

Design Criteria for Gravity Sanitary Sewer Construction Plans

1. Plan Review Procedures and Submittal Requirements

1.1 Pre-Design Meeting: A pre-design meeting is not required, although it is strongly recommended. During the pre-design meeting the design engineer and BCVSA staff will review the proposed development and identify the best location for connection to the existing sewer system, necessary easements, and the extent of off-site improvements. BCVSA staff will also provide an estimate of the fees associated with the proposed development.

1.2 Initial Design Submittal: The initial submittal shall contain all drawings and calculations as described in Sections 2 and 3 of these design standards. BCVSA staff will review the plans and calculations for compliance with the design standards. BCVSA staff will issue a plan review letter to the design engineer detailing any deficiencies or required changes in the plans.

Along with the plan review letter, BCVSA staff will also submit a Sewer Service Agreement letter which will describe the terms and conditions of the sewer project and itemize all associated fees.

1.3 Final Design Submittal: After all of the required plan changes have been made, the design engineer shall submit a final set of drawings printed on either mylar or vellum, along with the preliminary plans previously reviewed. The final design submittal shall also include the Sewer Service Agreement signed by both the developer and the engineer, executed easements, and all associated fees.

BCVSA staff will review the final submittal to ensure that all of the required changes have been made. When all of the final design requirements have been met, the BCVSA engineer will indicate plan approval by signing the drawings in the appropriate location. The approved drawings will be returned to the design engineer with a plan approval letter formally approving the project design.

1.4 Completed Project Submittal: Upon satisfactory completion of the project the design engineer shall submit detailed as-built drawings on both bond paper and 3 ½" computer disk. All deviations and changes from the original approved plan shall be noted and clouded to highlight the revision. The electronic format shall be compatible with AutoCAD Version 12, 13, or 14. The design engineer shall also submit a signed and stamped certificate of completion and copies of all test records.

Upon satisfactory receipt of the required completed project information, the BCVSA engineer will issue a project acceptance letter formally accepting the project and beginning the two year construction warranty. No permits to connect to the system will be issued until this is complete.

Please note: The ultimate responsibility for a properly constructed system remains with the property owner and the owner's engineer until the project is formally accepted by BCVSA. Preliminary inspections and approvals by BCVSA do not relieve the owner or engineer from this responsibility.

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2. Drafting Requirements: Sewer construction plans shall be printed on 24"x36" sheets. All drawings shall be dimensioned in metric units. English units may be used in parentheses. Drawings shall contain the following information:

2.1 Cover Sheet: A cover sheet shall be provided for sewer plans consisting of three or more pages or where project plans include water, street, or other improvements. The following information shall be provided on the cover sheet, or on the first page of the drawings where no cover sheet is used:

- a. Date
- b. Vicinity map showing location of project and overall sewer system.
- c. Schedule of quantities listed by size and pipe material.
- d. North arrow
- e. Project benchmark and basis of bearing. Benchmark elevation shall be referenced to the nearest existing manhole invert.
- f. General notes to include the following:
 - i. Construction shall be performed in accordance with BCVSA Standard Specifications and Standard Drawings, as last revised.
 - ii. Contractor shall notify BCVSA 48 hours in advance of construction.
 - iii. All taps to the existing sewer main shall be done by BCVSA maintenance personnel.
- g. Design engineer's name, address, and signed stamp clearly showing the expiration date. Engineer shall be a registered professional engineer in the State of Oregon.
- h. Owner/developer's name and address.
- i. BCVSA plan approval block. (This must be included on all sheets with sewer data.

2.2 Profile: Profile views shall be provided for all sewer main line. Profile views shall be on the same sheet as the associated plan view and shall include the following information:

- a. Class of backfill
- b. Size, slope, length, and class of pipe.
- c. Manhole rim and invert elevations.
- d. Horizontal and vertical scale. [maximum horizontal scale 1:600, (1" = 50'); vertical exaggeration as appropriate to show detail]
- e. Utility crossings with vertical distance between proposed sewer and existing or proposed utility shown.
- f. Existing ground profile.
- g. Match line when profile covers more than one page.
- h. Profile stationing to coincide with plan stationing.

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2.3 Plan View: Plan views shall be provided for all sewer main line. Plan views shall be on the same sheet as the associated profile view and shall include the following information:

- a. Drawing scale, maximum scale 1:600, (1" = 50').
- b. Township, Range, Section and Tax Lot numbers for areas to be served and adjacent properties. For subdivisions or partitions, the tax lot number of the parcel to be divided should be shown.
- c. Existing utilities, wells, and structures.
- d. Street names, right-of-way lines, and right-of-way centerlines.
- e. Property lines and easements.
- f. Distance from sewer centerline to centerline of right-of-way. Manholes shall be referenced to the centerline of the right-of-way and the road station.
- g. Sewer stationing shall begin at the lowest downstream manhole. Sewer mains within the right-of-way may use road stationing with offsets. Outside the right-of-way sewer stationing should be independent of the road stationing.
- h. Manholes shall be numbered in consecutive order, starting from the downstream manhole, and shall be referenced by sewer stationing that coincides with the profile stationing.
- i. New manholes over existing mains shall be dimensioned to the closest downstream manhole.
- j. Location of all service laterals, referenced by sewer station.
- k. City limits, urban growth boundary if applicable.
- l. Legend [utilities and other lines shall be differentiated by using varying line types and thicknesses].
- m. Proposed finished floor elevations.
- n. Test hole locations, if applicable.

3. General Design Requirements: Design calculations are required where a simple 8" diameter gravity sewer is inadequate to serve the current or future project area. Situations that would require calculations are pipe size increases to accommodate larger current or future populations, siphons, or any other irregularity in the design of the sewer. Complete calculations may also be required for any structural designs. If computer assisted design software is used to provide the design calculations, the software designer shall be identified including the version and serial number used, a sample calculation shall be provided with the printout.

3.1 Design Flow Rate: The design of sewer system facilities shall be based on a design flow rate of 350 gallons per day per residential unit. Commercial uses shall be converted to equivalent residential units using the conversion rates adopted by the Regional Wastewater Committee. Industrial flow rates shall be based on the design flows for the particular industry.

Peaking factor shall be calculated using the following formula:

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$$PF = 1.25 + [14 \div (4 + \sqrt{\mathbf{P}})]$$

where PF is the peaking factor and **P** is the contributing population in 1,000's.

Alternate methods of calculating flow rates and peaking factors may be used, provided that the design engineer submits sufficient data to justify the alternate methods.

3.2 Pipe Size and Slope: Pipe size shall be determined using full pipe flow at peak flow conditions. The Manning's friction factor used for all pipe shall be 0.013.

The minimum pipe size, regardless of flow rate, shall be 8 inch diameter, except that 6 inch diameter pipe may be used where the mainline length is less than 55m (180 feet) and there is no possibility of extension.

Minimum pipe slopes for various sized pipe shall be as follows:

Pipe Size	Minimum Slope (m/m)
6"	0.0060
8"	0.0040
10"	0.0028
12"	0.0022
15"	0.0016
18"	0.0012
21"	0.0010
24"	0.0008

The minimum slope should only be used when topography and existing sewer depth make greater slopes impossible or when anticipated flows are such that scouring velocity is achieved on a regular basis. Increases in pipe size to allow lower slope will not be permitted.

No maximum slope is specified, however, where flow velocity at half pipe flow is greater than 12 feet per second, special design of manholes is required to prevent scour of the channel or splashing. Velocities of greater than 20 feet per second or more are not allowed.

3.3 Main Line Alignment: Sewer mains shall generally be constructed in straight lines from manhole to manhole within the public right-of-way.

3.3.1 Horizontal separation To remain consistent with Oregon State Health Department regulations a 3.1m (10 foot) minimum horizontal separation between water and sewer lines is required. Horizontal separation may be reduced to 1.55m (5 feet) provided that there is a minimum of 0.5m (1.5 feet) vertical separation between the water and sewer pipes, with the sewer pipe being deeper.

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In subdivisions with full width street improvements the sewer main shall be located 2.13m (7 feet) from and parallel to the street centerline on the opposite side of the centerline from the waterline.

In areas where a street section is not being constructed in conjunction with the sewer main, the sewer main shall be constructed parallel to street centerline and on the property side of the drainage ditch or as directed by the Sanitary Authority.

The presence of water wells in the vicinity of sewer lines will require special construction to provide required horizontal separation.

3.3.2 Vertical separation - Mains shall be constructed with a minimum cover of 0.92m (3 ft.). Sewer mains shall generally be located below water mains.

Sewer mains parallel to or crossing water mains do not require special construction under the following conditions:

1. Parallel water and sewer mains with 3.1m (10 ft) or more horizontal separation.
2. Parallel water and sewer mains with 1.55m (5 ft) of horizontal separation and 0.5m (1.5 ft) of vertical separation, (sewer below water).
3. Perpendicular water and sewer mains with the sewer 0.5m (1.5 ft) or more below the water main.

Parallel construction within an area 4 feet each direction from the bottom of the waterline then upward at a 2V:1H slope will not be permitted.

All other areas will require special construction to protect the water main.

3.3.3 Curved Sewer Mains: Curved sewer mains may be used under certain conditions using the following minimum radii with manholes at each end:

PVC pipe size	Minimum curve radius
8"	128m (420 ft)
10"	160m (525 ft)
12"	192m (630 ft)
15"	224m (735 ft)

3.3.4 Easements: Where sewer mains cannot be located within a public right-of-way, they shall be located within an exclusive easement granted to BCVSA. Sewer easements shall have a width equal to twice the depth of the sewer main, or 4.6m (15 feet), whichever is greater.

Sewer mains shall not be installed within a Public Utility Easement.

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All easements shall also allow for year round vehicular access to all manholes and cleanouts.

4. Manholes: Manholes shall be located at all sewer main intersections, at all changes in vertical or horizontal alignment, and at the beginning and end of curved sewer sections.

4.1 Manhole Spacing: Maximum manhole spacing shall be 120m (400 feet). Manholes shall be installed at all terminating sewer mains longer than 55m (180 feet).

4.2 Manhole Diameter: Manholes 48 inches in diameter may be used for sewer mains up to 18 inch diameter and up to 4.6m (15 feet) deep.

Manholes 60 inches in diameter may be used for sewer mains up to 42 inch diameter and up to 6.1m (22 feet) deep, or where the alignment of the main lines is such that the distance between openings would be less than .5m (1.5 feet) with a smaller manhole.

4.3 Engulfment Protection: Manholes on sewer lines 21 inches and larger shall be designed with engulfment protection of corrosion proof materials resting in two pieces on the manhole shelf and sufficiently restrained and supported to the manufacturers design requirements for concentrated loads of 90 kg (200 lbs).

4.4 Drop Manholes: Drop through manholes shall be a minimum of 0.031m (0.1 ft) for straight runs or 0.061m (.2 ft) for all others. Inside drops shall have a maximum drop of .61m (2 ft). Drops greater than .61m shall be constructed with outside drop structures.

4.5 Flat Top Manholes: Flat top manholes shall be used where the distance from the invert to the rim is less than 1.8m (6 ft). Manholes greater than 1.8m deep shall be constructed with standard cone sections.

4.6 Manhole Necks: Manhole necks shall be adjusted to finished grade by the use of concrete grade rings with approved sealant between each ring. The maximum height of grade rings shall be 0.3m (12 inches) for new construction and 0.5m (18 inches) for modifications to existing manholes. Adjustments beyond these limits shall be made with full barrel sections.

4.7 Cleanouts: End of line cleanouts may be used when the terminal reach of sewer main is less than 55m (180 feet) long.

In line cleanouts shall be provided for wastewater relief whenever the proposed finished floor of a structure is lower than the next upstream manhole.

4.8 Access: All manholes and cleanouts shall be located in such a way that maintenance vehicles will have year round access.

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4.9 Hydrogen Sulfide Protection: Downstream transition manholes originating from a pump station or manholes where turbulence is a factor may be required to be coated with hydrogen sulfide resistant material.

4.10 Lockdown Manhole Covers: Manholes located outside of the paved surface shall be fitted with lockdown, watertight covers.

4.11 Connection to Existing Manholes: Connection to existing manholes shall be made with a concrete core saw and neoprene adapter boot only. There are no exceptions to this requirement.

New connections to existing manholes shall be fitted with a temporary plug until the entire project has been accepted.

Connections to structures other than manholes shall be specifically detailed on the plans for approval by BCVSA.

4.12 Watertight Manhole Covers: Where a manhole is in a sump or other area that is prone to flooding, watertight covers shall be used. Manhole cones shall be rotated to avoid areas of standing water to the extent possible.

4.13 Monitoring Manholes: Monitoring manholes may be required at commercial/industrial service connections at the direction of BCVSA.

5. Service Laterals: Service laterals shall be provided to every parcel being served as part of the project. Each individual building or dwelling unit requires a separate service lateral.

5.1 Pipe Size and Slope: Service line laterals shall be installed at a minimum slope of 1/8 inch per foot for 6 inch services and 1/4 inch per foot for 4 inch services.

Single family residences shall have 4 inch service laterals, multi-family services shall have 6 inch or larger laterals, as needed. Commercial and industrial services shall be sized as needed to accommodate the anticipated flow.

5.2 Connection to Existing Mains: Service line connections to existing mains may be made by tapping the existing main only when the service line is 0.75 times the main line size, or less. If this ratio is exceeded, the connection shall be made by removing a section of the main line and installing a properly sized wye fitting.

Service lines larger than 8 inches will require a mainline manhole.

4 inch diameter service laterals shall not connect directly to manholes.

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No service line connections shall be made into the main interceptors.

5.3 Alignment: Service laterals shall be constructed perpendicular to the main line and shall intersect the property line a minimum of 1.55m (5') from the property corners. Exceptions will be made in the case of cul-de-sacs where perpendicular service lines are not practical.

5.4 Service Cleanouts: Service laterals shall have a cleanout within 5 feet from the structure foundation..

5.5 Multiple Services: Multiple service laterals may be installed in a common trench provided that a minimum 0.31M (1 foot) clearance is provided between each pipe.

6. Pressure Sewer Systems: Pressure sewer systems will be allowed only when topographic conditions preclude the use of traditional gravity systems. Pressure systems must meet all of the design review requirements outlined above. In addition, pressure system designs must be submitted to the Department of Environmental Quality for review and approval. BCVSA approval will not be given until after DEQ has approved the design.