SECTION 02530
SANITARY SEWER SYSTEM

PART 1 GENERAL

1.1 RELATED WORK

A. Section 02321: Trenching, Backfilling and Compacting.
B. Section 02950: Site Restoration and Rehabilitation.
C. Special Conditions for Water Discharge Management and Environmental Pollution Prevention

1.2 REFERENCES

B. American Society for Testing and Materials (ASTM) D3034: Type PSM Polyvinyl Chloride (PVC) Sewer Pipe and Fittings
D. California Department of Transportation (CDT): Standard Specifications: Sections 55, 65, 70, 71, 75 and 90.

1.3 SUBMITTALS
A. Provide manufacturers specification and literature for all materials furnished.

B. Contractor shall submit manufacturers' Certificates of Compliance for any materials furnished from suppliers not specifically listed in this specification or as shown on the contract drawings.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Handling: Pipe, fittings, precast concrete manhole sections, and cast iron frames and manhole covers shall be handled carefully at all times. Only suitable equipment and appliances shall be used for the safe loading, hauling, unloading, handling, and placing of materials. Special care shall be exercised so that the preformed resilient joints on pipe and fittings are not damaged.

PART 2 PRODUCTS

2.1 POLYVINYL CHLORIDE PIPE

A. General: Pipe shall be of domestic manufacture: JM Mfg. Co., PW Pipe, or CertainTeed Fluid-Tite; no substitutions.

B. Polyvinyl chloride (PVC) pipe up to and including 15 inches in diameter shall conform to ASTM D3034, SDR 26.

C. Polyvinyl chloride (PVC) pipe for diameters 18 through 21 inches shall conform to ASTM F679, wall thickness T-1.

D. Polyvinyl chloride (PVC) pipe for diameters 24 through 30 inches shall be conform to all applicable requirements of ASTM F794 and Uni-Bell Uni-B-9 for ribbed pipe.

E. PVC pipe shall be bell and spigot type. Bells shall be integral with pipe. Spigot end pipe with separate double hub couplings is not acceptable.

2.2 DUCTILE IRON PIPE

A. Ductile iron pipe (DIP): Pipe shall conform to AWWA C151, minimum pressure class 250. All ductile iron pipe shall be cement mortar lined in conformance with AWWA C104 and shall have a 1-mil thick exterior petroleum asphaltic coating. Pipe shall be of domestic manufacture; U.S. Pipe Tyton joint, Pacific States; no substitutions.
2.3 HIGH DENSITY POLYETHYLENE PIPE

A. High Density Polyethylene pipe (HDPE): Pipe shall be high-density polyethylene (HDPE) of the SDR rating shown on the project drawings in accordance with ASTM D3035 and ASTM F714-85. Fittings shall meet specification requirements for butt heat fusion polyethylene (pe) plastic fittings for polyethylene plastic pipe and tubing in accordance with ASTM D3261 and polyethylene plastic pipe and fitting materials per ASTM D3350. Elastomeric seals (gaskets) for joining plastic pipe shall be in accordance with ASTM F477. HDPE resin shall be PE 3408 resin characterized by ASTM D3350. The HDPE pipe shall be easily identifiable with a minimum of one stripe integrally extruded longitudinally in the exterior of the pipe wall and inner wall shall be white or light in color. Pipe and fittings shall be homogenous throughout and free of serious abrasion, cutting, or gouging of the outside surface extending to more than 10 percent of the wall thickness in depth, cracks, kinking, flattening, holes, blisters or other injurious effects. Pipe and fittings shall be uniform in color, opacity, density, and other physical properties. Any pipe and fittings not meeting these criteria shall be rejected and shall be replaced at the Contractor's expense.

B. Service Connections: Electrofusion service saddles shall be self-tapping and sealing.

2.4 MANHOLES

A. Manholes bases shall be pre-cast concrete of the size and shape shown on the drawings and shall conform to Sections 70-1.02H and 71-1.07 of the CDT Standard Specifications and to ASTM C478. Equivalent poured-in-place may be used at the Contractor's option.

B. Cast-in-place Manhole Bases: Type A concrete as specified in CDT Standard Specifications Section 90.

C. Manhole Barrel sections shall be pre-cast concrete of the size and shape shown on the drawings and shall conform to Sections 70-1.02H and 71-1.07 of the CDT Standard Specifications and to ASTM C478.

D. Frames and covers shall be cast iron conforming to Section 55-2.03 and 75-1.02 of the Caltrans Standard Specifications. Manhole covers shall have the words "SANITARY SEWER" in letters not less than two (2) inch high cast into the cover. The clear opening for all manhole covers shall be twenty-four (24) inch; Manhole frames and covers shall be Stanford University “Rosette” pattern as supplied by D&L Supply.
2.5 LATERALS

A. Sanitary sewer laterals shall conform to the requirements for polyvinyl chloride sewer pipe and polyethylene sewer pipe.

B. New laterals installed by open cut shall utilize pipes and fittings of the same material as the mainline pipe.

C. Laterals on existing VCP mainline pipes shall be PVC or HDPE.

D. Pipe and fittings shall be handled, joined and installed in accordance with the printed instructions and recommendations of the pipe manufacturer. Unless otherwise specified, pipe shall be laid straight between changes in alignment and at uniform grade between changes in grade. Pipe bedding shall provide uniform and continuous support of pipe barrel.

2.6 CLEANOUTS

A. Cleanout riser pipe shall match main line pipe material and be a minimum of 4-inch diameter.

B. Utility Box. A utility box shall be provided for all cleanouts shown on plans. Boxes shall be pre-cast concrete box with cover marked "SEWER" as detailed on the Plans; Christy Box B9 with B9XTL traffic cover or FL9X fiberlyte lid (non-traffic areas); no substitutions.

2.7 CONCRETE AND MORTAR

A. Portland Cement Concrete: Portland cement concrete for manhole bases shall conform to Section 90 of the CDT Standard Specifications.

1. The concrete shall be Class "A" containing six (6) sacks of Portland Cement per cubic yard of concrete.

2. The grading of the combined aggregate shall conform to the requirements of 1-1/2 inches maximum.

3. The consistency of the fresh concrete shall be such that the slump does not exceed four (4) inches.
4. The concrete shall have a minimum compressive strength of 3,000 PSI after twenty-eight (28) days and a minimum of six sacks of cement per cubic yard.

B. Mortar: Mortar shall conform to Section 65 of the CDT Standard Specifications.

PART 3 EXECUTION

3.1 TRENCHING, BACKFILLING, AND COMPACTING

A. Refer to Section 02321: Trenching, Backfilling, and Compacting.

3.2 PIPE INSTALLATION

A. Pipe Laying

1. Pipe laying shall proceed upgrade with the spigot ends of bell and spigot pipe pointing in the direction of flow.

2. Each piece shall be laid true to line and grade and in such a manner as to form a close concentric joint with the adjoining pipe and to prevent sudden offsets in the flow line.

3. Debris Control: The interior of the sewer pipe shall be kept clean of dirt and debris at all times. When work is not in progress, open ends of pipe and fittings shall be temporarily plugged.

B. Pipe Bursting

1. Prior to commencement of construction, the Contractor shall submit to the Owner a pipe bursting plan which shall minimally include launch and receiving pit locations and dimensions, shoring methods, dewatering methods, other utilities impacted, laydown areas and length and width of working areas. Pits shall be strategically located along the alignment of the pipe to be burst to minimize the quantity of pits, excavation and traffic disruption. The contractor shall prepare a pit location schematic illustrating the planned pit locations and schedule for pit excavation, backfilling and restoration. The duration that the pits are open shall be kept to a minimum. Pit locations shall consider locations of existing and proposed valves, hydrants, fittings, services, and isolating sections of the existing system to minimize service interruption to customers.

2. Existing utilities shall be potholed at locations at which they cross
the sanitary sewer line to be burst. Potholed utility mains shall be fully exposed during pipe bursting to create a six-inch minimum void space all around crossing main. The contractor is responsible for all costs resulting from damage to existing utilities during pipe bursting operations.

3. A description of construction procedures and sequence/schedule to bypass sewage flow, install pipe and reconnect sewer laterals shall be submitted prior to start of construction.

4. Service pits shall be required to install service connection fittings and reconnect services to the newly installed pipe.

5. Sections of polyethylene replacement pipe shall be assembled and joined on the job site above the ground. Joining shall be accomplished by the heating and butt-fusion method in strict conformance with the manufacturer’s printed instruction. The Butt-fusion method for pipe jointing shall be carried out in the field by certified operators with prior experience in fusing polyethylene pipe with similar equipment using proper jigs and tools per standard procedures outlines by the pipe manufacturers. These joints shall have a smooth, uniform, double rolled back bead made while applying the proper melt, pressure and alignment. It shall be the sole responsibility of the contractor to provide an acceptable butt-fusion joint. The contractor shall make all joints available for inspection before insertion. The replacement pipe shall be joined on the site in appropriate working lengths near the insertion pit.

6. Existing service connections shall be located before initiating sewer main replacement operations. Service laterals shall be reconnected to the new sewer line after replacement and before video inspection is complete. Any services remaining offline for an extended period of time, or any connections as deemed necessary by the Owner to protect the customer, shall be bypass pumped until such time that they can be reconnected. Connection of the new services to the new main shall be accomplished by use of electrofused HDPE self-tapping saddles. All piping, fittings, and accessories shall have a 100-psi minimum working pressure.

7. During replacement work residents must have limited service at all times during the construction. Limited service shall mean minimal use of toilets and sinks. The maximum period for limited services shall be four hours. The Contractor shall ensure that no property is subjected to any sewage back up. Any damage resulting from sewage backup into private properties due to the Contractor’s extending past the four-hour requirement will be the responsibility of the Contractor.

8. Post-Installation Video of Completed Sections: The Contractor shall provide the Owner a color video tape taken by a pan and tilt camera that pans 275 degrees and
rotates 360 degrees for close up view showing the completed work, including the condition of the restored service connections. This shall be paid for as part of lump sum for pipe bursting.

9. Surface materials to be removed for excavation purposes shall be replaced to the condition they were prior to excavation. Areas within Santa Clara County right of way shall be restored to pavement section required by Santa Clara County Roads and Airports. This shall be paid for as part of lump sum for pipe bursting.

3.3 FIELD QUALITY CONTROL

A. General

1. The Contractor shall furnish the necessary labor, equipment, and materials necessary to perform air tests of the completed sewerage project before the system is placed in operation or connected to other lines.

2. In no case shall the Contractor place the newly constructed sewer in operation without written approval of the Water Shop.

B. Air Test

All sanitary sewers shall be air tested in accordance with ASTM C 828 based on the procedure described below. Test shall be conducted between two consecutive manholes, as directed by the Water Shop Representative in the presence of the Contractor and the Water Shop Representative.

1. The test section of the sewer line shall be plugged at each end. One of the plugs shall be tapped and equipped with an air inlet connection for filling the line from an air compressor.

2. All service laterals, stubs, and fittings into the sewer test section shall be properly capped or plugged and carefully braced against the internal pressure to prevent air leakage by slippage and blowouts.

3. An air hose shall be connected to the tapped plug selected for the air inlet; the other end of the air hose shall then be connected to the portable air control equipment, which consists of valves and pressure gauges used to control the air entry rate to the sewer test section, as well as to monitor the air pressure in the pipeline. More specifically, the air control equipment includes a shutoff valve, pressure regulating valve, pressure reduction valve, and a monitoring pressure gauge having a pressure range from 0-5 PSI. The gauge shall have minimum divisions of 0.10 PSI and an accuracy of \( \pm 0.04 \) PSI.

4. Another air hose shall be connected between the air compressor (or other source of compressed air) and the air control equipment. This completes the test equipment setup; test operations may then commence.
5. Air shall be supplied to the test section slowly, filling the pipeline until a constant pressure of 3.5 PSIG is maintained. The air pressure shall be regulated to prevent the pressure inside the pipe from exceeding 5.0 PSIG.

6. When constant pressure of 3.5 PSIG is reached, the air supply shall be throttled to maintain the internal pressure above 3.0 PSIG for at least five (5) minutes. This time permits the temperature of the entering air to equalize with the temperature of the pipe wall. During this stabilization period it is advisable to check all capped and plugged fittings with a soap solution to detect any leakage at these connections. If leakage is detected at any cap or plug, pressure in the line shall be released and all leaky caps and plugs tightened. The test operation may then be started again by supplying air. When it is necessary to bleed off the air to tighten or repair a faulty plug, a new five (5) minute interval shall be allowed after the pipeline has been refilled.

7. After the stabilization period, the air pressure shall be adjusted to 3.5 PSIG and the air supply shut off or disconnected. The gauge shall be observed until the air pressure reaches 3.0 PSIG. At 3.0 PSIG, timing shall commence with a stopwatch that is allowed to run until the line pressure drops to 2.5 PSIG, at which time the stopwatch shall be stopped. The time required, as shown on the stopwatch, for a pressure loss of 0.5 PSIG is used to compute the air loss. Most authorities consider it unnecessary to determine the air temperature inside the pipeline and the barometric pressure at the time of the test.

8. If the time in minutes and seconds for the air pressure to drop from 3.0 to 2.5 PSIG is greater than that shown in the following table for the designated pipe size, the section undergoing the test shall have passed and shall be presumed to be free of defects. The test may be discontinued at that time.

9. If the time in minutes and seconds for the 0.5 PSIG drop is less than that shown in the following table for the designated pipe size, the section of pipe shall not have passed the test; therefore, adequate repairs shall be made and the line retested.

10. Time Requirements for Air Testing:

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11. For larger diameter pipe use the following:
Minimum time in seconds = 462 x pipe diameter (in feet)
12. For eight (8) inch and smaller pipe only: If, during the five-minute saturation period, pressure drops less than 0.5 PSIG after the initial pressurization and air is not added, the test may be stopped.

13. Multiple pipe sizes: When the sewer line undergoing the test is eight (8) inch or larger diameter pipe and includes four (4) inch or six (6) inch laterals, the figures in the Table for uniform sewer main sizes will not give reliable or accurate criteria for the test. Where multiple pipe sizes are to undergo the air test, the engineer can compute the "average" size in inches, which is then multiplied by 38.2 seconds. The results will give the minimum time in seconds acceptable for a pressure drop of 0.5 PSIG for the "average" diameter pipe.

14. Adjustment required for ground water: An air pressure correction is required when the prevailing ground water is above the sewer line being tested. Under this condition, the air test pressure shall be increased 0.433 PSI for each foot the ground water level is above the invert of the pipe.

3.4 DEFLECTION TEST

A. General

1. Deflection testing shall be performed on all portions of the sewer system. This test shall be performed in sections between manholes after 30 days but not more than 90 days after installation.

2. Deflection testing shall be performed in accordance with the procedure outlined below and any section not meeting the minimum requirements for deflection shall be excavated and repaired at the Contractors expense.

B. Maximum Deflection

1. The maximum allowable deflection shall not exceed 5% of the pipe’s original diameter.

C. Testing Apparatus

1. Deflection testing shall be performed with a go, no-go mandrel which is sized to 95% of the line diameter.

D. Deflection Testing Procedure

1. Completely flush the line.

2. During the final flushing of the line, attach a floating block or ball to the end of the mandrel pull rope and float the rope through the line.

3. Connect a retrieval rope to the back of the mandrel, place mandrel in pipe entrance and remove all slack in rope.

4. Draw mandrel through sewer line. If any irregularities or obstructions are encountered in the line, corrective action shall be taken as required.
5. If a section of excessive deflection is found, it shall be located and excavated. The pipe shall be inspected for damage, if any damage is found it shall be replaced at the Contractors expense. If pipe is not damaged replace and backfill the section of sewer in accordance with these specifications.

6. Re-test this section of sewer line for deflection.

3.5 SURFACE RESTORATION

A. Refer to Section 02950: Site Restoration and Rehabilitation

3.6 FLUSHING CLEANING AND VIDEO INSPECTION

A. General

1. After all backfilling and pavement restoring operations have been completed, the Contractor shall flush, clean and perform a video inspection of all new sanitary sewer lines, including service laterals, under the supervision of the Water Shop's representative.

2. During the flushing and cleaning operation, a wire screen with a 1/4 inch mesh or smaller shall be placed over the downstream outlet of the lower manhole to prevent any debris from being washed into the existing sewer system.

3.7 GRADE ADJUSTMENTS TO SURFACE STRUCTURES

A. Frames, Grates, and Covers

1. Frames, grates, and covers of all surface structures (manholes, clean outs, etc.) shall be adjusted to within 1/8” +/- of proposed finish grade. Grade rings shall be supplied and installed as required.

2. Frames of new or adjusted surface structures shall be supported by concrete with minimum dimensions as follows: 12 inches wide by 10 inches deep in paved areas, and 6 inches wide by 10 inches deep in un-paved areas.

B. Structures Within Paved Areas

1. A structure located in an area resurfaced with asphalt concrete shall not be constructed to final grade until the adjacent pavement or surfacing has been compacted.
2. The Contractor shall be responsible for referencing structures prior to paving and locating them after paving operations are complete.

3. After asphalt concrete resurfacing is complete, the asphalt shall be cut out six inches (6") wider than the frames of all surface structures. Each frame shall then be raised to finished grade (sloped as necessary) and concrete shall be placed to approximately 1-1/2 inches below finish grade as noted above. After concrete collar has cured, a tack coat shall be applied and asphalitic concrete placed to finish grade. (See related Stanford Standard Detail Drawings)

END OF SECTION