CHAPTER 6
SANITARY SEWERS

6.1 General

This section contains the criteria necessary to design sanitary sewers. Flow rates shall be determined using the flow information from Section 4.0–Flow Determination.

6.2 Collector Sewers

Collector sewers are primarily installed to receive wastewater directly from property sewer laterals and transport the wastewater to trunk sewers.

Collector sewers are 10 inches or less in diameter.

Collector sewers shall not be located in detention/retention basins or the embankments that create the basin, drainage rights of way, or in the 10-year flood plain.

6.3 Trunk Sewers

A trunk sewer is a principal sewer to which collector sewers are tributary. Trunk sewers shall be designed to handle the drainage area/watershed above them consistent with Section 4.0–Flow Determination.

Trunk Sewers are 12 inches in diameter and greater.

Trunk sewers shall not be located in storm retention basins or the embankments that create the basin, drainage rights of way, or in the 10-year flood plain.

6.4 Hydraulic Design Criteria

6.4.1 Manning's Equation

Use Manning's Equation to determine the proper size and slope to transport the design flow. For design purposes, the roughness coefficient shall be considered 0.013 regardless of the proposed pipe material.

6.4.2 Collector Sewer Criteria

Design collector sewers as follows:

- Design for full flow conditions
- Minimum Velocity - 2 ft./second
- Maximum velocity - 10 ft./second
- Minimum allowable slopes - See Table 6.1 below.

6.4.3 Trunk Sewer Criteria

Design trunk sewers as follows:

- Design for two-thirds (2/3) full condition
- Minimum Velocity - 2ft./second
- Maximum Velocity - 10 ft./second
- Minimum allowable Slopes - See Table 6.1 below.

TABLE 6. 1 – MINIMUM ALLOWABLE SLOPES

Diameter, Inches	Slopes, %	Slopes, ft./ft.
8	0.40	0.004
10	0.28	0.0028
12	0.22	0.0022
15	0.15	0.0015
16	0.14	0.0014
18	0.12	0.0012
21	0.11	0.0011
24	0.08	0.0008

6.5 Manholes

6.5.1 Location

Manholes shall be located at all changes in pipe grade, pipe size, alignment, pipe intersections and at the end of a run of pipe.

6.5.2 Spacing

For pipes 15 inches and smaller, spacing shall not exceed 400 feet, maximum. For pipes larger than 15 inches, spacing shall not exceed 500 feet, maximum.

6.5.3 Size

A minimum 4-foot diameter manhole shall be used for pipes less than 15-inches diameter. Pipes 15 inches to 24 inches in diameter shall utilize a four- (4) or five- (5) foot diameter, depending on the deflection angles. See the Standard Sanitary Sewer Drawing No. 217 for the manhole sizing guide. Pipes larger than 24 inches in diameter to 36 inches in diameter require a five- (5) foot diameter manhole.

6.5.4 Elevations

The elevation of the nearest downstream manhole lid shall be at least one (1) foot below the lowest plumbing fixture in a structure. The intent is to eliminate the possibility of a clogged or overloaded sewer backing up into a structure, damaging the structure or its contents, or creating a health hazard for the occupants.

The elevation of manhole lids shall be at least one (1) foot above the 100-year flood elevation.

Manholes and sanitary sewer pipes shall not be located in storm retention basins or the embankment creating the basin, or the 10-year flood plain.

6.5.5 Manhole Frames and Covers

Manhole frames and covers shall be consistent with Standard Sanitary Sewer Drawing No. 220. Adjustable frames and covers shall be consistent with Standard Sanitary Sewer Drawing No. 221. Watertight frames and covers shall be consistent with Standard Sanitary Sewer Drawing No. 222.

6.5.6 Manhole Bench

Benches in manholes shall be one pipe diameter for pipes greater than 10 inches and one-half pipe diameter for pipes 10 inches or less. The bench shall slope upward from the flow channel to the walls of the manhole, per LFUCG Standard Drawing #213. All inlets shall have a flow channel.

6.5.7 Existing Brick Manholes

There shall be no new connections to existing brick manholes. Where connections are necessary to an existing brick manhole, the brick manhole shall be replaced with a new manhole that meets the specifications of the LFUCG standard drawings.

6.6 Pipeline Depth

Sewers shall be designed to meet the following depth requirements:

- Minimum four feet of cover, unless sewer is constructed with ductile iron pipe, whereby the minimum cover shall be two and a half (2.5) feet.

- Top of the pipe shall be two and a half (2.5) feet below a stream, creek, or ditch when it is crossed.

- Such a depth to allow proper connections of service laterals from the probable structure location.

Reference is made to Standard Sanitary Sewer Drawing No. 204 that provides details of acceptable fill depths for various pipe materials.

6.7 Sewer System Integrity

In locations where the sanitary sewer may be exposed to non-routine installation conditions, the sewer shall be constructed using ductile iron pipe. These conditions include, but are not limited to:

- Where depth of cover is less than four (4) feet
- Where depth of cover is greater than allowed by Standard Sanitary Sewer Drawing No. 204.
- Where the sewer crosses under a creek or stream.
- Where ductile iron pipe is used, it shall extend from manhole to manhole.
- Where the sewer is constructed of ductile iron pipe, the sanitary sewer service lateral from the main to the property line or easement line shall be ductile iron.

Where the sewer crosses over a storm drain pipe, PVC pipe is allowed, but the sewer joints shall be equidistant from the storm sewer trench.

The Engineer shall contact the Division of Engineering to determine the protection measures necessary when a sanitary sewer is proposed to cross under a new or existing storm drain pipe if the outside wall of the storm drain pipe will be within 18 inches vertically of the outside wall of the sanitary sewer.

The Engineer shall contact the Kentucky Division of Water to determine the protection measures necessary when a sanitary sewer is proposed to cross over or under an existing water main if the outside wall of the water main will be within 18 inches vertically of the outside wall of the sanitary sewer.

6.8 Other Requirements

6.8.1 Service Laterals

Service laterals to single family houses shall be four (4) inch diameter from a four (4) inch tee. Service laterals longer than five (5) feet in length shall be six (6) inches in diameter. Service laterals from the main to the property line or easement line shall be of the same material as the main. If two (2) or more residential units are connected to a common lateral, the line and tee shall be six (6) inch diameter. For commercial or multi- family connections the lateral shall be sized based on the number of units but in no case less than six (6) inches in diameter. Service laterals shall not be located in storm retention basins or the embankments that create the basin.

Six inch diameter laterals serving single family residential units shall be constructed with a cleanout at the end of the lateral where it enters the lot. These laterals shall be shown on the record drawings and shall be subject to the sewer testing requirements in Section 3.2.

The Engineer shall contact the Division of Engineering when a service lateral is to be connected to a manhole. All service laterals connecting to manholes (when approved) shall have a flow channel.

The Developer shall be responsible for installation of necessary additional laterals within the three-year warranty period. Any installation of laterals that were not shown on the Improvement Plans accepted by LFUCG shall meet new construction specifications. This includes installation of only rigid factory tees (no saddles shall be allowed.)

6.8.2 Water Main Separation

Sewers shall be laid at least ten (10) feet horizontally from existing or proposed water lines. The distance shall be measured edge of pipe to edge of pipe.

Sewers crossing water mains shall be laid to provide a vertical distance of 18 inches between the outside of the water main and the outside of the sewer. This shall be the case where the water main is either above or below the sewer. The crossing shall be arranged so that the sewer joints will be equidistant and as far as possible from the water main joints. Where a water main crosses under a sewer, adequate structural support shall be provided for the sewer to prevent damage to the water main.

6.8.3 Sewer in Fill Areas

Subgrade and backfill for sewers located in fill areas shall be compacted to not less than 95 percent of density determined from the Standard Proctor Test, or to not less than 90 percent of the density determined by the Modified AASHTO Method (AASHTO T-99).

6.9 Easements

6.9.1 General

Easements are often shared for the installation of several different utilities. Sanitary sewers, storm sewers, underground or overhead electric, cable television, and telephone are often in the same utility easement competing for space. With this being the case, it is extremely important that the easements and the utilities to be located in the easement be defined as early as possible in the design process. This information shall be included in the plans submittal to the Division of Engineering.

Sanitary sewers and storm sewers in the same easement shall be a minimum of four (4) feet off the property line, located on opposite sides of the property line, and not closer than two (2) feet from the outside edges of the easement. Underground electric service shall be separated from them by a minimum of six (6) feet. Sanitary sewers and storm sewers shall be spread further apart to allow underground electric to run between the two and the easement may be off-center relative to the property line to allow a good distribution of the various utilities in the easement. No other utilities may share the same trench with the sanitary or storm sewers and if any other utility is installed in error in the same trench, it shall be moved. No reason, including efforts to avoid rock, will be considered valid for not relocating utilities installed over the sanitary or storm sewer.

6.9.2 Variances and Encroachments

No structure shall be permitted in, on, over, or under the land within the easement. Developers and their Engineer shall plan the utilities, easements, property lines, and other features of the development so that homeowner improvements will not encroach on the easement. At-grade patios (without footings), slabs on grade (without footings), sidewalks, driveways, and permitted privacy fences with non-structural posts (no brick or masonry columns) are permitted in the easement.

6.9.3 Required Easement Widths

The required width of an easement varies based on the utilities that will be located in the easement. Table 6.2 addresses the required easement width.

TABLE 6. 2 – EASEMENT WIDTHS

Utilities in Easement	Width Required -ft. (min.)
Sanitary Sewer < 10 ft. deep	15
Sanitary Sewer > 10 ft. deep	20
Sanitary Sewer < 10 ft. deep & Storm or U.G. Electric (only 1)	15
Sanitary Sewer (any depth) & Storm & U.G. Electric	20
Force Mains (alone)	12
Force Mains-with any other single utility	15
Force Mains-with multiple other utilities	20 Additional width may be required if all utilities occupy same easement
Overhead Electric, Cable TV, Telephone, Street Light, or other small size utilities	May be included in any easement without additional width, but may not occupy same trench as sewers. Electric poles must be set to avoid all other utilities