

CITY OF CRESWELL
Public Works Design Standards

Division 4

Sanitary Sewer

DIVISION 4 SANITARY SEWER

4.1 PURPOSE

- a. In addition to the purposes outlined under Division 1 of these Design Standards, the purpose of these Standards is to ensure the development of a sanitary sewer system which will:
- 1) be of adequate design to carry the expected flow, within the design life, and at sufficient depth to serve all adjacent properties;
 - 2) have sufficient grade to maintain a minimum velocity of two (2) feet per second when flowing full;
 - 3) have sufficient structural strength to withstand all external loads which may be imposed;
 - 4) be of materials resistant to both corrosion and erosion with a minimum design life of 75 years;
 - 5) be economical and safe to build and maintain;
 - 6) prevent infiltration and inflow of ground and surface waters.
- Alternate materials and methods will be considered for approval on the basis of these objectives.
- b. These Standards cannot provide for all situations. They are intended to assist but not to substitute for competent work by professional design engineers.

4.2 APPLICABILITY

- a. These Standards shall govern all construction and upgrading of all public sanitary sewer facilities in the City of Creswell and applicable work within its service areas.
- b. Permanent sanitary sewer facilities shall be provided to all properties within the City of Creswell in accordance with these Standards. This shall generally be interpreted to mean that permanent sanitary sewer distribution facilities shall be provided for existing legal lots of record at the time development occurs, and for new legal lots of record created by a major or minor partitioning or subdivision of land at the time of partitioning or subdivision.
- c. These design requirements may be used for private systems when plumbing code requirements cannot be met, provided the system is designed and appropriately certified by a professional civil engineer licensed in the State of Oregon, and provided

design of private improvements to these public standards is not prohibited by the plumbing code or building official.

4.3 SPECIAL ITEMS

- a. The design of the following are considered special items and are not covered in detail in these Standards:
 - 1) Sewerage Pump Stations
 - 2) Force Mains
 - 3) Siphons
 - 4) Relining or Insitu Reconstruction of Existing Sewers
 - 5) Internal Sealing of Existing Sewers
 - 6) Treatment Plants
 - 7) Pretreatment Facilities
 - 8) Energy Dissipators
 - 9) Regulating Devices
 - 10) Flow Measurement Devices
 - 11) Hydrogen Sulfide and/or Hazardous Gases
- b. Review and approval of the above special items by the City Engineer and Public Works Director shall be required. When requested by the City, full design calculations shall be submitted for review prior to approval.

4.4 APPROVAL OF ALTERNATE MATERIALS AND METHODS

- a. Any alternate material or method not explicitly approved herein will be considered for approval on the basis of the objectives set forth in Paragraph 4.1, Purpose. Persons seeking such approval shall make application in writing to the City Engineer and Public Works Director. Approval of any major deviation from these Standards shall be in written form. Approval of minor matters will be made in writing, if requested.
- b. Any alternate must meet or exceed the minimum requirements set forth in these Design Standards.
- c. The written application is to include, but is not limited to, the manufacturer's specifications and testing results, design drawings, calculations and other pertinent

information.

- d. Any deviations or special problems shall be reviewed on a case-by-case basis and approved by the City Engineer and Public Works Director. When requested by the City, full design calculations shall be submitted for review with the request for approval.

4.5 CONSTRUCTION DRAWINGS

- a. Construction drawings shall conform to the requirements of Division 1 of these Design Standards.
- b. Detail drawings shall be included on the construction drawings for all sanitary sewer appurtenances including manholes, cleanouts, metering manholes, lateral connections, etc.

4.6 STANDARD DETAILS

- a. Standard details included in the appendix are supplemental to the text of these design standards and show the City's minimum requirements for the construction of standard structures and facilities.
- b. In the case of conflicts between the text of these design standards and the standard details, the more stringent as determined by the City Engineer and Public Works Director shall apply.
- c. As required by Division 1 of these standards, all applicable standard details shall be included on the construction drawings.

4.7 DEFINITIONS AND TERMS

- a. In addition to the definitions contained in Division 1 of these Standards, the following definitions may apply particularly to sanitary sewer systems. Unless otherwise defined in these Design Standards, the following definitions and abbreviations shall apply whenever used. Other definitions as outlined in the Oregon Plumbing Specialty Code (OSPC) shall also apply.
 - 1) Abbreviations: Acceptable abbreviations for showing types of new and existing pipe materials on the plans are as follows:
 - a) AC - Asbestos Cement
 - b) CI - Cast Iron
 - c) CP - Non-reinforced Concrete Pipe
 - d) DI - Ductile Iron

- e) HDPE - High Density Polyethylene
 - f) PVC - Polyvinyl Chloride
 - g) RCP - Reinforced Concrete Pipe
- 2) Building Drain: The building drain is that part of the lowest piping of the drainage system which receives the discharge from waste and other drainage pipes inside the walls of the building and conveys it to the building sewer, which begins five feet outside the building wall (building foundation).
 - 3) Building Sewer: That part of the horizontal piping of the drainage system which extends from the end of the building drain and which receives the discharge of the building drain and conveys it to a public sanitary sewer system, private sanitary sewer system, individual sewage disposal system, or other approved point of disposal.
 - 4) Collection Sewer: Lateral and mainline sanitary sewers.
 - 5) Collection System: Facilities maintained by the City for the collecting, conveying, pumping and controlling of wastewater.
 - 6) Contact Cooling Water: Water which is used as a medium for carrying away excess heat from apparatus, appliance, mechanism or device in which, in the course of cooling process, comes in direct contact with the product, is mixed or co-mingled with any other substance or used as a means of carrying off any other substance, in suspension or in solution. Contact cooling water is considered to be a process wastewater and may require pretreatment prior to discharge into the City's sewer system.
 - 7) Domestic Sewage: The liquid and water borne waste derived from the ordinary living processes, free from industrial wastes, and of such character to permit satisfactory disposal, without special treatment into the public sanitary sewer or by means of private sanitary sewage disposal system.
 - 8) Drainage Waste: Stormwater, groundwater, surface drainage, subsurface drainage, spring water, well overflow, roof drainage, or other like drainage other than sewage or industrial waste.
 - 9) Fixture Unit Equivalents: The unit equivalent of plumbing fixtures as tabulated in Chapter 4 of the Oregon Plumbing Specialty Code (OPSC).
 - 10) Flow: The wastewater flow from an industry, institution or house connection (daily average).
 - 11) Industrial Waste: A water borne waste and wastewater from an industrial user.

- 12) Lateral Sewer: Any public sanitary sewer which has no other common sanitary sewers discharging into it.
- 13) Mainline Sewer: Any public sanitary sewer which receives flow from one or more lateral sewers.
- 14) Noncontact Cooling Water: Water other than sewage or industrial waste which is used as a medium for carrying away excess heat from apparatus, appliance, mechanism or device in which, in the course of cooling process, is not mixed or co-mingled with any other substance or used as a means of carrying off any other substance, in suspension or in solution, thereby exiting such cooling process in substantially the same condition, save for temperature, as when it entered.
- 15) Plumbing System: All plumbing fixtures and traps, or soil, waste, special waste and vent pipes within a building and to a point five feet outside the building foundation thereof.
- 16) Private Collection System/Private Sewer: A privately owned and maintained sanitary sewer system installed to serve multi-unit structures on single ownership properties, which cannot legally be further divided, such as apartments, mobile home parks and schools or installed in commercial or industrial developments.
- 17) Property Line Cleanout: A cleanout (to City standards) is installed on a sanitary sewer service lateral and which is located at or near the point where the sewer service lateral leaves the public right-of-way (or at or near the point where it leaves the public sewer easement for sewer mainlines not constructed in public right-of-ways). This general term applies even if said cleanouts are not installed directly on the property line or easement boundary. Other cleanouts between the Property Line Cleanout and the building (whether or not installed on property other property lines crossed) are private cleanouts which must conform with the Oregon Plumbing Specialty Code standards.
- 18) Public Sewer: Any sanitary sewer in the public right-of-way or easement operated and maintained by the City.
- 19) Sewer Service Lateral: That portion of the building sewer from the right-of-way line to a public sanitary sewer, private sanitary sewer, individual sanitary sewage disposal system, or other point of disposal. (1) Where a sewer lateral property line cleanout does exist, the entire portion of the sanitary sewer lateral and building sewer located upstream of the property line cleanout shall be the sole responsibility of the property owner for cleaning, inspection, maintenance and/or repair (including the portion between the property line cleanout and the right-of-way line or easement line). (2) Where a sewer lateral property line cleanout does not exist, the entire portion of the sanitary sewer lateral and building sewer outside the public right-of-way (or outside

the public sewer easement for sewer mainlines not constructed in public right-of-ways) shall be the sole responsibility of the property owner for cleaning, inspection, maintenance and/or repair. The required property line cleanout for new services or rehabilitated existing services is required to allow the service lateral to be located, as well as to facilitate cleaning and maintenance of the portion of the sewer lateral under City streets, and decrease the likelihood of having to cut or excavate City streets.

- 20) Sewage: The wastewater derived from human habitation and use of buildings for residential, institutional or commercial purposes, excluding storm waters and industrial waste.
- 21) Structures: Those structures designated on the plans as manholes, siphons, junctions or diversion facilities, etc. Detailed drawings of structures or devices commonly used in City work and mentioned in these Standards are included in the standard construction specifications.
- 22) Trunk Sewer: A public sanitary sewer ten inches or larger which has been or is being constructed to receive the flow of more than one mainline sewer.

4.8 MATERIALS

a. General

- 1) Unless otherwise approved by the City Engineer, materials shall conform to the minimum requirements outlined herein and as shown on the Standard Details. This listing is not intended to be complete nor designed to replace the City's Public Works Construction Standards (PWS).
- 2) In the case of conflicts between the provisions of these design standards and the PWS, the more stringent as determined by the City Engineer and Public Works Director shall apply. Acceptable materials shall be as outlined in these Design Standards.
- 3) It is not intended that materials listed herein are to be considered acceptable for all applications. The design engineer shall determine the materials suitable for the project to the satisfaction of the City Engineer.

b. Non-Pressure PVC Pipe

- 1) Pipe and fittings fifteen (15)-inches in diameter or less shall conform to ASTM D-3034, SDR 35.
- 2) Pipe and fittings eighteen (18) through twenty-seven (27)-inches in diameter shall conform to ASTM F-679.
- 3) Pipe shall be continually marked with manufacturer's name, pipe size, cell classification, SDR rating, and ASTM classification.

- 4) The joints shall conform to ASTM D-3212, Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.

c. **Pressure PVC Pipe**

- 1) PVC pressure pipe 4-inches through 12-inches in diameter shall conform to the requirements of AWWA C-900 (design stress of 4000 psi), NSF approved, with cast iron pipe equivalent (CI) outside diameter dimensions. PVC pipe shall be Class 150 pipe with wall thickness equivalent to a standard dimension ratio (SDR) of 18.
- 2) PVC pressure pipe 14-inches through 24-inches in diameter shall conform to the requirements of AWWA C-905 (design stress of 4000 psi), NSF approved, with cast iron pipe equivalent (CI) outside diameter dimensions. PVC pipe shall be Class 165 pipe with wall thickness equivalent to a standard dimension ratio (SDR) of 25.
- 3) Restrained joint PVC pipe shall be used in locations and configurations as required by the City Engineer (CertaLok C900 or approved equivalent).

d. **Ductile Iron Pipe**

- 1) Ductile iron pipe shall be centrifugally cast in conformance to AWWA C-151.
- 2) Ductile iron sewer pipe shall be minimum Class 50 thickness for non-pressure applications, Class 52 for pressure applications.
- 3) All ductile iron pipe and fittings shall be cement-mortar lined and seal coated in accordance with AWWA C-104.
- 4) All ductile iron pipe and fittings buried underground shall be coated on the outside with a standard coating of black bituminous paint a minimum of 1 mil thick unless otherwise specified.

e. **Joints**

- 1) Joints for pipe shall be push-on joints using factory installed elastomeric ring gaskets. The gaskets shall be securely fixed into place by the manufacturer so that they cannot be dislodged during joint assembly.
- 2) The gaskets shall be of a composition and texture which is resistant to common ingredients of sewage and industrial wastes, including oils and groundwater, and which will endure permanently under the conditions of the proposed use.

f. **Pipe Accessories**

- 1) Fittings shall be of the same material as the pipe, molded or formed to suit pipe size and end design, in required tee, bends, elbows, cleanouts, reducers, traps and other configurations as required.
- 2) Couplings for gravity PVC Pipe (D3034 or F679) to other PVC pipe.
 - a) Couplings shall be gasketed solid sleeve slip PVC couplings (gasketed no stop coupling designed to be slid fully onto the pipe on one side of the connection, and then slid back over and centered on the joint).
 - b) Flexible couplings shall not be used to connect pipe joints on new pipe systems, or to connect same diameter PVC pipe.
- 3) **Flexible, Mechanical Couplings and Adapters (gravity applications)**
 - a) Flexible, mechanical couplers and adapters shall be used for connecting plain ends of non-compatible types or sizes of pipe and for the installation of cut-in tee connections and other fittings into existing lines.
 - b) Couplers and adapters shall be supplied with stainless steel band clamps and stainless steel shear sleeves.
 - c) Flexible mechanical couplers and adapters shall be as manufactured by Fernco or approved equivalent.

g. **Manholes**

- 1) **General**
 - a) Precast concrete pipe manhole sections, transition sections, eccentric cones, flat slab tops, and adjusting rings shall conform to the requirements of ASTM C-478 except as modified herein. Reinforcing in transition sections shall be equal to the requirements of that specified for wall sections of the larger diameter.
 - b) Unless otherwise approved, all joints between manhole sections shall be keylock or O-ring type conforming to ASTM C-443.
 - c) Precast base sections shall be of monolithic construction and shall be manufactured such that the base riser section is integral with the base slab.
 - d) The bottom of the precast base section shall be a minimum of six (6) inches thick, and contain a minimum of 0.32 sq. inches of reinforcing steel each way in the top of the slab.

- e) Sanitary sewer manhole bases shall be provided with core-drilled openings and flexible manhole-to-pipe connectors for the connection of stubouts.

2) Manhole Steps

- a) All manholes shall be equipped with permanent factory installed steps to provide a continuous ladder of 12-inch center-to-center rung spacing.
- b) Manhole steps shall be of polypropylene plastic reinforced with a 1/2-inch grade 60 reinforcing rod.
- c) There shall be no more than 30 inches from the manhole rim and the rung of the top step.

3) Manhole Grade Rings

- a) Concrete grade rings shall have precast keyway grooves, and the height from the top of the cone or the bottom of the flattop section shall not exceed eighteen (18) inches in height.

4) Manhole Frame and Cover Assemblies

- a) Castings shall be cast iron conforming to the requirements of ASTM A-48, Class 30, and shall match the dimensional requirements of the standard details.
- b) Standard frames and covers shall be used for all paved areas. Sanitary sewer manhole lids shall have 2 holes (as opposed to storm manhole lids, which have 16 holes).
- c) Where pressure tight manhole covers are called for, lid seals shall be a continuous round rubber gasket supplied by the manufacturer. Threaded inserts shall be cast in eccentric cones or flat slab tops and holes formed or cored in adjusting rings to match bolt size and spacing specified for the manhole casting.

h. Mainline Cleanouts

- 1) Mainline cleanouts shall consist of a lid and frame of heavy duty cast iron construction with closed lid design. A 3,300 psi concrete collar is required for cleanouts located outside of paved areas.
- 2) A 3,300 psi concrete collar is required for cleanouts located outside of paved areas.
- 3) The shaft or chimney of the cleanout shall be a minimum of 8-inches in

diameter, except for 6-inch lines, which shall have a chimney diameter of 6-inches.

i. **Underground Warning Tape**

- 1) Underground warning tape shall be detectable or non-detectable acid and alkali resistant safety warning tape. The tape shall consist of a minimum 4.0 mil (0.004") thick, virgin low density polyethylene plastic film formulated for extended use underground. The tape shall be in accordance with the APWA national color code and shall be permanently imprinted in lead free black pigments suitable for direct burial.
- 2) The tape shall be safety green and shall be provided with the legend "CAUTION BURIED SANITARY SEWER LINE BELOW" or approved equivalent printed continuously down the length of the tape.

j. **Toning Wire**

- 1) A continuous insulated 12 gauge solid core copper toning wire shall be supplied with non-metallic pipe. Insulation shall be green in color for sewer piping.
- 2) Wire shall penetrate into manholes within 18 inches of the rim elevation.

k. **Bore Casings and Accessories**

- 1) Carrier pipe used in bore casings shall be Ductile Iron or PVC as specified herein.
- 2) Bore casing and carrier pipe design and installation shall conform to the requirements outlined under Division 5, Water Distribution.

4.9 GENERAL DESIGN CONSIDERATIONS

a. **General Requirements**

- 1) Sanitary sewer systems shall be designed and constructed to achieve total containment of sanitary wastes and maximum exclusion of infiltration and inflow.
- 2) Sewers shall be designed to convey the peak instantaneous wet weather flows anticipated over the design period without surcharging.
- 3) Gravity Flow: Where possible, all sanitary sewers shall be designed to flow by gravity to an existing or new sewer without sewage lift stations.
- 4) As a condition of sewer service, all developments will be required to provide public sewers to serve adjacent upstream parcels in order to provide for the

orderly development of the drainage area, as well as connection (to the new system) of existing sewer lines or laterals crossed or intercepted by the new sewer lines, at locations as required by the City Engineer and Public Works Director (see also PWDS 1.6.e). 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 extension to the far side of streets fronting or adjacent to the development as required to avoid work within or under these streets in the future. This shall include trunk sewers which are oversized to provide capacity for upstream development.

- 5) Storm water, including street, roof or footing drainage, shall not be discharged into the sanitary sewer system but shall be removed by a storm drainage system separate from the sanitary sewer system.
- 6) Unpolluted (noncontact) cooling waters shall not be discharged into sanitary sewers.
- 7) Public sewers within easements will be permitted only upon a showing that services cannot be provided from a line within a right-of-way. Minimum easement widths shall be as outlined herein, but in no cases shall easements narrower than 15 feet be considered.

b. **Design Factors**

- 1) The following factors as a minimum shall be addressed in the design of sanitary sewers and determination of design flows.
 - a) Drainage basin to be served.
 - b) Topography of the area
 - c) Depth of excavation
 - d) Service lateral elevations
 - e) Soils conditions
 - f) Land use within the area to be served.
 - g) Projected population within the area to be served at build-out.
 - h) Per capita sewage flow.
 - i) Flows from commercial, industrial or institutional users.

- j) Infiltration and Inflow
 - (1) Infiltration allowance for new facilities.
 - (2) Infiltration and inflow from existing facilities.
- k) Maximum hourly and peak instantaneous flows
- l) Condition and size of existing sewers
- m) Location of WWTP
- n) Pumping requirements
- o) Maintenance, including accessibility for cleaning and inspection personnel and equipment.

4.10 DESIGN PERIOD

a. Mainline and Lateral Sewers

- 1) Mainline and lateral sewers shall be designed for the ultimate development of the tributary area. Consideration shall be given to the maximum anticipated capacity of institutions, industrial parks, commercial establishments, etc.

b. Trunk Sewers

- 1) Selection of the design period for trunk sewers shall be based on evaluation of functional and other considerations. Some of the factors that should be addressed in the design of trunk sewers are:
 - a) Solids deposition, odor, and pipe corrosion at initial flows.
 - b) Effect of sewer sizing on land use and development.
 - c) Population and economic growth projections and the anticipated accuracy of these projections, coupled with the comparative costs of staged construction and the anticipated manner in which the future improvements will be funded.

4.11 DESIGN BASIS & CAPACITY

a. Design Basis

- 1) Generally, sewers shall be designed to carry the peak domestic, commercial and industrial contributions, plus infiltration/inflow from the individual gravity service laterals, sewer mains and manholes. Where more detailed information is not available, new sewer systems within the City may be

designed on the basis of the following flows.

- a) Residential domestic flows: 100 gal/capita/day (gpcd)
 - b) Schools, non-residential students & staff: 25 gpcd
 - c) Commercial, non-residential customers
 - (1) Restaurant/Cafe: 40 gal/day/seat
 - (2) Tavern/Bar: 50 gal/day/seat
 - d) Laundries, self-service: 500 gal/day/machine
 - e) Infiltration/Inflow
 - (1) New facilities: 1,600 gal/acre/day
 - (2) Existing facilities: As measured.
- 2) Assumed flows from types of establishments not listed above shall be as approved by the City Engineer.

b. **Capacity:** Generally, sewers should be designed to carry, when flowing full but not surcharged, not less than the following plus existing or planned flows from upstream properties:

- 1) Lateral and Mainline Sewers:
 - a) For new installations serving new areas, minimum peak design flow shall not be less than 4 times the design sanitary flow plus I/I allowance.
 - b) For new installations serving existing sewer areas, minimum peak design flow shall not be less than 4 times the design sanitary flow plus an additional I/I allowance based on existing conditions.
- 2) Trunk Sewers:
 - a) For new installations serving new areas, minimum peak design flow shall not be less than 3 times the design sanitary flow plus I/I allowance.
 - b) For new installations serving existing sewer areas, minimum peak design flow shall not be less than 4 times the design sanitary flow plus an additional I/I allowance based on existing conditions.

3) Roughness Coefficient:

- a) A minimum "n" value of 0.013 shall be used in Manning's formula for the design of all sewer facilities regardless of pipe material. The use of higher "n" values for existing pipe may be required by the City Engineer.
 - b) In theory, new PVC sewers have manufacturer's "n" value of 0.009. However, sand and grit as well as slime build up on the pipe walls over time tend to render a true "n" value of 0.013. Hence, an "n" value of less than 0.013 will not be considered for approval.
- 4) It is recommended that design calculations include estimates of average, maximum and minimum daily flows. The submission of design calculations will not ordinarily be required, but engineers should be prepared to substantiate pipe sizes, layout, population estimates, land uses or other design assumptions as may be requested.

4.12 MINIMUM SIZE

- a. Public lateral or mainline sewers shall not be less than eight (8) inches in diameter unless approved in writing by DEQ and the City Engineer.

4.13 MINIMUM DEPTH

- 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.
- b. Under normal conditions, sanitary sewers in residential areas shall be placed in the street with the following minimum cover:
 - 1) Lateral and Mainline Sewers - Six (6) Feet
 - 2) Trunk Sewers:
 - a) In the roadway - Seven (7) feet
 - b) In easements - Eight (8) feet
 - 3) Where the topography is relatively flat and existing sewers are shallow (five feet or less) and cannot practically be lowered, the minimum cover may be reduced to three (3) feet. Cover depths less than three (3) feet will require the approval of the City Engineer, and will require the installation of Class 50 ductile iron pipe (corrosion resistant mortar lined) or Class 150 C900 PVC.

- c. In new designated 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. Deviation from these standards will be considered on a case-by-case basis when the following circumstances exist and the required documentation is submitted.
 - 1) Underlying rock strata: A request in writing must be submitted to the City Engineer together with a soils report including a plan and profile certifying bed rock exists below the undisturbed ground surface at all investigated alignments.

4.14 MINIMUM SLOPE

- a. All sanitary sewers shall be laid on a slope which will produce a mean velocity when flowing full of at least two (2) feet per second based on Manning's formula using minimum roughness coefficient of 0.013 or the pipe manufacturer's recommendations, whichever is greater.
- b. The minimum acceptable slopes for various pipe sizes are listed below:

MINIMUM MAINLINE PIPE SLOPES	
Inside Pipe Diameter (inches)	% Slope (feet per 100 feet)
(private sewers only)	
6	0.60
8	0.40
10	0.28
12	0.22
15	0.15
18	0.12
21	0.10
24 & larger	Case-by-Case

- c. In general, gradients greater than those shown above are desirable and are particularly recommended on the upper ends of lateral sewers.
- d. Sewers shall be laid with uniform slope and alignment between manholes.
- e. Engineers are cautioned not to specify sewers of sizes which are obviously larger than necessary for satisfactory carrying capacity but which are specified in order to meet

grade requirements (ie. a 10-inch pipe for an 8-inch pipe to acquire a decrease in slope).

- f. Grades (slopes) shall be determined to the pipe invert at the edge of the manhole and lengths to the center of the manhole.
- g. The difference between the inlet pipe slope (Si) and outlet pipe slope (So) at any manhole shall not exceed 25 percent.
- h. Sewers on slopes of 20 percent or more shall be anchored with concrete anchor walls or other restraining methods approved or specified by the City.
- i. Where velocities greater than fifteen (15) feet per second are attained, the pipe material shall be ductile iron and special provision shall be made to protect manholes against erosion and displacement by shock. This may be accomplished by installing one additional manhole to decrease the slope or to split a 90° horizontal direction change into two 45° incremental changes.

4.15 ALIGNMENT AND LOCATION

a. General

- 1) Sewer lines shall be laid on a straight alignment and uniform slope between consecutive manholes.
- 2) Horizontal and vertical curves in sanitary sewers are not permitted.

b. Location in Relation to Water Lines and Other Utilities

- 1) Sewer mainlines and lateral mainlines shall be separated from all other utilities by a minimum of 5 feet clear.
- 2) Sewer mainlines and lateral mainlines shall generally be separated from water mainlines by a minimum of 10 feet. In no case shall the separation be less than 5 feet or as required by OAR 333.

3) Water Main Crossings

- a) Where new sanitary sewer lines cross above or within 18-inches vertical separation below a waterline, such sewer mains and/or laterals shall have one full length of approved PVC (or approved equal) sewer pipe centered at the point of crossing per OAR 333-061-0050(9).

b)

c. Location in Streets

- 1) Unless otherwise approved by the City Engineer and Public Works Director,

sanitary sewers shall generally be located in the street right-of-way five (5) feet from the street centerline on the low side of the street. Unless otherwise approved by the City Engineer and Public Works Director, horizontal alignment of new sewer mainlines shall be parallel with the centerline of the right-of-way.

- 2) Where sewer alignments cross the street centerline, the design shall demonstrate that the requirements of ORS 92.044(7) are satisfied with relation to street centerline monuments (ie. utility infrastructure is not to be placed within 1 foot of a survey monument location shown on a plat).
- 3) If streets have curved alignments, the minimum distance between manholes or sewer lines and the curb face shall be as listed below. For streets improved to less than full width, the location shall be measured from the future curb location. The intent is to prevent a conflict with new storm drain lines while still providing for the least number of manholes required to transverse the curve.
 - a) Center of manhole to curb face: 6-feet minimum.
 - b) Sewer centerline to curb face: 6-feet minimum.

d. **Location in Easements**

- 1) **Offset:** When sewers in easements are approved by the City, the sewer line shall be offset a minimum of 6 feet from any property line, or 1/3 the required easement width, whichever is greater.
- 2) Sewers in easements will be allowed only after all reasonable attempts to place the mains in a right-of-way have been exhausted. All easement installations must be approved in writing by the City Engineer and Public Works Director on a case-by-case basis.
- 3) 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 or tree be placed over a sanitary sewer main or sewer easement, nor shall any parallel fences be constructed within the easement (access gates acceptable to the City shall be installed in fences which the City allows to be constructed across City easements). Prohibited structures shall include decks, as well as footings or overhanging portions of structures located outside the easement.
- 4) 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 forces.
- 5) All easements must be furnished to the City for review and approval prior to

recording. All recording costs shall be borne by the Developer.

- 6) Minimum Easement Widths: Unless otherwise specified or authorized by the City, minimum easements widths for sanitary sewers shall be as follows:

MINIMUM SANITARY SEWER EASEMENT WIDTHS		
Sewer Diameter	Depth to Invert	
	≤ 6 feet	> 6 feet
8 - 10 inches	15 feet	15 feet plus 2 feet for each foot (or fraction thereof) deeper than 6 feet to invert.
12 - 15 inches	20 feet	20 feet plus 2 feet for each foot (or fraction thereof) deeper than 6 feet to invert.
> 15 inches	25 feet	25 feet plus 2 feet for each foot (or fraction thereof) deeper than 6 feet to invert.

Note: Easements shall be a constant width between manholes or other in-line structures. Easement width shall be based on the deepest portion of the line between such structures.

- 7) Easement widths shall vary from the minimum by even foot increments. Sewers with a nominal inside diameter of 24 inches or larger will require wider easements than outlined above.
- 8) Common placement in the easement of a sanitary sewer and storm drain line may be allowed under certain conditions subject to approval by the City Engineer and Public Works Director. Easements wider than the minimum may be required.
- 9) Common easements will be reviewed on a case-by-case basis. Separation of utilities must meet Oregon State Department of Environmental Quality (DEQ) and Oregon Health Division (OHD) requirements.

e. **Location in Relation to Streams and Drainage Channels**

- 1) Generally, the top of all sanitary sewers entering or crossing streams shall be at a sufficient depth below the natural bottom of the stream bed to protect the sewer line. In general, as much cover as possible shall be provided. If less than 3 foot of cover is provided, the sewer shall be encased in concrete, CDF or CLSM backfill. Design shall include provisions to prevent floatation of the pipe during concrete, CDF or CLSM backfill placement.
- 2) 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 at the crossing.

- 3) Sewers located along streams shall be located outside of the stream bed and sufficiently removed therefrom to provide for future possible stream channel widening. All manhole covers at or below the 100 year flood elevation shall be leakproof.
- 4) Pipe material at crossings shall be Class 50 ductile iron with an 18 foot length of pipe centered on the stream or drainage channel centerline. The ductile iron pipe shall extend to a point where a 1H:1V slope from the top of the bank and sloping away from the channel centerline intersects the top of the pipe.
- 5) Concrete encasement will be required when the above cover requirements can not be met. Concrete caps in lieu of concrete encasement are not acceptable. Each deviation from the above requirements will be reviewed on a case-by-case basis.

4.16 MANHOLES AND MAINLINE CLEANOUTS

a. General

- 1) Sewer service laterals shall not be connected into manholes unless approved by the City Engineer and the Public Works Director on a case-by-case basis. Where lateral connections to manholes are allowed, the crown of the lateral pipe shall be installed at or above the crown of the manhole outlet pipe.

b. Mainline Sewer Cleanouts

- 1) Mainline cleanouts will not be approved as substitutes for manholes. Cleanouts shall only be allowed at the upper end of lateral or main sewers less than 150 feet long which will be extended on the same grade and alignment during the next construction phase of a multiphase development, and which does not have any laterals.
- 2) All mainline cleanouts will be considered on a case-by-case basis and approved by the City Engineer and the Public Works Director. In all cases, plan and profile showing the alignment and depth of the anticipated future extension from the proposed cleanout to the next manhole shall be submitted prior to approval of cleanouts.

c. Manhole Size

- 1) For pipe 21-inches in diameter and smaller, the minimum diameter of manholes shall be 48 inches.
- 2) For pipe 21-inches or 27-inches in diameter, the minimum diameter of manholes shall be 60 inches.

- 3) For pipe larger than 27-inches in diameter, the minimum diameter of manholes shall be 72 inches unless otherwise approved by the City Engineer.
- 4) Larger manholes may be required for multiple pipe connections.
- 5) Manholes sizes for drop structures or metering manholes will be reviewed on a case-by-case basis.

d. **Manhole Location:**

- 1) Manholes shall be placed at the following locations:
 - a) Upper end of all lateral sewers, except as provided above.
 - b) Every change in grade or alignment of a sewer.
 - c) Every change in size of a sewer.
 - d) Each intersection or junction of sewers, excluding service laterals 6-inches or less in diameter.
 - e) Adjacent to the center radius point of a cul-de-sac.
 - f) In front of the last property or lot being served, a minimum of 10 feet past the common lot line of the adjoining parcel served.
 - g) At intervals of 450 feet or less.
- 2) Where practical, manholes shall be located at street intersections. All manholes from which future sewer line extensions are anticipated, shall have a pipe stub designed and installed at the grade and direction of the anticipated sewer main extension. Pipe stubs shall be a minimum of eight inches in size and shall protrude at least one foot outside the manhole base.
- 3) Manholes shall not be located in the curb or in the gutter. Placement of manholes behind the curb shall be reviewed on a case-by-case basis for approval. Consideration shall be given to those sewer or public utility lines which already exist behind the curb.
- 4) Two manholes shall be installed when the horizontal deflection angle between two sewers is an acute angle less than or equal to 80°. Spacing of such manholes shall be a minimum of ten feet outside to outside. The intent is to prevent lateral sewer connections from discharging into sewers against the direction of flow.

e. **Manhole Rim Elevation**

- 1) The rims of all manholes located within paved or other hard surfaced areas shall be set to finished grade.

- 2) Concrete riser rings shall be used to bring casting to grade. The height from the top of the cone or flattop section to the rim shall not exceed 18-inches.
- 3) The rims of all manholes located outside of paved or other hard surfaced areas shall be set 6-inches above finish grade. Finish grade shall be defined as the final ground surface after grading and landscaping.
- 4) Manholes within easements shall have lockdown lids only where specifically required by Public Works.

f. **Drop Across Manhole Structure**

- 1) Generally, the minimum vertical drop across a 4-foot diameter manhole is required as shown below.
 - a) Straight through runs: 0.1' minimum drop
 - b) Bends greater than 45°: 0.2' minimum drop
- 2) Maximum vertical drop across a 4-foot diameter manhole shall not exceed 18-inches with a beaver slide channel.
- 3) Where pipes of different sizes enter the same manhole, the design shall generally provide that the crowns of the pipes are set at the same elevation.
- 4) In cases where two pipes discharge into a manhole from opposite directions and one pipe has a slope more than 4% steeper than the pipe opposite, the invert of the pipe with the lower slope shall be set a minimum of 0.35 feet or ½ the pipe diameter, whichever is greater, above invert of the steeper pipe.
- 5) **Manhole Flow Channels**
 - a) Flow channels in manholes shall be of such shape and slope to provide smooth transition between inlet and outlet sewers and to minimize turbulence.
 - b) Flow channel height shall be to the crowns of the sewers. Benches beside flow channels shall be sloped from the manhole wall toward the channel to prevent accumulation of solids.
 - c) Beaver slide channels shall be shaped to allow the insertion of a 6-inch diameter by 3-foot long TV camera into the downstream sewer.

g. **Drop Manholes**

- 1) Drop manholes shall only be used in extreme cases of slope difference between existing and proposed sewer lines or when very special conditions exist such as a conflict with existing facilities which cannot be relocated. All

drop manhole installations must be approved in writing by the Public Works Director on a case-by-case basis.

- 2) When allowed, outside drop assemblies shall be provided for pipe lines 12 inches in diameter and smaller when entering a manhole more than 24 inches above the invert of the outlet line. The vertical displacement shall be measured at the inside manhole walls and not the manhole centerline. Pipe lines larger than 12-inches shall be introduced into the manhole at the manhole invert.
- 3) When allowed, inside drop manholes shall be a minimum of 60 inches in diameter. All inside drops shall be constructed with pipe with stainless steel support structures. No partitions will be allowed.

h. **Manhole Taps**

- 1) When an existing manhole is tapped to install a new sewer which will drain into the manhole, the crown of the new sewer shall generally match the crown of the existing pipes.
- 2) When the size of the new pipe being tapped into the existing manhole is the same size as the existing pipe exiting the manhole, the invert of the new pipe should be a minimum of 0.35 feet above the invert of the existing pipe, or higher as required to be above the normal sewage flow level.
- 3) A detail drawing showing the steps, bench and proposed connection is required for connections to existing manholes.
- 4) The drawing shall include notes to the effect that openings for connections to existing manholes shall be made by core-drilling the existing manhole structure and installing a rubber boot. Small chipping hammers or similar light tools which will not damage or crack the manhole base may be used to shape channels. Use of large pneumatic jackhammers shall be prohibited.
- 5) Unless otherwise approved by the City Engineer, manhole steps shall be installed in any manhole tapped which do not have existing steps.

i. **Metering & Sampling Manhole**

- 1) A metering and sampling manhole shall be installed on all systems meeting one of the following criteria:
 - a) A private sewer which contributes more than 5,000 gallons per day to the public sewer.
 - b) A private sewer which serves more than one structure on the same premises (private collection system).

- c) Industry or business which discharges high strength wastewater or wastewater with characteristics not commonly found in domestic sewage.
- 2) Metering and sampling manholes shall include provisions for continuous and composite sampling, continuous flow monitoring and recording, and flow paced sampling.
- 3) Sampling and flow monitoring may be required at the discretion of the City Engineer and Public Works Director. All machinery, equipment, supplies and labor required to carry out the sampling and flow monitoring program shall be provided by the Developer, and shall meet the City's prior approval.

4.17 WORK ON EXISTING SEWERS

a. General

- 1) Connections of service laterals to existing sewers shall be made watertight. Connection shall be made where possible to existing tees or wyes previously installed and plugged. In all cases, the integrity of the existing tee or wye shall be verified by Public Works prior to connection.
- 2) Where tees or wyes for connection are absent or unusable, connection of service laterals into existing sewer lines shall be made with approved couplings or service saddles. Taps shall be installed without protrusion into or damage to the existing sewer, and shall result in a watertight connection.
- 3) Service lateral connections to existing AC pipe shall be with approved service saddles. Connections to all other types of existing pipes shall use Insert-a-Tee type couplings. A note shall be added to the drawings stating that the coring machine for Insert-a-Tee couplings shall be anchored in accordance with the manufacturer's recommendations.
- 4) As a condition of connecting to and/or extending sewer mainlines, the design shall include verification that the existing sewer is in adequate condition and with adequate capacity to handle the new flows. This shall include verification of existing sewer slopes downstream of the connection point (as part of the design topographic survey), and cleaning/TV inspection of existing mainlines which meet any of the following conditions: (a) existing or design slopes less than 1.0% or (b) have had a history of flow or maintenance problems, or (c) end with mainline cleanouts. Costs for cleaning and TV inspection are the responsibility of the development team. Unless otherwise approved in writing by the City Engineer, this survey verification and TV inspection shall be done as part of the design process (approval by the City to defer this pre-design TV inspection work shall not relieve the Developer and/or his contractor of the responsibility to correct problems subsequently discovered). The design shall include provisions to correct any adverse grade

conditions, broken/obstructed pipe or other conditions found in the existing sewer which, in the opinion of the City Engineer, may cause sewer backups or significant maintenance issues upon extension of the mainline and connection of additional services. Any corrections of adverse grade conditions shall occur prior to extending the mainline or setting new manholes.

b. Manholes over Existing Sewers

- 1) Manholes constructed over existing sanitary sewers shall conform to the requirements of OSSC (ODOT/APWA) 490.41, Manholes Over Existing Sewers. The existing pipe shall not be broken out until after the completion of the manhole test. Notes to this effect shall be placed on the construction drawings.

c. Maintaining Sanitary Sewer Flows. The construction of sewer improvements that impact existing sewers shall address the following, including notes on the drawings.

- 1) All existing sanitary sewer system components shall remain in service through the construction operations unless specific exceptions are approved in writing by Public Works and the City Engineer, and written approval from each affected property owner.
- 2) Sewer service from upstream and affected properties must be maintained unless such written approval is granted. The methods used to maintain sewer flows shall be the Contractor's design, subject to approval by the City. Required methods of conveying sewer flows may include, but are not limited to, bypass pumping, use of flow through plugs with periodic release of sewage flows, etc. The bypass system shall be capable of conveying flows when the sewers are flowing full. Normal unrestricted flows shall be restored at the end of each work day. Bypass systems left in place or operated outside normal working hours shall be monitored continuously by the Contractor personnel unless alternate arrangements proposed by the Contractor are acceptable to the City (ie. high level & pump fail alarm callouts, etc.). The Contractor shall provide for City review all submittal information required to demonstrate (to the satisfaction of the City) compliance with these requirements.
- 3) Contractor shall be responsible for all costs related to cleanup, damages and fines resulting from any sewerage spill or overflow associated with any methods used to convey sewage flows during construction.

4.18 SEWER SERVICE LATERALS

a. General

- 1) Sewer service laterals are building sewers as defined above.
- 2) Sewer service laterals shall not tie into manholes unless approved by City

Engineer and Public Works Director on a case-by-case basis. Where allowed, lateral inverts shall provide a minimum of 0.5 feet fall across the manhole, or the lateral shall match crowns with the outlet pipe, whichever is higher.

- 3) As a minimum criterion, construction of the sewer service lateral shall be of the same quality and meet the same requirements as the public sewer with regard to materials, watertightness, and location. In addition, these sewers shall conform to the State and local plumbing codes and restrictions. No roof, surface, foundation, or stormwater drain lines shall be connected to the public sewers or service laterals.
- 4) Each legal lot of record shall be provided with a separate sewer service lateral connected to the public sewer main or approved private sewer main. Combined sewer service laterals will be permitted only when the property cannot legally be further divided. An example of this is a residential lot with a house and unattached garage or shop with plumbing fixtures.
- 5) Separate sewer service laterals shall be installed to serve each side of duplex lots. Separate sewer service laterals shall be installed to serve each unit of condominiums or developments with separate detached dwelling units (except where otherwise approved by City for manufactured home parks).
- 6) Additional sanitary sewer laterals must be stubbed into the property lines sufficient to serve all residential parcels (including those which can be further partitioned in the future) where such service or future partition would require that new streets be cut to install such services.
- 7) A backwater check valve shall be installed when the lowest floor level of a house to be connected to the public sewer is less than 12-inches above the top of the nearest upstream manhole or cleanout structure. A gate valve in addition to the required backwater check valve is optional but should be considered for installation for additional protection should the backwater valve fail or become clogged with debris.
- 8) Grease Removal. Provisions acceptable to Public Works shall be made for grease removal for any installations with commercial or similar kitchens, or other applications as required by Public Works. Unless otherwise approved by Public Works, a minimum two compartment exterior gravity grease interceptor vault (1000 gallon minimum) shall be provided, particularly in any application where hot water or steam cleaning of commercial type kitchens is utilized. Any proposal for a gravity grease interceptor vault smaller than 1,000 gallon capacity shall include documentation that the unit is sized per the requirements of the 2011 Oregon Plumbing Specialty Code (OPSC) table 10-3 (or current edition). A maintenance agreement (acceptable to the Public Works Director and City Attorney where applicable) shall be recorded against the property.

9) Private Sewer Pump Stations.

- a) As noted under PWDS 4.9.a.3, gravity sewer service is required where possible. Installation of private sewer pump stations is not allowed except with express prior written approval by Public Works and the City Engineer (during land use approval where applicable, and prior to submittal of project design drawings for review otherwise).
- b) Any private sewer pump stations approved by the City shall meet standards established by the Public Works Director and the City Engineer (see PWDS 4.3), the Oregon Plumbing Specialty Code and other applicable codes or standards (whichever is more stringent).
- c) An operation & maintenance agreement acceptable to the City shall be recorded against the property. Furthermore, the Creswell Municipal Code 13.10.220 requires a specific variance to be granted by the City Council prior to approval of any private sewer pump station.

b. Service Cleanouts

- 1) A cleanout (set in a cleanout box conforming with City standard details) shall be installed at or near the right-of-way or easement line for all sanitary sewer service laterals, at a location acceptable to the Public Works Director. The sanitary sewer service lateral shall extend beyond the cleanout to the back of any private utility easement (PUE) fronting the right-of-way or easement.
- 2) For long sewer service laterals, a cleanout shall be installed at maximum 100-foot intervals beyond the right-of-way or easement line, as well as on the upstream side of any intermediate property lines crossed.
- 3) Unless otherwise approved by the City Engineer, sewer service laterals shall have at least four (4) feet of cover from finish grade (typically sidewalk grade) at the right-of-way or easement line. Generally, the topography of the property will dictate how deep the service line must be.

c. Minimum Diameter and Slope

- 1) The minimum inside diameter of a sewer service lateral shall be four (4) inches and shall be equal to or greater than the building plumbing stub (building drain) diameter.
- 2) The minimum inside diameter of sewer service laterals to serve multifamily dwellings or commercial buildings shall be six (6) inches. Fixture unit equivalents shall be determined in accordance with the Oregon Plumbing Specialty Code (OPSC).
- 3) Minimum sizes and slopes for sewer service laterals, based on the fixture unit equivalents, shall be in accordance with the Oregon Plumbing Specialty Code

(OPSC).

- 4) Sewer service laterals for townhouses and similar cluster housing developments shall be installed on a uniform slope from the main line sewer connection to a point five (5) feet from the end of the building drain conforming to the above requirements.

d. Existing Sewer Service Laterals

- 1) The City is under mandate from the Oregon Department of Environmental Quality (DEQ) to reduce infiltration and inflow (I/I) of storm runoff and groundwater into the City's sanitary sewer system. A significant portion of the (I/I) problems in the City's sewage collection system are attributable to leaking sewer service laterals or drains connected to service laterals. DEQ and City standards require that "No person shall discharge or cause to be discharged any storm water, surface water, groundwater, roof runoff, subsurface drainage to any sanitary sewer." The City requires applicants to demonstrate compliance with this ordinance by testing existing sanitary sewer service laterals which are proposed for continuing use.
- 2) Unless waived in writing by Public Works (for newer PVC laterals), all existing sewer service laterals shall be tested from the mainline to the building to verify that it is free of leaks or defects (see CMC 13.10.200), witnessed by Public Works. The service laterals shall be tested at 4 to 5 psi, and a loss of 0.5 psi in 15 seconds constitutes a test failure. Where approved by Public Works Director, hydrostatic testing per OSSC (ODOT/APWA) 00445.72.b may be used (for existing service laterals). The service lateral shall be replaced if defective. Cleanouts per PWDS (& plumbing code) requirements shall be installed on existing sanitary sewer service laterals which are proposed for continuing use (ie. those which do not already have cleanouts).

4.19 PRIVATE COLLECTION SYSTEMS

- a. Private collection system sewers shall be designed in conformance with main line standards specified herein when plumbing code grade requirements of Oregon Plumbing Specialty Code Section 1106 cannot be met.
 - 1) A manhole is required at the connection to the City system.
 - 2) A metering manhole may be required at the property line upstream from the manhole connection at the City main.
- b. PWDS 4.18, Sewer Service Laterals, must be used for sewer service lines in the system with the following exceptions:
 - 1) The minimum size sewer line upstream of the monitoring manhole structure shall be six (6) inches.

- c. See requirements and criteria under PWDS 4.18.a.9 relating to private sewer pump stations.

4.20 UNDERGROUND WARNING TAPE & TRACER WIRE

- a. Detectable or non-detectable acid and alkali resistant safety warning tape shall be provided along the full length of all service laterals and all mainlines not located under sidewalks or paved portions of public streets.
- b. Underground warning tape shall be placed a minimum of 12-inches and a maximum of 18-inches below the finish ground surface, and shall be continuous the entire length of the service laterals installed from the mainline to the back of the PUE. Where required for mainlines not located under sidewalks or paved portions of public streets, the warning tape shall be continuous between manholes or cleanouts.
- c. All sanitary piping (both public lines and private lines within right-of-way or easements) shall have an electrically conductive tracer wire, 12 gauge minimum size single strand insulated copper with green sheathing, installed in the trench for the purpose of locating the pipe in the future. The tracer wire shall run the full length of the installed pipe, with each end accessible from the surface through a manhole or cleanout.