BRYAN / COLLEGE STATION

UNIFIED DESIGN GUIDELINES

~~2012~~
2016

Sanitary Sewer

Sentences and/or paragraphs that are double underlined indicate revisions that were made from the ~~2009~~ 2012 manual.

Table of Contents

GENERAL 1
Submittal Requirements 1
Special Designs 2
Connections 2
PIPE SELECTION 2
Pipe Materials 2
Pipe Sizing 3
Standard Pipe Sizes 3
Minimum Pipe Sizes 3
Flow Requirements 3
Flow Calculation 4
System Design Criteria 4
PIPE ALIGNMENT 5
Horizontal Layout 6
Vertical Layout 6
Separation from Water Facilities 6
MANHOLES 7
CROSSINGS 7
ENCASEMENTS 8
EASEMENTS 8

List of Tables

Table I – Fixture Units Per Unit Or Group 10
Table II – Peak Wastewater Flows Based On Fixture Units 11
Table III – Average Wastewater Generations 11

Figures

Figure I – Utility Corridor 12

GENERAL:

The purpose of this manual is to establish certain minimum criteria for the design of wastewater collection mains in the Cities' jurisdiction. It is intended to be used by the city staff and private consulting engineers for all new utility construction, replacements and modifications to the existing systems. Unusual circumstances or special designs requiring exception from the standards in this manual must be approved by the City Engineer.

This manual is intended to be used in conjunction with all current American Water Works Association (AWWA) and Texas Commission on Environmental Quality (TCEQ) requirements. In the case of a conflict between this manual and either or both of these other requirements, the most restrictive will govern.

The criteria outlined in this manual are also intended to be used in conjunction with the Cities' Unified Technical Specifications.

For the purpose of this manual, wastewater collection mains are those mains of 18 inches in diameter or smaller. Larger diameter mains are considered to be interceptor or transmission mains and are subject to additional design criteria and review.

Proposed wastewater collection systems that accept flows from existing upstream sewers shall be designed to accommodate all flows generated by the upstream service area. The existing upstream sewers may experience variable peak flows greater than the peaks utilized in the design of new sewers. The peak flow rates (particularly the infiltration/inflow rates) for each existing subsystem is highly variable. Consult with the City Engineering Services Department to confirm the proper peak flow rates to be used for any existing upstream wastewater collection system. The proposed wastewater collection system design shall include a review of all existing downstream sewers receiving flow from the proposed sewers to verify that flows generated from the proposed wastewater collection system do not adversely affect the performance of the downstream systems.

Submittal Requirements

The design engineer shall submit the following information with all wastewater system designs:

- Plan and profile sheets containing all information necessary to review, construct and inspect the improvements. This shall include a traffic control plan as applicable. Plans shall be clear and legible and shall typically flow left to right and top to bottom.

- Wastewater Design Report showing that the design of the proposed improvements meets the flow requirements of this manual.
- Copy of information provided to TCEQ in compliance with TCEQ submittal requirements (TAC217) for City records purposes. If the project is exempted from TCEQ submittal, this submittal to the City is also exempted.
- Certification that plans meet all requirements except where noted.
- Erosion Control Plan (project limits)
- All engineering documents required to be submitted to the City for Review (i.e. Reports, Construction documents) shall be complete, conform to local, state, and federal regulations, and bear a seal of a Professional Engineer with Signature and date unless the proposed improvements are below the threshold specified in the Texas Board of Professional Engineers.

Special Designs

The City Engineer may, upon request, approve an alternate design or construction methodology that differs from the requirements in this manual if the City Engineer determines that: (1) the alternative design or construction methodology is equivalent to, or superior to, the methodology required in this manual, and (2) the alternative design or construction methodology is sufficient to ensure public health and safety..

Lift station design shall follow acceptable engineering practices and be reviewed by City staff. Lift stations to be owned and maintained by the City of College Station shall be designed utilizing the Lift Station Design Guideline.

Connections

All residential connections and service leads shall be installed to both sides of all roads and alleys at the time of main line installation. Four (4") inch standard service leads shall not be more than 150 feet in length.

Service connections shall be tied into the main line. Service connections do not require a manhole at point of connection. Should the service tie into a manhole, the service shall be close to the flow line or a drop should be installed in accordance with TCEQ Ch. 217.2. Services dropped into a manhole should be no deeper than what is required to service the lot, unless otherwise approved by the City. When manhole is located near normal service location at lot lines in residential areas, service should be

brought to manhole rather than tapping the main. ~~Whenever possible tap the manhole for service taps and extend to property lines.~~

PIPE SELECTION:

Pipes shall be designed to provide a safe, efficient and maintainable system for the collection of wastewater from its various sources of generation to the existing collection and interceptor systems.

Pipe Materials

The following pipe materials may be specified for wastewater, collection, and force mains within the City's rights-of-ways.

- Ductile iron pipe (DIP) per ANSI/AWWA C151/A21.5 pressure class 350 for sizes 6 through 12 inches, pressure class 250 for 18 inch, and pressure class 200 for 24 inch and greater.
- Force mains shall be DIP, pressure class 350 or green colored PVC ASTM D2241 pressure class 200 ~~160~~ and shall not be greater in size than 8 inches.
- Green colored Polyvinyl chloride pipe (PVC) and all fittings shall be SDR26-ASTM D3034 in sizes 6 through 12 inches and SDR26-ASTM F679 for larger sizes. PVC pipe will not be permitted for aerial crossings.

For material information on pipe encasements refer to the "Encasements" section of this document.

Changes in pipe material shall only occur at manholes with the exception of short replacements of sewer lines needed to meet TCEQ separation requirements.

Pipe Sizing

Pipes and pipe systems shall be designed to provide the service criteria listed below.

Standard Pipe Sizes

The standard pipe sizes for wastewater collection mains are 6, 8, 10, 12, and 18 inches in diameter.

Minimum Pipe Sizes

Minimum wastewater pipe sizes shall be as follows:

- Collection Mains – 6 inches
- Residential Service Leads – 4 inches (single & double)
- Commercial Service Leads – 4 or 6 inches depending on demand (single or double when capacity is shown to be adequate and should tie into a manhole)
- Duplex lots shall have a double 4" service per lot or a double service per two lots with a 6 inch service line.

Flow Requirements

Wastewater collection mains shall be sized to meet all of the following requirements using an analysis method based on Manning's equation.

Flow Calculations

One of the following three methods shall be used to determine the peak hourly flows by which a new wastewater system at the fringes of the existing system is to be designed (For new systems being developed within the existing system, consult the Wastewater Master Plan for design criteria). In each method, the following equations apply:

Peak Hourly Flow = (Average Daily Flow)(4)

- **Method 1 - Fixture Count Determination**

  For multi-family residential, institutional, commercial and industrial uses, the "fixture unit" method of estimating peak wastewater generation may be used in accordance with the current duly adopted City Plumbing Code. Table I shows a fixture unit value for various plumbing fixtures and groups of fixtures. Table II shows the probable peak rate of flow generation from systems consisting of various numbers of fixture units.

- **Method 2 – Land Use Determination**

  Table III contains the average daily flow per capita to be expected from a variety of uses.

  The population factor for residential land uses is 2.67 persons per unit, which is then applied to the actual number of units per acre if known, or the maximum units per acre from the current land use plan if the property development is not yet finalized.

  The population factors for non-residential uses are 30 persons per acre for commercial, office and institutional uses and 15 persons per acre for Industrial uses.

- **Method 3 – Historical Data**

  If there is information regarding average daily flows for a particular type of development that is more accurate than the data from the other methods, the historic information may be used. Please discuss this with the City prior to using so as to ensure the information is acceptable.

System Design Criteria

Wastewater mains and collection lines shall be designed to carry the peak daily load estimated from the tributary areas when fully developed to the current land use plan. Determination of peak loadings shall be based on an analysis of the density and character of the land uses in the tributary area and the probable wastewater generation from those uses.

Utilizing the peak hourly flow, pressure flow should not result where the depth of flow exceeds the pipe flowing full.

MINIMUM / MAXIMUM PIPE SLOPES

PIPE SIZE	SLOPE (%)	
	MINIMUM	MAXIMUM
6”	0.80	7.80
8”	0.55	5.30
10”	0.40	3.90
12”	0.30	3.10
18”	0.20	1.80
24”	0.20	1.20
30”	0.20	0.90
36”	0.20	0.70

For lines larger than 36 inches in diameter, the slope may be determined by Manning’s formula to maintain a minimum velocity greater than 2.5 feet per second when flowing full and a maximum velocity less than 8 feet per second when flowing full when using a Manning’s “n” of 0.013.

Pipe velocities should be consistent between manholes and avoid abrupt reductions in velocity.

PIPE ALIGNMENT:

The design of the wastewater collection mains should provide economical access for maintenance and repair, reliability of location and minimum disruption to surrounding facilities during repair operations. In all cases wastewater facilities shall comply with TCEQ requirements.

Horizontal Layout

Wastewater mains and collection lines should be laid straight between manholes and at a uniform distance from the right-of-way line.

The deflection angle from the inflow to outflow pipe at any junction shall not be less than 90 degrees.

The centerline of wastewater mains and collection lines constructed in street rights-of-way shall be located on the opposite side of the street from the water main. Where possible, avoid placing sewer under paved areas, especially manholes.

The City may require the location of a proposed sewer main within a site to be revised based upon proximity to any existing or proposed buildings. ~~Where possible s~~Sewer lines should be located at least 15 to 20 feet away from structures, however size and depth of proposed sewer line may increase this distance. Additional easement may be required.

Vertical Layout

The desired depth for sanitary sewer main shall be six feet (6') as measured from the outside top of pipe vertically to finished ground or pavement surface elevation. The minimum depth shall be two feet (2'). Where the cover is 3.5' or less, ductile iron pipe should be used and cement stabilized sand backfill required where erosion may occur.

Wastewater mains and laterals should be laid on a straight grade between manholes while avoiding excessive depths. Elevations must be shown on construction plans at 100-foot stations and at all manholes and match marks. Elevations are to be calculated to the nearest 0.01 foot.

Wastewater mains and collection lines must be constructed to a depth which will insure gravity flow in service connections to adjacent properties. In general, this is accomplished by setting a 2% (1.04% Min.) grade from the centerline of the collection main to a point one (1) foot below floor

elevation at the building line of the structure being served. The service lead must have a minimum cover of 2 feet at its shallowest point including roadside drainage ditches where present.

Separation From Water Facilities

Separation of public water and wastewater mains will be consistent with the current Rules and Regulations for Public Water Systems of the TCEQ.

Separation of public water and wastewater mains from other underground utilities (storm, gas, etc.) shall be a minimum of ~~3~~ 5 feet longitudinally and 3' vertically.

MANHOLES:

Manholes will be required at changes in horizontal alignment, changes in grade, changes in pipe size and junctions with other wastewater mains or collection lines. Manholes will not be required at the junctions where service leads join mains.

The maximum distance between manholes shall be as per the requirements of TCEQ.

When a change in the size of a wastewater main or collection line occurs without a change in grade, the inside top of pipe (soffit) elevations will be matched in the manhole. Elevation differences between pipes at a manhole may require a drop manhole (see TCEQ for more information).

A 0.1 foot drop through the manhole is desired.

At the end of a main or collection line, the line shall be terminated with a manhole or clean out as per TCEQ requirements. Clean-outs shall only be allowed when there is no physical means for an extension and the line is less than 4 feet in depth. If an extension is anticipated, a plugged stub-out of one full pipe joint with a clean-out is required.

Manholes may be constructed of fiberglass or concrete. Fiberglass manholes may only be used in non-structural areas as a special design.

Manhole sizes shall be as follows:

Manhole Diameter	Main Size
4 ft	<18 in.
5 ft	≥18 in. < 30 in.
6 ft	≥36 in.

CROSSINGS:

Wastewater collection mains that cross state highways must conform to the Cities' Unified Technical Specifications and the requirements of the Texas Department of Transportation (TxDOT).

Wastewater collection mains that cross railroads must conform to the Cities' Unified Technical Specifications and the requirements of the railroad company whose right-of-way is being crossed.

For wastewater collection mains crossing creeks or drainage channels, piers must support the elevated sections of such crossings.

Dry bore all crossings of existing streets unless otherwise authorized by the City Engineer.

Below grade crossings of creeks and drainage channels shall have a minimum cover of 3.5 feet below the flowline at the time of construction. All below grade crossings will require encasement with steel encasement pipe and all ends shall be capped and sealed. The casing shall be carried into the bank a distance that should consider changes in the creek channel. This distance would usually be beyond the high bank such that if you measured a 1:1 slope from the high bank away from the channel, the casing would terminate at that location.

Additional requirements may be needed if depth of pipe is less than 3.5 feet.

ENCASEMENTS:

Steel cylinder pipe shall be used for all encasement pipe. Other encasement pipe material may be used per TCEQ requirements and City Specifications. Carrier pipes sized less than 30 inches shall use an encasement pipe with a wall thickness no less than 3/8-inch. For carrier pipes 30 inches and larger, a wall thickness of no less than 1/2-inch shall be used. Coating of encasement pipe may be required in special soil conditions.

Pipe encasement will be required for all wastewater collection mains crossing any existing street and on new streets classified as major collector or greater. This does not apply to services. Special field conditions may require an alternate method of installation, which must be approved by the City Engineer.

Encasement pipe diameter shall be as specified in the Technical Specifications. Encasement pipes shall extend 2 feet beyond the back of both curbs on the street. Ends of encasement pipes shall be sealed to prevent the intrusion and collection of groundwater.

All carrier pipes will be supported by Cascade carriers (or approved equal), that will allow the removal of the carrier pipe from the encasement pipe in a single direction by means of tension on the carrier pipe only.

BORING/TRENCHLESS INSTALLATION:

Location and size of bore/receiving pits shall be drawn on the plans and details provided on the operation and maintenance of the pits.

EASEMENTS:

Wastewater lines constructed outside of or not adjacent to public rights-of-way shall be in easements of not less than 15 feet in width. ~~except for the following: if the sewer main bury is deeper than 6 feet, the easement width shall be not less than 20 feet: and if the sewer main bury is greater than 14 feet, the easement width shall be 30 feet. Larger widths will be required depending on the depth of the sewer main and type of easement.~~ The minimum easement width required to install and maintain City water and wastewater mains are summarized as follows:

Size of Main (inch)	Depth of Pipe* (ft)	Minimum Width** (ft)
8” through 12”	≤ 6 > 6 and ≤ 14 > 14	15 20 30
16” through 24”	≤ 6 > 6 and ≤ 14 > 14	20 30 40
30” through 66”	≤ 6 > 6 and ≤ 14 > 14	45 50 55
72” and larger	≤ 6 > 6 and ≤ 14 > 14	60 65 70

*Depth of pipe shall be measured from the top of pipe to the ground surface.

**Pipes shall be centered in the easement

If both wastewater and water mains are located within the same easement, the width shall not be less than 30 feet.

Where sewer mains will be adjacent to building structures, easement width shall be increased.

The easement must be located such that the centerline of the wastewater line is no closer than 5.5 feet to the closest edge of the easement.

Wastewater collection mains constructed adjacent to TxDOT maintained roadways shall be located in the utility accommodation zone provided by TxDOT. If there is no utility accommodation zone, or if the zone is occupied, then the wastewater main shall be installed in a separate easement (min. 15 feet) adjacent to the right-of-way.

TABLE I
FIXTURE UNITS PER UNIT OR GROUP

FIXTURE TYPE	FIXTURE UNIT VALUE LOAD FACTOR
One Bathroom Group – tank operated water closet, tub or shower, lavatory	6
Bathtub (with or without shower)	2
Dishwater (domestic)	2
Kitchen Sink With food grinder	1 2
Lavatory	2
Shower Group, per head	3
Sinks, commercial -Surgeon's -Flushing Rim (with valve) -Service -Pot (scullery, etc.)	 3 8 3 4
Urinals	4
Washer, clothes	4
Water Closets -Tank Operated -Valve Operated	 4 8

TABLE II
PEAK WASTEWATER FLOWS BASED ON FIXTURE UNITS

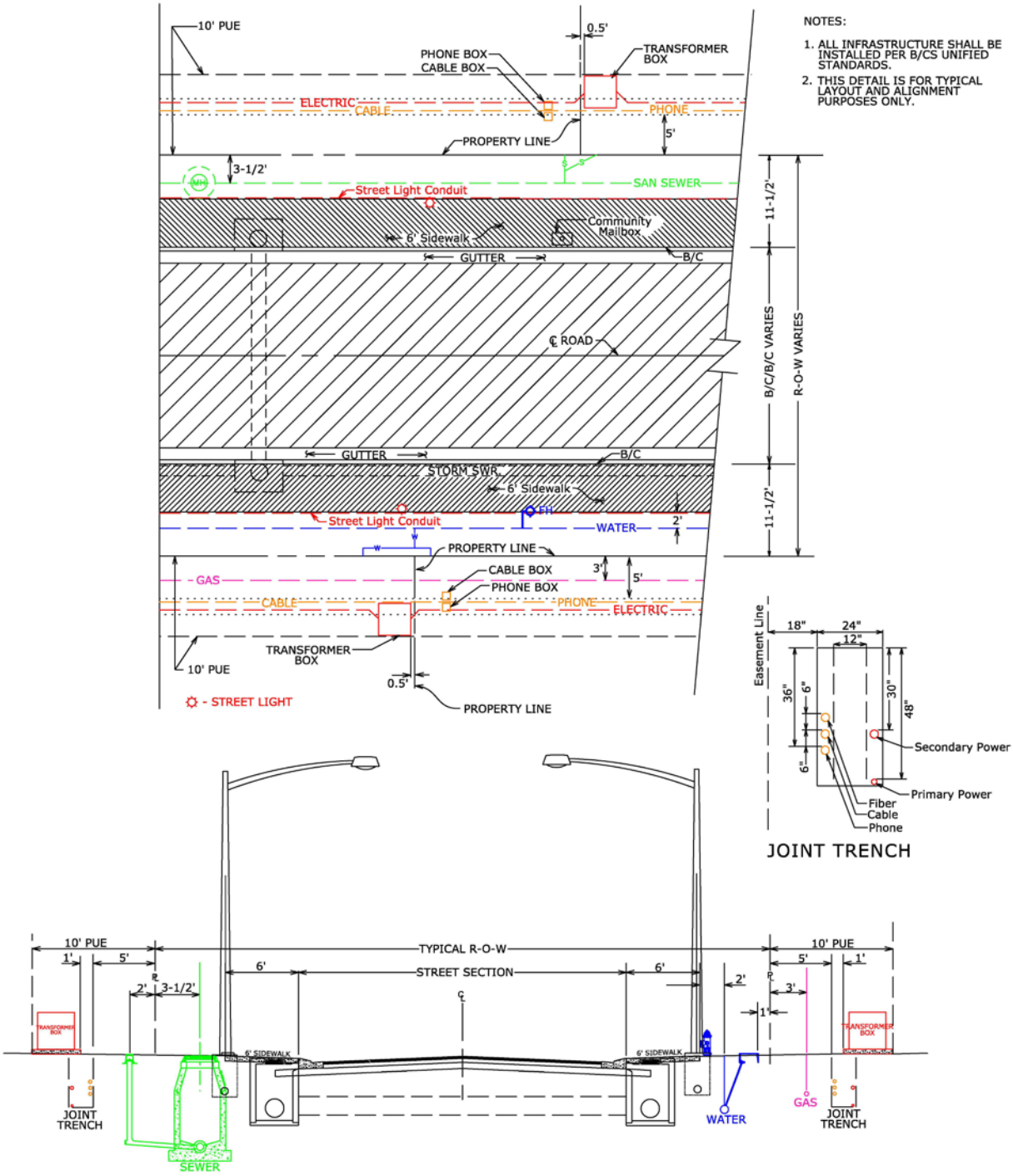
FIXTURE UNITS	PEAK DEMAND (GPM)
500	125
1000	215
1500	300
2000	330
2500	380
3000	420
3500	490
4000	560
4500	630
5000	700
6000	840
7000	980
8000	1120
9000	1260
10000	1330

TABLE III
AVERAGE WASTEWATER GENERATIONS

USE	AVERAGE FLOW GPD/CAP
Residential	100
Commercial -Office -Retail -Hotel/Motel -Restaurants	 50 25 50 * 600 GPD/1000 SF
Institutional -Schools -Hospitals	 35 200
Industrial	50

***** Does not include restaurants or other ancillary

FIGURE I
UTILITY CORRIDOR



UTILITY LOCATION W/ STD CURB INLET
10' PUE - ALL UTILITIES OUTSIDE OF ROAD