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**SPECIFICATIONS - DETAILED PROVISIONS**  
**Section 02769 - Furnish & Install High Density**  
**Polyethylene (HDPE) Sewer Pipe System**

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**SECTION 02769  
FURNISH & INSTALL HIGH DENSITY  
POLYETHYLENE (HDPE) SEWER PIPE 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 High Density Polyethylene (HDPE) larger diameter profile wall sewer for main line sewer construction. Use is limited to those projects which specify or indicate the use of (HDPE) as an alternate.

HDPE pipe may only be used where indicated on plans approved by the District. Where HDPE pipe is used, one type of pipe shall be used between consecutive manholes. No service laterals shall be directly connected to the sewer main.

**1.02 RECORDS**

A true and accurate record of all "as built" conditions shall be furnished to the Engineer prior to, or immediately upon, completion of the work.

**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.

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 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.

**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 terminal.
  2. Manholes will be measured on the basis of each manhole completely installed, including required stub-outs.
  3. Special Bedding. In addition to the bedding requirements of the District's standard drawing SB-157 and the drawing bedding details, if due to conditions not anticipated by soils report or shown on construction drawings and over excavation is ordered by the engineer, the 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.
  4. 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.
  5. 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, and 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 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, appurtenances, bore casing, excavation, backfill, imported select granular backfill, special bedding, cradles or encasements, 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. 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.
3. 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.
4. Bore Casing. Payment for bore casing in place measured as stated above shall be made as specified on the Bidding Sheets.
5. 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, but the minimum period will be one year from the date of the Notice-of-Acceptance.

## **PART 2 - PRODUCTS & MATERIALS**

### 2.01 MATERIALS FURNISHED BY CONTRACTOR

- A. Pipe & Fittings. The pipe and fittings shall conform to ASTM D-1248 and F 894 standard specification for polyethylene (PE) large diameter profile wall sewer and drain pipe and shall be nominal pipe classification as shown on the construction drawings.
- B. Manholes. Manholes shall conform to section 3.02 of this specification.
- C. Pipe Jointing shall be accomplished by gaskets bell and spigot in accordance with ASTM F 894 and the manufacturer's recommendations.
- 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. Manhole Connections. Manhole connections for cast-in-place, pre-cast, and polyethylene units for above and below ground water table shall be per manufacturer's recommendations. All pipe in/out of manholes shall be core-wall.

## **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 placed in the trench with any elongation oriented vertically. For pipe sizes larger than 36 inches in diameter, struts must be provided and installed per the manufacturer's recommendations. However, the struts shall not cause more than 1½% vertical elongation; in no case will horizontal elongation be permitted.

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 full length of standing water.

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 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. All bedding materials must be mechanically compacted/consolidated to a minimum of 90% standard proctor or as required by the Engineer.

Bedding shall be per the bedding details shown on the plans. Crushed rock to be placed in the pipe zone in equal lifts of one foot on both sides of the pipe. The bedding operation shall not cause the pipe to have a vertical elongation of more than 1½%.

If the Engineer determines that ground water will be encountered or that the ground water is anticipated to exceed the springline of the pipe during the service life of the line, the backfill material within the pipe zone shall be approved by the Engineer and be installed at no extra cost to the District.

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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.

B. Shoring, sheeting, or trench shields shall be utilized in such a manner as to minimize disturbance of the backfill material beneath the pipe crown. Trench sheeting that extends below the crown should either be left permanently in place or consist of adequately supported steel sheets 1" (one inch) thick or less which can be extracted with minimal disturbance to the pipe embedment. Where moveable trench shields are used, the following steps shall be followed unless an alternate technique that does not disturb the pipe embedment can be demonstrated:

1. Excavation of the trench below the elevation of the pipe crown shall be done from inside of the trench shield to prevent the accumulation of loose or sloughed material along the outside of the shield. Excavation of the trench ahead of the shield at an elevation below the pipe crown is not permitted unless approved by the Engineer.
2. After laying the pipe in the trench, bedding and pipe embedment shall be placed in lifts and the shield must be lifted in steps. As the shield is lifted, embedment material shall be shoveled under the shield so as to fill all voids left by the removal of the shield.

Backfill material placed under the pipe haunches shall be thoroughly shovel sliced along the length of the pipe.

Where compaction/consolidation of bedding and backfill materials is required, compact by mechanical means. Suitable mechanical means includes vibratory sleds, gasoline driven impact tampers, and air driven impact tampers or other approved means. Compact to a minimum of 90% Standard Proctor or as required by the Engineer.

Pipe shall not be subject to a roller or wheel loads until a minimum of one diameter or 36" (whichever is larger) of backfill has been placed over the top of the pipe and a hydrohammer shall not be used until a minimum depth of one diameter or 48" (whichever is larger) of backfill has been placed over the top of the pipe.

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 are acceptable when the following requirements and conditions are met:

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 1801, of said Orders for applicable requirements.

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.

Pipe alignment shall not deviate from that shown on the plans by more than two inches in 20 feet.

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.

### 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. Polyethylene units shall conform to ASTM D-1248 and the manufacturer's requirements. The bottom section shall be formed to accept the pipe sizes and configurations as shown on the plans. The bottom section shall be supported by a cast-in-place base that extends from the molded shelf to a minimum of 8 inches below the bottom of the base section and shall be held in place with No. 8 bend bars. The concrete base shall extend at least 12 inches outside of the bottom section of the manhole.

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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.

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 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

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 95.5% of the nominal inside diameter, shall be pulled through the pipe by hand.

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.

In addition to the deflection test described above, the contractor shall deflection test the first 300-400 feet of pipe after it has been backfilled to grade in order to verify that his installation and compaction procedures are adequate to meet the requirements of the content. No additional pipe shall be installed until this test has been successfully completed.

The District, at its discretion and at the contractor's expense, will in the eleventh month after project acceptance have the pipe deflections monitored and any deflections greater than six percent (6%) of the nominal inside diameter will require the contractor to return to the jobsite, excavate, and adjust the vertical deflection to 6% or less.

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 Engineer.

- A. Preparation for Tests. Each section of sewer 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 filling the pipe and manhole with water to a level of 2' above the soffit 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 line being tested in feet  
D = inside diameter of the pipe in inches  
H = difference in elevation (in feet) between the water surface in the upper manhole and the invert of the pipe in the lower manhole

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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 50 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.

**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. The closure will be made with a "closure coupling" as supplied by the manufacturer of type pipe used, or alternate welding of repairs as approved by the manufacturer.

**END OF SECTION 02769**

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