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SANITARY SEWERS

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SANITARY SEWERS

110.1 DESIGN FLOW

Sanitary sewer lines shall be designed to transport wastewater, exclusive of storm run-off, at peak flow rates corresponding to the population and land use saturation density of all land area tributary to the outfall point of the line. The density of the tributary areas shall conform to the requirements set forth in the Arvada Comprehensive Plan, Zoning Ordinance, and Master Plan.

Design flow rate of a sanitary sewer line shall be the accumulative total of all wastewater contributions from each of the various types of land use areas; within a tributary basin, sub-basin or development to its outfall point; plus an allowance for infiltration/inflow and peak flows where applicable. The design flow rate shall be developed using the average daily flow rates, peak hour factor and I/I allowances as set forth in Table 110.1.

All calculations made in determining the design flow rate shall be submitted for approval, at time of platting or submission of development plans, whichever occurs first.

110.2 HYDRAULIC DESIGN

Sanitary sewer collector lines, those subject to having service connections thereon and hereafter referred to as laterals and mains, shall be sized to flow 75% full at peak hour flow rates. City designated interceptor and trunk lines, lines which require specific City approval for service connections, shall be sized to flow 90% full at peak hour flow rates.

Flow through inverts in manholes shall provide a minimum of: 0.2 ft. drop in a straight through manhole or a manhole angled at 45 degrees or less; and 0.3 ft. drop in manholes angled greater than 45 degrees. The maximum allowable deflection through a manhole connecting eighteen (18) inches and larger diameter lines shall be 45 degrees. The maximum interior drop through any manhole shall be 0.3 ft.

In manholes where the downstream sewer line is larger in diameter than the upstream line, the pipe crown elevations of the two pipes shall match.

Landing platforms shall be provided only when specifically requested by the Utilities Department. Landing platforms shall only be in manholes showing 30 feet of depth or greater. Landing platforms shall be provided for each 20 feet of height or fraction thereof.

Types of sewer pipe, allowable manhole spacing, minimum line slope between manholes, Manning's coefficient, minimum and maximum allowable flow velocities, peak hour factor, infiltration/inflow allowances etc., shall be as set forth in Table 110.1 and 110.2 of this section.

TABLE 110.1

Basis for Developing Design Flow Rates
For Sanitary Sewers

SOURCE	Average Daily Contribution Gallons Per Day
Residential	
	*
Multi-family	(100 g/c/d) (1.7 c/u)
Townhouses	(100 g/c/d) (2 c/u)
Apartments	(100 g/c/d) (2 c/u)
Duplex	(100 g/c/d) (2.5 c/u)
Single Family Detached	(100 g/c/d) (3.3 c/u)

Where: g/c/d=gal/capita/day
and
c/u=capita/unit

Commercial(1)	
Hotel-Motel	50 (No. employees + No. Beds)
Hospitals	200 (No. employees + No. Beds)
Restaurants	15 (No. employees) + 4 (meals/day)
Offices	15 (No. employees)
Service Station	15 (No. employees + 2 X No. pumps + 10 X No Bays)
Schools	20 (No. employees + No. students)
Self Service Laundry	50 (No. of machines)
Theater	5 (No. of seats)
Warehouses	15 (No. of employees)
General Planning	1000 gallons/acre/day
Industrial(1)	
Factories	15 (No. employees) + industrial and cafeteria waste
General Planning	1000 gallons/acre/day
Other	Evaluate separately

Peak Hour Factor = PHF*

$PHF = 1 + (14/(4 + P^{0.5}))$ or $PHF = 1 + (14/(4 + 10Q)^{0.5})$ and $P \leq 4.0$

Where: P = saturation population in 1000's or fraction there of.
Where: Q = average day flow in cfs, to a point

Infiltration/Inflow

Pipe Diameter Inches	Type	I/I Gal/Day/Inch Dia./Mile
8-27	PVC (Polyvinyl Chloride)	50
24-54	RCP (Reinforced Concrete)	200

Design Flow Rate = Q = cfs = Summation of all Average Daily Contributions converted to cfs x PHF where applicable + I/I

(1) Average daily flow rates set forth in Appendix I, Table 1-3 of the Uniform Plumbing Code shall govern in case of discrepancies.

TABLE 110.2
SANITARY SEWER DESIGN DATA

Pipe Diameter Inches	Manhole Dia. Ft.	Manhole Max. Space Ft.	Type of Pipe	Manning's Coefficient (n)	Slope (Min.) %
4[1]			PVC	0.011	2.08
6[1]			PVC	0.011	1.04
8 [2] [3] [4]	4	400	PVC	0.011	0.40
10[3][4]	4	400	PVC	0.011	0.30
12[3][4]	4	400	PVC	0.011	0.23
					Velocity (3)
15	4	400	PVC	0.011	Note (3)
18	4	400	PVC	0.011	Note (3)
21	4	400	PVC	0.011	Note (3)
24	4	400	PVC	0.011	Note (3)
27	5	400	PVC	0.011	Note (3)
30	5	400	PVC/RCP	0.011/0.013	Note (3)
33	5	400	PVC/RCP	0.011/0.013	Note (3)
36	6	400	PVC/RCP	0.011/0.013	Note (3)
39	6	400	PVC/RCP	0.011/0.013	Note (3)
42	6	400	PVC/RCP	0.011/0.013	Note (3)
48	Special	400	PVC/RCP	0.011/0.013	Note (3)
54	Special	400	PVC/RCP	0.011/0.013	Note (3)

(1) Service Lines
(2) Minimum diameter for collector laterals and mains
(3) Maximum velocity, regardless of depth of flow = 10 fps. Minimum velocity, when flowing 75% full = 2 fps.
(4) The minimum slope of the sewer line shall be 0.5% within 200 linear feet both upstream and downstream of all manholes angled greater than 45 degrees.

110.3 MANHOLES

Manholes shall be provided at each change in slope, change in pipe diameters and at connections with other sewer lines. A manhole shall be installed at the end of a sewer line and provide plugged stub-outs, for future extensions. Cleanouts at the terminus of a sewer line will not be allowed.

Outside drop manholes will not be allowed, except by authorization of the City Engineer or designee. If approved, the barrel and cone sections of the drop manhole and the adjacent upstream and downstream manhole shall be given two coats, each ten mil thick, of an approved epoxy type material that is inert to hydrogen sulfide (Aquatapoxy) or a ½" minimum thickness spray applied coating of Calcium Aluminate Cement (Sewpercoat).

110.4 COLLECTOR AND OUTFALL LINES

Sanitary sewer lines shall be eight (8) inches or larger in diameter. Lines shall be installed in a straight alignment and on a uniform slope between manholes. Curvilinear alignment between manholes will not be allowed.

Unless specifically approved for non-basement developments the minimum bury between finish grade and the crown of a lateral or main, on which services will be connected, shall be nine (9) feet. The bury on designated interceptor and trunk lines, where service lines enter only through manholes, need only sufficient cover to protect them from live loads crossing and/or paralleling the line.

Dead end lateral lines shall terminate in a manhole. Plugged outlets, set in the direction of future line expansion, shall be provided in the terminating manhole. Upstream terminating manholes shall be located within ten (10) feet of the most distant property line of the lot or building site being served or the perimeter line of a new development

A lateral or main sewer line shall be located five (5) feet west or south of the centerline of the local or collector street in which it is to be installed. In arterial streets, lateral or main sewer lines may be installed in the right-of-way between the property line and sidewalk or back of curb, if approved by the City Engineer or designee. However service lines, to the lateral or main, will not be permitted to cross an arterial street. Sewer lines installed; along back or side lot lines; or in easements; shall be located in a manner that provides easy access for maintenance crews.

Easements and right-of-way: The minimum width right-of-way or easement for City use in which a sewer main will be installed is twenty (20) feet except as authorized for Planned Unit Developments (PUD).

110.5 SERVICE LINES

Domestic sanitary sewer service lines from each unit, townhouse or commercial tenant shall be four (4) inches or larger in diameter and connected, by means of a wye, watertight saddle or fused adaptor to a lateral or main in the street or common area. The wye saddle or adaptor shall be mounted such that the service line effluent enters at an angle of 45 degrees or more above the springline of the lateral or main.

Vertical risers shall be installed when the top elevation of the wye, installed through the service saddle or adaptor, is more than twelve (12) feet below finish grade. Riser connections shall reach a grade of nine (9) feet below finish grade within a horizontal distance of two (2) feet from the vertical centerline of the lateral or main.

Industrial service lines (lines collecting waste from manufacturing or commercial processes as distinguished from sanitary or domestic waste) from each unit or tenant shall provide means of disposing or treating industrial waste prior to, the non-toxic effluent therefrom, entering a City maintained lateral or main. Domestic sewage from an industrial or commercial tenant shall be serviced independently from its industrial waste.

Individual service lines will not be allowed to connect or enter a City designated interceptor or trunk sewer line. Entrance to these designated lines shall be by means of a manhole. Service lines larger than six (6) inches in diameter must enter through a manhole.

110.6 MISCELLANEOUS

An approved cut off wall or plug shall be installed in the trench, around, under and over a sewer line that crosses under an open ditch, channel or stream. The wall or plug shall be constructed on the downstream or downhill side, parallel to the open flow so as to prevent water from following the sewer trench.

All sewer and service line pipe joints that are installed within ten (10) feet of a potable water line shall be concrete encased when the sewer line: crosses over a water line; crosses under and within two (2) feet of the water pipe invert; or parallels the waterline such that the sewer pipe crown elevation is less than two (2) feet below the water line pipe invert.

Where underdrain piping is to be installed below a sewer line, two-way cleanouts shall be installed in each manhole to provide access to the underdrain for flushing.