

DESIGN CRITERIA FOR  
SANITARY SEWERS AND APPURTENANCES

DC2-001 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.

DC2-002 SEWER DESIGN. Sewers shall be designed for the total tributary area using the following minimum criteria:

The table below should be used to establish the Peak Flow for a project. Low density residential shall be considered as up to and including 3.5 residences/acre. Above that value will be considered high density residential. Extrapolations to determine the Peak Flow/Acre may be made for the specific size of the development (acres).

**Peak Flows for Design**

Area (acres)	Residential		Commercial / Industrial (cfs/acre)
	High Density (cfs/acre)	Low Density (cfs/acre)	
Up to 100	0.022	0.019	0.0175
200	0.021	0.018	0.0165
500	0.017	0.014	0.0125
1000	0.014	0.0118	0.01
1500	0.0135	0.0108	0.009
2000	0.013	0.01	0.008

Peak Flows can be increased by outside circumstances, such as other watershed contributions flowing by gravity or being pumped into the design watershed. If this is the case, the system design shall include these external factors.

Using this criteria, interceptor or main sewers and relief interceptor sewers 18-inch and larger pipes are to be sized flowing **three-fourths** full; up to 18-inch pipes are to be sized flowing **two-thirds** full. Lateral sewers may be designed to flow at capacity. All sewers are to be designed for anticipated flows from a 50-year return interval storm. Design calculations for proposed pipe, as well as existing pipe the proposed pipe will tie into, shall be included in the plans or provided as a separate submittal. In addition to the design calculations, a map must be included which shows the entire tributary area.

DC2-003 MAXIMUM SIZE. The diameter of sewers proposed shall not exceed the diameter of the existing or proposed outlet, whichever is applicable.

DC2-004 MINIMUM SIZE. No public sewer shall be less than eight inches (8”) in diameter. Stublines for service connections shall not be less than six inches (6”) in diameter.

DC2-005 MATERIALS OF CONSTRUCTION. Sanitary sewers shall be constructed of pipe material resistant to or protected from bacterial 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 Gardner:

- \*PVC Pipe
- \*Reinforced Concrete Pipe
- \*Ductile Iron Pipe

\* See Standard Specifications Section 3000 for material and lining specifications.

For PVC pipe, PVC SDR-35 shall be used for depth to invert up to 15 feet and PVC SDR-26 used for depths greater than 15 feet.

DC2-006 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.

	MINIMUM SLOPE IN PERCENT
SEWER SIZE	FULL AND HALF FULL FLOW
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 houses. Said sewers shall have a minimum slope of 0.76 percent. All sewers larger than 30 inches in diameter shall have the slope approved by the city engineer.

Where lateral sewers serve less than 10 houses, the minimum slope shall not be less than 1 percent (1%).

- DC2-007 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.
- DC2-008 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.
- DC2-009 ALIGNMENT. All sewers shall be laid with straight alignment between manholes. The interior angle between incoming and outgoing lines for both existing and new mains shall be clearly labeled at all manholes in the plan view in degrees, minutes, and seconds at each manhole. Interior angles less than 90 degrees shall not be accepted.
- DC2-010 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 feet (400') for sewers eighteen inches (18") or less in diameter and not greater than six hundred feet (600') for larger sewers.
- DC2-011 MANHOLES. The construction of all manholes shall conform to the details shown on Standard Details 31-1 through 31-4. A standard manhole shall be four feet in diameter for depths up to 20 feet deep, 5 feet diameter for depths 20 to 25 feet deep and/or pipes entering and exiting the manhole with diameter 24 inches to 30 inches, and 6 feet diameter for depths over 25 feet deep and/or pipes entering and exiting the manhole with diameter greater than 30 inches. All manholes over 20 feet deep must be approved by the City Engineer.

Drop manholes should be avoided as much as possible. However, an outside drop pipe shall be provided for a sewer entering a manhole at an elevation of twenty-four (24) inches or more above the manhole invert. The outside drop pipe shall be protected against breaking or settling by the use of concrete encasement. When PVC pipe is used for the drop pipe, gravel may be substituted for the concrete encasement around the drop pipe and fittings. The drop pipe shall have the same nominal diameter as that of the incoming sewer.

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	1/4" per foot rise above top back of curb
Maximum Elevation	1/2" 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 except for manholes located within the floodplain. The top of all manholes located in a floodplain shall be 1.0 foot above the 100-year floodplain and shall be constructed with 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.

DC2-012 SEWER LOCATIONS. Sanitary sewers shall be located within street or alley rights-of-way unless topography dictates otherwise. Sanitary sewers should also be located outside of pavement when at all possible. When located in easements 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 feet (8') cover shall be provided over top of pipe in street and alley rights-of-way and five feet (5') in all other areas.

Sanitary sewer mains shall be extended to property lines and a manhole provided at the edge of property lines to accommodate future main extensions.

DC2-013 CLEANOUTS AND LAMPHOLES. Cleanouts and lampholes will not be permitted except on service lines.

DC2-014 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.

**GRAVITY SANITARY SEWERS:** When potable water pipes and gravity sanitary sewers are laid parallel to each other, the horizontal distance between them shall be not less than 10 feet. The distance shall be measured from edge to edge. The laying of water pipes and sanitary sewers shall be in separate trenches with undisturbed earth between them. In cases where it is not practical to maintain a 10 ft separation, KDHE will consider proposals providing equivalent protection by other methods on a case-by-case basis, if supported by data from the design engineer. Equivalent protection may require sanitary sewer construction with one of the following additional protective features: concrete encasement, vacuum sewers, or jointless pipe such as polyethylene or cured-in-place.

When a water pipe and a sanitary sewer cross and the sewer is 2 ft or more (clear space) below the water pipe, no special requirements or limitations are provided herein. At all other crossings, the sanitary sewer is to be constructed of one of the following materials (or approved equal) and pressure tested to assure water tightness pursuant to Chapter VI of the KDHE Minimum Standards of Design of Water Pollution Control Facilities.

- Ductile iron pipe conforming to ASTM A536 or ANSI/AWWA C151/A21.51 with minimum thickness class 50, and gasketed, push-on or mechanical joints in conformance with ANSI/AWWA C110/A21.10 or ANSI/AWWA c111/A21.11.

- PVC pipe conforming to ASTM D3034 with minimum wall thickness of SDR41, ASTM F679, ASTM F789, or ASTM F794, with gasketed push-on joints in conformance with ASTM D3212.
- Reinforced concrete pipe conforming to ASTM C76 with gasketed joints in conformance with ASTM C361 or ASTM C443.

Joints in the sewer pipe shall be located as far as practical from the intersected water main.

Where a water main is laid across or through an area where there is an existing sanitary sewer, which is not constructed of one of the above specified materials and is 2 feet or less below the water pipe, the existing sewer shall be encased in concrete with a minimum of six inches thickness for a 10 foot distance on each side of the crossing or the crossed section of sewer replaced to meet the above specified construction requirements. KDHE will consider proposals providing equivalent protection by other means on a case-by-case basis, if supported by data from the design engineer.

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

- DC2-015 SEPARATION FROM OTHER UTILITIES. A minimum of 5 feet horizontal separation shall be provided between the outer wall of sanitary sewer mains and all other utilities (except as noted for water as discussed above in Section DC2-014). In addition, utilities shall not be located in a common trench, but separated by a minimum of 3' undisturbed earth. The separation between the outside walls of sanitary sewers and all other utilities that are within 10 feet of each other must be labeled on the plans.
- DC2-016 AERIAL CROSSINGS. Adequate support shall be provided at all joints in pipes utilized for aerial crossings. All aerial crossings shall be approved by the city engineer.
- DC2-017 UNSEWERED DWELLINGS. All existing addresses that will be provided access to the sewer that previously did not have sewer service available shall be identified. This identification shall include the approximate distance from the dwelling to the sewer.
- DC2-018 MAXIMUM SLOPE. All sewers which are designed to flow at 10 feet per second or greater shall be reviewed by the city engineer for approval or alternate design considerations. Concrete collars for steep slopes shall be proposed when pipe slopes are 10% or greater.
- DC2-019 STUB LINES. Stub lines will not be permitted in manholes except for manholes at the end of a line. Stub lines will be provided for all service lines requiring street crossings. Service lines for properties not requiring street crossings will be tapped at the time of building construction. If necessary, risers shall be installed so that stubs are no deeper than 8 feet below ground surface.

Stub lines shall be constructed no closer than 10 feet from property lines, but should be placed so that they are not in conflict with existing infrastructure and/or future driveways.

- DC2-020 LIFT STATIONS. All lift stations shall be manufactured by Smith and Loveless, Inc. (classic style) and shall be wetwell mounted. The lift station must meet firm pumping capacity and shall be designed in accordance with the design criteria as specified under Sewer Design (Section 5-1, Item B). Any variation from the specified lift station or design must be approved by the city engineer.
- DC2-021 LOW PRESSURE FORCE MAIN. Low pressure force mains are not recommended. If a low pressure force main is necessary, the engineer must submit plans and specifications along with a cost/benefit analysis prior to approval. All low pressure force mains must be approved by the city engineer.
- DC2-022 EASEMENTS. Permanent easements must be provided for all sanitary sewer mains. Permanent easements for sanitary sewer mains shall be centered on the main. The minimum easement width shall be 15 feet; however, easement widths may be increased depending upon the depth of the sewer main.