

City of West Linn

Public Works Design Standards

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SECTION THREE – SANITARY SEWER REQUIREMENTS

3.0000 SANITARY SEWERS

3.0010 General Design Requirements

- A. Sanitary sewer system design shall meet the policies and guidelines of the adopted City of West Linn Sewer Master Plan and its updates.
- B. Sanitary sewer systems shall be designed to provide gravity service to all areas of development.
- C. Sanitary sewer system capacity shall be designed for ultimate development density of the tributary area. The system shall allow for future system extension and for future development.
- D. Sanitary sewers shall be designed to remove the domestic sewage and industrial wastes from basements of houses, where practical, commercial or industrial buildings, and all public and private establishments where possible.
- E. Storm water, including street, roof, or footing drainage, shall not be discharged into the sanitary sewer system but shall be removed by a system of storm drains or by some other method separate from the sanitary sewer system.
- F. Unpolluted or non-contact cooling waters shall not be discharged into sanitary sewers. The overflow drains and filter backwash lines of swimming pools and "hot tubs" shall drain into a sanitary sewer.
- G. In general, sewer systems shall be designed to allow for future loads and for ultimate development of the specific drainage area or basin concerned.
- H. As a condition of sewer service, all developments will be required to provide public sewers to adjacent upstream parcels in order to provide for an orderly development of the drainage area. This shall include the extension of sewer mains in easements across the property to adjoining properties, and across the street frontage of the property to adjoining properties when the main is located in the street right-of-way. This shall include trunk sewers that are oversized to provide capacity for upstream development.
- I. All sewer mainlines shall be located within the public right-of-way or public easement as directed by the City Engineer. These lines are placed in the public streets and right-of-way for ease of maintenance and access, control of the facility, operation of the facility, and to provide required replacement and/or repair.
- J. Design shall comply with the sewer design guidelines of Oregon Department of Environmental Quality (DEQ), OAR Chapter 340, Division 52, and the requirements of Tri-City Service District.
- K. City Engineer approval will be required for any sanitary lift or pump stations.

3.0011 Pipe Materials and Size

- A. All public sanitary sewers shall be constructed with PVC pipe or concrete pipe as specified in **DIVISION THREE–SANITARY SEWER TECHNICAL REQUIREMENTS**, of the West Linn Public Works Standard Construction Specifications. Where required for added strength, Class 50 Ductile Iron pipe will be used.
- B. Private sanitary sewers shall meet the appropriate sections of the Uniform Plumbing Code.
- C. All sanitary sewer main lines shall be a minimum diameter of 8 in. A 6 in. diameter sewer will be allowed with the City Engineer's approval.

3.0012 Minimum Design Criteria

- A. In general, sewer systems should be designed to care for future loads which may reasonably be expected within a period of 30 to 50 years, and for ultimate development of the specific drainage area concerned.
- B. Velocity - All sanitary sewers shall be designed on a grade which produces a mean velocity, when flowing half-full or full, of no less than 2-1/2 ft. per second. Where velocities greater than 15 fps are attained, special provisions shall be made to protect against displacement by erosion and shock. The minimum grades for the various sizes of pipe are shown in the table below.

Inside Pipe Diameter (inches)	Grade (feet per 100 feet)
6	0.77
8	0.55
10	0.55
12	0.31
15	0.23
18	0.18
21	0.15
24	0.13
27	0.11
30	0.09
36	0.07

- C. In general, slopes greater than those shown above are desirable and are particularly recommended on the upper ends of lateral sewers.
- D. **Manning Equation** - When calculating minimum pipe slopes and velocities, the Design Engineer shall use the Manning pipe friction formula.
- E. **Pipe Coefficient** - The minimum pipe roughness coefficient for sanitary sewers shall be 0.013.

3.0020 Alignment and Cover

3.0021 Right-of-Way Location

- A. Sanitary sewer lines shall be located in the street right-of-way, 5 ft. north and west of centerline whenever possible. All changes in direction of pipe shall be made at a manhole.
- B. Sewers shall be located in the street right-of-way. If streets have curved alignments, the center of the manhole shall not be less than 6 ft. from the curb face on the outside of the curve, nor the sewer centerline less than 6 ft. from the curb face on the inside of the curve.
- C. Curved alignments will not be permitted.

3.0022 Minimum Cover

- A. All sanitary sewers shall be laid at a depth sufficient to drain building sewers, to protect against damage by frost or traffic, and to drain basement sewers, where practical. Sufficient depth shall mean the minimum cover from the top of the pipe to finish grade at the sewer alignment. In new residential hillside subdivisions, mainline and lateral sewers shall be placed in the street at a depth sufficient to drain building sewers on the low side of the street.
- B. Sanitary sewers in residential areas shall be placed in the street with the following minimum cover:

1. Building Service Lateral - 6 ft.
 2. Trunk and Collector Sewer
 3. In the roadway - 8 ft.
 4. In easements - 8 ft.
- C. Where the topography is relatively flat and existing sewers are shallow 5 ft. or less; the minimum cover shall be 3 ft. Where required for additional strength or when minimum cover is not met, ductile iron pipe or concrete pipe with CDF backfill shall be required by the City Engineer.
- D. Deviation from the above standards will be considered on a case-by-case basis when one of the following circumstances exist:
1. Underlying rock strata - required: A request in writing to the City Engineer, together with submittal of a soils report, with a plan and profile certifying that bed rock exists 3 ft. below the undisturbed ground surface at all investigated alignments.
 2. A ditch or stream must be crossed - required: A plan and profile; horizontal scale 1 in. = 20 ft., vertical scale 1 in. = 2 ft.

3.0023 Separation with Waterlines

- A. Water mains shall be installed a minimum clear distance of 10 ft. horizontally from sanitary sewers and shall be installed to go over the top of such sewers with a minimum of 18 in. of clearance at intersections of these pipes (in accordance with the requirements of OAR Chapter 333, Public Water Systems). Exceptions shall first be approved by the City Engineer. In all instances the distances shall be measured edge to edge. The minimum spacing between water mains and storm drains, gas lines, and other underground utilities, excepting sanitary sewers, shall be 3 ft. horizontally when the standard utility location cannot be maintained.
- B. Where water mains are being designed for installation parallel with other water mains, utility pipe, or conduit lines, the vertical location shall be 12 in. below (or in such a manner which will permit future side connections of mains, hydrants, or services) and avoid conflicts with parallel utilities without abrupt changes in vertical grade of the above mentioned main, hydrant, or service. Where crossing of utilities are required; the minimum vertical clearance shall be 6 in.

3.0024 Easements

- A. Sewers placed in easements along a property line shall have the easement centered on the property line and the sewer shall be offset 18 in. from the property lines. For sewers placed in easements located other than along a property line, the sewer shall be placed in the center of the easement. The conditions of the easement shall be such that the easement shall not be used for any purpose which would interfere with the unrestricted use for sewer main purposes. Under no circumstances shall a building or structure be placed over a sanitary sewer main or sewer easement. This shall include overhanging structures with footings located outside the easement.
- B. Easements for sewers less than 12 in. in diameter shall have a minimum width of 15 ft. Sewers greater than 12 in. in diameter shall have a minimum easement width of 20 ft. In some instances larger width easements may be required, such as excessively deep pipes or location of a building near the easement.
- C. Easement locations for public sewer mains serving a PUD, apartment complex, or commercial/industrial development shall be in parking lots, private drives, or similar open areas which will permit an unobstructed vehicle access for maintenance by City personnel.

- D. All easements must be furnished to the City Engineer for review and approval prior to recording. Easements shall state that the City will not in any way be responsible for replacing landscaping including any shrubs or trees, fencing, or other structures that may exist or have been placed in the easement.

3.0025 Relation to Watercourses

- A. Generally, the top of all sanitary sewers entering, crossing or adjacent to streams shall be at a sufficient depth below the natural bottom of the streambed to protect the sewer line. One foot of cover is required where the sewer is in rock; 3 ft. of cover is required in other materials. In paved channels, the top of the sewer line shall be placed at least 6 in. below finish grade of the bottom of the channel, except as provided above.
- B. Sewers located along streams shall be located outside of the streambed and sufficiently removed therefrom to provide for future, possible stream channel widening. All manhole covers shall be watertight at or below the 100-year flood elevation.
- C. Sewers crossing streams or drainage channels shall be designed to cross the stream as nearly perpendicular to the stream channel as possible, and shall be free from change of grade. The minimum cover shall be 36 in. from the bottom of the streambed or drainage channel.
- D. Pipe material shall be ductile iron with an 18 ft. length of pipe centered on the stream or drainage channel centerline. The ductile iron pipe shall extend to a point where a one-to-one slope begins at the top of the bank and slopes down from the bank away from the channel centerline and intersects the top of the pipe.
- E. Concrete encasement will be required when the above cover requirements cannot be met. Each deviation from the above requirements will be reviewed on a case-by-case basis.

3.0030 Structures

3.0031 Manholes

- A. Manholes shall conform to ASTM C 478.
- B. Manholes shall be located at all changes in slope, alignment, pipe size, and at all pipe junctions with present or future sanitary sewers.
- C. Manhole spacing shall not be greater than 400 ft. Spacing may be increased for sewer mains in excess of 36 in. in diameter with City Engineer approval.
- D. Manholes outside of vehicle or pedestrian travel-ways shall have a tamper proof lid.

3.0032 Cleanouts

- A. Cleanouts will not be approved as substitutes for manholes on public sewer lines. Cleanouts are permitted at the upper end of a sewer that will be extended during a future construction phase. If future extension requires a change in sewer alignment or grade, a manhole will be required at the cleanout location.
- B. Cleanouts located outside of vehicle or pedestrian travel ways shall have cover located in 18 in. x 24 in. concrete pad.

3.0040 Structure Design

3.0041 Manholes

- A. Designs for manholes are shown in the West Linn Standard Drawings. They are suitable for most conditions.
- B. All sanitary manholes shall be of watertight construction. If ground water or surface drainage can be expected, watertight covers shall be used.
- C. New or revised designs of manhole drawings should not be shown on the construction plans unless the West Linn Standard Drawings are not suitable. New or revised designs of manhole drawings may be necessary if;
 - 1. One or more of the sewers to be connected to the manhole is over 36 in. in diameter (smaller diameters may require a special design if the manhole is at an alignment change.)
 - 2. Several sewers will be connected to the manhole.
 - 3. There is less than 90° between the incoming and outgoing sewer.
 - 4. The manhole will be subject to unusual structural loads.
 - 5. Diversion or other flow control measures are required.
- D. Where any combination of a, b, or c are encountered, a drawing of the manhole base should be made to determine if it is feasible to use designs shown in the Standard Drawings. It may be necessary to restrict the options to a specific Standard Drawing specified by a note on the construction drawings. If a special design is required for any reason, it will be necessary to show the details on the construction drawings and to provide structural calculations as needed.
- E. Some alternate manhole features are shown in the Standard Drawings. Where these features are required, they must be specified by a note on the construction drawings. Some examples are:
 - 1. Slab tops must be used in lieu of cones where there will be less than 4 ft. between the manhole shelf and the top of the manhole lid.
 - 2. Watertight manhole frames and covers are to be used if floodwaters are expected to cover the manhole top or if the manhole must be located in the street gutter. Such conditions should be avoided wherever feasible.
 - 3. Tamperproof manhole frames (7 in. depth) and covers are required in all areas outside the paved public right-of-way or pedestrian travel ways. Rims shall be 1 ft. above the finished grade if not in a paved way.
- F. Standards for elevation differences at manholes have been established to compensate for normal energy losses and to prevent surcharging of a sewer by a larger sewer. For purposes of slope calculation and for establishing elevation differences, the elevations are given at the intersection of the sewer centerlines (usually the center of the manhole). The rules for elevation differences at manholes are:
 - 1. The crowns of incoming sewers shall be at least as high as the crown of the outgoing sewer.
 - 2. If the incoming and outgoing sewers are of equal size and are passing straight through the manhole, no added elevation change is required.
 - 3. If sewers intersect or the alignment changes at the manhole, the invert elevation difference shall be at least 0.10 ft. for 0°-45° of horizontal deflection angle, and 0.20 ft. for over 45° of horizontal deflection angle.
 - 4. The slope of a sewer within a manhole shall be no less than the slope of the same sewer outside of the manhole.

5. Drop connections are required when the vertical distance between flow-lines exceeds 2 ft. The diameter of the drop connection must be specified on the construction drawings. The diameter of the drop connection shall not be more than one pipe size smaller than the diameter of the incoming sewer. Smooth flow-lines with vertical distances of less than 1 ft. must be provided wherever feasible. Outside drop assemblies only will be permitted, see the Standard Drawings.
 6. All connections must enter the manhole through a channel in the base. This includes drop connections and connections to existing manholes.
- G. Where conditions make compliance with these rules impractical, exceptions will be permitted. It will be necessary, however, for the Design Engineer to provide a complete analysis of the need for such designs.

3.0050 Service Lateral

- A. Service laterals are those private sewer lines to which a private building sewer connects.
- B. Each individual building site shall be connected by a separate, private, building-sewer-service line connected to the public sewer. Each individual property shall have an individual lateral.
- C. Where the invert of the lateral is 1 ft. or less above the manhole shelf, formed channel will be constructed utilizing Portland Cement Concrete. The sewage entering the manhole will follow a smooth concrete channel transitioning evenly from the invert of the inlet pipe into main channel. Sewage will not be allowed to fall freely to the manhole base.
- D. Where the invert of the lateral exceeds 1 ft. above the manhole shelf, Standard Drawing WL-302 governs.
- E. The minimum inside diameter of a sewer service lateral shall be 4 in. and shall be equal to or greater than the building sewer diameter. Service laterals shall be built to the same construction standards and of the same materials as the sewer mainline. Service laterals in general shall be placed at 90° to the main sewer line to avoid excessive exposure to other utilities during excavation for construction or maintenance of the service lines. Angles other than 90° (45° minimum) may be approved for special conditions such as cul-de-sac lots. Service line connections may be made at manholes (90° to sewer mainline) if such placement would not interfere with other present or future connections to the manhole.
- F. The minimum slope of sewer service lines shall be 2% (1/4 in. per ft.), except for unusual conditions, when a slope of 1% (1/8 in. per ft.) may be approved. It will be necessary, however, for the Design Engineer to provide a complete analysis of the need for any sewer service lateral slope less than 2%. The maximum slope shall be 100% (45° or 1 ft. per ft.). Deep connection risers (see the Standard Drawing for service laterals to deep sewers) or drop connections to manholes must be used where service line slopes would exceed 100%.
- G. Tees for service laterals shall be installed at 100% slope, and 1/16 or 1/8 bends installed to provide proper grade for service lateral. Service laterals shall be installed to end beyond the street right-of-way line or easement line where sewer is installed in easement. A watertight plug shall be installed in end of lateral and a 2 in. x 4 in. wood marker shall be placed at lateral end from pipe invert to at least 4-feet above the finish grade. The 2 in. x 4 in. top shall be painted green and marked with the depth of the lateral measured from ground to invert of pipe. In new subdivisions, at the time the curbs are poured, an S shall be stamped in the top of the curb at each point a lateral crosses beneath the curbline.

3.0060 Connection to Existing Sewers

- A. Connections to, and extensions of, existing sewers will occur to facilitate new development. Certain requirements will be placed on the Design Engineer as to permitted methods and/or locations.
- B. Connections to existing manholes shall be made with the following guidelines:
 1. Where the invert of the connecting pipe is more than 2 ft. above the manhole shelf, the contractor will be required to construct an outside drop with the inlet pipe invert being located at the manhole shelf. The sewage entering the manhole will follow a smooth concrete channel transition from the inlet pipe into the

main channel. No drops are allowed. Any exceptions to this policy shall be approved by the City Engineer. Connection to existing manhole shall be done with a core only. Invert elevation shall be at 0.2 ft. above outlet invert elevation, with a smooth concrete channel transition from the inlet pipe to the main channel.

2. Where the invert is required to enter below the shelf of the manhole, the inlet pipe will not enter below a point where the crown of the new inlet pipe is below the crown of the outlet pipe. The base of the manhole will be rebuilt if damaged in this process. The sewage will enter the main flow in a smooth channel transitioning from the inlet pipe to the main channel.
 3. No pipe will enter an existing manhole where the angle between the incoming flow and the outgoing flow is greater than 90°.
- C. When sewers are extended from cleanouts, the entire cleanout assembly, including the wye, shall be removed.
 - D. New building service laterals will be made at existing tees where possible.
 - E. No connection to existing sanitary system shall occur prior to acceptance of the new system.
 - F. When tees do not exist on the Public Sanitary Sewer System, the new lateral sewer will enter the collection system through a "cored" opening with an approved connector. This connection shall be done in conformance with Standard Drawing WL-303.

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3.0100 Sewage Pump Station Design Standards

- A. The pump station shall be a submersible pump type facility.
- B. Station shall include: Submersible pumps, wet well, valve vault, associated piping and valves, electrical controls, instrumentation, telemetry, access road, fencing, landscaping, potable water supply, and shall generally conform to the City of West Linn conceptual pump station.
- C. Pump station shall be designed to pump the peak wastewater flow from the service area. When the service area is not built out, staging of pump station capacity will be allowed.
- D. Where the flow is substantial or where environmental damage may occur due to power failure, the City Engineer may require permanent standby power.
- E. Wet well-mounted or wet well/dry well stations will not be allowed.

3.0120 Design

- A. Pump station shall be designed to meet the minimum requirements and guidelines standards of the Department of Environmental Quality (DEQ), OAR Chapter 340, Division 52.
- B. Design shall be by registered engineer experienced in design of such facilities.
- C. Service area, peak flow, and pump station calculations shall be submitted to the City Engineer.
- D. Wet well shall be designed to provide 4 hrs. of storage above high water alarm.

3.0130 Materials

3.0131 Pumps

- A. A minimum of two pumps shall be supplied. Each pump shall be capable of pumping the peak wastewater flow. Where more than two pumps are used, the station shall be able to pump peak wastewater flow when the largest pump is out of service.
- B. Pumps shall be submersible pumps manufactured by FLYGT (or equal), explosion-proof, suitable for hazardous location, and shall be UL or FM listed.

3.0132 Piping and Valves

- A. Piping and fittings shall be ductile iron.
- B. Valves shall be metal, suitable for wastewater use. Valves shall be designed for wastewater service.
- C. Provide pressure gages on pump discharge piping.

3.0133 Electrical

Electrical controls shall be located above ground mounted in a waterproof enclosure. Electrical panels shall be UL listed. The pump station wet well shall be considered a hazardous location.

3.0134 Controls

- A. Controls may be mechanical relays or programmable logic controllers.
- B. Pumps shall alternate lead-lag position with each pumping cycle.
- C. Bubbler shall control pump start/stop.
- D. Float activated alarm shall indicate high water level.
- E. An auxiliary power connector and manual transfer switch shall be provided.

3.0135 Alarms and Telemetry

- A. Alarms shall be telemetered to the City of West Linn Public Works Open Complex radio.
- B. Alarms include:
 - 1. Pump failure
 - 2. Power failure
 - 3. Telemetry failure
 - 4. High water level
 - 5. By-pass
 - 6. Seal failure
 - 7. Generator
 - 8. Compressor

3.0136 Landscaping and Fencing

A 6 ft. chain link fence with three strands of barbed wire and redwood slats shall surround the pump station. Access for easy maintenance shall be incorporated in the design.

3.0137 Additional Features

- A. Provide 1 in. hose bib at valve vault. Potable water shall be provided by reduced pressure backflow preventer.
- B. Provide positive ventilation in valve vault.
- C. Odor control as required.

3.0138 Force Main

Force main shall be designed for a nominal flow velocity in the range of 3 to 5 ft. per second.

3.0140 Construction

- A. Pump station and related facilities will be constructed to Electrical and Building Codes.
- B. Steel fabrications shall be hot dipped galvanized; painting required on valves, piping, and pipefittings.

3.0141 Operating and Maintenance Data

- A. Compile product data and related information appropriate for City's maintenance and operation of products furnished under the contract.
- B. Prepare operating and maintenance manual.
- C. Instruct City's personnel in the maintenance of products and in the operation of equipment and systems.

3.0142 Spare Parts

Supply two sets each of all gaskets, bearings, and mechanical seals for rotating equipment.