

## Chapter 2.00

### SANITARY SEWER DESIGN STANDARDS

*The Department of Public Works and Utilities is assigned responsibility for administration of these design standards.*

#### Section 1. GENERAL

The City of Lincoln Wastewater System is regulated by the requirements of the Federal and State *Clean Water Acts*. Design and construction of facilities for the City's system shall generally follow the *Recommended Standards for Sewage Works*, a Report of the Committee of the Great Lakes-Upper Mississippi River Board of State Public Health and Environmental Managers (10- State Standards). Details of construction shall conform to the *City of Lincoln Standard Specifications for Municipal Construction* and the *Lincoln Standard Plans*.

#### Section 2. SANITARY SEWER POLICIES

##### 2.1 Drainage Area Restriction

The various elements of the sanitary sewer system in the City of Lincoln are designed to handle only that wastewater contribution which originates within the natural surface watershed wherein the sanitary sewer system is located. The transfer of wastewater from one watershed to another by any means, such as a lift station or construction of a sanitary sewer which cuts through the ridge separating the watersheds, shall not be permitted.

##### 2.2 Provisions for Future Extensions

In new developments, the sanitary sewers shall be extended to the limits of the development at such location(s) and of such size(s) required for future extension to serve upstream drainage area(s).

##### 2.3 Tapping Restrictions

When sewer service stub-outs are not available, service taps can only be made to sanitary sewers up to and including 15 in. (375 mm) diameter. Private sanitary sewer systems shall be connected to the public sewer system at an existing manhole, or a new manhole shall be constructed on the main in a more desirable location. On private systems, the Lincoln Wastewater System shall determine the proper method of connection to the public sewer system. The Lincoln Wastewater System makes all taps of service lines to public and private sewer systems.

Each lot in a new subdivision must be provided an abutting sewer main. A residential lot should have a minimum of 20 feet (6.1 m) of frontage on the main to be considered abutting to the sanitary sewer.

## **2.4 Sanitary Sewer Services**

On new sanitary sewer projects in residential developments, sewer service stub-outs shall be constructed from the sewer main to each abutting lot. The stub-out should generally extend to the center of the lot frontage along the platted street and terminate at the right-of-way line. This termination point may vary in cul-de-sac locations, in situations where the sewer is not in the street right-of-way and at locations where the sewer does not extend completely across the lot frontage. Construction of service lines shall conform to the *City of Lincoln Standard Specifications for Municipal Construction* and the *Lincoln Standard Plans*. Construction drawings shall indicate the location (stationing) of the service wye and terminating invert elevation of the service stub-out at the right-of-way line or other point of termination. All service laterals shall be properly plugged and clearly marked as set forth in the *City of Lincoln Standard Specifications for Municipal Construction* and the *Lincoln Standard Plans*.

## **2.5 Private Sewers**

Private sewer systems connected to public sewers shall be designed and installed under a Plumbing Permit in conformance with Title 24 of the Lincoln Municipal Code.

## **2.6 Easements**

Permanent easements are required for all public sanitary sewers not located within the public street right-of-way. The normal easement width is 30 ft. (9.14 m). Easements wider than that may be required when conditions warrant. Where the sanitary sewer is located near structures the easement must provide 15 ft. (4.57 m) horizontal clearance between the main and the structures. If that clearance cannot be obtained, the Public Works and Utilities Department and the Lincoln Wastewater System shall require specific added design considerations for the sanitary sewer pipe.

An easement for a public sewer located along a private roadway should include the width of the roadway plus the area between the main and the roadway plus an additional 15 ft. (4.57 m) on the side of the sewer opposite the roadway.

Blanket easements are not acceptable. Easements granted for public sewers should be specifically described with dimensions and angles sufficient to allow the easement to be accurately located. The dedication of any easement shall prohibit the location of permanent structures on, under or over the easement and shall allow the City access to the easement for construction, reconstruction, replacement, repair, operation, and maintenance purposes; and shall hold the City harmless for the cost of replacement or damage to any improvement or vegetation within the easement. Other appropriate or necessary requirements may also be included.

## **2.7 Reviewing Agencies**

All plans for construction of wastewater system improvements shall be reviewed and approved by the Public Works and Utilities Department, and the State of Nebraska Department of Environmental Quality prior to construction.

### Section 3. DESIGN AND CONSTRUCTION

#### 3.1 Design Flows

All sanitary sewers being constructed within the City of Lincoln shall be designed to carry, when flowing full, the total flow derived from *Equation 1* below, or the total flow derived using *Table 1* below. The design flow formula and the tabulated flows have been derived from metered flows in the City of Lincoln. In computing the design flow, the entire gross acreage of the natural watershed is used, excluding the aggregate area in excess of 50 acres (20 ha) of any public or private park lands, golf courses, cemeteries, and other dedicated open-space that decreases the developed density in the watershed.

Sanitary sewers serving commercial and/or industrial developments may require consideration of higher total or peak flows, pretreatment of wastes before discharge into the public system and special provisions for monitoring both quality and quantity of flows. This type of design will be handled on an individual basis and must be coordinated with the Public Works and Utilities Department and the Lincoln Wastewater System.

#### Equation 1 - Flow Equations

$$Q_a = (0.0064 \div (0.007A)^{0.2}) + 0.003 \quad \text{or}$$

$$Q_t = (0.01726) (A)^{0.8} + (0.003) (A)$$

and

$$Q_h = ((0.0064 \div (0.0173A_h)^{0.2}) + 0.003) 0.06998 \quad \text{or}$$

$$Q_m = (0.01726) (2.471A_h)^{0.8} + (0.003) (2.471A_h)$$

Where:

- $Q_a$  = design flow in cfs/acre
- $Q_h$  = design flow in m<sup>3</sup>/ha
- $Q_t$  = total design flow in cfs
- $Q_m$  = total design flow in m<sup>3</sup>/s
- $A$  = watershed area in acres
- $A_h$  = watershed area in hectares

**Table 1**  
**Estimating Flow per Unit Area of Watershed**

Watershed Area acres	Flow cfs per acre	Watershed Area hectares	Flow m <sup>3</sup> per hectare
0 - 750	0.00775	0 - 300	0.00054
750 - 1,500	0.00730	300 - 600	0.00051
1,500 - 3,000	0.00674	600 - 1,200	0.00047
3,000 - 5,000	0.00630	1,200 - 2,000	0.00044
5,000 - 7,500	0.00600	2,000 - 3,000	0.00042
7,500 - 10,000	0.00580	3,000 - 4,000	0.00041
10,000 - 15,000	0.00560	4,000 - 6,000	0.00039
15,000 - 20,000	0.00545	6,000 - 8,000	0.00038
over 20,000	0.00529	over 8,000	0.00037

**3.2 Minimum Size**

Public sanitary sewers shall be no less than 8 in. (200 mm) in diameter. Capacity of the pipe flowing full shall be determined using *Manning's Formula* with  $n = 0.013$ .

**3.3 Slope**

Sanitary sewers shall be designed and constructed with a uniform slope between manholes. Listed in *Table 2* below are the minimum slopes which shall be provided for each nominal pipe size.

**Table 2**  
**Minimum Slope**

Nominal Pipe Diameter		Minimum Slope
in.	mm	
8	200	0.00400
10	250	0.00280
12	300	0.00220
15	375	0.00080
18	450	0.00120
21	525	0.00100
24	600	0.00080
27	680	0.00067
30	760	0.00058
36	900	0.00046

### **3.4 Location**

Sanitary sewers located in public or private residential streets should be placed outside of the roadway and 3.5 ft. (1.07 m) from the back of curb. They are generally to be located on the south or west side of the streets except in areas with curvilinear street alignments where this orientation may be varied to avoid conflicts between the sanitary sewers and water mains. The location of sanitary sewers in streets other than residential is subject to the approval of the Public Works and Utilities Department.

### **3.5 Horizontal Alignment**

Sanitary sewers serving residential areas are to be constructed parallel to the centerline of the streets. On curvilinear alignments curves are to be accomplished by deflecting the pipe at its joints so long as the maximum permitted joint deflections are not exceeded. Minimum horizontal radii and the maximum allowable joint deflections are set forth in the *City of Lincoln Standard Specifications for Municipal Construction*. Where the curve radius requires pipe joint deflections greater than the amounts shown, factory made deflection couplings shall be used. Bending of the pipe barrel to achieve curvilinear alignment shall not be permitted.

### **3.6 Depth**

The standard depth of cover for sanitary sewers in residential areas should range from 9 to 11 ft. (2.74 to 3.35 m) as measured from top of curb to top of pipe. Sewer depth should be determined by considering the depth necessary to insure that the sewer will be deep enough to serve normal depth basements and that conflicts between the sanitary sewer system and other utilities will be held to a minimum. Excessive sewer depths shall not be used in order to serve areas outside the natural surface watershed area. The slope of the sanitary sewer should parallel the slope of the street or finish grade as much as possible so that excessive depths are minimized. Specific conditions may require deviation from the standard depths of cover. When sewer depths exceed this standard, sewer service stub-outs shall be constructed to grades which ensure that service connection excavation depths at the stub-out termination do not materially exceed the standard depth of cover. Construction of sanitary sewers at depths greater than 15 ft. (4.57 m) will require specific approval of the Public Works and Utilities Department.

### **3.7 Manhole Placement and Spacing**

Manholes shall be installed at the end of all sanitary sewer lines, at all changes in grade, changes in size, at changes in alignment, at all sanitary sewer intersections and at points of reverse curvature in curvilinear sewer alignments. Cleanouts and lampholes are not permitted. The maximum spacing for manholes on straight sewer alignments is 600 ft. (182.9 m). If the sewer is constructed on a curvilinear alignment, the maximum spacing between manholes shall be 400 ft. (121.9 m). Where possible, manholes located outside of the paved roadway should be placed at a point opposite the lot corners of abutting lots extended. This will minimize the placement of manholes in driveway approaches. When the construction of manholes along creeks and drainageways is necessary, the manhole tops shall be set at an elevation 1.0 ft. (0.3 m) above the 100 year flood (water-surface) elevation.

### **3.8 Manhole Construction**

All manholes shall be constructed in accordance with the *City of Lincoln Standard Specifications for Municipal Construction* and the *Lincoln Standard Plans*.

#### **3.8.1 Drop Manholes**

Normal design requires that manhole flowlines be set so the sewer pipes entering a manhole match tops with the outlet pipe. A drop manhole may be used if a sewer pipe enters a manhole at a flowline at least 2.5 ft. (0.76 m) above the flowline of the manhole outlet sewer.

### **3.9 Sewer Crossings and Parallel Sewers**

#### **3.9.1 Parallel Sewer and Water Mains**

Sanitary sewers shall be separated by at least 10 ft. (3.48 m) horizontally from any existing or proposed parallel water mains. If, in the opinion of the Public Works and Utilities Department, extremely unusual conditions do not permit that horizontal separation, the sanitary sewer may be laid closer to the water main provided it is laid in a separate trench and the elevation of the bottom of the water main is at least 18 in. (457 mm) above the top of the sanitary sewer.

#### **3.9.2 Water Main Crossings**

Sanitary sewers shall be laid at such an elevation that the top of the sanitary sewer is at least 18 in. (457 mm) below the bottom of the water main. In those instances where the bottom of the water main is less than 18 in. (457 mm), above the top of the sanitary sewer or the sanitary sewer is located above the water main, the sanitary sewer shall be constructed using a 20 ft. (6.10 m) length of PVC pressure pipe, meeting the requirements of AWWA C900 for DR18, Pressure rating 150 psi (1034 kPa), centered on the water main.

### **3.10 Railroad and Highway Crossings**

Plans and specifications for proposed installations on highway, county road or railroad rights-of-way shall be submitted to the appropriate railroad company, to the Lancaster County engineer or to the State of Nebraska Department of Roads for approval and the issuance of the required permit. The permit shall be obtained in the name of the City of Lincoln. All required permits shall be issued (or obtained) prior to final approval of plans. Sanitary sewers crossing railroad or highway rights-of-way, if required by the permit, shall be installed in an encasement pipe. Encasement pipes and appurtenances shall comply with the requirements of the permit and the *City of Lincoln Standard Specifications for Municipal Construction* and the *Lincoln Standard Plans*.