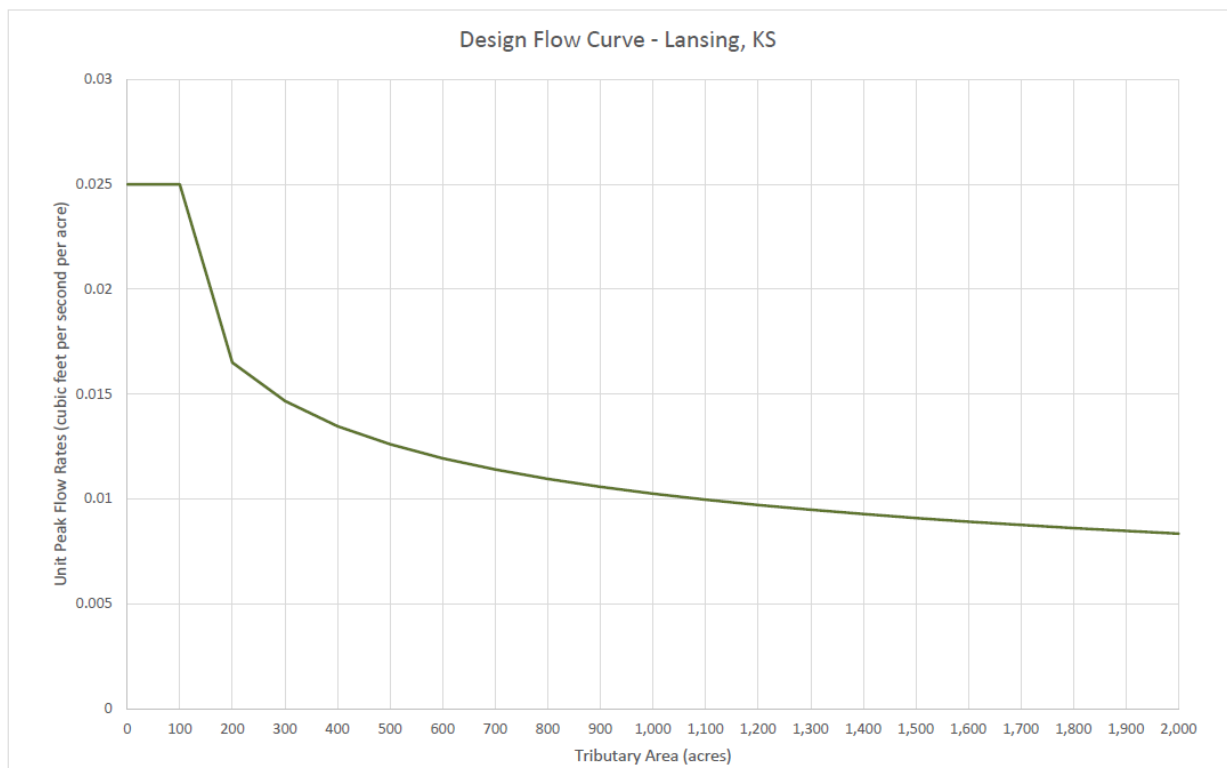


DESIGN CRITERIA FOR SANITARY SEWERS AND APPURTENANCES

- A. DESIGN FACTORS. Sanitary sewers shall be designed for the ultimate tributary population. Due consideration should be given to current zoning regulations and approved planning and zoning reports where applicable. Sewer capacities shall be adequate to handle the anticipated maximum hourly quantities of sewerage and industrial waste together with reasonable consideration given to infiltration/inflow.
- B. SEWER DESIGN. Sewers shall be designed for the total tributary area using the following minimum criteria:

Sewers up to and including a diameter of 18-inch are to be sized flowing two-thirds full; interceptors, main sewers, and relief interceptor sewers larger than 18-inch diameter are to be sized flowing three-fourths full. Lateral sewers may be designed to flow at capacity. All sewers are to be designed for anticipated flows from a **10-year** interval storm.



- C. MAXIMUM SIZE. The diameter of sewers proposed shall not exceed the diameter of the existing or proposed outlet, whichever is applicable, unless directed by the Wastewater Utility Director or City Engineer.
- D. MINIMUM SIZE. No public sewer shall be less than eight (8) inches in diameter. Stublines for service connections shall not be less than six (6) inches in diameter.
- E. MATERIALS OF CONSTRUCTION. Sanitary sewers shall be constructed of pipe material resistant to or protected from degradation, acid and alkaline solutions, normal sewer temperature variation, abrasion, and industrial wastes or

other materials which may be transmitted by the collection system.

The following types of commercial pipe are approved for gravity sanitary sewer systems constructed in the city of Lansing:

PVC Pipe	ASTM D3034, Type PSM Polyvinyl (Chloride), SDR 26 (SDR 21 will be required for depths in excess of 20 ft.); PVC Material shall conform to ASTM D1784 and shall have a cell classification of 12454-B, 12454-C, or 13364-B. Sizes 18" to 36" shall conform to ASTM F679-80. The minimum pipe stiffness for pipe used for stublines shall be SDR 26.
Reinforced Concrete Pipe	ASTM C76
Ductile Iron Pipe (only with approval of Engineer and with appropriate lining)	ANSI A21.51; ASTM A536, Grade 60-42-10; thickness Class 50, unless otherwise required by the Engineer.

The use of PVC pipe, ASTM D3034, shall be limited to residential or commercial areas as approved by the Wastewater Utility Director or City Engineer and shall not be used for pipelines exceeding 24 inches in diameter, unless approved by the City Engineer. Concrete pipe shall be approved on a per project basis as recommended by the Design engineer and approved by the City Engineer.

- F. MINIMUM SLOPE. All sewers shall be designed to give mean velocities when flowing one-half full of not less than 2.0 feet per second.

All velocity and flow calculations shall be based on the Manning Formula using an N value of 0.013. The following slopes shall be minimum for the size indicated.

<u>SEWER SIZE</u>	<u>MINIMUM SLOPE IN PERCENT FULL AND HALF FULL FLOW</u>
8"	0.40
10"	0.28
12"	0.22
15"	0.15
18"	0.12
21"	0.10
24"	0.08
27"	0.065
30"	0.058

Exceptions to these minimum slopes shall be made at the upper end of the lateral sewers serving under 30 dwelling units. Said sewers shall have a minimum slope of 0.80 percent. All sewers larger than 30 inches in diameter shall have the slope approved by the Wastewater Utility Director or City Engineer.

Where lateral sewers serve less than 10 dwelling units, the minimum slope shall not be less than 1.0 Percent.

- G. INCREASING PIPE SIZE. When a sewer joins a larger one, the invert of the larger sewer should be lowered sufficiently to maintain a continuous energy gradient.
- H. HIGH VELOCITY PROTECTION. In situations where flow is continuous and grit is a problem or where velocities greater than 10 feet per second are possible, special provisions shall be made to protect against abrasion damage to

the pipe and manhole. Such protection may be attained utilizing ductile iron pipe, and T-Lock lining of manholes.

- I. ALIGNMENT. All sewers shall be laid with straight alignment between manholes, with the bell-end pointed upstream or as per the manufacturer's recommendation.
- J. MANHOLE CONSTRUCTION. Manholes shall be installed at the end of each line; at all changes in grade, size, or alignment; at all intersections; and at a distance not greater than four hundred (400) feet for sewers eighteen (18) inches or less in diameter and not greater than six hundred (600) feet for larger sewers.
- K. MANHOLES. The construction of all manholes shall conform to the details shown on Standard Details 31-1 through 31-4.

The minimum horizontal clear distance within the barrel of standard manholes should not be less than four (4) feet. Manholes with connecting pipe diameters greater than 24 inches shall have a minimum inside clear dimension of five (5) Feet. The Engineer may require diameters in excess of four (4) feet when warranted by excessive depth or other circumstances.

Drop manholes should be avoided as much as possible. However, an inside drop pipe shall be provided for a sewer entering a manhole at an elevation of twelve (12) inches or more above the manhole invert. The drop pipe shall have the same nominal diameter as that of the incoming sewer. The minimum diameter of an inside drop type manhole must be increased to five (5) feet.

Without utilizing drop manholes, the difference in elevation between the invert of any incoming sewer and the invert of the outgoing sewer should not exceed twenty-four (24) inches except where required to match crowns. When a sewer joins a larger one, the crown of the smaller sewer shall not be lower than the crown of the larger one. The minimum drop through manholes shall be 0.2 feet for manholes with greater than 45° turns and 0.1 feet for straight-through trough and up to 45° turns.

Where manholes are to be built in close proximity to streets, the top of manhole elevation shall be set within the following limits:

Minimum Elevation	¼" per foot rise above top back of curb
Maximum Elevation	½" per foot rise above top back of curb

All other sanitary sewer lines (sewer lines across unplatted land, etc.) shall have the tops of manholes set flush with the existing ground elevation. The top of all manholes shall be located a minimum of 1.0 feet above the 100-year flood elevation. Manholes adjacent to flood plain areas must have bolt-down lids.

Any variation from the above top of manhole criteria will require a letter of explanation to be submitted with the drawings and be subject to approval by the City Engineer or Wastewater Utility Director.

- L. SEWER LOCATIONS. Sanitary sewers shall be located within street or alley rights-of-way unless topography dictates otherwise. When located in easements outside of street pavement on private property, access shall be provided to all manholes. A manhole shall be provided at each street or alley crossing. End lines shall be extended to provide access from street or alley rights-of-way where possible. Imposed loading shall be considered in all locations. Not less than eight (8) feet of cover shall be provided over top of pipe in street and alley rights-of-way and five (5) feet in all other areas.

The center of sanitary sewer manholes shall be located five (5) feet beyond the right-of-way, and five (5) feet off a property line, within a dedicated easement. Other locations require the Engineer's approval of a written request.

Tees and stub lines shall not be located within ten (10) horizontal feet of any pipe, structure, or other improvements without approval of the Engineer. Stub lines shall extend to the easement boundary, opposite of the right-of-way unless directed by the Engineer.

- M. CLEANOUTS AND LAMPHOLES. Cleanouts and lampholes will not be permitted on public lines. Cleanouts must be

installed on private service lines at a maximum spacing of 100 feet, and at alignment changes.

- N. PROTECTION OF WATER SUPPLIES. There shall be no physical connection between a public or private potable water supply system and a sewer, or appurtenance thereto, which would permit the passage of any wastewater or polluted water into the potable water supply.

Sanitary sewer lines and water lines shall be constructed a distance of ten (10) horizontal feet apart when they are to be installed parallel to each other. Exceptions to this requirement shall be granted only upon written approval by the Kansas Department of Health and Environment.

Where sanitary sewer lines are to be installed over or under and across water lines and a two (2) foot clearance cannot be obtained because of limited grades or grades of existing structures, then the sewer pipe shall be encased in concrete for a distance of at least ten (10) feet in each direction from the crossing.

- O. AERIAL CROSSINGS. Adequate support shall be provided at all joints in pipes utilized for aerial crossings. All aerial crossings shall be approved by the Wastewater Utility Director or City Engineer.
- P. UNSEWERED DWELLINGS. All existing addresses that will be provided access to the sewer that previously did not have sewer service available shall be identified by the Design Engineer. This identification shall include the approximate distance from the dwelling to the sewer.
- Q. MAXIMUM SLOPE. All sewers which are designed to flow at 10 feet per second or greater shall be reviewed by the Engineer for approval or alternate design considerations.
- R. EXTENSIONS OF THE SEWER. All extensions of the sanitary sewer shall be made so that future extensions may be made by upstream users. When a future sanitary sewer extension will be required to serve adjacent upstream properties, the location for the center of the uppermost manhole, whenever possible, should be at least five (5) feet beyond the plat boundary in a permanent sewer easement.
- S. ANALYSIS OF RECEIVING SEWER REQUIRED. Authorization to extend any existing sanitary sewer shall not be granted until an analysis of the receiving sewer system has been completed as outlined in Section T below.
- a. Any proposed developments or additions to the existing sanitary sewer pipe network whose additional flows WILL cause or will likely cause a bypass of untreated sewage to the environment or an existing building shall not be approved.
 - b. Developments or additions to the existing sanitary sewer pipe network whose additional flows WILL NOT cause a bypass of untreated sewage to the environment or an existing building will be considered for approval on a case by case basis. Applicants seeking approval must submit sufficient engineering documents and downstream sewer analysis to the Lansing Wastewater Utility Department staff for their consideration in making a final determination and subsequent recommendation to the Lansing City Council.

- T. CITY OF LANSING SANITARY SEWER CAPACITY ANALYSIS PROCEDURE.

As required by the City, the developer shall submit complete sanitary sewer information by creating a spreadsheet with information containing:

1. Building use,
2. Acreage,
3. Square footage,
4. Point of connection to the public system,
5. 24-hour average and peak sanitary sewer flow graphs for the peak day, showing average daily and peak daily flows
6. Seasonal peak if it differs from daily peak
7. Flow line elevations,

8. Pipe diameters,
9. Flow depths and manhole top elevations,
10. Reach distances, reach slopes, and reach capacity using Manning's equation,
11. Also include any other information that would support approval.

The design engineer will then create a hydraulic model with existing flows in the system and add the proposed development to the model to determine adequacy of the receiving sewer downstream to the Wastewater Treatment Facility. As an alternative, for a fee (as listed in the City's current fee and fine schedule), the proposed development may submit the above information to the city to have it evaluated using the City's Sanitary Sewer Hydraulic Model for the trunk sanitary sewer system.

If there is not enough capacity in the existing modeled trunk sanitary sewer system, the developer may be required to upgrade the sanitary sewer system as determined by the City. The required sanitary sewer upgrades will be at the developer's expense. In instances in which KDHE issues the developer an extension permit based and contingent on an approved action plan prior to such time that the trunk capacity is adequate, developer expense for the trunk capacity upgrade may be a prorated portion, as determined by the City.

If the design flow exceeds the pipe capacity, and would cause surcharging to homes, businesses, or the environment, the system would be considered hydraulically overloaded.

If the engineer wishes to propose alternative methods of sanitary sewer evaluation, the engineer must submit a written proposal clearly detailing the method and assumptions to be used in that evaluation. The proposal will be reviewed by the City Engineer and Wastewater Utility Director for appropriateness for the situation. Do not submit alternative analyses until the proposed alternative method has been approved in writing by the Wastewater Utility Director.