

## SECTION 02730

### SANITARY SEWERS

#### PART 1 – GENERAL

##### 1.01 WORK INCLUDED

- A. Trenching and other excavation.
- B. Ground water control.
- C. Pipe bedding.
- D. Installation of sanitary sewers and appurtenances.
- E. Backfill and compaction of backfill.
- F. Infiltration and leakage testing for gravity sewers.
- G. Hydrostatic and leakage testing for force mains.
- H. Dust alleviation and control.
- I. Cleanup and restoration of surface in improved areas.
- J. Supplying all labor, materials, equipment and apparatus not specifically mentioned herewith or noted on the plans, but which are incidental and necessary to complete the work specified.

##### 1.02 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the general designation only.
- B. American Society for Testing and Materials (ASTM) Publications:
  - A - 48 Gray Iron Castings.
  - A - 276 Standard Specifications for Stainless and Heat-Resisting Steel Bars and Shapes.
  - C - 478 Precast Reinforced Concrete Manhole Sections.
  - D - 1784 Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
  - D - 3034 Type PSM Poly (Vinylchloride) (PVC) Sewer Pipe and Fittings.
  - F - 477 Elastomeric Seals (Gaskets) for joining Plastic Pipe.

F - 679 Standard Specification for Poly (Vinyl Chloride) (PVC) large Diameter Plastic Gravity Sewer Pipe and fittings.

**C. American Water Works Association (AWWA) Publications:**

C - 110 Gray-Iron and Ductile-Iron Fittings 3" through 48" for Water and other Liquids.

C - 111 Rubber Gasket Joints for Ductile-Iron and Gray Iron Pressure Pipe and Fittings.

C - 900 Polyvinyl Chloride (PVC) Pressure Pipe, 4" through 12", for Water.

**1.03 QUALITY ASSURANCE**

**A.** Sanitary sewer gravity mains shall be subject to a ball test, infiltration and leakage tests. Sanitary sewer force mains shall be subject to air testing, and hydrostatic and leakage tests. In Bay Mud, sewers will be video inspected.

**B.** Class of pipe requirements shown or called for on the plans shall be the minimum acceptable.

**C.** Submit manufacturer's data on the pipe material, fittings and service material.

**D.** Construction practices for PVC pipe shall comply with Uni-Bell's "Handbook of PVC Pipe".

**E.** The Engineer may require manufacturer's certificates showing conformance with this specification with any shipment of materials to the job site.

**1.04 JOB CONDITIONS**

**A.** Note and conform with conditions and requirements indicated and specified under Section 02202 of these Specifications.

**B.** Contractor shall conduct operations and schedule cleanup in a manner to cause the least possible obstruction and inconvenience to traffic, pedestrians and to adjacent property owners or tenants.

**PART 2 - PRODUCTS**

**2.01 PIPE MATERIALS**

**A.** All PVC pipe and fittings for sanitary sewers and laterals shall conform to the requirements of ASTM D-3034 or ASTM F – 679 with SDR rating of 26. All the pipe and fittings shall be made of PVC plastic having a minimum cell classification of 12454-B as defined in specification ASTM D – 1784. The size of pipe shall be as designated on the plans and the size indicated shall be the internal clear diameter of the pipe. Individual pipe lengths shall not exceed

twenty (20) feet in length. All pipe shall be stenciled with the words "SANITARY SEWER" in 1-5/8" high block lettering with permanent ink. The words shall be repeated at 2-foot spacing along the pipe length.

- B. The Contractor may substitute pressure-sensitive tape in lieu of stenciling. Adhesive-backed Pipe Labeling Tape shall be PVC Plastic tape manufactured specifically for direct placement onto pipe, cable or conduit for warning and identification. Tape shall be a minimum of 2.2 mils, an adhesive strength of 26 psi, and with tensile strength of 32 lb. per inch of width. Tape shall be of the type provided in rolls, color coded for the utility involved with warning and identification imprinted in bold letters continuously and repeatedly over entire tape length. Code and letter coloring shall be permanent, unaffected by moisture or other substances contained in trench material.
- C. Joints shall be with either a factory provided, rubber gasketed coupling, or integral bell; couplings or bells shall have a solid rubber ring conforming to ASTM F-477, factory assembled and locked into place to prevent displacement during installation.
- D. Wye branches at the cleanout and the cleanout riser shall be PVC conforming to ASTM D-3034, DR 26.

## **2.02 ADDITIONAL REQUIREMENTS FOR FORCE MAINS**

- A. Pipe for sanitary sewer force mains shall conform to the requirements of AWWA C-900, Class 150, DR 18 pipe.
- B. Fittings for PVC sanitary sewer force mains shall be ductile iron castings conforming to the requirements of AWWA Standard C153 for two hundred (250) psi working pressure. Fittings shall be furnished with either push-on joints for use with pressure pipe or flanged joints as designated on the plans. Both push-on and flanged joints shall conform to the requirements of AWWA Standard C111 for cast-iron pressure pipe.
- C. Bolts, nuts, and washers for flanged fittings shall be stainless steel, ASTM A-276, Type 316.

## **2.03 SANITARY SEWER MANHOLES**

- A. Barrel and cone sections for sanitary sewer manholes shall be precast reinforced concrete of the form and dimensions shown and detailed on the plans and shall conform to the requirements of ASTM Designation C478. Concrete used for manhole barrel and cone sections shall conform to Section 02550 of these Specifications.
- B. Frames and covers for manholes shall be gray iron castings of the form and dimensions shown and detailed on the plans and shall conform to the requirements of ASTM Designation A48 for Class 30B castings. Frames and covers shall be match marked in sets which have been machined after fabrication to provide a firm and continuous seat. Each cover shall have cast into

it the raised letters "SANITARY SEWER." All castings shall be thoroughly cleaned and coated with commercial quality asphaltic varnish prior to delivery.

- C. Steps for manholes shall be polypropylene conforming to the form and dimensions shown and detailed on the plans.
- D. Concrete for manhole and cleanout bases shall be Class "A" conforming to the requirements of Section 02550 of these Specifications.
- E. Reinforcement for manhole and cleanout bases shall be deformed steel bars conforming to Section 02550 of these Specifications.
- F. Mortar for precast barrel and cone section joints shall consist of one (1) part Portland cement conforming to the requirements of Section 02550 of these Specifications, with two (2) parts of mortar sand by volume. Sand shall be well graded and of such size that all will pass a No. 8 sieve. Mortar materials shall be mixed to a consistency suitable for making joints on concrete pipe and all mortar shall be used within thirty (30) minutes after mixing water has been added. Admixtures shall not be added to mortar without the prior approval.
- G. PVC manhole adapters shall be as shown on the drawings.

#### **2.04 SANITARY SEWER CLEANOUTS**

- A. Wye branches and risers for sanitary sewer cleanouts shall conform to the City's Standard Details.
- B. Concrete boxes for cleanouts shall be Christy B-9 with B-9D lid, or equal; provide B9 - C traffic cover if located in vehicular areas.

#### **2.05 CONCRETE FOR THRUST BLOCKING FOR FORCE MAINS**

- A. Reinforcement for concrete thrust blocks shall conform to Section 02550 of these Specifications.
- B. Concrete for thrust blocks shall be Portland cement concrete conforming to the applicable requirements of Section 02550 of these Specifications.
- C. All exposed reinforcing bars required for thrust blocks and anchors shall be fusion epoxy coated conforming to Section 02661 of these Specifications, or stainless steel with equivalent load carrying capabilities as specified for deformed steel bars.

#### **2.06 PIPE BEDDING AND COVER MATERIAL**

- A. Shall conform to Section 02202 of these Specifications.

## **PART 3 - EXECUTION**

### **3.01 TRENCHING, BACKFILL AND SHORING**

- A. Shall conform to Section 02202 of these Specifications.

### **3.02 PIPE INSTALLATION**

- A. **Installation:** Pipe and appurtenances shall be installed in accordance with the best practice, and in conformance with the applicable requirements of the manufacturer's handbooks. Pipe laying shall start at the low end of each section and proceed up grade. All bell and spigot pipe shall be laid with the bell end up grade. All pipes shall be laid on a bed prepared by handwork, dug true to line and grade, to furnish a true and firm bearing for the pipe throughout its entire length. Adjustment of pipes to the line 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. Unless otherwise indicated or directed by the Engineer, pipe shall be laid continuously through manhole locations and any connections therein made by means of appropriate fittings to provide a smooth and continuous channel. 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. Each length of pipe shall be rotated so that the stenciled or taped words "SANITARY SEWER" will be located on the top of the pipe.
- B. **Handling:** Pipe shall be carefully handled during hauling, unloading, and placing operations, so as to avoid breakage or damage. Strap-type slings shall be used for lifting and placing; no chains or hooks will be permitted. Broken or damaged pipe or appurtenances will be rejected, and shall thereupon be removed from the work and replaced.
- C. **Alignment:** All pipe shall be accurately laid in conformity with the prescribed lines and grades as established by the Engineer. Each length shall be jointed to the preceding section as specified, and after said jointing has been completed, there shall be no movement of the pipe in subsequent operations.
- D. **Pipe Deflections:** The laying of pipe on curved alignment by means of un-symmetrical closure of joints, will be permitted only when necessary to conform to the alignment shown on the plans. Grade breaks indicated on the plans shall be accomplished by un-symmetrical closure of pipe and NOT by means of fittings. Joint deflections called for on the plans shall be permitted up to one-half of the deflections recommended by the pipe manufacturer.
- E. **Cleaning:** Before each new length of pipe is placed, the interior of the preceding pipe shall be carefully cleaned of all dirt and debris. When pipe laying is not in progress, all open pipe ends shall be satisfactorily closed with watertight plugs.
- F. **Bearing:** Pipe in the trench shall have continuous uniform bearing along its bottom, except at bell holes. Before lowering pipe into the trench, the Contractor shall remove all stakes, debris, loose rock and other hard material from the bottom of the trench.

- G. Positioning: After the final positioning, pipe shall be held in place in the trench with backfill material placed equally on both sides of the pipe at as many locations as required to hold the pipe section in place. After joints are completed, the backfill material shall be redistributed and compacted as herein required.
- H. Closure: At the end of each day and when work is not in progress, all open ends of pipe installed in the line shall be satisfactorily closed with watertight plugs.
- I. Thrust Blocking for Force Mains: Concrete thrust blocks of the form and dimensions shown or noted on the plans shall be provided at all changes in horizontal and vertical alignments and at such other points as may be called for on the plans. Thrust blocks shall be installed in strict conformance with the details shown or noted on the plans.

### **3.03 CONNECTIONS**

- A. Unless separately listed on the bid schedule, Contractor shall make all required connections to existing facilities and improvements at no additional cost, and compensation for such work shall be deemed as included in the price bid for pipe installation.
- B. All connections in manholes shall be constructed with concrete channels directed toward the outlet pipe as shown and detailed on the plans.
- C. Use PVC manhole adapters in break-out holes in manholes for connecting new PVC pipe and grout all around to prevent ground water infiltration. Pipes shall be cut off flush with the inside surface of the manhole.
- D. Use 2-foot nominal lengths of pipe when entering and leaving manholes and structures.

### **3.04 STRUCTURES**

- A. Structures and appurtenances shall be installed at the location and to the lines and dimensions shown on the plans and detail drawings, and as established by the Engineer. Structures shall be installed in conformance with the applicable requirements of Section 71-1.07 of the State Standard Specifications. Precast structures shall be accurately assembled with full mortar bed joints.
- B. Frames for manholes in paved areas shall be accurately placed flush with and in the plane of the finish pavement. Tops of structures in unpaved areas shall be constructed to the grades shown or called for on the plans and established by the Engineer. Manhole frames in new roadway subgrade shall be brought to finish pavement plane and grade immediately after paving operations. All manhole frames in paved areas shall be secured by means of concrete frame anchor slabs as shown and detailed on the plans and detail drawings.

### **3.05 LATERALS**

- A.** Unless otherwise noted on the plans, all sanitary sewer laterals shall terminate in a cleanout constructed to the form and dimensions shown and detailed on the plans and detail drawings.

### **3.06 CLEANING SANITARY SEWERS**

- A.** Contractor shall flush and clean all sewer mains by means of pneumatic, sewer cleaning balls. The balls shall be of the appropriate size to fit the sewer pipe being cleaned. "Sewer Balling" operations shall be conducted by experienced personnel under the observation of the Engineer. The ball shall be introduced at the uppermost manhole and passed from manhole to manhole by means of a line with sufficient head of water to carry the ball along. The movement of the ball shall be controlled by a rope; care shall be exercised not to feed the ball too rapidly in order that all debris can be removed at each manhole.
- B.** Each section of the sewer line shall be thoroughly cleaned before proceeding to the next section. Where sewer balls will not pass, flexible sewer rods with approved spears or cutters may be used to clear the obstruction. Where obstructions cannot be cleared by sewer rodding, the obstructions shall be removed by excavation at the Contractor's expense. The Contractor shall remove all debris from sewer lines using approved methods.
- C.** Installation cost shall include cost for water for sanitary sewer flushing and cleaning operations.

### **3.07 TESTING SANITARY SEWERS**

- A.** Sanitary sewer systems including laterals, and sanitary force mains shall be tested for tightness after completion of all backfilling and prior to request for final inspection. Contractor shall notify the Engineer at least two (2) working days in advance of proposed testing dates. Tests of gravity sewers shall be made from end or manhole to manhole unless grades are flat enough to permit testing two or more sections at one time. Sections which fail to pass the tests shall be repaired or replaced, and the section retested until it falls within specified allowances.
- B.** All water for sanitary sewer testing shall be provided and the tests performed by the Contractor in conformance with the following requirements:
  - 1. Mandrell Test
    - a. Pipes shall be tested for deflection by passing a mandrel through the pipe without obstruction.
    - b. The size of the mandrel shall be set at 92.5% of the base inside diameter of the pipe, as defined in ASTM 3034.

## 2. Water Leakage Test

- a. Preparation for Test: The sewer line to be tested shall be plugged at the downstream manhole. All openings in the upstream manhole shall be plugged except the downstream opening for the line to be tested. All branch sewers running from wye connections on the mains shall be plugged at their upper ends if the test head would cause them to overflow. The Test section shall then be filled with water and allowed to stand for at least thirty (30) minutes before test is started.
- b. Test Procedure: The water level in the upstream manhole or test tee shall be brought to a height approximately 4 feet above the crown of the open sewer at the upper end of the test section. The hydrostatic head in the test section shall be maintained so that no point in the section is the head less than four (4) feet or greater than 18 feet. In the case of a submerged section of line, the said head limitation shall be the difference between internal and external water levels. The test shall consist of measuring the loss of water during a one (1) hour period.
- e. Allowable Leakage: The allowable leakage in one (1) hour's time based on an average hydrostatic head of 4 feet for the entire test section, shall not exceed 0.4 gallons per inch of pipe diameter for each 500 feet of pipe.
- d. Manhole Leakage: Should an initial test show excessive leakage in a section of line, it is permissible to draw off the water 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.

## 3. Force Mains

- a. Preparation for Tests: The Contractor shall provide all necessary material and equipment, and shall perform all work required in connection with the testing of the force main system, as specified herein. Hydrostatic and leakage tests shall be made only after the trenches have been backfilled sufficiently to hold the pipe firmly in position. Hydrostatic tests for sewer force mains shall be made on all sections to a hydrostatic pressure of 150 psi. Excess pressure will not be permitted. Each section of pipe to be tested shall be slowly filled with water using care to expel all air. Water shall be allowed to stand in the pipe for 24 hours before test pressure is applied.
- b. Test Procedure: The required pressure as measured at the lowest elevation, shall be applied for not less than one hour. Any leakage discovered in consequence of the pressure test shall be corrected, and the test shall be repeated until satisfactorily completed. Any defective pipe, fittings, or valves, shall be repaired or replaced.

- c. Allowable Leakage: No section of force main will be accepted until the leakage is less than 15 U.S. gallons per 24 hours per mile of pipe per inch of internal pipe diameter.
- 4. Air Leakage Test - The Contractor, at his option, may substitute an air pressure test in lieu of the hydrostatic test specified above for gravity sewers.
  - a. The procedure shall be as described in Uni-Bell B-6-90, "Recommended Practice for Low Pressure Air Testing of Installed Sewer Pipe."
  - b. The procedure shall be to securely plug all openings in the section of the line to be tested, and apply an air pressure of approximately four (4) psi.
  - c. The elapsed time observed for a pressure drop of one (1) psi shall not be less than shown on Table I of Uni-Bell B-6.

**3.08 SPECIAL REQUIREMENTS FOR VIDEO INSPECTION IN BAY MUD**

- A. In lieu of a ball test, prior to acceptance of any sanitary sewer line, said line shall be inspected internally by television as outlined below.
- B. Defects such as high and low spots, joint separations, offset joints, chipped ends, cracked or damaged pipe, infiltration points and debris in lines shall be corrected to the satisfaction of the Engineer. For joint separations, low spots and chipped ends, the following maximum acceptable limits will apply for 6-10 inch pipes:

Joint separations	1/2 inch
Low spots	1 inch maximum depth
Chipped ends	1/4 inch

- C. For pipe larger than 10 inch, maximum limits will be specified by the Engineer for each project.
- D. The complete job is ready for television inspection when the following work has been completed:
  - 1. All sewers pipelines are installed and backfilled.
  - 2. All structures are in place, all channeling is complete and pipelines are accessible from structures.
  - 3. All other underground facilities, utility piping and conduits are installed.
  - 4. Final street grading is complete and ready for asphaltic concrete surfacing.
  - 5. Pipelines to be inspected have been preliminarily balled and flushed or cleaned by a high pressure cleaner.
  - 6. Final leakage test has been completed and approved.
  - 7. Flood and drain the sewer system just prior to video inspection.

- E. When the above work is completed, the Contractor shall arrange with the Engineer for the video inspection.
- F. The Contractor shall repair or replace failed sections as required by the Engineer.
- G. Those portions of the pipeline system that have been corrected must be re-televised.

**3.09 SANITARY SEWER PLUGS**

- A. All ends of sanitary sewers provided for future connection shall be plugged with material of the same joint characteristics as specified for the sanitary sewer main or lateral.

**3.10 CLEANUP**

- A. Upon completion of sanitary sewer construction operations, all lines, manholes, and other structures shall be thoroughly cleaned of dirt, rubbish, debris and obstructions of any kind to the satisfaction of the Engineer, and the entire work site shall be cleaned of all waste, rubbish, and construction debris of any nature.

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