used in these specifications or on the plans is used to designate branch or lateral sewers, laid from a main sewer to points at the property lines, or other locations as shown on the plans, from which sewer service can be obtained by proper extension.

The house connection shall be constructed in accordance with details shown in Plate IX on an unyielding foundation, with joints closely and accurately fitted, true to line, and on a straight grade from the bend joining the main sewer to their upper ends, unless otherwise indicated on the plans. House connections shall not be laid on a slope greater than 45 degrees from a horizontal line unless

approved by the District Engineer. Wyes for house connections shall be installed as specified in Sub-Section 3-04. The house connection sewer lines shall be joined to the wye branch by eighth bends. All eighth bends are a part of the house connection sewer lines. Where a house connection sewer line to be connected with a chimney, all bends leading away from the wye branch are a part of said house connection sewer line. All house connections shall be installed with a suitable stopper of the size of the connection.

3-07 MANHOLE

a. General

Manhole invert channels shall be smooth and semicircular in shape, conforming to the inside of the adjacent sewer section. Changes in direction of flow shall be made with a smooth curve of as large a radius as the size of the manhole will permit. Changes in size and grade of the channels shall be made gradually and evenly. The invert channels may be formed directly in the concrete of the manhole base, may be half tile laid in concrete, or may be constructed by laying full section sewer pipe through the manhole and breaking out the top half after the surrounding concrete has hardened. The floor of the manhole outside the channels shall be smooth and shall slope toward the channels not less than one (1) inch per foot or more than two (2) inches per foot. Edge of channel shall be rounded and smooth.

Manhole frames and covers shall be installed in accordance with Plate V. Top of manhole frames and covers shall be installed six (6) inches below finish grade in new tract developments. After paving, frames and covers shall be adjusted to top of pavement. Manhole frames and covers in existing street pavement shall be constructed to top of pavement.

b. Precast Manholes

Precast Mannholes shall be installed and assembled in accordance with details shown on Plate No. II and in accordance with the manufacturer's

specifications. The inside joints shall be neatly struck and pointed with mortar not to exceed 3/8" in thickness. As an alternate to applying mortar to the inside joints, a flexible plastic gasket as manufactured by Henry Company, or approved equal, may be used. An eccentric cone shall be used with the straight wall downstream except at permanent sewer dead ends where the straight wall shall be upstream. All junction manholes shall have concentric cones. All manholes shall have three (3) inch and six (6) inch grade rings with a minimum height of twelve (12) inches, and a maximum height of eighteen (18) inches, below the manhole frame. (rev 9/15/99)

c. Drop Manholes - Plate IV

d. Remodeling Existing Manholes

Pipe connections to existing manholes or existing stubs shall be made in such manner that the finished work will conform as nearly as practicable to the essential applicable requirements specified for new manholes, including all necessary brick work, concrete work, cutting and reshaping of inverts to provide proper channels for flow.

3-08 DEAD ENDS

Dead Ends may be constructed as shown on Plate VI or VI-A at locations approved by the District Engineer. The top of Dead End frames and covers shall be installed six (6) inches below finish grade in new tract developments. Dead End frames and covers shall be installed in accordance with Plate No. VII. After paving, the top of dead end frames and covers in existing pavement shall be constructed to top of pavement.

3-09 BORED CROSSINGS

a. General

The work covered by this paragraph of the specifications includes all pipe, pipe fittings, casing, special appurtenances and materials between the stations indicated as bored crossings on the drawings.

b. Installation

Crossings shall be bored with an earth auger to the line and grade shown on the plans. The maximum allowable variation in line or grade will be two-tenths (0.20) of a foot in the distance bored. Should voids be created outside the casing pipe, the voids shall be filled as directed by the District Engineer. The approved sewer main shall be strapped to redwood skids with stainless steel bands and shall be threaded through the casing. After the pipe is in the casing, the space between the pipe and the casing shall be filled with blown in sand.

3-10 CONCRETE WORK

Concrete as specified herein before, shall be used for manhole bases, pipe bedding encasements and for other support and backfill as the District Engineer may direct. In general, forms will not be required, provided that concrete may be successfully placed to the minimum dimensions as shown on the drawings using side walls of excavations for support. If side walls of excavations are not suitably stable in the opinion of the District Engineer, the Contractor shall furnish and use forms for concrete placement.

3-11 TESTS

a. General

The completed sewers, including laterals and manholes, shall be watertight, clean of uniform grade and free from obstructions or offsets which could interfere with the functional design of the system. Except as indicated below, the Contractor shall furnish all materials, equipment and services required for the test. Compaction tests shall be completed to confirm satisfactory

densification of backfill prior to tests for displacement, leakage or deflection of sewer pipe. Any backfill recompaction effort or sewer pipe repair done after testing will require retests for compaction displacement, leakage and deflection. Tests shall be made in the presence of the District's authorized representative and shall be performed prior to the sewers being placed in service. All sewers will require testing unless otherwise directed by the District.

b. Test for Displacement of Sewers

Sewer main will be checked by the District Engineer to determine whether any displacement of the pipe has occurred after the trench has been completely backfilled and compacted as specified. The test will be as follows: A light will be flashed between manholes, or if the manholes have not as yet been constructed, between the locations of the manholes, by means of a flashlight. After the sewer mains have been visually inspected, the District's maintenance crew will pass their cleaning equipment through the sewer mains to check for obstructions. If the illuminated interior of the pipeline shows poor alignment, displaced pipe, or the District's cleaning equipment will not pass through the sewer mains freely, the defects designated by the District shall be remedied by the Contractor at his expense to the satisfaction of the District.

c. Test For Leakage

1. General

Water tightness of sewers and manholes shall be determined by one of three methods:

- (a) Infiltration testing
- (b) Exfiltration Testing
- (c) Low pressure air testing

2. Infiltration Test

Sewer lines installed in areas where the sewer is subject to high ground water infiltration shall be tested using direct flow measurement in each reach of

sewer. The total infiltration shall not exceed 200 gallons per day per inch diameter per mile of pipe as shown in the table below.

ALLOWABLE LIMITS OF INFILTRATION OR EXFILTRATION

Sewer Diameter (in.)	Gals/Hr per 100 ft.	Sewer Diameter	Gals/Hr per 100 ft.
4	0.63	15	2.36
6	0.95	18	2.83
8	1.26	21	3.31
10	1.57	24	3.78
12	1.89		

3. Exfiltration Test

Each section of sanitary sewer shall be tested from manhole to manhole or dead-end. The tests shall be made by closing the lower end of the sewer to be tested and the inlet of the upper structure with plugs and filling the pipe and structure with water to a point four (4) feet above the invert of the open sewer in the upper manhole or dead-end. Where the difference in elevation of inverts of the lower and upper structures is more than 20 feet, an air test shall be used. Prior to the actual test, the sewer and manhole to be tested shall be allowed to saturate at the test head for a period to be determined by the District Engineer. the allowable leakage shall be 200 gallons per day per inch of inside diameter per mile of sewer. If the leakage disclosed by the test is greater than that allowed by the formula, the sewer main shall be repaired and if necessary, relaid until the joints shall hold satisfactorily under this test. All sewer mains will require testing unless otherwise directed by the District Engineer. The Contractor shall, at his own expense, furnish all materials and labor for making said tests, and the tests shall be made only in the presence of the District Engineer or his authorized representative.

4. Hydrostatic Test - Manholes

When the air pressure test is used for testing of the pipe and where required by the District Engineer, manholes shall be water tested separately. The inlet and outlet of the manhole shall be plugged and the cylindrical section of the manhole filled with water. The maximum allowable leakage rate per foot of depth tested shall be one (1) gallon per hours. The test shall run a minimum of thirty (30) minutes.

5. Air Test

Length of line tested at one time shall be limited to the length between adjacent structures.

Pressurize the test section to 4.0 psi and hold at 4.0 psi for not less than two minutes. Add air if necessary, to keep the pressure at 4.0 psi.

Disconnect air supply. When pressure decreases to 3.5 psi, start stopwatch. Determine the time in seconds that is required for the internal pressure to reach 2.5 psi. This time interval shall be greater than time given in the following table. The section of pipe shall not have passed if the time is less than shown.

Minimum Air Test Time

Sewer Diameter Minimum Time (min & sec) for 1.0 PSIG Pressure Drop for Length (Feet) of Sewer Shown

(in.)	<u>100</u>	<u>150</u>	<u>200</u>	<u>250</u>	<u>300</u>	<u>350</u>	<u>400</u>	<u>450</u>
4	0:18	0:27	0:36	0:45	0:53	1:02	1:11	1:20
6	0:40	1:00	1:20	1:40	2:00	2:20	2:40	3:00
8	1:11	1:47	2:22	2:58	3:34	4:09	4:44	5:20
10	1:51	2:47	3:42	4:38	4:43	5:11	5:56	6:40
12	2:40	4:00	5:20	5:40	5:40	6:14	7:07	8:00
15	4:10	6:15	7:05	7:05	7:05	7:18	8:20	9:23
18	6:00	8:30	8:30	8:30	8:30	8:30	9:37	10:49
21	8:11	9:55	9:55	9:55	9:55	10:24	11:54	13:23
24	10:41	11:20	11:20	11:20	11:20	12:28	14:14	16:00

When the prevailing ground water is above the sewer being tested, air pressure shall be increased 0.43 psi for each foot the water table is above the flow line of the sewer.

If the time for the pressure to drop 1.0 psi is not more than 125 percent of the time given in the table, the line shall immediately be repressurized to 4.0 psi and the test repeated.

If the test is not passed, the leak shall be found and repaired to the satisfaction of the District Engineer.

House sewers shall be considered part of the main sewer to which they are connected and no adjustment of test time shall be allowed to compensate, i.e. the length of four (4) and six (6) inch house sewers or laterals which are tested as part of the main sewer shall be ignored for determining minimum time.

The pressure gauge used shall be supplied by the Contractor; shall have minimum divisions of 0.10 psi, and shall have an accuracy of 0.04 psi. Accuracy and calibration of the gauge shall be certified by a reliable testing firm at six-month intervals, or when requested by the District Engineer.

When the air pressure test is used for testing of the pipe, the manholes shall be hydrostatically tested in accordance with 3-11-c (4).

d. Mandrel Test of PVC and ABS Pipe

Following the placement and densification of backfill and prior to the placing of permanent pavement, all main line PVC and ABS pipe shall be cleaned and then mandrelled. A rigid mandrel, with a circular cross section and a minimum of nine (9) longitudinal bars, having a minimum length of the circular portion equal to the nominal diameter of the pipe, shall be pulled through the pipe by hand. If the mandrel sticks in the pipe at any point, the pipe shall be replaced

and retested. The mandrel diameter shall be at least 95 percent of the specified average inside pipe diameter for PVC and ABS solid wall pipe and 96 percent for PVC and ABS composite pipe.

e. Compaction Tests

Compaction tests of the trench backfill is required approximately every 300 feet, or more often if tests indicate the need, along the alignment of the main pipeline, and, in addition, of approximately 20 percent of all laterals within the street right-of-way. The tests shall be made at varying depths. Final test results shall be submitted in the form of a test report by an approved soils testing laboratory. Any additional requirements of governing bodies having jurisdiction must be met. If the work is done under a permit, the Contractor shall obtain written confirmation that the work is acceptable to the governing body having jurisdiction.

SECTION 4
GUARANTEE

The applicant shall be virtue of a bond, satisfactory to the District, guarantee the completed work against repairs caused by defective workmanship or materials furnished and installed for a period of one year from the date of acceptance by the District of the Dedication of Sewers.

The applicant shall furnish to the District a satisfactory bond in the amount of 100 percent of the total installation cost, upon a form furnished by the District to guarantee the fulfillment of such obligation.