

# Water and Sanitary Sewer Design Manual



## SECTION 5 – DESIGN CRITERIA FOR SANITARY SEWER FACILITIES

### 5.1 General

The following are the minimum requirements that must be met for all sanitary sewer main connections to, and improvements and extensions of, the City's public sanitary sewer system.

The following references should be adhered to in conjunction with these requirements:

- *Waco Development Guide*, latest edition
- *City of Waco Code of Ordinances*, latest edition
- *City of Waco Standard Specifications for Construction*, latest edition
- *City of Waco Manual of Standard Details*, latest edition
- *City of Waco Wastewater Collection System Master Plan*, latest edition
- *Texas Administrative Code (TAC), Title 30, Part 1:*
  - *Chapter 217: Design Criteria for Domestic Wastewater Systems*
  - *Chapter 285: On-site Sewage Facilities*
  - *Chapter 290: Public Drinking Water*
- *Texas Administrative Code (TAC), Title 43, Part 1, Chapter 21, Subchapter C: Utility Accommodation*
- *International Building Code (IBC)*, latest adopted
- *International Fire Code (IFC)*, latest adopted
- *International Plumbing Code (IPC)*, latest adopted
- *National Electric Code (NEC)*, latest adopted

### 5.2 Typical Location of Sanitary Sewer Mains within Public Right-of-Way and Easements

#### A. Right-of-Way:

1. New sanitary sewer lateral and collector mains ( $\leq 15$ -inch) shall generally be placed in the outermost lane of traffic, 9' from the back of curb (or back of ribbon curb for non-guttered streets) in the southern or western portion of the right-of-way. Manholes should preferably be outside wheel traffic.
2. Horizontal alignment shall be maintained, to the greatest extent possible, throughout project.

3. Street and major utility crossings shall be installed at approximately 90° to the centerline of the roadway/utility.
4. New sanitary sewer trunk and interceptor main locations ( $\geq$  18-inch) shall be coordinated with the WUSD.
5. Sanitary sewer mains shall not be placed closer than 5 feet to any right-of-way or property line.

**B. Easements:**

1. New sanitary sewer mains shall generally be placed in the center of designated sanitary sewer main easements. Refer to *Section 3 - Easement Requirements*.
2. If a shared easement is used that contains water and wastewater utilities, refer to *Section 5.3*, below, for required separation distances.

**C. Main Extensions:**

Sanitary sewer main extensions are required to extend to a point ten feet inside the property line. Sewer designs shall take into consideration the future connection needs of adjoining properties.

### **5.3 Horizontal and Vertical Alignments of Sanitary Sewer Mains and Separation Distances**

**A. Horizontal Alignments:**

The horizontal alignment of proposed gravity sanitary sewer mains shall be uniform between manholes and follow right-of-way, easement, or roadway centerlines as closely as practical. Curved sewer main alignments cannot exceed 50% of the manufacturers recommended deflection of the pipe joint. Maximum manhole spacing shall be 300 feet along a curved main. No horizontal or vertical fittings are permitted in a gravity sewer main.

**B. Vertical Alignments:**

1. The vertical alignment of proposed sanitary sewer mains should follow the existing, or proposed ground surface as closely as practical.
2. Vertical Grade: Shall remain uniform between manholes. No grade breaks between manholes is allowed.
3. Depth of Cover: Measured from the top of surface (existing, proposed, or future) to the invert of the main.
  - a. Minimum: 6 feet
  - b. Maximum: 20 feet\*

\* Where depths that exceed 20 feet are necessary, the type, class, embedment and backfill shall be as approved by the WUSD.

**C. Clearance Requirements:**

1. Water Lines:

As per Texas Administrative Code (TAC), Title 30, Chapter 217.53 (d) and 290.44 (e)(4):

- Wherever possible, a collection system pipe must be located below a water supply pipe. If a collection system pipe cannot be located below a water supply pipe, the owner must justify in the engineering report why it is not possible to locate the collection system pipe below the public water supply pipe.
- Wherever possible, collection system pipes and manholes must be located at least nine feet from all water supply pipes. If a collection system pipe or manhole cannot be located at least nine feet away from a water supply pipe, the owner must justify in the engineering report why it is not possible to provide at least nine feet of separation.
- Collection system pipes must be installed in trenches separate from water supply trenches.

If a collection system pipe cannot be located at least nine feet away from a water supply pipe:

	Wastewater Main above Drinking Water Line	Drinking Water Line above Wastewater Main
<b>Parallel</b>	Encase wastewater main in casing pipe, maintaining a minimum distance of 5 ft horizontally	Encase wastewater main in casing pipe, maintaining a minimum distance of 5 ft horizontally  <b>OR</b> use pressure pipe for wastewater main*, maintaining a minimum distance of 2 ft vertically and 4 ft horizontally
<b>Crossing</b>	Water line to be perpendicular to wastewater main  <b>AND</b> water line to be centered over wastewater main with joints at least 9 feet horizontally from the centerline of both crossing pipes  <b>AND</b> maintain at least 1 ft of vertical separation between water line and wastewater main  <b>AND</b> One of the following options:  1. Encase waterline 2. Use ductile iron or steel pipe for waterline with mechanical or welded joints as appropriate  <b>AND</b> One of the following options:  1. Encase wastewater main 2. use pressure pipe for wastewater main	Water line to be perpendicular to wastewater main  <b>AND</b> water line to be centered over wastewater main with joints at least 9 feet horizontally from the centerline of both crossing pipes  <b>AND</b> maintain at least 6 in of vertical separation, measured from outer surface of pressure pipe or casing (when casing is used) when wastewater main is new and 2 ft when wastewater main is an existing non-pressure rated main  <b>AND</b> The wastewater pipe shall have a minimum pipe stiffness of 115 psi at 5.0% deflection.*  <b>AND</b> The wastewater main shall be embedded in cement stabilized sand for the total length of one pipe segment plus 12 inches beyond the joint on each end.*  <b>AND</b>

		One of the following additional requirements:*
		<ol style="list-style-type: none"> <li>1. Encase wastewater main</li> <li>2. use pressure pipe for wastewater main.</li> </ol>

\*: Exception - If an existing wastewater main is not disturbed and a PE determines that it is not leaking, the wastewater main does not have to be improved.

Absolute minimum horizontal distance of a water supply line to a sanitary sewer manhole is five feet. Manhole within nine feet of a water supply pipe:

- **Must have no measurable leakage during a leakage test conducted according to the requirements in Texas Administrative Code (TAC), Title 30, Chapter 217.58; or**
- **Be encased in cement-stabilized sand**

All distances in this section are measured from outside wall of the pipe or manhole.

Where pressure pipe is called for by the TAC, the sewer main/line pipe and gaskets shall have a minimum pressure rating of 150 psi.

## 2. Other Sanitary Sewer Mains:

- a. Horizontal Separation: If two or more sanitary sewer mains are located parallel to one another, a minimum horizontal clearance of 5 feet shall be required, as measured from the outermost edge of each main.
- b. Vertical Separation: In the event that two sanitary sewer mains cross one another, the minimum vertical separation shall be 6 inches, as measured from the outermost edge of each main.

## 3. Storm Drains and Franchise Utilities:

- a. Horizontal Separation: If a storm drain or underground franchise utility is located parallel to a proposed sanitary sewer main, a minimum horizontal clearance of 5 feet shall be required, as measured from the outermost edge of each main/line.
- b. Vertical Separation: When a sanitary sewer main is proposed to cross a storm drain or underground franchise utility, the minimum vertical separation shall be 2 feet, as measured from the outermost edge of each main/line.

4. Coordination with Permitting Authorities: Where proposed sanitary sewer mains are required to be placed within or crossing easements or the right-of-way of a permitting authority (e.g. TxDOT or Railroad), the design is to adhere to the permitting requirements with such entity and should confirm that future expansions from the entity will not impact the proposed sanitary sewer main.

## 5.4 Sanitary Sewer Main Sizing and Construction

### A. Sewer Mains ( $\leq 15$ -inch):

Sewer mains shall have a minimum internal diameter of 8-inches, or larger, as

determined by the engineer or as directed by the WUSD.

**B. Interceptor Mains ( $\geq 18$ -inch):**

Interceptor mains shall be a minimum internal diameter of 18-inches, or larger as directed by the WUSD.

**C. Standard Sizes:**

1. Sewer Mains: Shall consist of the following diameters (in inches): 8, 10, 12, and 15.
2. Interceptor Mains: Shall consist of the following diameters (in inches): 18, 21, 24, 27, 30, 36, and multiples of 6-inch thereafter.

**D. Minimum and Maximum Pipe Slopes:**

Sanitary sewer mains must be designed with a slope that provides a water velocity of 2 feet per second (2 ft/sec.) if the pipe is flowing full. The maximum velocity of any sanitary sewer main is restricted to 10 ft/sec. when flowing full. Table 5.4.1 shows the WUSD's minimum and maximum allowable pipe slopes within the City and its ETJ.

**E. Sags:**

Sewer main grade sags are not permitted.

**F. Construction Survey Requirements:**

All newly installed sanitary sewer manholes shall be surveyed to determine uniform grade and accurate construction slope. Survey must be conducted by a Texas Registered Licensed Professional Surveyor.

**Table 5.4.1 Minimum and Maximum Pipe Slopes**

Size of Main (Inches)	Minimum Slope (%) <sup>1</sup>	Maximum Slope (%)
8	0.40	8.00
10	0.30	6.00
12	0.25	4.50
15	0.20	3.50
18	0.15	2.50
21	0.12	2.00
24	0.10	1.80
27	0.08	1.60
30	0.06	1.40
36	0.05	1.10
$\geq 42$	See Section 5.4.G	

<sup>1</sup> When connecting to an existing SSMH, existing sewer line grade, or where there are proven grade limitations, TCEQ minimums may be used with the WUSD's approval.

**G. Large Mains**

For mains larger than 36-inches in diameter, the slope shall be calculated by using the *Manning's Equation* to determine a pipe slope to ensure a full pipe velocity greater than 2.0 ft/sec. and less than 10 ft/sec. ( $n=0.013$ ).

$$Q = VA = \left( \frac{1.49}{n} \right) AR^{2/3} \sqrt{S}$$

Where:  $Q$  = Peak Daily Flow Rate ( $\text{ft}^3/\text{s}$ )  
 $V$  = Velocity ( $\text{ft}/\text{s}$ )  
 $A$  = Flow Area ( $\text{ft}^2$ )  
 $n$  = Manning's Roughness Coefficient ( $n = 0.013$ )  
 $R$  = Hydraulic Radius ( $\text{ft}$ )  
 $S$  = Pipe Slope ( $\text{ft}/\text{ft}$ )

## H. Sizing Criteria:

All sanitary sewer mains must be sized in accordance with any approved master plan established for the area. The City will require a sewer system capacity study, performed by the Engineer of Record, to ensure there is adequate capacity to support the proposed development or subdivision. The limits of this study will be determined by the WUSD.

Sanitary sewer mains shall be designed to convey the calculated Peak Dry Weather Flows (PDWF) and Peak Wet Weather Flows (PWWF) as follows:

1. Sewer Mains ( $\leq 15$ -inch):

  - a. The main shall be designed such that the PDWF does not exceed 65% of the capacity of the pipe when flowing full.
  - b. The main shall be designed such that the PWWF does not exceed 85% of the capacity of the pipe when flowing full.

2. Interceptor Mains ( $\geq 18$ -inch): The main shall be designed such that the PWWF does not exceed 80% of the capacity of the pipe flowing full.

Sewage flow projections shall be based on the actual population, number of residential units and/or commercial density, and actual water use, if known. Developers or their engineers may utilize City of Waco historical water use records to estimate proposed water demands. Use of comparative data sourcing shall be preapproved by WUSD.

If population and water use data is not available, the sewage flow projections shall be calculated using the population estimation chart and flow formulas provided herein.

**Table 5.4.2 Sewer Design Population Estimation**

Land Use	Zoning	Avg. Population (Population/Acre)
Rural Residential	R-E	3*
Suburban Residential	R-1A	10*
Urban Residential	R-1B, R-1C, R-2	25*
Medium Density Residential Office Flex	O-1, O-3, R-2, R-3A, R-3B, R-3C	50*
Office Industrial Flex	O-1, O-2, O-3, C-1, C-2, M-1	50* 80**

Mixed Use Flex	R-3C, R-3D, R-3E, O-1, O-2, O-3, C-1, C-2	50* 90**
Mixed Use Core	R-3D, R-3E, O-2, C-2, C-4	50* 100**
Industrial	M-2	80**
Institutional	O-2	80**
Open Space	R-E	N/A

\* Acreage equals total land area.

\*\* Acreage equals the building square footage x # of floors / 43,560 sf/acre.

## I. Peak Wet Weather Flow (PWWF):

### 1. Residential:

- Average Dry Weather Flow (ADWF) = 100 gallons/per capita/day (GPCD) = 0.0694 GPM/per capita
- ADWF of population = (0.0694 GPM/per capita) x (Population) = (Total flow in GPM)
- Ratio of ADWF to PDWF using *Harmon Formula*:

$$R = 1 + \left( \frac{14}{4 + \sqrt{P}} \right)$$

Where:  $R$  = Peaking Factor\*

$P$  = Contributing Population in thousands

\* Minimum Peaking Factor ( $R$ ), equals 4.0 for new subdivisions.

Note: The WUSD shall require use of Master Plan peaking data or other documented system peaking factors.

- Inflow and Infiltration (I/I): When available or warranted, the Engineer shall use measured I/I data. In the absence of available data, a value of 750 GPD per acre served (0.52 GPM per acre served) shall be used to account for I/I.
- Peak Wet Weather Flow (PWWF) =  $R$ (ADWF) + I/I

### 2. Mixed Land Use:

- Average Dry Weather Flow (ADWF)
  - Residential: 80 gallons/per capita/day (GPCD) = 0.0555 GPM/per capita
  - Non-residential: 40 gallons/per capita/day (GPCD) = 0.0278 GPM/per capita
- ADWF of population = (0.0555 GPM/per capita) x (Residential population) + (0.0278 GPM/per capita) x (Non-residential population) = (Total flow in GPM)
- Ratio of ADWF to PDWF using *Harmon Formula*:

$$R = 1 + \left( \frac{14}{4 + \sqrt{P}} \right)$$

Where:  $R$  = Peaking Factor\*

$P = \text{Contributing Population in thousands}$

\* Minimum Peaking Factor ( $R$ ), equals 4.0 for new subdivisions.

Note: The WUSD shall require use of Master Plan peaking data or other documented system peaking factors.

- d. Inflow and Infiltration (I/I): When available or warranted, the Engineer shall use measured I/I data. In the absence of available data, a value of 750 GPD per acre served shall be used to account for I/I.
- e. Peak Wet Weather Flow (PWWF) =  $R(\text{ADWF}) + \text{I/I}$
3. Single Developments: Peak Design Flows shall be based on *Plumbing Code* requirements.

## 5.5 Sanitary Sewer Main Materials

Allowable sanitary sewer main materials, joints, and fittings shall be in accordance with the City's *Standard Specifications for Construction, Materials and Construction Methods, Section 4.7: Piping Materials*, and as follows:

### A. Polyvinyl Chloride (PVC) Pipe:

1. 8-inch through 15-inch: ASTM D3034 or ASTM D2241 (Type PSM, SDR-26), default unless noted otherwise.
2. 18-inch through 36-inch: ASTM F679 or ASTM D2241 (PS115), default unless noted otherwise.
3. Joints: Rubber gasket (ASTM D3212 and ASTM F477)

### B. High Density Polyethylene (HDPE) Pipe:

1. Diameter: Design of HDPE sanitary sewer mains, including pipeline capacity shall be based on actual pipe ID
2. 4-inch through 12-inch, AWWA C906: PE4710 Pressure Class 160, (DIPS) DR13.5
3. 18-inch and 24-inch, AWWA C906: PE4710 Pressure Class 160, (DIPS) DR13.5, or as specified by Design Engineer and approved by the WUSD.
4. Joints: Heat fusion joining in accordance with ASTM F2620. All valves shall be installed with a HDPE flange adapter with backing ring.
5. Debeading: All HDPE gravity sanitary sewer shall be debeaded. No bead shall intrude more than 1/8-inch into the pipe.

### C. Other:

Additional sanitary sewer main materials may be considered for use with large interceptor mains or trenchless rehabilitations. Materials may include: FRP, HDPE, etc. Engineer shall coordinate the use of these sanitary sewer main materials and obtain pre-approval by the WUSD.

## 5.6 Embedment and Backfill Requirements for Sanitary Sewer Mains

### A. Embedment (or Pipe Bedding Material):



Embedment requirements for sanitary sewer mains shall meet the requirements for Type “A” backfill as defined in the City’s *Standard Specifications for Construction, Section 4.2, Part 2.A.2 and Part 2.A.3* and the City’s *Manual of Standard Details, Detail G-8 & G-10*.

1. Standard: Standard embedment is utilized in ALL areas, unless an alternative embedment is approved by the WUSD AND the City Engineer.
2. Concrete Encasement: Concrete Encasement is required in lieu of standard embedment at ALL utility crossings where the vertical separation distance is less than 2 feet and any other location shown on the construction drawings. Concrete encase the lower utility, unless otherwise shown.

#### **B. Backfill:**

Backfill requirements for sanitary sewer mains shall meet the requirements for backfill as defined in the City’s *Standard Specifications for Construction, Materials and Construction Methods, Section 4.2, Part 2.A.3* and the City’s *Manual of Standard Details, Detail G-10*.

1. Standard Trench: Type “A” backfill is required for ALL areas subject to the influence of traffic, including right-of-ways, alleyways and parking areas.
2. Off-street Trench: In areas not influenced by traffic, select fill may be used in lieu of Type “A” backfill.
3. Excavated Material: Native material which has been excavated may only be utilized as backfill should it meet City of Waco Standard Specifications for Construction, or if preapproved by the WUSD or City Engineer.

#### **C. Clay Dams:**

Clay dams shall be installed near the downstream manhole, at storm drain main crossings, near bodies of water, at maximum 1,000 LF intervals, in areas with groundwater, and where deemed appropriate by the WUSD.

### **5.7 Connection to Existing Sanitary Sewer Mains**

#### **A. Service Connections:**

1. Grade:
  - a. Minimum: 2%
2. Residential:
  - a. Minimum 4-inch diameter in accordance with the City’s *Manual of Standard Details, Detail S-2*.
  - b. Taps may only be connected to laterals or collector mains  $\leq$  15-inches in diameter.
  - c. Taps should be perpendicular to the public sanitary sewer main (with the exception of the wye fitting at the main) and not contain bends or deflections to the cleanout.

- d. Taps shall be placed where the available sewer main elevation is the lowest, i.e. the place that allows for the greatest private service grade - the “low” side of the property service.
3. Non-residential:
  - a. Minimum 6-inch diameter in accordance with the City’s *Manual of Standard Details, Detail S-4*
  - b. Connection must be at an existing or proposed manhole on a main  $\leq$  15-inch in diameter, unless otherwise approved by the WUSD.
  - c. Should be no greater than 90°, or less than 45°, from the upstream direction of flow within the main.

#### **B. Extensions:**

Any extension or tangential connection to an existing sanitary sewer main shall be of the same size, material, and slope. Any change to pipe size, pipe material, or grade requires the installation of a transition sewer manhole.

### **5.8 Manholes**

#### **A. Location:**

1. Manholes shall be placed at ALL points of change in pipe alignment, grade, nominal diameter, and material. Manholes shall be placed at all intersections of sanitary sewer mains and at the end of all mains that may be extended in the future.
2. All public manholes should be located within public right-of-way or a public sanitary sewer easement.
3. Manholes located in undeveloped areas shall include a 10-foot x 10-foot concrete pad and locator signs on indicator posts in accordance with the City’s *Manual of Standard Details, Details S-13 and G-12*.
4. Manholes located within a 100-yr. floodplain or areas subject to flooding shall require a watertight manhole ring and cover in accordance with the City’s *Manual of Standard Details, Detail S-8*.

#### **B. Spacing:**

Refer to Table 5.8.1 for the maximum allowable distance between manholes.

**Table 5.8.1 Maximum Allowable Distance between Manholes**

Size of Largest Main	Max. Distance (feet)
$\leq$ 15-inch	450
18-inch to 30-inch	800

≥ 36-inch	1,000
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### C. Size:

The minimum inside diameter of a manhole must be no less than 48 inches. Refer to Table 5.8.2 for the minimum allowable inside diameter. A larger manhole may be required to accommodate multiple penetrations, a drop structure, a flow meter, special access, or other maintenance requirements.

**Table 5.8.2 Minimum Allowable Inside Diameter Manhole**

Size of Largest Main	Depth of Manhole (feet)	Min. Diameter (feet)
8-inch	6-10	4
	10-20	5
	> 20	6
12-inch to 15-inch	6-20	5
	> 20	6
> 15-inch	All	6 min.

### D. Type:

1. Standard:
  - a. 48-inch inside diameter and in accordance with the City's *Manual of Standard Details, Details S-5, S-6, S-7, S-8, S-9, S-10, S-11, and S-13*.
  - b. 6 feet is the standard depth.
  - c. If a main enters more than 24 inches above the exiting invert, the manhole must have an external drop fixture.
2. Internal Drop:
  - a. Internal drop manhole designs must be approved by variance.
3. External Drop:
  - a. In accordance with the City's *Manual of Standard Details, Detail S-16*.

### E. Material:

Sanitary sewer manholes shall be either cast-in-place concrete, precast concrete, or preapproved polymer concrete. Fiberglass manholes are permitted only by approved variance.

### F. Corrosion Protection:

Protective Coating: TNEMEC Series 218, primed, then TNEMEC Series 436, on the inside. (60 mil minimum). Coating shall be added to the manhole exterior for all exposed applications. Extend exterior coating 18-inches below ground.

Precast Concrete Admixture: Con<sup>MIC</sup>Shield® or approved equal. Contractor shall provide a 5-year maintenance bond warranty for parts and labor for manhole installations.

### **G. Venting:**

1. Shall be provided for bolted and/or gasketed covers at least every 1,500 feet or every third manhole (whichever is less).
2. Must be designed to prevent inflow and be located a minimum of 2 feet (5 feet maximum) above the 100-year flood elevation.

### **H. Private Manholes:**

Private manholes shall meet all the requirements of public manholes with the following exceptions:

- a. Private manholes shall be located on private property.
- b. Private manhole covers shall not bear the City of Waco logo.

## **5.9 Sanitary Sewer Service and Cleanout Requirements**

### **A. Residential:**

1. Minimum 4-inch diameter in accordance with the City's *Manual of Standard Details, Details S-2 and S-3*.
2. Service lines from the sewerage main to the public/private cleanout must be located within public right-of-way or a public sanitary sewer easement and shall be owned and maintained by the City.
3. Service lines shall not cross property lines.
4. Service lines from the public/private cleanout to the point of use are considered private and shall be owned and maintained in good working condition by the property owner.
5. Service lines should be straight and generally perpendicular to the public sanitary sewer main (with the exception of the wye fitting at the main) and not contain horizontal bends or deflections toward the public/private cleanout.
6. Services within cul-de-sacs may be connected to a manhole. Services tied to manholes shall penetrate such that the flow line of the service matches the crown of the downstream main. All other residential services should be connected directly to the sewerage main.
7. Service lines not connected to a sanitary sewer manhole shall have a minimum of 5 feet of separation from one another.
8. A 2-way cleanout near right-of-way/easement line is required to demarcate public vs. private maintenance responsibilities. To the extent possible, cleanouts should be located outside of paved areas.
9. On construction plans, the Engineer of Record shall illustrate building finished floor elevations, clean-out flowline information, and grades for ALL sanitary sewer service designs. Engineers shall provide notification to the City when available grade is less than 2% for private side sewer service.
10. Sewer service reroutes from the front-to-back or back-to-front of a house shall be detailed for each property being rerouted.

### **B. Non-residential:**

1. Minimum 6-inch diameter in accordance with the City's *Manual of Standard Details*,

*Detail S-4.*

2. Does not require an ownership delineation cleanout; however, an “S” should be stamped or cut into the face of the curb where the service line is located, in accordance with the City’s *Manual of Standard Details, Detail S-1*.
3. Sewer service must connect to an existing or proposed sanitary sewer manhole.
4. Should be no greater than 90°, or less than 45°, from the upstream direction of flow in the main.
5. New sanitary sewer service (non-redevelopment) shall be perpendicular to the sanitary sewer main

## **5.10 Closed Circuit Television Video (CCTV)**

Post-CCTV is required for all public sanitary sewer main construction projects and should be included as a bid item in the construction documents. Pre-CCTV is required for all rehabilitation or relocation sanitary sewer main projects and shall be included as a bid item in the construction documents. All CCTV is required to be performed per the City’s *Standard Specifications for Construction, Section 4.8, Part 3.C*. In addition, the Contractor or television camera technician shall document the condition of all sewer mains (and casing pipes) in accordance with the National Association of Sewer Service Companies (NASSCO) standards and shall utilize Pipeline Assessment Certification Program (PACP) inspection nomenclature. Deviations from this standard are not permitted.

## **5.11 Odor Control Units**

The City may require the installation of odor control units at force mains, lift stations, inverted siphons, drop manholes, or 18-inch (and larger) diameter sanitary sewer mains in order to prevent the collection system from becoming a nuisance. Odor control units must be designed in accordance with requirements of the WUSD.

## **5.12 Pretreatment Facilities**

Pretreatment facilities shall be required for all categorical industrial users and/or significant industrial users proposing to connect to or contribute to the City’s sanitary sewer system in accordance with *Title 40 Code of Federal Regulations (40 CFR), Subsection 403*.

- A. Fats, Oils and Grease (FOG) Removal Systems: Required for all applicable food manufacturing, processing, preparation, and food service providers.
- B. Oil/Sand Separators: Required for the proper handling of any flammable wastes, sand or other harmful constituents.

Pretreatment facility locations shall be as approved by the City and privately owned, operated and maintained.

All applications for pretreatment systems must be reviewed and approved by:

***Waco Metropolitan Area Regional Sewerage System (WMARSS)  
Pretreatment Coordinator  
City of Waco  
P.O. Box 2570***

**Waco, Texas 76702**  
**Phone: (254) 299-2453**  
**Phone: (254) 750-8040**

### **5.13 Lift Stations and Force Mains**

It is the intent of the City of Waco to provide sanitary sewer service through gravity main extensions. In the event that a gravity main extension is not practical, the WUSD may allow the design and construction of a lift station and force main to serve a new development. Lift stations and force mains shall be designed in accordance with *Texas Administrative Code (TAC), Title 30, Chapter 217.59 through 217.68 and applicable portions of 217.90 through 217.100*, the City's *Standard Specifications for Construction, Materials and Construction Methods, Section 4.13*, and the City's *Manual of Standard Details, Details S-24A and S-24B*.

#### **A. Engineering Design Report:**

In order for a lift station to be approved for construction, the design engineer shall develop and submit a report for review and approval by the WUSD that satisfies all TCEQ requirements, and the following:

1. Report must be signed and sealed by a professional engineer licensed in the State of Texas.
2. Adequate justification for the proposed lift station, including a cost analysis that compares a traditional gravity system extension vs. the installation and 30 year O&M costs of the proposed lift station.
3. Calculation of peak wet weather flows (PWWF) into the lift station in accordance with *Section 5.4 Sanitary Sewer Main Sizing*.
4. Design data including: storage requirements – in accordance with 30 TAC 217.60, cycle time, total dynamic head (TDH), Net Positive Suction Head available (NPSHa), Net Positive Suction Head required (NPSHr), pump(s), pump curves, system curves, motor(s) etc.
5. Capacity analysis of downstream receiving sanitary sewer main(s) or facility.
6. Electrical power availability, reliability, and necessary standby power requirements.
7. SCADA communication study.
8. Emergency power requirements in lieu of additional wet well capacity.
9. Security and access requirements.
10. Odor study.

#### **B. Lift Stations:**

1. Private:
  - a. Shall comply with applicable portions of 30 TAC 217.90 – 217.100, Alternative Collection Systems.
  - b. Shall only serve a single property (commercial or residential) where a gravity system is not feasible.
  - c. Shall only be allowed when a public collection system exists adjacent to the development but is not deep enough to serve the development.

- d. Require a backflow prevention device to protect from public collection system backups.
- e. The force main shall discharge to a gravity sanitary sewer service via a clean-out, located per detail S-2, S-3, and S-4 and gravity flow to the public sanitary sewer main. Private force mains shall not be allowed to discharge directly to a public sanitary sewer main or manhole. Commercial private lift stations shall discharge to a private manhole, located on private property. Only gravity flow is allowed within public right-of-way.

2. Public:

- a. Shall serve multiple properties where a gravity system is not feasible.
- b. At a minimum shall be sized to serve the development when completely built out, including peak wet weather flow.
- c. Shall be identified and located to contribute as much service to a region of a sewer basin as possible. The City may participate in lift station projects that serve or may serve multiple developments.
- d. Site shall be located as remotely as possible from residences. Site equipment, including wet well and check valve vault, shall not be located less than 100 feet from a residential lot or less than 150 feet from a residential dwelling.
- e. Site and access shall be dedicated to the City.
- f. The lift station shall include a minimum of two (2) pumps. The capacity of the pumps shall be such that the PWWF can be handled with the largest pump out of service.
- g. The lift station shall include provisions for pump removal by hoist or crane.
- h. Shall be designed to prevent nuisance odors.
- i. Wet well design:
  - i. Shall be designed in accordance with the City's *Standard Specifications for Construction, Materials and Construction Methods, Materials and Construction Methods, Section 4.13*, and the City's *Manual of Standard Details, Details S-24A and S-24B*.
  - ii. Shall be constructed of polymer concrete, or
  - iii. Shall be constructed reinforced concrete and have an approved coating..... or approved equal.—Look up Cloice, or
  - iv. Shall be constructed of FRP reinforced with 6" concrete all around.
  - v. Design shall include odor mitigation controls.
  - vi. Shall have an entry that provides access to the entire wet well or a minimum of two entry points for cleaning and maintenance.
  - vii. Wet well shall terminate 2 feet above the 100 year floodplain.

**C. Force Mains:**

- 1. Force mains shall be designed in accordance with *Texas Administrative Code (TAC), Title 30, Chapter 217.64 through 217.68* and the City's *Standard*

*Specifications for Construction, Materials and Construction Methods, Section 4.13*  
and the following:

- a. Material: All force mains shall be DR 18, C900 PVC or DR 13.5, Class 160 HDPE and meet the requirements of *Section 4.5.C*, as a minimum. A higher pressure class pipe may be required due to working pressure or surge conditions.
- b. Identification:
  - 1. A detectable underground warning tape AND tracer wire must be laid in the same trench as the force main pipe. The detectable underground warning tape must be located above and parallel to the force main.
  - 2. The detectable underground warning tape must bear the label "PRESSURIZED WASTEWATER", continuously repeated, in at least 1.5-inch tall letters.
- c. Alignment: Force mains shall be aligned to minimize peaks and valleys which requires the use of combination air valves.
- d. Separation Distance: The separation distance between a sanitary sewer force main and a water supply line shall be in accordance with *Section 5.3.C.1*.
- e. Surge Pressure: The engineer shall evaluate, and when necessary, include surge control measures to manage pressure surges due to water hammer.
- f. Valves:
  - i. Air Release Valves:
    - 1) Shall be placed as required to vent air accumulation in the force main and to prevent negative pressures from occurring within the force main.
    - 2) Are to be installed at all high points (peaks) and where required along the force main.
    - 3) Shall be located inside of a vault that is at least 48-inches in diameter and has a vented access opening of at least 30-inches in diameter.
    - 4) Shall be made of corrosion-resistant material.
    - 5) Shall have a passive odor control system.
    - 6) All hardware, connecting piping between the main and cut-off valve internals, shall be 316 stainless steel.
  - ii. Gate Valves:
    - 1) Gate valves must be spaced at no more than 2,000-foot intervals to facilitate testing, maintenance, and repairs.
    - 2) Gate valves shall be required at water body crossings, railroad crossing, and highway crossings.
    - 3) Gate valves will be required at the base and at the top of hills that exceed 300 linear feet in alignment length. A gate valve will also be required at the midpoint in hills that exceed 1,000-feet in length.



## 5.14 Siphons and Aerial Crossings

New sewerage designs shall be performed in accordance with this manual and shall limit the installation of siphons and aerial crossings. ALL development plans that consider the installation of sewerage siphons and/or aerial crossings shall be accompanied with an Engineer of Record report that analyzes multiple sewerage alternatives and demonstrates that a gravity sewerage solution is not technically feasible, produces an extreme burden on the developer, or is a maintenance benefit to the City of Waco. ALL aerial crossings and siphons shall be individually approved on a case-by-case basis by the WUSD.

## 5.15 Removal and Abandonment of Sanitary Sewer Mains and Appurtenances

### A. Removal:

1. Existing sanitary sewer mains and appurtenances shall be removed and properly disposed of if a proposed sanitary sewer main is to be located within 3' of the existing main.
2. Existing sanitary sewer mains that are scheduled to be abandoned are to be removed throughout the entire conflict trench, plus 2 feet, and plugged at any proposed improvement conflict location.
3. Manholes:
  - a. Remove and salvage ring and cover (deliver to WUSD).
  - b. Demolish, remove, and dispose of the entire manhole. Backfill with Type A Material (as per City's Standard Specifications for Construction, Materials and Construction Methods, Section 4.2 Part 2, A.3.a.) and re-establish surface as per Standard Detail G-9.

### B. Abandonment:

1. Existing sanitary sewer mains  $\leq$  6-inch: Mains to be abandoned in place shall be plugged at all cut and removal locations.
2. Existing sanitary sewer mains  $\geq$  8-inch: Mains to be abandoned in place shall be grouted with flowable fill and plugged at all cut and removal locations.
3. Manholes:
  - a. Remove and salvage ring and cover (deliver to WUSD).
  - b. Abandon in accordance with the City's *Manual of Standard Details, Detail S-18*.

### C. Abandonment Plugs:

Abandonment plugs shall consist of flowable fill placed at the ends of all sanitary sewer mains that are to be abandoned to a minimum distance of 3 feet inside the main to be abandoned, or as otherwise specified.

## 5.16 Bypass Pumping

If construction necessitates removing or abandoning an existing sanitary sewer main prior to the new main being put into service, provisions must be made for a temporary bypass. Any required bypass pumping shall be indicated on the construction drawings along with a sequence of construction and bypass pumping plan.

## **5.17 Sanitary Sewer Main Crossings**

### **A. General:**

#### **1. Steel Casing:**

- a. Where required, casing shall extend a min. of 4 feet beyond each side of a crossing.
- b. Casing pipe nominal diameter shall be a minimum of 12-inches larger than carrier pipe nominal diameter.
- c. Carrier pipe (sanitary sewer main) shall be restrained joint and installed with plastic or stainless steel casing spacers.
- d. Casing pipe shall include end seals at each end of casing pipe.
- e. Metallic casing pipe shall be fully welded and watertight to 150 psi.

### **B. Texas Department of Transportation (TxDOT) Crossings:**

1. The design of sanitary sewer mains under or along TxDOT right-of-way must be in compliance with all applicable TxDOT requirements and in accordance with *Texas Administrative Code (TAC), Title 43, Part 1, Chapter 21, Subchapter C: Utility Accommodation*.
2. Prior to construction, an approved *TxDOT Utility Installation Permit* must be obtained.
3. Location:
  - a. Sanitary sewer mains shall be located to avoid or minimize the impact of known future highway projects and improvements.
  - b. Longitudinal installations, if allowed, shall be located on an alignment of uniform distance to the right-of-way line and provide space for future highway construction and possible future utility facility installations.
  - c. New sanitary sewer mains crossing a highway shall be installed at approximately 90° to the centerline of the highway.
  - d. All new sanitary sewer mains proposed to cross TxDOT right-of-way shall be installed by boring or tunneling and encased in steel casing pipe from right-of-way to right-of-way. Boring shall be per TxDOT's requirements and the City's *Manual of Standard Details, Detail W-31*.
  - e. All new sanitary sewer main crossings shall include a manhole on each side of the highway crossing.

### **C. Railroad Crossings:**

1. The design of sanitary sewer mains within railroad right-of-way must be in accordance with the requirements of the railroad with jurisdiction of the railroad being crossed. The engineer should obtain the railroad's utility accommodation policies prior to beginning design. These include, but are not limited to, insurance and

licensing agreement requirements.

2. Prior to construction, an approved railroad crossing Permit or License Agreement must be obtained.
3. New sanitary sewer mains crossing a railroad shall be installed at approximately 90° to the centerline of the railroad.
4. All new sanitary sewer mains proposed to cross railroad right-of-way shall be designed in accordance with the latest addition of the *American Railway Engineering & Maintenance Association's (AREMA's)* guidelines.
5. All new sanitary sewer mains proposed to cross railroad right-of-way shall be installed by boring and encased in steel casing pipe from right-of-way to right-of-way. Boring shall be per railroad requirements and the City's *Manual of Standard Details, Detail W-30*.
6. All new sanitary sewer main crossings shall include a manhole on each side of the railroad crossing, outside of the limits of the right-of-way.

#### **D. River, Stream and Lake Crossings:**

The crossing of rivers, streams, lakes, and other bodies of water is discouraged. When there is no other reasonable alternative, crossings are required to meet jurisdictional determination and permitting requirements in accordance with the United States Army Corps of Engineers and other regulatory agencies.

- a. Trenchless Installation: All new sanitary sewer mains proposed to cross under any existing channel or body of water shall be installed by bore or horizontal directional drill and encased in casing pipe. Bore shall be per the City's *Manual of Standard Details, Detail W-31*.
- b. Open Cut Installation: Open cut installation should be avoided. If boring or horizontal directional drill is not practical, open cut installation shall be as approved by the WUSD and in accordance with the United States Army Corps of Engineers and other regulatory agency requirements.

#### **E. Elevated Crossings:**

Elevated crossings for sanitary sewer mains should be avoided. If an elevated crossing is warranted, the crossing shall be as approved by the WUSD.

### **5.18 On-Site Sewage Facilities (OSSF)**

The OSSF program is governed by McLennan County and is implemented and enforced under the *Texas Health and Safety Code, Chapter 366* and *Texas Administrative Code (TAC), Title 30, Chapter 285: On-Site Sewage Facilities*. Through an agreement between the City of Waco and McLennan County, the Public Health District administers the program for McLennan County, the cities in McLennan County and the City of Waco.

All applications for OSSF systems must be reviewed and approved by:

**Waco-McLennan County Public Health District  
OSSF Program  
Mae Jackson Development Center  
P.O. Box 2570  
Waco, Texas 76702**

**Phone: (254) 299-2405**

**Fax: (254) 750-6619**

The OSSF program is comprehensive in nature since the goal is to eliminate and prevent health hazards and pollution. The staff members achieve this goal by regulating, permitting, planning, and inspecting the location, design, construction, installation, operation and maintenance of all on-site sewage disposal systems. The division is responsible for investigating and resolving complaints regarding on-site sewage facilities (septic systems).

Sewer service within the City of Waco shall be performed as follows:

- A. Residential Property: Shall tie to an existing public collection system within the City of Waco, if available.
- B. Commercial Property: Shall tie to an existing public collection system or provide an extension to a public collection system within the City of Waco.

Sewer service not performed in accordance with 5.18 (A) or 5.18 (B) must obtain permission from the WUSD or seek remedy via current City Ordinance.