

## **SECTION 5 SANITARY SEWERS**

### **5.01 GENERAL**

#### **A. SUBMITTAL REQUIREMENTS**

1. Sanitary sewer system design within a developing area shall conform to the City General Plan, Master Sewer Plan, and any applicable Specific Plan of the City of West Sacramento and include provisions for size and capacity to adequately convey all domestic and industrial waste that can be reasonably anticipated under conditions of full ultimate development. Engineering calculations to support the sewer system design shall be submitted to the City Engineer for approval. The calculations shall include:
  - a. Map indicating service area within the sewer system including any future contributing development with projected land use, zoning, and any physical features contributing to the sewer system design.
  - b. Sanitary sewer waste volumes either existing or proposed within the service area of the system and upstream areas to be served by the proposed improvements at full ultimate development.
  - c. Size and slope of each pipe between appurtenant structures.
  - d. Invert, rim elevation, and hydraulic grade line of each pipe and appurtenant structure.
2. Plan Requirements. Plans to be drafted to provide plan and profile views in accordance with Section 2 of these Design Standards and shall include sanitary sewer (geometric) design improvements; main and lateral sizes and slopes; hydraulic grade line; pipe material (including SDR or wall thickness values); trench details; other utility locations, crossings, and separation; manholes and rim elevations; cleanouts and rim elevations; and invert elevations with direction of flow at manholes. Design standards shall conform to the other additional requirements of these City Standard Specifications, State Water Resource Control Board Division of Drinking Water, Yolo County Health Department, and the California Plumbing Code.

### **5.02 PIPE DIAMETER**

- A. PUBLIC MAINS - The minimum size of any new public sewer main shall be six inches (6) in diameter or larger unless otherwise approved by the City Engineer.
- B. RESIDENTIAL SERVICES - The minimum lateral size is four inches (4) where grade requirements can be met, and the intended use is to serve single-family or duplex residences.
- C. NON-RESIDENTIAL SERVICES - Six (6) inch or larger laterals shall be installed where intended use is industrial, commercial, public facilities or greater than single-family or

duplex residential flows unless otherwise directed by the City Engineer.

### 5.03 DESIGN

A. FLOW CALCULATION - The design sanitary sewer flow shall be computed using the following formula:

$$Q_D = Q_P + I \quad (\text{eq. 5-1})$$

Where:  $Q_D$  = Design Flow  
 $Q_P$  = Peak Flow  
 $I$  = Infiltration and Inflow

$$\text{And: } Q_P = Q_{AVE} * PF \quad (\text{eq. 5-2})$$

Where:  $Q_{AVE}$  = Average Flow  
 $PF$  = Peaking Factor

#### 1. Residential Flow

- a. Average flow ( $Q_{ave}$ ) shall be based upon the following criteria:
  - i. Three persons per single family dwelling unit
  - ii. Two and a half persons per multi family dwelling unit
  - iii. One hundred gallons per person per day
- b. Peaking Factor (PF) shall be three (3), (two (2) for industrial use only.)
- c. Infiltration and Inflow (I) shall be computed, assuming four thousand (4,000) gallons per inch diameter mile per day for sewer mains and laterals. Residential laterals shall be assumed to be a minimum of seventy-five (75) feet in length.

#### 2. Non-Residential Flow

- a. Average Flow ( $Q_{AVE}$ ) shall be based upon the following criteria:
  - i. Other Commercial<sup>1</sup> 1500 gpad\*
  - ii. Prof. Office/Business Park<sup>2</sup> 1500 gpad\*
  - iii. Recreation 500 gpad\*
  - iv. Schools 40 gpd/student (Elem., Jr. HS)  
50 gpd/student (High School)
  - v. Light Industrial 2000 gpad\*
  - vi. Heavy Industrial (case-by-case basis)

\* (gpad - gallons per gross acre per day)

<sup>1</sup>High volume generators such as restaurants or food processing facilities shall be considered on a case-by-case basis.

<sup>2</sup>Multi-story structures will be considered on a case-by-case basis.
- b. Peaking Factor (PF) shall be based upon the following criteria
  - i. Industrial = 2
  - ii. Non-Industrial = 3
- c. Infiltration and inflow (I) shall be the same as for residential flows.

B. PIPE CAPACITY CALCULATION

1. Manning's Formula  $[Q= A (1.499/n) R^{2/3} S^{1/2}]$  shall be used to determine pipe capacity. The "n" value shall be 0.013 or the pipe manufacturer's recommendation. Manning's "n" values, which are less than 0.013 shall require City Engineer approval and shall only be allowed if minor losses are accounted for.

Q = Flow Rate at Full Pipe Capacity

A = Cross-Sectional Area of Flow

n = Coefficient of Roughness

R = Hydraulic Radius

S = Slope of Pipe

2. All sewer mains shall be sized to carry the design flows (QD) at a maximum of seventy (70) percent of pipe capacity.

C. SEWER PIPE VELOCITY AND GRAVITY PIPE MINIMUM SLOPES

1. Sewer velocity shall be equal to or greater than two (2) feet per second for all sewers when flowing full.
2. Where design velocities for main sewers exceed ten (10) feet per second, polyethylene lined ductile iron pipe conforming to Section 14 of the Standard Construction Specifications shall be used. In addition, the ductile iron pipe shall be wrapped with an eight (8) millimeter polyethylene encasement.
3. Force main velocity shall be at a maximum of eight (8) feet per second at design flows (Q<sub>D</sub>).

D. PIPE COVER AND CLEARANCES

1. Minimum pipe cover and clearance shall be maintained in the design of sanitary sewers. If certain conditions exist which make it impractical to meet the minimum cover and clearance requirements to other utilities, the conditions and locations shall be specifically noted above the sewer profile on the plans. Each location not meeting the minimum cover and clearance requirements will require special State Water Resources Control Board and City approval. Any planned condition being specially approved with less than minimum cover will require special pipe, bedding, and/or backfill as approved by the City Engineer.
2. Main and trunk sewers shall have a minimum depth of four (4) feet as measured from the top of the pipe to the finished grade.
3. Laterals shall have a minimum depth of three (3) feet from the top of the pipe to finished grade.
4. Pipe shall be laid with a minimum of twelve (12) inches vertical clearance below water lines and six (6) inches clearance from all other improvements and utilities, unless otherwise approved by the City Engineer. All other utilities shall not, under any circumstances, be installed directly over and parallel to any sanitary sewer line installation.

E. HORIZONTAL ALIGNMENT

1. Centerline of sewer mains and trunks shall be located six (6) feet south or east of

and parallel with the street centerline or edge of center median curb unless otherwise approved by the City Engineer.

2. Alignment of sanitary sewer mains shall be straight between manholes. Whenever it is essential that a curved alignment be used, a minimum radius of two hundred (200) feet shall be required unless a larger minimum radius is otherwise required by the pipe manufacturer but shall be greater whenever possible. The radius, delta, and length of all curves shall be indicated on the plans adjacent to the curve.
3. The deflection in the joint between any two (2) successive pipe sections shall not exceed eighty (80) percent of the maximum deflection as recommended in writing by the pipe manufacturer.
4. Minimum horizontal separation between parallel sewer and water mains shall be ten (10) feet.

#### F. LATERAL SEWERS

1. Laterals are those portions of the sewer system between the sewer main, and the portions of the sewer service maintained by the property owner. The usual location of the line separating responsibility of the City and property owner is the back of sidewalk cleanout or manhole. In all cases, City maintained sewer lines will lie in a street right-of-way or dedicated public easements. In all new residential subdivision work, the house lateral line and cleanout from the sewer to the property line shall be installed at the time the sewer main is constructed. Each lateral line shall be referenced to the Improvement Plan stationing.
2. All laterals, from property line or edge of easement to the point of connection with the main line or a manhole shall have an alignment that provides an angle of intersection with the downstream section of the main sewer of no less than ninety (90) degree prior to the wye at the main line connection.
3. The maximum deflection at any one point in a lateral, not including fittings at saddle or wye connection to main sewer or at angle points having cleanouts, shall be twenty-two-and-a-half-degree bend (or one-sixteenth (1/16) bend) and any two consecutive deflections (bends) shall not be less than two (2) feet apart.
4. For single family residential and duplex laterals, cleanouts shall be provided on the lateral sewer at twelve (12) inches inside the edge of right-of-way or public utility easement as shown on Standard Detail #401.
5. For sewer laterals serving multi-family, commercial and/or industrial facilities, manholes shall be constructed where the lateral connects to the sewer main line and just inside the edge of the right-of-way or public utility easement as shown on City Standard Detail #401A unless otherwise approved by the City Engineer.
6. Laterals connecting houses having a finished floor elevation twelve (12) inches or less above the rim elevation of the nearest upstream manhole or structure shall require the installation of an approved backflow prevention device on the lateral adjacent to the lateral service cleanout.
7. Sewer laterals shall be installed with a minimum of six (6) inches below and a five (5) foot horizontal separation from water services for all single-family and duplex

uses. A minimum horizontal clearance of five (5) feet is required from trees and other utilities unless otherwise specifically requested of and authorized by the City Engineer in writing or recommended by a certified Arborist with City approval.

8. Laterals shall connect to the main at manholes whenever possible. Laterals for residential properties located within cul-de-sac circles shall be connected at a manhole.
9. A single sewer connection shall not serve more than one parcel. Each individual parcel shall have a separate sewer connection.

#### G. APPURTENANCES

##### 1. Manholes

- a. Along straight alignments of sewer mains, the maximum spacing for manholes shall be four hundred (400) feet. Where the location of two manholes is determined by intersecting lines greater than four hundred (400) feet, the distances between intervening manholes shall be approximately equal.
- b. Sewers constructed on curved alignments where two hundred (200) feet < radius < four hundred (400) feet shall have additional manholes placed per the following criteria:
  - i. Where curve length < fifty (50) feet; no additional manholes required.
  - ii. Where fifty (50) feet < curve length < one (100) hundred feet; a manhole shall be required at either the BC or the EC
  - iii. Where curve length > one hundred (100) feet; a manhole shall be required at the BC and the EC and at a maximum three hundred (300) feet intervals along the length of the curve.
- c. Whenever a change in the size of pipe, or a change in the alignment of twenty (20) degrees or more occurs at a manhole, the flow line of the incoming pipe shall be a minimum of twelve hundredths (0.12) feet above the flow line of the outgoing pipe. The invert elevations in and out of the proposed manhole shall be shown on the improvement plans.
- d. Manholes shall be used at the termination of all sewer mains including cul-de-sacs. Cleanouts may be installed at the upstream end of mains, which are proposed to be extended in the future on an approved development plan.
- e. Manholes shall be lined as specified in Section 14.02 G of Division IV, Standard Construction Specifications when located on a conveyance sewer with a diameter of ten (10) inches or larger, or the first downstream manhole at the outlet of a force main unless otherwise directed by the City Engineer. Alternative methods of addressing corrosive conditions may be required by the City Engineer.

- #### H. UNUSUAL DESIGN - Special design of sewer force mains, siphons, discharges from force mains or siphons into gravity sewers or manholes, or other unusual features or structures shall be subject to the approval of the City Engineer.

## 5.04 WASTEWATER PUMP STATION DESIGN

Existing pump stations will be considered to require capacity expansion improvements if the associated firm capacity (i.e., capacity with the largest pump out of service) is not sufficient to convey the design flow ( $Q_D$ , as defined in Section 5.03A above).

Pump station wet wells shall be designed with sufficient volume and depth such that the pump station can be operated using the wet well and not the tributary collection system as storage during design flow conditions. Pumps shall be sized so that they can operate within the pump manufacturer's design curve for design flow conditions.

Refer to Sacramento Area Sewer District ([Sac Sewer Standards & Specifications](#)) pump station design standards for technical requirements.

All pump stations shall be designed and constructed to conform to OSHA standards.

## 5.05 RIGHT-OF-WAY POLICY

- A. REQUIREMENTS - All public sewers shall be located within the City right-of-way dedicated for public streets unless the use of a public utility easement is specifically approved by the City Engineer. Easements outside public street right-of-way shall be granted or dedicated for sewers and/or public utility/service easement (PUE/PSE). In the case that public sewer installation is within public rights-of-way for streets, further dedication is not necessary.
- B. WIDTH - Easements for sanitary sewers shall meet both of the following width criteria:
  - 1. Minimum width of any easement shall be fifteen (15) feet.
  - 2. All easements shall have a minimum width in feet equal to the required trench width according to the standard detail for trench backfill plus two (2) additional feet of width for every (1) foot of depth of the pipe as measured from the bottom of the pipe to finished grade. All sewer pipes shall be centered within their easements.