

CITY OF LATHROP

Department of Public Works

*Design & Construction
Standards
Section 5 Sewer System
Standards*

July 2024



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SECTION 5 SEWER SYSTEM STANDARDS

PURPOSE

These Standards are intended to establish the minimum standards for any sewer facility or sewer system in the City that meets any one or more of the following conditions:

- A. The system is or will be in City right-of-way or other public easement.
- B. The proposed system provides, or will provide, sanitary sewers, sewer pump stations, sewage treatment plants and sewer systems to any land development project subject to approval of the City Council, Planning Commission, or Public Works Department.

5-2 DEFINITIONS

See Section 1.2 – DEFINITIONS.

5-3 GENERAL REQUIREMENTS

The design and construction of sewer systems, sewer pump stations, and sewage treatment plants in the City subject to control or permit requirements of the City, shall be in accordance with these minimum design standards. The work shall comply with these standards, except where specific modifications have been approved by the City Engineer in writing.

- A. Plumbing Code: All work on house laterals, house sewers and building sewers that are outside of public right-of-ways or sewer easements will be governed by the provisions of the Uniform Plumbing Code as amended by these Standards and other applicable ordinances of the City.
- B. Other Standards: Where these Standards do not cover a subject fully, subject to approval by the City Engineer, additional references (latest edition) which may be used, include but not necessarily limited to the following:
 1. “Design and Construction of Sanitary and Storm Sewers” (ASCE Manual of Engineering Practice No. 37 or Water Environment Federation (WEF) Manual No. 9).
 2. “Sewage Treatment Plant Design” (ASCE Manual of Engineering Practice No. 36 or WEF Manual of Practice No. 8).
 3. “Gravity Sanitary Sewer Design and Construction” (ASCE Manual, Engineering Practice No. 60 or WEF Manual of Practice No. FD-5).

4. Design of Municipal Wastewater Treatment Plants – 4th Edition (ASCE Manuals and Reports on Engineering Practice No. 76).
5. Uni-Bell Handbook of PVC Pipe, Design and Construction.
6. The State of California, Department of Transportation (Caltrans) Standard Plans and Specifications.

5-4 SEWER SYSTEM DESIGN REQUIREMENTS

5-4.1 Sewer Capabilities

Sewers shall be designed to carry the peak wet weather flow rates (PWWF) from all areas tributary to them. The design flow rate at any point shall be the average dry weather flow of all tributary areas times the peaking factor per Figure 5-1. Sewer shall be designed for both size and depth to accommodate developments in upstream tributary areas that would logically be served by them.

- A. General: Main sewers shall be designed and constructed to transmit the design flow, which will result from the ultimate development of the entire tributary area even though said area may not be within the project boundaries.
 1. Consideration of the type of development anticipated or existing shall be given in arriving at the design flow but in no case shall any sewer mains be smaller than the size required by the General Plan in the areas determined by the City of Lathrop, current Master Plan Studies, with the sewer mains flowing half full. In no case shall any sewer be less than 8" in size except in cul-de-sac and alleys serving six or fewer homes.
 2. In no case shall a smaller pipe be used in any location than that upstream of said location. Sewer mains shall be designed to withstand the vertical loads that will be imposed on them.
- B. Hydraulic Design:
 1. Hydraulic analyses for all sanitary sewers shall be computed using Manning's formula with a constant "n" value of 0.013.
 2. Pipes 15 inches in diameter and smaller are designed for peak flows with a maximum depth to diameter (d/D) ratio of 0.50. Pipes 18 inches in diameter and larger are designed for peak flows at a maximum (d/D) ratio of 0.75.

3. Design velocity and head loss for force mains shall be calculated using Hazen-Williams formula with a roughness constant of 110.
 4. Minimum velocity for any sanitary sewer shall be two (2) feet per second for pipes flowing half full.
 5. Maximum velocities shall not exceed 10 fps.
- C. Minimum Sewer Slope: Minimum slope requirements are necessary to ensure self-cleansing and self-oxidizing velocities in order to avoid significant generation of hazardous, odorous, and corrosive sulfur compounds.
1. Minimum Slopes/Capacity – Slopes of sewers shall equal or exceed those set forth in Table 5-1.
 2. Substandard Slopes – Slopes below the minimum slopes may be used in order to avoid pumping only when specifically approved by the City Engineer. Such approval should be solicited in advance of completion of design.
 - a. Pipe – Pipe in substandard slope areas or for flows less than 2 feet per second and pipe in all areas downstream from substandard slope areas to the point where the peak flow is four times than in the section with substandard slope, shall be corrosion resistant sewer pipe.

TABLE 5-1**MINIMUM PIPE SLOPES**

Pipe Size (in)	Minimum Slope ratio (ft/ft)	Capacity at 0.7 depth (MGD)	Capacity in full depth (MGD)
<i>Service Laterals</i>			
4	0.0208 (1/4" per 1')		
6	0.0208 (1/4" per 1')		
<i>Sewer Mains</i>			
6	0.0050	0.22	
8	0.0035	0.38	
10	0.0025	0.58	
12	0.0020	0.85	1.00
15	0.0015	1.32	1.60
18	0.0012	1.95	2.35

5-4.2 Sewer Quantities

- A. The average dry weather daily sewage flow shall be calculated according to

the land use wastewater flow factors set forth in Table 5-2.

TABLE 5-2
WASTEWATER FLOW FACTORS

Land Use	Residential Density (DU/ac)	Wastewater Flow Factor (gpd/DU or ac)	
		City-Wide	West Lathrop
Low Density Residential	1.0 – 9.0	240	200
Medium Density Residential	9.0 – 15.0	200	155
High Density Residential	15.0 – 35.0	110	
Commercial	-	755	
Industrial	-	240	
Parks	-	55	
Schools / Institutional	-	220	

To compute the peak flow from the average flow, the peaking factor in Figure 5-1 shall be used. Designer shall submit calculations for review and approval by the City Engineer.

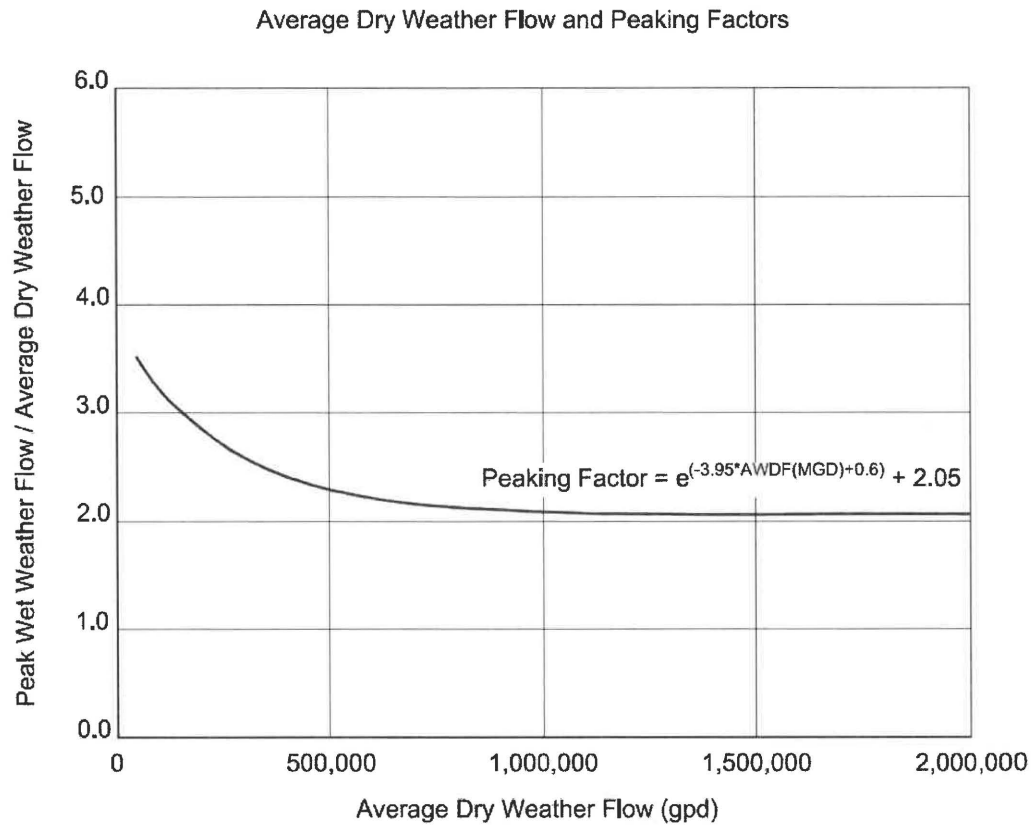


FIGURE 5-1

WASTEWATER PEAKING FACTORS

5-4.3 Sewer Location

A. Roads:

1. Sewer mains in new roads shall be located as indicated in Standard Detail No. R-63. Standard Details R-64 or R-65 shall be used only if approved by the City Engineer. Exceptions to these location requirements may be made only with approval of the City Engineer.
2. Sewer mains shall maintain a minimum twelve (12) inches vertical clearance from other utilities. Sewer mains shall be below other utilities unless approved by the City Engineer.

B. Water-Sewer-Separation: Separation of sewer from water is identified in Section 4-5.4. B of these Standards.

- C. Easement: Sewers within easements shall conform to the requirements in Section 4-5.3.
- D. Future Extensions: When an area outside the proposed project can be logically served by future extension of a proposed sewer, the proposed sewer shall extend to the proposed project boundary or to the end of a paved street in a manner to facilitate the future extension.
- E. Alignment: Alignments shall be parallel to the street centerline whenever possible. Sewers shall be laid on a straight alignment and grade between manholes except that curved sewers may be used subject to the following requirements.
 - 1. All curve data shall be shown on plans.
 - 2. Radius of curvature and joint deflections shall be 80% of the pipe manufacturer's recommendation and approved by the City Engineer; however, in no case shall the radius be less than 200 feet.
 - 3. All deflections shall be at the pipe joints or by specially metered pipe sections. Actual bending of the pipe itself will not be allowed.
 - 4. A manhole shall be constructed at both the B.C. and E.C. of curves where the length of curve exceeds 100 feet, otherwise a manhole shall be required at one end of the curve only.
 - 5. Vertical curves may be used in combination with horizontal curves. Where vertical curves are used, the sewer shall be sized for the flattest slope within the curve.
 - 6. Maximum combined horizontal and vertical deflection at any joint shall be 80% of the manufacturer's recommendation, but in no case more than 3 degrees.
 - 7. The arithmetic sum of all horizontal and vertical deflection in curved sewers between adjacent manholes shall not exceed 22 ½ degrees. Sweep shall be avoided unless approved by City Engineer.

5-4.4 Depth of Sewers

Sewers shall be installed at a depth which will provide suitable service to the properties connected and will allow subsequent installation of water lines in accordance with the water-sewer separation rules so as to minimize special construction of the water lines. Attention to joint spacing on the water lines will be required.

- A.** Standard Depth: Minimum cover for any sewer main shall be five (5) feet from finished grade within the street section or three (3) feet below the street pavement section whichever is greater, and three (3) feet in sewer easements. Any deviation from this cover shall require special design and approval by the City Engineer.
- B.** Maximum Depth: The maximum invert depth of any Polyvinyl Chloride (PVC) SDR26 sewer main shall be 20 feet from finished surface unless approved by the City Engineer. Any sewer main with an invert greater than 20 feet shall be required to use pipe material for pressure pipe such as PVC C900-16, or ductile iron as required herein.
- C.** Exceptions: Special pipe cover shall be used when total cover over public and house connection sewers is less than four (4) feet, and may be required when total cover will not be placed immediately after pipe installations, or when other special conditions exist.
1. Three (3) to four (4) feet of cover shall require the use of ductile iron pipe or approved bedding or encasement specifically designed for the cover conditions.
 2. Less than 3 feet of cover shall require concrete encasement. In no case shall cover less than two and one-half foot (2.5) be permitted.
 3. All pipelines shall be designed and constructed to a load safety factor of 1.5.
 - a. The engineer, during design, shall consider impact and dead loads imposed upon the pipe both during and after construction.
 - b. The construction plans shall show the maximum permissible trench width at the top of the pipe that shall be predetermined by the design engineer.
 - c. No sewer service shall be connected to a main greater than 12 feet in depth. No service lateral shall connect into sewer mains greater than 15 inches in diameter. Where groundwater is expected at or above the bottom of the pipe, the design shall comply with City Standard R-57 & R-58.
 - d. Trench design calculations shall be submitted to the City Engineer for approval for all trenches.

5-4.5 Structures

- A. Manholes: Manholes shall be located at all changes in alignment or grade and at all junctions. Manholes shall be located at the following maximum intervals:

On pipes 12-inch in diameter and under 400 foot intervals

On pipes over 12-inch in diameter 500 foot intervals

1. Drop Manholes: Drop manholes shall be constructed in accordance with Standard Detail S-2 and shall be used wherever sewers enter manholes at more than 24 inches above the outlet elevation of the manhole. The use of drop manholes shall require the approval of the City Engineer.
2. Design: Manholes shall be constructed in accordance with Standard Detail S-1.
 - a. If direction of the through flow changes by 45 degrees or greater, the invert grade at the exit must be at least 0.20 foot below that of the entrance pipe.
 - b. If the pipes entering and exiting any manhole are of differing diameter, the minimum invert elevation differential (that is, fall in elevation through the manhole) shall be such that the pipes are matched crown to crown. The invert of the entering pipe shall be no higher than the crown of the exiting pipe.
 - c. Drop connections are not governed by the above elevation requirements.
 - d. All manholes installed within 500 linear feet of any pump station or other detention facility shall have a polyurethane or fiberglass coating, or PVC liner recommended by a reputable manufacturer as being suitable for this use, applied to the interior of the manhole.
3. Protection: Where new proposed sewers are to be connected into a manhole that is in active use, the designer shall call for such protection as is necessary to prevent construction debris from being washed into the active sewers. Plugged inlets or other suitable protection shall be called for in the active manhole before beginning manhole modifications or proposed sewer cleaning.

4. Elevations: Finished elevations of frames and covers shall be set flush with finished grades of the completed road surface or 12 inches above immediate surface when more than 10 feet outside of paved roadway. Manhole placed on unimproved lands shall be marked with a green five-foot-high 4x4 post or metallic post designed for that purpose.
- B.** Cleanout Requirements: Dead end 8-inch sewer mains not over 200 feet in length shall terminate in standard manholes or flushing branch. Dead ends over 200' long shall terminate in standard manholes unless future extension of said dead end will include a manhole within distances specified in Item (A) above of the uppermost manhole, in which case a temporary flushing branch may be permitted.
- C.** Structures and Pipes: All structures and pipe placed under public roads shall be of sufficient strength to support with an adequate factor of safety the backfill, road surfacing and H-20 truck loading with impact.
1. Sewers under other pipes and structures shall be protected from damage and shall be constructed so as not to endanger the other pipe structure.
 2. The concrete blanket method is not required where the distance between the outside of crossing pipes exceeds 12" unless required by water sewer separation rule.

5-4.6 Service Laterals

- A.** Requirements: Wherever it is known or can be reasonably assumed that a building sewer connection is required, a service lateral shall be shown on the plans and installed to the property line as a part of the street sewer construction, prior to paving.
1. Service laterals shall be installed whenever possible during construction of the sewer main using prefabricated fittings.
 2. Unused service connections shall be tightly sealed and staked in a manner to facilitate their future location and use.
- B.** Size: Service laterals for single dwellings and small single stores or offices shall be 4 inches minimum or as required by Uniform Plumbing Code. All other service laterals shall be 6 inches or larger and at least equal to the size of the building sewer.
- C.** Depth: Service laterals shall be at the minimum depths herein provided and in addition such depth shall be sufficient to provide a connection to any point

on the lot, within the established building setback lines, with a cover of one foot and a slope of not less than 0.02 and a minimum of 4 feet at the property line. Any exception to this requirement shall be approved by the City Engineer.

- D. **Backflow Prevention:** Sewers shall be designed to preclude the backflow of sewage into service laterals. If it is infeasible to install the waste receptacles in any building at least 1 foot higher than the rim elevation of the next upstream manhole, or other structure providing hydraulic relief, then backflow prevention devices shall be installed in the building waste line on the property side of the service lateral cleanout.
- E. **Curb Markings:** The location of all sewer service laterals shall be marked by an "S" cast into the concrete of the curb at completion of construction (See Standard Detail R-5)
- F. **Grease Traps:** On-site grease trap may be required on service laterals and sized accordingly using the latest edition of the Uniform Plumbing Code (UPC). The City Engineer shall make this requirement on a case-by-case basis.

5-4.7 **Pump Stations**

The developer shall conform to the requirement in Appendix H for the design of wastewater pump stations.

5-5 **MATERIALS**

Materials shall be chosen for their strength, durability, and ease of maintenance with due consideration for dead and live loads, flexural strength, and resistance to corrosion.

5-5.1 **Pipe Joints**

Pipe joints shall be selected to provide positive protection against entrance of roots and groundwater with sufficient flexibility to adjust to the trench bedding. In general, the joints shall be non-rigid and the joint sealer shall be restrained against lateral and axial movements. The installed joint shall provide positive separation between adjoining pipe sections to prevent failure of rigid materials by axial expansion.

5-5.2 **Pipe Material**

Gravity sewer pipe material shall be Polyvinyl Chloride (PVC) SDR26. Other materials such as ductile iron shall be approved by the City Engineer. Force main sewer pipe shall be either C900-16, Class 150 or greater.

- A. Polyvinyl Chloride (PVC) Pipe: Solid wall PVC pipe and fittings 4 inch through 15 inch shall conform to ASTM D-3034 and shall have a minimum cell classification of 12454-B or 13364-A or 13364-B as defined in ASTM D-1784. Additives and fillers shall not exceed 10 parts by weight per 100 parts of PVC resin in the compound.
1. PVC pipe and fittings shall be installed in accordance with ASTM D-2321 the Uni-Bell Handbook of PVC pipe, the Water Environment Federation Manual FD-5 and City standards.
 2. All pipe and fittings shall be suitable for use as a gravity sewer conduit, with provisions for expansion and contraction at each joint.
 - a. All joints shall be made with flexible elastomeric seals meeting the requirements of ASTM 3212, and shall be capable of passing all tests specified in said standard and within these specifications.
 - b. A factory-applied reference mark shall be provided on the spigot end to ensure proper positioning in the adjoining bell.
 - c. The pipe shall be uniform in color, opacity, density, and other physical properties.
 - d. Pipe shall be marked in accordance with ASTM D3034 for a gravity sewer.
 - e. All pipe shall be green or white in color with caution green tape placed one to two feet above pipe.
 - f. Polyethylene sleeves may be required by the City Engineer at joints.
 3. Laterals shall be wye type and shall be complete fittings.
 4. Solvent type joints for pipe or saddle, Y or T, are not allowed at any time.
 5. Flexible pipe not installed within 120 days of the latest test shall not be used without prior written approval from the City Engineer.
 6. Written certification, by the manufacturer, shall be submitted showing that all pipe and fittings meet the requirements herein.

7. Pipe stored on the job site shall be covered with canvas or other opaque material to protect it from the sun's rays. Air circulation shall be provided under the covering.

5-5.3 Concrete

All concrete for sewer structures and sewer pipe encasement shall be Class II per Section 90 of the Standard Specifications unless otherwise shown herein or approved by the City Engineer.

5-6 TRENCHING, BACKFILL AND BEDDING

5-6.1 Trenching, Backfill and Bedding

Trenches shall be excavated to a width that will provide adequate working space, but not less than the minimum design width. Trench walls shall not be undercut. Trench width shall be per Table 5-6.

TABLE 5-6

NARROW TRENCH WIDTH, MINIMUM

<u>Nominal Pipe Size Inches</u>	<u>No. of Pipe Diameters (O.D.)</u>	<u>Trench Width, Minimum Inches</u>
4	7.0	28
6	5.0	30
8	4.0	32
10	3.4	34
12	3.0	36
15	2.6	39
18	2.3	42
21	2.2	45
24	2.0	48
27	1.9	51
30	1.8	54
33	1.7	57
36	1.6	60
42	1.6	66

- A.** The trench walls can be sloped where indicated by the City Engineer to reduce trench wall failure as long as the measured width at the top of pipe does not exceed the maximum design trench width.
- B.** Trenches, other than for Class "D" bedding, shall be excavated to provide space for the pipe bedding.
- C.** Bell holes shall be excavated to prevent point loading of the bells or couplings of pipe laid.
- D.** Sheet, shore, and brace trenches, as necessary, to prevent caving or sliding of trench walls, to provide protection for workmen and the pipe, and to protect adjacent structures and facilities.
- E.** Sheet piling shall not be removed below the top of pipe if the resulting slope of the native soil increases the trench width to such an extent that the load on the pipe exceeds the safe field supporting strength of the pipe and bedding system.
- F.** When a movable box is used, secure the installed pipe to prevent it from moving when the box is moved.
- G.** The use of pea gravel as bedding or backfill is NOT allowed at any time.
- H.** Trenches within the historic water table or where groundwater is encountered shall comply with the following conditions:
 - 1. The bottom of the trench shall be kept entirely free of water.
 - a. Dewater and dispose of the water so as not to cause injury to public or private property, or to cause a nuisance or menace to the public.
 - b. The dewatering system shall be installed and operated so that the groundwater level outside the excavation is not reduced to the extent that would cause damage or endanger adjacent structures or property.
 - c. The static water level shall be drawn down a minimum of two foot below the bottom of excavation to maintain the undisturbed state of natural soils and allow the placement of any fill to the specified density.
 - d. Dewatering systems shall operate continuously until backfill

has been completed to one foot above the normal static groundwater level.

2. The contractor shall control surface water to prevent entry into excavations. At each excavation, a sufficient number of temporary observation wells to continuously check the groundwater level shall be provided.
3. Sumps shall be no deeper than five feet and shall be at the low point of excavations. Excavations shall be graded to drain to the sumps.
4. The control of groundwater shall be such that softening of the bottom of excavations, or formations of "quick" conditions or "boils", does not occur.
 - a. Dewatering systems shall be designed and operated so as to prevent removal of the natural soils.
 - b. The release of groundwater at its static level shall be performed in such a manner as to maintain the undisturbed state of the natural foundation soils, prevent disturbance of compacted backfill, and prevent flotation or movement of structures, pipelines and sewers.
 - c. If an NPDES (National Pollutant Discharge Elimination System) permit is required for disposal of water from construction dewatering activities, it shall be obtained prior to any dewatering activities.
5. Gradation and relative size of the embedment material and adjacent material must be compatible to minimize migration of fines. If bedding and backfill will allow migration of adjacent finer materials, a non-woven geo-textile is required.

5-7 TESTING AND ACCEPTANCE

5-7.1 Requirements

All sewer lines shall be tested for obstructions and cleaned by cleaning ball and flushing. An approved commercial sewer cleaning ball shall be used, which shall be controlled by a tag line or rope or sewer rods and permitted to move slowly through the sewer.

All labor, materials and equipment required for testing shall be provided by the contractor. The cost of testing shall be borne by the contractor.

- A. All obstructions or irregularities shall be removed or repaired by the contractor.
 - 1. All testing, cleaning, and repairing shall be done to the satisfaction of the City Engineer.
 - 2. The contractor shall provide all necessary materials and utilities for the tests and shall dispose of all waste, including water, at his own expense.
 - 3. The water shall not be allowed to enter existing sanitary sewer systems.
- B. In addition to other tests specified, PVC gravity sewer pipe shall be tested for deflection as follows:
 - 1. A 5 percent deflection test shall be performed within 30 days following installation. The maximum allowable 30-day deflection shall be determined based on the pipe manufacturer reported ID less 5 percent and compared to the measured ID 30 days following installation.

5-7.2 Leakage

After laying, backfilling, and compacting, all sewers and manholes shall be tested for leakage. The program of testing must fit the condition as mutually determined by the City Engineer and the contractor.

- A. The contractor may use either an air or vacuum test as specified below and shall furnish all labor, tools, and equipment necessary to make the tests and to perform any work incidental thereto.
- B. The contractor shall take all necessary precautions to prevent any joints from drawing air or water while pipelines or their appurtenances are being tested. The contractor shall, at his own expense, correct any excess leakage and repair any damage to the pipeline and its appurtenances or to any structures indicated by or resulting from these tests.
- C. Air Test Procedure
 - 1. Pressurize the test section to 3.5 psi and hold above 3.0 psi for not less than five minutes.
 - 2. Add air if necessary to keep the pressure above 3.0 psi.

3. At the end of this five-minute saturation period, note the pressure (must be 3.0 psi min.) and begin the time period.
4. The pipe fails a test if the pressure drops 0.5 psi in less than the time given in Table 5-7.

TABLE 5-7**AIR TEST PIPE HOLD TEST**

Sewer Main Size (in)	Minimum Time (min)
4	4
6	4
8	4
10	4
12	4
15	8
18	8
22	8
24	8

5. When the prevailing groundwater is above the sewer being tested, pressure shall be increased 0.43 psi for each foot of the water table above the flow line of the sewer.
6. If the time for the pressure to drop 0.5 psi is 125 percent or less of the time given in the table, the line shall immediately be re-pressurized to 3.0 psi and the test repeated.
7. For 8" and smaller pipe only: if during the five-minute saturation period pressure drop is less than 0.5 psi after the initial pressurization and air is not added, the section undergoing test shall have passed.

8. If the test is not passed, the leak shall be found and repaired to the satisfaction of the City Engineer and the length of repaired line retested.
 9. House sewers shall be considered part of the lateral to which they are connected with no adjustment of test time allowed to compensate for the small diameter of the house sewers.
 10. The pressure gauge used shall be supplied by the contractor, shall have maximum division of 0.10 psi, and shall have an accuracy of 0.04 psi.
 - a. Accuracy and calibration of the gauge shall be certified by a reliable testing firm at six-month intervals or when requested by the City Engineer.
 - b. In addition, the City Engineer may compare the contractor's gauge with a City owned gauge at any time.
- D. Manholes:** Vacuum test manholes in accordance with ASTM C1244 prior to backfill using the following general procedure:
1. Start vacuum and seal leaks, if necessary
 2. Attain a vacuum of 10" Hg
 3. Time Pressure drop to 9" Hg. The time must be held for at least the minimum time shown in the following table to be considered a passing test:

TABLE 5-8
VACUUM TESTING CONCRETE MANHOLES (ASTM C1244)

Depth (ft)	Diameter (in)								
	30	33	36	42	48	54	60	66	72
	Times (sec)								
8	11	12	14	17	20	23	26	29	33
10	14	15	18	21	25	29	33	36	41
12	17	18	21	25	30	35	39	43	49
14	20	21	25	30	35	41	46	51	57
16	22	24	34	39	40	46	52	58	67
18	25	27	32	38	45	52	59	65	73
20	28	30	35	42	50	53	65	72	81
22	31	33	39	46	55	64	72	79	89
24	33	36	42	51	59	64	78	87	97
26	36	39	46	55	64	75	85	94	115
28	39	42	49	59	69	81	91	101	113
30	42	45	53	63	74	87	98	108	121

4. Release vacuum and backfill

- E. Televising of Sanitary Sewers: Following the placement and densification of backfill and completion of other required testing, but prior to the placing of pavement, the Contractor at his expense shall provide Closed Circuit Television (CCTV) equipment to inspect the inside of the total length of the gravity sewer mains. The means and methods of the CCTV inspection is

provided in Appendix J. The contractor shall provide a record (DVD or USB memory card of the CCTV logs) in digital format to the City Engineer. Contractor shall obtain the preferred media and format from the City prior to submitting the materials. Any defective pipe or conditions that are discovered by the CCTV inspection shall be corrected by the Contractor at no expense to the City. Any corrective method proposed by the Contractor shall be approved by the City Engineer prior to the performance of the corrective work.

Defective pipe or conditions shall include the following:

1. Breaks or cracks in the pipe.
2. Joint offsets.
3. Protruding, folded or otherwise deformed gaskets.
4. Standing water exceeding the following:

Pipe (diameter)	Depth
6"	1"
8"	1.25"
10"	1.3"
12"	1.75"
15" or larger	2.5"

- F.** Repair Work: When test results indicate damaged pipe, the repair shall be as recommended by the manufacturer and as approved by the City Engineer.
- G.** Force Main pressure testing shall be completed by maintaining a minimum pressure of 150 psi for a minimum of 2 hours.

5-7.3 Final Cleaning

Upon completion of all testing, but prior to the CCTV inspection above, the Contractor shall clean the sewer in such a manner as to insure that no foreign matter or debris has been left in the sewer. All foreign matter and debris shall be removed and disposed of in a manner acceptable to the City Engineer.

END OF SECTION