

## SECTION VI

### SANITARY SEWERS

#### **VI-1. DESIGN STANDARDS**

Sewer collection lines and appurtenant structures within the jurisdiction of City of Paso Robles shall be constructed by a California A-Licensed Contractor in accordance with plans prepared by a Professional Civil Engineer, consistent with these specifications and as approved by the City Engineer.

##### **A. Design Flow**

An average flow of 220 gallons per dwelling unit per day, based on the 2019 Wastewater Master Plan, for residential developments shall be used for sewer system design. Peak flow flowrates shall be double the average flowrate used. Sewer Pipes shall be sized to handle peak flows with pipe flowing half full.

##### **B. Sewer Pipe Sizing**

Sizing of sewer pipes must include consideration of the ultimate upstream development in accordance with density established in the Land Use Element of the General Plan, the City's latest Wastewater Collection System Master Plan, or as determined by the City Engineer.

The minimum size sewer pipe shall be eight (8) inches inside diameter. Six-inch diameter pipe may be used on terminal branch lines, less than 200 feet in length, but must be approved by the City Engineer through the design exception process outlined in Section II.

##### **C. Gradient**

The following table indicates the minimum slopes acceptable for the design of sewer pipes in the City of Paso Robles. Lesser slopes may be approved by the City Engineer where topographic features preclude the use of the table below. It is not acceptable practice to increase pipe sizes for the purpose of reducing the slope criteria to meet minimum standards without regard to the volume of flow. Scouring velocity must be maintained. See minimum pipe slopes below.

<u>Diameter</u>	<u>Slope in Feet/Foot (Minimum Acceptable)</u>
4"	0.02 (Private Residential Laterals Only)
6"	0.010 (Special Permission or Commercial/Industrial laterals)
8"	0.0050
10"	0.0025
12"	0.0020
>12"	Refer to Table 4-1, 2019 Wastewater Master Plan

Special provisions for erosion protection shall be provided where design velocities for sanitary sewer pipelines exceed ten feet per second at average daily flow. Where sufficient flow exists, design velocities must equal or exceed two feet per second. The maximum design discharge rate shall not exceed the critical flow rate. Sanitary sewer pipe must not be designed for flow conditions at critical slope and velocity.

To assist in the protection of health and property, a backflow valve or overflow device shall be installed in the sewer serving any building where the lowest floor elevation (containing plumbing fixtures) will be less than one foot above the rim of the upstream manhole or flushing inlet.

When an overflow device is installed, the elevation of discharge of said installation shall be at least one foot below the lowest floor elevation containing a plumbing fixture system, building sewer or sewer lateral and may include a back-up check valve wherever and whenever the city may deem advisable.

#### **D. Location**

All sanitary sewer mains must be located in public streets. In new streets the sewer main shall be typically located six feet south or east of the centerline of the right-of-way.

A sewer main may be located in an easement specifically dedicated to the City for the purposes of construction, operation and maintenance of a sanitary sewer main when a public road is not available. The minimum width of the easement shall be 20 feet. A minimum 12-foot wide all weather aggregate base access road must be provided in the easement. The access road shall be designed to support 60,000 lbs.

No sanitary sewer shall be located within fifty feet of a City owned water well. Pressure and gravity sewers shall be separated as shown on **Standard Detail U-1**.

Sanitary sewer design must conform to special construction requirements as outlined by the California State Water Resources Control Board's "*Separation of Water Mains and Non-potable Pipelines – Requests for Alternatives to the Waterworks Standards*" memo. A State waiver is required when sewer mains are or will be constructed closer than ten feet parallel to a water line or service, crossing above water lines and water appurtenances, do not meet other City minimum separation requirement, or any other special situation as determined by the City Engineer or Utility Director. Replacement of sewer laterals that do not meet the State and City's separation requirements are subject to the requirements of the aforementioned memo.

## **E. Horizontal Alignment**

Sewer pipelines shall typically be designed in straight alignments between manholes. Curved sewer lines will be allowed where the minimum radius conforms to the pipe manufacturers recommendations. In no case shall the radius be less than 200 feet.

The alignment between any two manholes may consist of one curve and one tangent section. A manhole must be placed at the beginning or end of any curve. Reverse curves are not allowed between manholes.

## **F. Depth**

The minimum design depth of a sanitary sewer system shall be six (6) feet to top of pipe. It is desirable to obtain a cover of four (4) feet for the service lateral at the property line. Under topographic constraints, lesser depths may be approved by the City Engineer through the Design Exception process. See Section II. The maximum depth of any sewer line shall be sixteen (16) feet. The City Engineer may approve deeper sewers on a case-by-case basis through the design exception process. However, sewers deeper than sixteen (16) feet will generally not be approved if solely proposed to allow gravity flow from residences. Onsite pumps must be used when gravity flow is not possible with standard design.

## **G. Manholes**

Maximum spacing for manholes shall be 500 feet, except when approved by the City Engineer on a case by case basis. Manholes shall be designed and constructed in accordance with **Standard Detail F-1**.

Drop manholes may be constructed in accordance with **Standard Detail F-2** where the vertical distance between incoming and discharge sides of the manhole exceeds 24 inches.

Where a sewer pipe flows straight through a manhole, the difference in elevation between the inverts of the inlet pipe and outlet pipe shall be no less than 0.1 foot. Where the sewage flow makes a ninety (90) degree turn within the manhole, the difference in elevation between the inverts of the inlet pipe and outlet pipe shall be no less than 0.2 feet.

## **H. Sewer Clean-out**

A clean-out may be used in lieu of a manhole on any branch line with a length of 200 feet or less in residential areas. Cleanouts on branch lines serving commercial or industrial areas will be allowed only on approval of the City Engineer. Any branch line more than 200 feet in length shall have a manhole at the end.

## I. Private Laterals

Each private property shall have its own separate and distinct sanitary sewer lateral connection to the City main. All sewer laterals must be connected downstream of a sewer manhole or sewer clean-out. In no case shall a sewer lateral be connected directly to a sewer manhole.

In all new subdivision work, the house service laterals from the sewer to the property line shall be installed at the time the sewer is constructed. Each house service line shall be referenced to the plan stationing. The lateral shall be placed a minimum of five (5) feet from any property line and ten (10) feet from any water service. A "S" symbol shall be stamped into the curb at the lateral's location.

The minimum size of a **residential lateral** shall be **four (4) inches** inside diameter. Laterals larger than four inches shall be sized in accordance with Uniform Plumbing Code requirements.

All **commercial laterals** shall be a minimum of **six (6) inches** inside diameter. Laterals greater than six inches shall be connected to the main with a manhole.

When existing sewer laterals are replaced, if the lateral crosses a City water line, the crossing location must be potholed to determine the vertical separation between the lateral pipe and water pipe before any further excavation or trenchless work is completed. The City Engineer must be notified at least 48-hours prior to the potholing and the City Engineering Inspector must observe the open pothole. If the sewer lateral crossing the water line has less than 12 inches of vertical separation from the water pipe (outer wall to outer wall), trenchless installation methods such as pipe reaming may not be permitted and/or special construction may be required to meet State Water Resources Control Board requirements.

## J. Sewage Lift Stations and Force Mains

Sewage lift stations are discouraged and will only be allowed by permission of the City Engineer if no feasible alternative is available. If the proposed design of a new or expanded sanitary sewer system includes a sewage lift station and force main, the following data shall be submitted for review and tentative approval before plans are submitted:

1. Documentation showing that a gravity sewer extension is not feasible or has a higher life-cycle cost than a sewage lift station. Analysis of the life-cycle cost of the sewage lift station shall include the cost of all manpower, electricity, and other inputs required to operate and maintain the lift station for perpetuity.
2. Average and peak wastewater flows anticipated to and through the lift station. Lift stations shall be sized to be compatible with ultimate development in the sewer tributary area. The submittal shall include calculations of the wet well

size, pump size, force main diameter, and velocity of flow in the force main pipe.

3. Plot plan showing the dimensions of the lift station site and its location with respect to homes or other structures. Minimum distance from a lift station to any residence shall be fifty (50) feet.

If based on the above information the City Engineer determines a sewage lift station is permissible, the design of the lift station must meet all the requirements outlined below. These requirements apply regardless of whether the lift station will be dedicated to the City or will be privately owned, operated, and maintained. Project Engineers may propose design exceptions through the Design Exception process outlined in Section II. Design exceptions for convenience, package lift stations, or material shortages will not likely be granted.

1. The capacity of the wet-well shall have a minimum two-hour peak flow storage capacity.
2. The wet-well shall be constructed of polymer concrete such as Armorock to be resistant to damage by sewer gas.
3. If a new project or subdivision is phased such that sizing of the wet well results in sewage being held in the wet well for more than eight hours between pump cycles, the lift station shall include features to control septicity and/or release of odorous sewer gas.
4. A minimum of two active pumps are required for redundancy and peak flow capacity.
5. Pumps must have screw-type impellers capable of passing rags, such as Hidrostal, ShinMaywa, or approved equal.
6. Pump rails and discharge piping within the wet well must be constructed of Type 316 or better stainless steel to resist damage by sewer gas. The lift station hatch shall consist of Type 316 stainless construction or better.
7. Each discharge pipe shall be equipped with a check valve and gate valves. These valves and all transition piping from the discharge piping to the force main pipe shall be contained in a concrete vault separate from the lift station wet well. This vault shall also contain an extra pipe with valves and a camlock fitting to facilitate a temporary pumping system if a future bypass of the wet well or pumps should become necessary.
8. Pumps and force main piping must be sized to achieve a minimum cleaning velocity of two feet per second and maximum flow velocity of 10 feet per second.

9. Force main pipe material shall be either C-900 PVC with restrained joints, fused HDPE, or an equal material approved by the City Engineer.
10. The manhole at the discharge end of the force main must be constructed of polymer concrete such as Armorock.
11. The lift station must include a control and alarm system of a type and quality that will easily integrate into the City-wide radio telemetry network (SCADA) or the private operator's equivalent system. The control and alarm system must be equipped with a battery-powered uninterruptible power supply. The system shall be housed in a stainless-steel enclosure with a small air conditioner or other provisions to protect all electronics from excessive heat.
12. The lift station shall be equipped with a permanent standby generator and automatic transfer switch. The generator shall have enough capacity to power both pumps operating simultaneously. The generator shall be fueled by natural gas. Propane may be approved if a natural gas supply is not available.
13. The lift station must have a water service (spigot) to facilitate wet well maintenance. The water service shall be equipped with a backflow prevention device.
14. The lift station may not include any bypasses that would allow wastewater to enter any drainageway, stream or watercourse.
15. Private lift stations will be required to have a funding and maintenance agreement to address long-term operation and demonstrate that contracts or other mechanisms are in place for ongoing operation and maintenance.

## **VI-2. MATERIALS**

### **A. Pipe**

All sanitary sewer PVC pipe must meet ASTM Standard 3034/SDR 35 for typical open-trench-installation. Sewers deeper than twelve (12) feet below ground surface must be pressure-rated (Class 165) green C900 PVC pipe. For trenchless sewers, C900 PVC pipe with Certa-Lok restraints, or City Engineer approved equivalent, shall be used. Insulated solid core, green, AWG 12 locator wire must be installed and securely taped to the top of all new force main pipes and curved gravity sewer pipes and terminated at inside surface of manhole, near top of manway.. All locator wire connections are to be made with water/weather tight connectors. Gravity and pressure sewers shall be completely colored green to distinguish the sewer pipe from other utility pipes and conduits.

## **B. Manholes**

Manholes shall be watertight structures constructed by placing precast concrete sections on a pre-cast concrete base. Minimum manhole diameter for sewers less than 16 feet deep or 12 inch in diameter is forty-eight (48) inches. Sewers over 16 feet deep or for sewer pipe 12 inches diameter and larger require sixty (60) inch manholes. Sewers deeper than sixteen (16) feet must be approved through the design exception process outlined in Section II.

Where force mains discharge into a manhole, the pre-cast manhole sections must be made of polymer concrete (Armorock or approved equal), to resist damage by corrosive sewer gases. Minimum manhole size for these applications is sixty (60) inches. Force mains must discharge into one twenty (20) foot long stick of gravity sewer pipe leading into the manhole, so that turbulence is reduced prior to the flow reaching the manhole.

## **VI-3. CONSTRUCTION STANDARDS**

### **A. Excavation for Sewers**

Unless otherwise specified, the excavation for sewer pipe shall be an open trench, excavated to six inches below the bottom of the pipe. This undercutting shall be refilled with suitable bedding material as specified in VI-3.D, below.

Whenever the bottom of the trench is soft, yielding, or unsuitable as a foundation for the pipe, sufficient crushed rock or coarse, clean gravel shall be rammed into the soft material until in the opinion of the observing Geotechnical Engineer, a suitable bottom condition is achieved. If such treatment does not provide a proper bottom condition, the unsuitable material shall be removed and the Geotechnical Engineer shall provide an alternative design..

When groundwater is encountered, the trench shall be kept dewatered until the laying and jointing of the pipe and placing of the bedding material has been completed and observed by the City inspector. The Contractor shall place not less than six inches of 2-1/2" maximum size rock below the required bedding material, or otherwise de-water the trench in a manner which has received prior approval of the Engineer.

Temporary covers of 3/8" steel plate of sufficient size to adequately cover the opening shall be placed on manhole cones until the pavement is completed. Ribs shall be welded to the underside of the cover to hold it in place during the grading and paving operations.

The total depth of the manhole throat measured from the top of the frame shall not exceed eighteen (18) inches. Manhole frames and lids shall be placed a minimum of

12" above natural ground or high water when placed in easements outside of unpaved or easement road areas.

## **B. Safety**

All safety orders, rules, or recommendations of the Occupational Safety and Health Administration (OSHA) and the Division of Industrial Safety of the Department of Industrial Relations of the State of California, applicable to this work, shall be obeyed and enforced.

The Contractor shall conform to the permit requirements of the Division of Industrial Safety and Division of Occupational Safety and Health and shall obtain a trenching permit directly from said State Office prior to such activity. A copy of the State trenching permit shall be available onsite and shall be made available to the City Engineer upon request.

The Contractor's attention is directed to the provisions of the State Labor Code concerning trench excavation safety plans. (Note: Contractors are hereby advised that the independent monitoring regulations of OSHA, as enforced by CAL OSHA officers, is to be complied with at all times).

## **C. Bracing and Shoring**

Adequate bracing and shoring, as required by the Division of Industrial Safety of the State of California, to protect personnel, adjacent property, and roadway areas shall be used. Any damage to structures occurring through settlement, water or earth pressure, slides, caves, or other causes due to failure or lack of sheeting or bracing or improper bracing, or through negligence or fault in any other manner, shall be repaired immediately to the approval of the City Engineer. Where practical, all such bracing and shoring shall be removed from the trench as the backfilling proceeds.

## **D. Laying of Sewer Pipe**

Pipe shall be laid in conformity to the lines and grades established on the approved plans. Pipe shall be laid continuously upgrade with the bell of the pipe opposite the direction of flow. Each length of pipe shall be laid on a firm bed and shall have a true bearing for the entire length. No wedging or blocking up of the pipe will be permitted.

Both bell and spigot shall be clean and lubricated before the joint is made. Care shall be taken that nothing, but the joint-making material enters the joints. At the end of each workday the end of the pipe must be sealed to preclude infiltration of water, dirt or debris.

## **E. Trench Backfill**

Bedding material meeting the minimum standards listed below, shall be deposited and compacted to 90% relative compaction in the trench uniformly on both sides of the



pipe for the full width of the trench and to a depth of 12 inches over the top of the pipe (**Standard Detail U-2**).

Sand Equivalent      20

<u>Sieve Size</u>	<u>Percentage Passing Sieve</u>
1"	100
No. 4	80-100
No. 200	0-15

The balance of the backfill shall contain no rock or boulders in excess of two (2) inches and shall be free from all deleterious matter. Backfill shall be compacted to a minimum relative compaction of 90%. The top eighteen (18) inches shall be brought to 95% compaction. The backfill under and around all pipes shall be thoroughly consolidated before any additional material is placed. Compaction methods must be carried out, so no damage or displacement of the pipe occurs. Around circular manhole sections, small tools such as "jumping jack" type compactors shall be used to carefully compact the soil immediately around the manhole. A soils engineer shall confirm adequate compaction around all manholes.

#### **F. Connection to Existing Manholes**

Connection to existing manholes shall be made by carefully core-drilling an opening in the wall of the manhole. The pipe shall be inserted with elastomeric ring-seal through the opening flush with the inside wall. The opening around the pipe shall be packed with a stiff mix of cement mortar, thoroughly compacted to form a watertight connection. The mortar shall be finished smooth and flush with the interior surface of the manhole. Channelizing of the flow through the manhole shall conform to the details shown on the standard Drawings for new manholes. Where chipping out of existing manhole base is required to accommodate a new sewer penetration, Contractor shall ensure debris is properly managed and disposed of, and under no circumstances shall debris flow into the existing sewer pipe.

The Contractor shall notify the City Engineer 72-hours in advance before any connection is made to existing structures. Work shall be scheduled so that interruption of flow is held to a minimum.

#### **VI-4. TESTING**

Prior to acceptance all sewer lines shall be cleaned, tested for leakage by a standard low-pressure air or water test, tested for deflection with a mandrel, and inspected by video. All testing shall be performed after all backfill and compaction procedures are complete and prior to street paving.

Leakage test is by internal air pressure or water. Infiltration test is by measurement of rate of flow of water. Each section of pipe between manholes, along with the manholes, shall

be tested. Use the air test where the difference in elevation between the invert of the upper structure and the invert of the lower structure is more than 10 feet.

Testing procedures shall be as outlined below:

**A. Air Test Procedure**

Each section of sanitary sewer between two successive manholes shall be tested by plugging all pipe outlets with inflatable and expandable test plugs. Pressure-relief valves shall be set to limit the internal pipe test pressure to five pounds per square inch gauge pressure (5 psig). Air shall be slowly added until the internal pressure is raised to 4.0 psig. Care shall be taken to guard against the sudden expulsion of a poorly installed plug or a plug that is partially deflated.

The internal pressure of 4 psig shall be maintained for at least two minutes to allow the air temperature to stabilize after which the air supply shall be disconnected and the pressure allowed to decrease to 3.5 psig. The Table below provides the minimum time requirements for a pressure drop to occur from 3.5 psig to 3.0 psig.

Should the test disclose an air loss rate greater than permitted, the contractor shall, at his own expense, locate and repair the defective joints or pipe sections. After the repairs are completed, the line shall be retested until the air loss rate is less than specified below.

**Timetable:**

<u>Pipe Size</u>	<u>Time</u>
6"	4 minutes
8"	5 minutes
10"	6 minutes 30 seconds
12"	7 minutes 30 seconds

**B. Water Test Procedure**

Test each section of pipe between two successive structures by closing the lower end of the pipe to be tested and the inlet pipe of the upper structure with plugs or stoppers. Fill the pipe and structure with water to a point 4 feet above the invert of the open pipe in the upper structure or to a height of 10 feet above the invert of the sewer in the lower structure, whichever gives the least hydrostatic pressure on the lower structure. The total leakage shall be the decrease in volume of water in the upper structure. The leakage shall not exceed 0.025 gpm per inch of nominal diameter of pipe per 1,000 feet of pipe being tested.

If the leakage is greater than allowed, overhaul the pipe and, if necessary, replace and re-lay until the joints and pipe comply with this test. All tests and any required repairs must be completed before the street over the trench is paved.

### **C. Test for Infiltration**

If, in the construction of a section of the sewer between structures, excessive groundwater is encountered, close the end of the pipe at the upper structure sufficiently to prevent the entrance of water. Discontinue pumping groundwater for at least three days. Then test the section for infiltration. The infiltration shall not exceed 0.025 gpm per inch of diameter per 1,000 feet of main line pipe being tested.

Where infiltration exceeds the maximum acceptable, immediately uncover the pipe and reduce the infiltration to within the maximum acceptable by replacing, re-laying, or encasing the pipe in concrete.

### **D. Test Procedure - Force mains**

See test procedures for water mains **Section VII-4.**

### **E. Test Procedure – Manholes**

Watertightness of manholes may be tested in connection with hydrostatic tests of the pipeline or at the time the manhole is completed and backfilled.

Fill the manhole with water to an elevation 1 foot below the bottom of the cone section with a maximum water depth of 20 feet. Plug inlets and outlets with stoppers or plugs and fill the manhole to the limits indicated above. The maximum allowable drop in the water surface shall be 1/2 inch for each 15-minute period of testing.

Even though the infiltration is less than the maximum acceptable, stop any individual leaks that may be observed.

### **F. Cleaning**

The contractor shall clean all lines with a Wayne-type sewer cleaning ball under hydrostatic pressure and shall apply a mandrel to test for deformation. The mandrel shall be the 9-vane design and sized to 95% of the nominal internal diameter of the pipe. Replace and re-lay until the pipe complies with the mandrel test.

### **G. Video**

All new sewer main installations must be inspected by video by the City's Wastewater Division staff prior to acceptance by the City. Inspections may be scheduled by contacting the Wastewater Collections Supervisor at (805) 227-7200 ext. 6701. The video inspection will be used to check for any defects such as debris in the pipe and manholes, pipe deflection, offset joints, or damaged pipe. All defects will be documented and must be corrected prior to City acceptance and use.

### **H. Placement and/or Replacement of Road Surfaces**

Trench paving shall conform to **Standard Detail U-2.** New street paving shall conform to Section IV of these specifications.

All testing procedures outlined above must be completed prior to pavement replacement or new street paving. After street paving, all manholes shall be raised to grade and concrete collars shall be installed in accordance with **Standard Detail F-3**. The concrete collar shall be stamped to show flow direction of sewer lines connected to the manhole. Prior to acceptance of new sewer lines, the lines shall be thoroughly cleaned once again.