



2015 PUBLIC WORKS STANDARDS



**Community Development Department
29799 SW Town Center Loop E
Wilsonville, OR 97070**

Revised December 2015

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CITY OF WILSONVILLE

PUBLIC WORKS STANDARDS - 2015

Community Development Department

Revised December 2015

**These Standards were compiled by information obtained from,
or input received from the following sources:**

American Association of State Highway and Transportation Officials
American Public Works Association
American Water Works Association
Asphalt Institute
City of Beaverton Public Works Standards
City of Gresham Public Works Standards
City of Hillsboro Public Works Standards
City of Portland Public Works Standards
City of Tualatin Public Works Standards
CleanWater Services Agency of Washington County
King County, Washington
Oregon Department of Environmental Quality
Oregon Department of Fish and Wildlife
Oregon Department of Transportation
Oregon Health Division
Portland Cement Association
Portland General Electric
Stormwater Management Manual for Western Washington
Tualatin Valley Fire and Rescue
Tualatin Valley Water District Water System Standards
Washington County Department of Land Use and Transportation
Water Environment Services of Clackamas County

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STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION

FOREWORD

The 2015 edition of the City of Wilsonville Public Works Standards will provide the technical engineering design and construction information standards for all Public Works transportation projects, storm system projects, sanitary sewer projects, and water distribution system projects in the interest of health, safety and welfare of the residents of the City of Wilsonville. These Public Works Standards – 2015 will supersede all previously issued Standard Specifications.

Interpretation and enforcement of these standards shall be the responsibility of the City of Wilsonville Engineering Division.

All federal, state, county (Clackamas or Washington) or local laws and ordinances are to be adhered to. If there is any conflict between the Standard Specifications and pertinent laws and ordinances, the laws and ordinances shall prevail.

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SECTION 1

GENERAL CONSTRUCTION REQUIREMENTS AND ADMINISTRATIVE PROVISIONS

101.1.00 AVAILABILITY

Copies of these “Public Works Standards” for the City of Wilsonville, Oregon, or any subsection of the standards are available from the Wilsonville Community Development Department, given reasonable notice and payment of current reproduction costs, or are available to download from the City of Wilsonville, Engineering website.

Due to its size, Chapter 3 “Stormwater & Surface Water Design and Construction Standards” is provided under separate cover, but is still considered a part of these Public Works Standards.

The “Public Works Standards” are subject to change (see [Section 101.3.00.c](#), “Scope”); check the City of Wilsonville Engineering website or with the City of Wilsonville Engineering Division for revisions or updates.

101.1.01 Reference to Standards

The design engineer may, at his or her sole discretion, use the standards by direct reference in the contract documents prepared for the construction of public streets, storm drainage, water, and sanitary sewer facilities in the City of Wilsonville. If the design engineer incorporates the City’s standards in that way, the contract documents shall contain the following statements:

- a. Material and workmanship shall be in strict accordance with the standard specifications of the City of Wilsonville. No changes from the approved project plans and specifications shall be made without approval of the City’s authorized representative.
- b. The standards are in outline form only, and shall not operate to relieve the design engineer of his or her professional responsibilities during project design and construction.
- c. These standards represent the minimum requirements for construction in a public right-of-way or public easement to protect the public health, safety and welfare. Any deviation from the standards must be approved, in writing, by the City’s authorized representative.

101.2.00 INTENT

101.2.01 Intent of Public Works Standards

These standards for constructing public facilities in the City of Wilsonville are intended to protect the public health, safety, and welfare by:

- a. Setting forth uniform material and workmanship standards.
- b. Supplementing and completing the public health and safety requirements of Chapter 4 of the Wilsonville Code.
- c. Streamlining the administration and construction of public facilities in the City and minimizing repairs to these public facilities.

101.2.02 Interpretation

Where situations arise that are not clearly covered by these Standards, the City’s authorized representative will review the issue on a case by case basis to determine the design and/or construction methodology acceptable to the City.

101.2.03 Order of Precedence

All federal, state, county (Clackamas or Washington) or local laws and ordinances are to be adhered to. If there is any conflict between the Standard Specifications and pertinent laws and ordinances, the laws and ordinances shall prevail.

If there is a conflict between approval documents, the document highest in precedence shall control. The order of precedence shall be:

First: Permits from other agencies or jurisdictions, as may be required by law.

Second: Land use decision-making authority’s Conditions of Approval.

Third: City of Wilsonville master plans (latest editions): Parks and Recreation Master Plan, Transportation Systems Plan, Storm Water Master Plan, Wastewater Collection System Master Plan, Water System Master Plan.

Note: Permits, Land Use Conditions of Approval, and Master Plans are intended to provide the authority for what public facilities are to be constructed; the below public works detail drawings and standards and the various standards that follow describe how public facilities are to be constructed through the use of the approval component materials equipment, and methods set forth.

Fourth: City of Wilsonville *Standard Detail Drawings*.

Fifth: City of Wilsonville *Public Works Standards*.

- Sixth:** City of Wilsonville *Planning and Land Development Ordinance*.
- Seventh:** City of Wilsonville Bicycle and Pedestrian Master Plan, latest edition.
- Eighth:** *Oregon Standard Specifications for Construction* (current edition) (ODOT, Oregon APWA) and any reference specifications and standard practices adopted by nationally recognized professional societies such as ASCE, AWWA, APWA, ACI, ASTM, and AASHTO, and any reference specifications or guidelines as presented in the latest edition of the MUTCD.
- Ninth:** *ODOT Pavement Design Guide*.
- Tenth:** *Uniform Building Code* and City-issued building, mechanical, electrical, and plumbing permits.
- Eleventh:** Americans with Disabilities Act latest approved standards or guidelines as referenced in the Standard Details of these standards. .
- Twelfth:** Plans and details prepared by the design engineer.

Supplemental written agreements, franchise agreements, and approved revision to plans and specifications by the appropriate jurisdictions and conforming to local, state, and federal law will take precedence over documents listed above. Detailed plans shall have precedence over general plans. In any event, the determination of the City Engineer shall be final.

101.3.00 SCOPE

These standards for construction of public facilities in the City of Wilsonville:

- a. Cover all public streets, storm drainage, water, sanitary sewer, and appurtenant facilities inside the corporate limits of the City that are to be turned over to the City for maintenance and operation.
- b. Relate only to public facilities constructed in the City and should not be confused with building codes, zoning ordinances, and other regulations for which the City has established separate procedures and standards.
- c. May be amended or updated periodically by ordinance of the City Council on the recommendation of the City Engineer to protect the public health, safety, and welfare.
- d. Notwithstanding the foregoing, the City Engineer shall have the authority to modify the Standard Detail Drawings of these standards, as needed to maintain conformance to the periodic changes to national and state design requirements, guidelines, and specifications and industry standards.

101.4.00 DEFINITIONS

The following definitions apply throughout these standards:

AASHTO:	American Association of State Highway and Transportation Officials
AC:	Asphaltic concrete
ACI:	American Concrete Institute
ACPA:	American Concrete Pavement Association
ADA:	Americans with Disabilities Act
ADAAG:	American with Disabilities Act Accessibility Guidelines and Standards
ADT:	Average daily traffic
ANSI:	American National Standards Institute
APWA:	American Public Works Association
ASTM:	American Society for Testing and Materials
AWWA:	American Water Works Association
Act of God:	Earthquake, flood, cyclone, or other cataclysmic natural phenomenon
Addendum:	Written or graphic modification or interpretation of contract documents
Agreement:	Written agreement covering performance of work and furnishing of labor and materials in construction of work
Alley:	Street or road primarily intended to provide secondary access to road or side of lots or buildings and not intended for normal through vehicular traffic

Applicant:	Person, organization, or duly authorized representative identified as such in specifications and in agreement, and referred to throughout contract documents as if singular in number and masculine in gender; means owner or authorized representatives, including parties acting as designated authority for aspects of work
Approve:	“Approved,” “approve,” “approval,” or similar words shall mean to give, in writing, limited, conditional, or qualified permission to use material, equipment, or methods, such conditions being in strict compliance with City’s standards; approval will be by the City’s authorized representative
ARCPACS:	A federation of certifying boards in agriculture, biology, earth, and environmental sciences. Provides professional certification for soil scientists whose education, experience and career path are in some aspect of the soil science profession and can meet the standards of the ARCPAC program
As-Built Plans/Record Drawing:	Plans signed and dated by the Project Engineer indicating that the plans have been reviewed and revised to accurately depict all known as-constructed details of a particular public works project
As-Constructed Plans/Record Drawing:	See As-Built Plans/Record Drawing
Authorized representative:	Party or parties authorized or employed by applicant to observe, test, or review quality and sufficiency of work performed, materials used, and determine compliance with plans and specification; for the City of Wilsonville, designated authority shall be the City Engineer or one of the City’s authorized representatives
Bid bond:	Form of security furnished by contractor, guaranteeing that he/she will enter into a contract in accordance with contract documents if the proposal is accepted
Bidder:	Any individual, firm, or corporation formally submitting a proposal for work contemplated, or any part of it, acting directly or through an authorized representative

Bioengineering:	A construction methodology used to stabilize and conserve soils through the use of live plants alone or in combination with biodegradable material to produce living, functioning systems that can prevent erosion, control sediment, and provide habitat
BPMP:	City of Wilsonville’s Bicycle and Pedestrian Master Plan, latest edition
Building Drain:	The building drain is that part of the lowest piping of the sewer 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 (5’) outside the building wall (building foundation)
Building Foundation:	That part of the horizontal piping of the sewer 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 sewer, or privately managed sewage collection system, or other point of disposal
CD:	Construction documents
CDF:	Control density fill
CEC:	Cation exchange capacity
CLSM:	Controlled Low-Strength Material
CN:	Curve number
Certificate of Insurance:	Evidence of insurance coverage of the contractor, furnished to the City
Change order:	Written order to contractor by City Engineer or the City’s representative authorizing addition, deletion, or revision of work within general scope of contract, or adjustment in price or time
City:	City of Wilsonville

City Boards and Commissions:

City Council: Five-member governing body responsible for identifying community problems and needs, and establishing policies and goals to address those needs

<i>Development Review Board:</i>	Empowered to review and take action on land-use applications; decisions are usually binding, but may be appealed to City Council
<i>Planning Commission:</i>	Makes recommendations to City Council regarding City's comprehensive plan, facilities plans, capital improvements program, and planning and zoning ordinances and provide input on traffic-related concerns
<i>Parks & Recreation Advisory Board:</i>	Aids in planning and developing present and future parks and recreation in City and advises City Council on policy matters regarding parks and recreation services
City Engineer:	Professional Engineer registered in the State of Oregon, designated by the City Manager to carry through with planning, designing, and project supervision of public facilities that will be accepted and owned by the City
Contract:	Binding agreement between contractor and applicant covering performance of work and furnishing of labor and materials for construction of public facilities
Contractor:	The person or entity that has entered into contract with the applicant; "contractor," though here used to describe an individual, shall mean contractor, agents, employees, officials, subcontractors, or anyone connected with work set forth on behalf of contractor
Contract documents:	Agreement, addenda, instructions to bidders, contractor's proposal, bonds, notice of award, notice to proceed, general provisions, technical provisions, plans, change orders, field orders, and all other modifications of such documents entered into in accordance with contract
Contract price:	Total amount payable to contractor for work, including all sales, use, and other consumer taxes related to work.
Contract time:	Number of calendar days allowed contractor to complete work
Construction maintenance assurance:	A one-year bond for 10% of the cost to construct public improvements

County road:	Public road incorporated into county roadway system by formal action of Board of County Commissioners; these roads are assigned numbers and county assumes maintenance responsibility
Cut Sheets:	Sheets of tabulated data, indicating stationings, structures, fittings, angle points, beginning of curve, points on curve, end of curves, sewer slope, staking offset, various elevations, offset cuts, and sewer depths
Definition of Words:	Wherever, in these PS & FM Standards, the works directed, required, permitted, ordered, designated, or words of like meaning are used, they shall be understood to mean the direction, requirement, permission, order or designation of the City Engineer. Similarly, the words approved, acceptable, satisfactory, shall mean approved by, acceptable, or satisfactory to the City Engineer
DBH	Diameter at Breast Height: Standard method of determining the size of a tree
DEQ:	Oregon Department of Environmental Quality
Design engineer:	Professional Engineer registered in the State of Oregon responsible for planning, designing, and producing record drawings of public facilities that will be accepted and owned by the City
Detail Drawings:	Construction drawings produced by the City of Wilsonville providing details of acceptable construction standards for public facilities. Drawings may be periodically updated or changed, as needed, by approval of the City Engineer
Development:	Development includes new development, redevelopment, and/or partial redevelopment
Directed, required, etc.:	In these standards, “directed,” “required,” “permitted,” “ordered,” “designated,” or similar words shall mean at the direction, requirement, permission, order, or designation of applicant or City Engineer
Domestic Sewage:	The liquid and water borne waste derived from the ordinary living process, free from industrial wastes, and of such character to permit satisfactory disposal, without special treatment, into the public sewer or by means of private sewage disposal system

Drainage Waste:	Storm water, ground water, surface drainage, subsurface drainage, spring water, well overflow, roof drainage, or other like drainage other than sewage or industrial waste
Dwelling Unit:	A facility designed for permanent or semi-permanent occupancy and provided with minimum kitchen, sleeping, and sanitary facilities for one family
Easement:	An interest in land owned by another that entitles the easement holder to a specific limited use of the land; however, ownership of the land does not change
Easement, Public Pipeline:	The space identified within the easement document that is in, upon, above, along, across, over or under the publicly owned and maintained storm, sanitary, or water facility
Easement, Public Utility:	The space in, upon, above, along, across, over or under the easement as identified within the easement document. By way of general description, public utility easements are typically created along the border(s) of a tax lot or frontage along public right-of-way and are intended for the use of utility companies and other authorized users to operate, place, relocate and maintain facilities in accordance with city requirements and standards
EPSC Plan:	Erosion Prevention and Sediment Control Plan following recommendations outlined in the Erosion Prevention and Sediment Control Planning and Design Manual, latest edition
EPSC Planning and Design Manual:	Erosion Prevention and Sediment Control Planning and Design Manual developed in partnership between CleanWater Services of Washington County, Water Environment Services of Clackamas County, City of West Linn, ODOT, and Harza Engineering, latest edition
FEMA:	Federal Emergency Management Agency
FHWA:	Federal Highway Administration
Field order:	Written order to contractor, approved by applicant, changing work but not affecting contract price or time

Final completion:	Date when project correction list is completed; a 10% maintenance bond is submitted in accordance with contract documents, as modified by change orders agreed to by parties, or as specified in Section 101.8.17 , “Project Closeout;” and the City’s authorized representative receives confirmation that all easements and legal documents have been recorded with the County Recorder
First party:	Applicant or duly authorized representative
Flow:	The liquid and water borne waste derived from domestic sewage, industrial wastes, and in some cases drainage waste
Grout:	Thin, fast-setting, high-strength, non-shrink mortar used to fill cracks and joints in masonry
HMAC:	Hot mixed asphalt concrete
ICEA:	Insulated Cable Engineers Association
Inclement weather:	Weather conditions so extraordinary that previous climatic conditions in locality of work give no reasonable warning of them; shall be determined by City Engineer
Indicated, shown, etc.:	“Indicated,” “noted,” “shown,” “called for,” or similar words shall mean indicated, noted, shown, or called for in the contract documents for the work referred to
Industrial Waste:	A water borne waste and wastewater from other than domestic users
Intersection:	Area jointed by two or more roads intersecting; for design purposes, intersection is not formed by naming two approaches of continuous street at curve or other point with different street names
Landscape maintenance assurance:	A bond for 100% of the cost to install all required landscaping in water quality/quantity facilities and vegetated corridors, plus 100% of the cost to maintain the landscaping in these areas for the duration of the bond
Large-diameter pipe:	Pipe with diameter larger than 24 inches

Lateral Sewer (Service Lateral):	Any sewer line to which a private building sewer connects or may connect. The lateral sewers are located within public right-of-way or easement, and generally connect to the main sewer and extend to the right-of-way or easement
Letter of commitment:	A letter issued by another jurisdictional agency to the City as performance assurance or maintenance assurance and warranty for public improvements
Main Sewer (Public Sewer):	A public sewer that has been or is being constructed to accommodate more than one lateral sewer or to which a building sewer connects or may connect. (Normally not less than eight inches in diameter)
Maintenance Assurance Bond:	Maintenance assurances required by the City for work performed to ensure post-construction quality and landscape survivability. May consists of both construction maintenance assurance and landscape maintenance assurance
Manager:	The City Manager of the City of Wilsonville or his/her authorized representative
Manufacturer's Name:	Any manufacturer's name, specification, catalog number, or type used herein is specified to make and order to establish the standard requirements of the City. Other equivalent makes will be considered for approval, providing they are comparable with this established standard
Mortar:	Plastic building material of cement or lime, sand, and water that hardens in place and is used in masonry or plastering
MUTCD:	<i>Manual on Uniform Traffic Control Devices</i> , latest edition
NAVD 88:	North American Vertical Datum of 1988: the vertical control datum established in 1991 by the National Geodetic Survey
Neighborhood Erosion Control Plan:	An approved erosion-prevention and sediment-control plan for multiple lots
NEMA:	National Electrical Manufacturers Association
NGVD 29:	National Geodetic Vertical Datum of 1929: vertical control datum established for vertical control in the United States by the general adjustment of 1929 (formerly called the "Sea Level Datum of 1929")

NPSH:	Net Positive Suction Head, in association with sanitary sewer pumping units
NRCS:	National Resource Conservation Service
Notice to proceed:	Written notice given by designated authority to contractor fixing date when contractor shall begin to perform the obligations under contract documents
O&M plan:	Operation and maintenance plan for mechanical systems to be operated by the City, or plan designed for stormwater facilities and prepared by the responsible party in the Stormwater Maintenance Covenant and Access Easement
ODFW:	Oregon Department of Fish and Wildlife
ODOT:	Oregon Department of Transportation
ODOT QPL:	Qualified Products List; published twice each year by ODOT's Construction Section
ODOT SSC:	2015 Oregon Department of Transportation Standard Specifications for Construction
OSHA:	Occupational Safety and Health Administration
Or equal:	"Or equal," "or approved equal," or similar words shall mean to possess same performance qualities and characteristics and fulfill utilitarian function without any decrease in quality, durability, or longevity and shall meet with approval of designated authority (no inference is intended that items must be identical in all respects if above conditions are satisfied)
Owner:	Any individual partnership, firm or corporation by whom the Project Engineer has been retained or who, as a property owner, is making arrangements with the City
PCA:	Portland Cement Association
PCC:	Portland Cement Concrete
Payment bond:	Form of security furnished by contractor and their surety guaranteeing payment of all labor, material, equipment, and all other obligations arising from work

Performance bond:	Security furnished by applicant, or such other party acceptable to the City, and their surety guaranteeing complete and faithful performance of all obligations and conditions placed on contractor by contract
Person:	Individual, firm, corporation, association, agency, or other entity
Plans:	Plans, profiles, and detailed drawings showing locations, character, dimensions, and details of work to be done
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
PRMP:	City of Wilsonville's Parks and Recreation Master Plan, latest edition
Predevelopment:	Considered as the natural, unimproved and unaltered state of the land.
Product data:	Complete catalog data for manufactured items of equipment and all component parts, including specific performance data, material description and source, rating, capacity, working pressure, material gauge thickness, brand name, catalog numbers, and other necessary information
Project correction list:	Final project inspection to repair checklist, or punch list, compiled after construction of total project is complete, and after all testing is satisfactorily finished
Project Engineer:	The engineer, licensed by the State of Oregon as a Civil Engineer, under whose direction plans, profiles, and details for the work are prepared and submitted to the City for review and approval
Proposal:	Offer for work made out and submitted on prescribed proposal form and properly signed and guaranteed by bidder
PUE:	Public Utility Easement
Public road:	Road dedicated for use by public; maintained by the City and funded by the road maintenance fee

Public works facility:	Any facility constructed in public right-of-way or public easement that is either immediately or eventually to be taken over by City for maintenance and operation; includes but is not limited to streets, sidewalks, curbs, parking lots, driveways, storm drainage facilities, water system works, and sanitary sewer systems
Public Sewer:	Any sewer in public right-of-way or public easement operated and maintained by the City
Punch list:	Final project inspection to repair checklist, or project correction list, compiled after construction of total project is complete, and after all testing is satisfactorily finished
Representative:	City Engineer or authorized representative
Reserve strip:	A 1-foot wide- section adjacent to or at terminus of right-of-way , to be recorded as a plat restriction with access controlled by the City Engineer.
Residential User:	The owner, lessee, or occupant of a single-family dwelling unit in one structure
Right-of-way:	The space in, upon, above, along, across, over or under the public streets, roads, highways, lanes, courts, ways, alleys, boulevards, sidewalks, bicycle lanes, and places used or intended to be used by the general public for travel as the same now or may hereafter exist, that the City has the right to allow User to use. Right-of-Way shall not include the airspace above the Right-of-Way used for cellular mobile radio service or broadcast television service
Road:	Part of right-of-way used for vehicular traffic, including appurtenances, storm drain system, traffic control devices, etc.
Roadway:	All of the right-of-way dedicated, granted, used or to be used, for vehicle movement
SBUH:	Santa Barbara Unit Hydrograph
SCS:	Soil Conservation Service, U.S. Department of Agriculture
Sensitive areas:	Areas sensitive to environmental degradation, such as existing or created wetlands; rivers, streams, and springs with year round or intermittent flow; and impoundments (natural lakes and ponds). Sensitive areas also include any resource protected within the SROZ

Service Lateral:	See Lateral Sewer
Sewage:	The wastewater derived from human habitation and use of buildings for residential, institutional, or commercial purposes, excluding storm waters and industrial waste
Shop drawings:	Diagrams, drawings, illustrations, brochures, schedules, and all other data submittals required by contractor and furnished by contractor illustrating fabrication, installation, dimensions, and other aspects of work
Specifications:	Directions, requirements, explanations, terms, and provisions in these standards, supplemented by such special conditions as may be necessary pertaining to various features of work to be done, manner and method of performance, and manner and method of measurement and payment; specifications include directions, requirements, and explanations that appear in plans
SROZ:	Significant Resource Overlay Zone: the delineated outer boundary of an identified significant natural resource as defined by Wilsonville’s Development Code
Standard specifications:	Codes, rules, and regulations set forth in City of Wilsonville “Public Works Standards” as adopted by City Council and considered to be the latest issue, with all amendments as of date of these standards
Standards:	Specifications in the “Public Works Standards” adopted for use in City of Wilsonville.
Steel plate:	A-36 steel meeting AASHTO H-20 loading specifications
Stock pile:	Temporary staging of construction and/or excavated materials
Streets or Roads:	Any public highway, road, street, avenue, alley, way, easement, or right-of-way used or to be used for vehicle movement
Structures:	Those structures designated on the Standard Drawings as manholes, cleanouts, weirs, etc. Detailed drawings of structures or devices commonly used in City work and mentioned in these PS & FM Standards are included in Section IV, Standard Drawings
Subcontractor:	Any individual, firm, or corporation having contract with contractor or with any other subcontractor for performance of part of work

Substantial completion:	In the opinion of the City’s authorized representative, construction is to the point of completion where all facilities are usable for their intended purpose: utilities (storm, sanitary, and water) are tested, approved and connected to public lines, all weather access is completed; roadway striping is completed; street lighting is approved and activated; all fire, life, and safety issues meet code
Substantial progress:	In the opinion of the City’s authorized representative, construction work is proceeding at a rate close to that of the submitted construction timetable
Traffic coefficient:	Number used in determining structural section of street
Trunk Sewer:	A public sewer ten inches or larger which has been or is being constructed to accommodate more than one Main Sewer or lateral sewer
TSP:	City of Wilsonville’s Transportation Systems Plan, latest edition
TVF&R:	Tualatin Valley Fire and Rescue
Uniform Plumbing Code:	The Uniform Plumbing Code adopted by the International Association of Plumbing and Mechanical Officials, current edition
USCGS:	United States Coast and Geodetic Survey
Wet-season:	For the purpose of monitoring ground water elevations, the “wet-season” is defined as November 1 through April 30
WQV:	Water Quality Volume
WPWS:	Wilsonville Public Works Standards, current edition
Work:	Furnishing of all labor, materials, equipment, and other incidentals necessary or convenient to successfully complete project or part of project, and carrying out of all duties and obligations imposed by contract
Working Day:	Calendar day, any and every day shown on the calendar, excluding Saturdays, Sundays, and legal holidays.

Written notice: Written communication delivered in person to individual or to member of firm or to officer of corporation for whom it is intended. If delivered or sent by mail to last business address known to one who gave notice, it shall be duty of each party to advise other parties to contract of any change in business address until contract is complete

101.5.00 CONTROL OF PUBLIC WORKS CIP PROJECTS

- a. All public system improvements and public works facilities, or improvements or facilities to become public, shall be designed by or under the direction of the Project Engineer, a Professional Engineer registered in the State of Oregon. All public system improvements and public works facilities shall be designed and constructed in accordance with all applicable rules and regulations of the City and any City interpretations of those rules and regulations, including applicable technical guidance manuals, and in accordance with all applicable federal, state, and local statutes and rules.
- b. Project Engineer Responsibilities.
 1. The Project Engineer shall, at a minimum, be available for the following:
 - (a) Project Orientation
 - (b) Preliminary Design
 - (c) Final Design: Includes 50%, 90% and 100% bid design.
 - (d) Pre-Bid Conference
 - (e) Construction Management: Includes preconstruction conference, weekly (at a minimum) construction meetings, and completion.
 2. The Project Engineer shall prepare agendas and meeting minutes for all project-related meetings unless otherwise directed by the City's authorized representative. Meetings shall be scheduled at least 10 business days in advance. The Project Engineer shall distribute agendas and supporting information through the City's authorized representative to all invited attendees at least 2 business days in advance of any meeting. The Project Engineer shall distribute meeting minutes to all meeting attendees and other interested parties within 5 business days of the meeting date.
 3. The Project Engineer shall develop and submit to the City's authorized representative a detailed schedule for the entire project (design, property acquisition, permits and construction) showing major tasks and supporting

activities for completion of the project. The schedule shall account for periods of City review and comment submission where required.

- c. Approval of the plans and schedule must be made by the City's authorized representative before construction is permitted. An authorized representative of the City will be available for construction observation during construction of the project.
- d. At the completion of construction, the design engineer shall submit a completion certificate to the City stating that all permitted work has been completed in accordance with the approved project plans and specifications, or approved modifications to the plans.
- e. All surveys for public works facilities shall be performed under the direction of a Professional Land Surveyor registered in the State of Oregon. A list of acceptable benchmarks is available at the City. It is the surveyor's responsibility to verify the accuracy of these benchmarks. Surveys shall be in compliance with [Section 101.7.07](#), "Surveying and Land Monuments."
- f. Materials and workmanship shall meet or exceed the adopted standards and at all times shall be subject to the approval of the City's authorized representative.
- g. On completion of projects to become public works, the applicant or their Project Engineer shall submit one complete set of reproducible "record drawings" (see [Section 101.8.17.a](#), "Record Drawings") to the City's authorized representative for future reference. The drawings shall show any deviations from the original construction drawings and shall include sufficient information to accurately locate water, sanitary sewer, and storm sewer service extensions. No bond will be released until the City's authorized representative receives an acceptable set of reproducible record drawings from the design engineer, with his or her stamp of certification.
- h. Before the City accepts a public works project for operation and maintenance, a guarantee on all materials and workmanship incorporated in the project shall be provided to the City on one of the acceptable forms described in [Section 101.8.18](#), "Maintenance and Warranty."

101.6.00 PRIVATE DEVELOPMENT PROCESS REQUIREMENTS

101.6.01 Pre-Application Conference

The City of Wilsonville will hold a pre-application conference with the applicant (owner/developer), unless otherwise waived by the Planning Director, before formal application for public works permits and review of site design and construction plans. The pre-application process allows the applicant and the City to discuss the proposed project and the standards and regulations that will apply while the project is still in a preliminary stage. Any specific development standards, regulations, or problem areas can thus be discussed before the applicant makes a substantial investment in the project or proceeds with a formal application unaware of the issues.

101.6.02 Plan Check and Permits

- a. Permit required: No work shall be performed, nor materials stored, nor encroachment made on or within a Right-of-Way, Public Easement, or Public Utility Easement without first acquiring a permit from the City's Engineering Division, except as provided by City Ordinance.
- b. Plan checks and/or permits are required and issued on all construction projects within public rights-of-way, or easements, which will eventually be maintained and operated by the City of Wilsonville. Any permits required by federal, state, and local governments shall be obtained by the person proposing the improvements.
- c. Public Works Permit: Projects requiring Public Works Permits shall include, but not necessarily be limited to, improvements or upgrades to publicly owned and maintained streets, sidewalks, curbs, driveway approaches, water systems, sanitary sewer systems, and storm drainage systems. Projects that also require plan checks and permits include all private storm drainage, sanitary sewer, and water systems that will be connected to or that will discharge into a system under the jurisdictional control of the City of Wilsonville.
- d. Utility Construction Permit: The construction, repair, maintenance, or replacement of all other utilities located within a public right-of-way or public easement, including, but not exclusively, power, telephone, gas, and cable television, shall be required to submit for plan check and obtain a Utility Construction Permit.
- e. Right of Way Permit: For all other work done within the Right-of-Way that blocks, partially blocks, hinders or impedes the flow of traffic, cyclists, or pedestrians, a Right of Way Permit shall be required.

101.6.03 Plan Check Requirements

At the pre-application conference, the applicant will be given a copy of the Community Development Department Plan Review Checklist, which is to be used as a guide during the review of all proposed new, or improvements to, public works facilities.

Along with the items in the plan review checklist, the following requirements shall be met before the City's authorized representative completes a plan check:

- a. Satisfy all requirements of Chapter 4 of the Wilsonville Code and other ordinances and regulations pertaining to construction in the City of Wilsonville.
- b. Submit detailed plans printed to PDF and combined into a single electronic file and specifications printed to PDF and combine into a single electronic file, with each being stamped and digitally signed by a Professional Engineer registered in the State of Oregon, along with three printed copies. Incorporated within the construction plans and specifications shall be applicable franchise utility installation plans, stamped and signed and prepared by the proper authority.

- c. For projects which include street construction, re-construction or expansion, submit two sets of the Street Design Report and a single electronic file in PDF format, stamped and signed by a Professional Engineer registered in the State of Oregon in conformance with [Section 201.2.00](#), “Street Design Standards.”
- d. Submit two sets of storm water design report and a single electronic file in PDF format, stamped and signed by a Professional Engineer registered in the State of Oregon in conformance with [Section 301.3.00](#), “Submittal Requirements”.
- e. Submit two sets of design calculations for the water system design or wastewater system design and a single electronic file in PDF format, stamped and signed by a Professional Engineer registered in the State of Oregon, where applicable or as required.
- f. A plan check fee must be paid before a plan review will be started. The amount of the fee will be established by resolution of the City Council.
- g. Plans deemed incomplete by the City’s authorized representative may be returned without a full plan review being completed. An explanation will be provided by the City indicating sections of the plans deemed incomplete. Once all items are addressed, plans may be resubmitted for review.
- h. Plans shall include all necessary current City details and City Construction Note Sheet.

101.6.04 Plan Review

- a. If all conditions of the plan check requirements as specified in [Section 101.6.03](#), “Plan Check Requirements,” are met, and no additional information is requested by the City’s authorized representative, the plan review will be commenced. The City’s authorized representative will prepare a plan review redline comments list, to be sent to the appropriate permit applicant or responsible party. The list will indicate any deficiencies in the construction plans and specifications. The proper party shall then make the corrections and resubmit the plans and specifications for review.
- b. The plan check fee submitted as per [Section 101.6.03.f](#), “Plan Check Requirements,” covers the City’s first and second plan reviews. An additional plan review fee shall be required for the third, fifth, and every other plan review performed by the City. A partial plan review or plans deemed incomplete as per [Section 101.6.03.g](#), “Plan Check Requirements,” will be considered as a full plan review in respect to the plan check fee. The amount of the additional fee will be established by resolution of the City Council.
- c. Once the plans and specifications are approved for construction, the City’s authorized representative shall issue a written notice of plan approval. The written notice of plan approval shall remain in effect for 90 calendar days from the date of approval. If the applicant cannot proceed with the project within the 90-day limit, a 180-calendar-day

extension can be applied for. If no substantial progress has been made within the allotted time, no further plan approval extension will be granted, the plan review fee shall be forfeited to the City, and the plan approval will expire. Plans may be resubmitted, subject to payment of new plan review fees.

101.6.05 Record Drawings, Maps, and Plans Not Guaranteed

Record drawings, maps and plans stamped and signed by the Project Engineer, a Professional Engineer registered in the State of Oregon, shall be provided to the City by the Owner/Developer upon completion of development and/or improvement projects within the City. The City does not guarantee the accuracy of measurements, elevations, locations, or other information on such maps and plans. All information should be independently verified by the Project Engineer, as part of their due diligence, via survey, potholing, or other appropriate means prior to conducting any improvement or development.

101.6.06 Permit and Assurances

- a. Before any public construction begins, a letter of commitment, letter of credit, assignment of deposit, bond, or cash deposit in form and substance satisfactory to the City and meeting the requirements in [Section 101.6.08](#), “Qualifications of Insurance and Bonding Companies” shall be submitted by the applicant as a performance assurance for such construction. The amount of the performance assurance for private development projects shall be 150% of the design engineer’s estimate or bid total on public improvements and shall be conditional on the performance of all terms and conditions of the permit and these standards. The guarantee shall include, but not be limited to, restoration of settled fills, trenches, pavement, and surfaces. The amount of the performance assurance for public projects financed by the City shall be 100% of the full contract price in accordance with ORS 279C.380. Additionally, a payment bond in the amount of 100% of the full contract price shall be submitted in accordance with ORS 279C.380 unless exempted by the Local Contract Review Board in accordance with ORS 279C.390..
- b. When all requirements stipulated here are met and the construction plans are stamped and signed by the City’s authorized representative, a Public Works Permit can be issued on payment of the Public Works Permit fee. The amount of the fee will be established by resolution of the City Council.
- c. The Public Works Permit shall be valid for one year from the date of issuance. If time elapses on the permit, the applicant can request, in writing, a permit extension from the City Engineer or the City’s authorized representative. If the request is approved, the permit holder then has 180 calendar days to begin construction on permitted projects and shall show substantial progress during this permit extension, as determined by the City. If no substantial progress is made within the allotted time, no further permit extension will be granted, the permit will expire, and the permit fees will be forfeited to the City. Plans may be resubmitted, subject to payment of new

fees. Resubmitted plans shall be reviewed to determine compliance with the Public Works Standards, including any newly approved codes and/or regulations.

101.6.07 Insurance Requirements

The City requires additional assurances from the applicant/contractor including, but not limited to, Certificates of Insurance from insurance companies or entities acceptable to the City meeting the requirements of [Section 101.6.08](#), “Qualifications of Insurance and Bonding Companies.” The Certificate shall specify all of the parties who are Additional Insureds. The contractor shall be responsible for paying all deductibles, self-insured retentions and/or self-insurance included under these provisions. For City financed projects, a Certificate of Insurance shall be executed by the successful bidder and their insurance company prior to the execution of the contract by the applicant.

101.6.08 Qualifications of Insurance and Bonding Companies

- a. **Minimum requirement:** All bonding and insurance companies providing insurance or bonds required by the City must meet certain minimum financial security requirements. These requirements conform to the rating published by A.M. Best & Co. and a current Bests Key Rating Guide Property Casualty. All companies providing bonds or insurance must meet the following requirements.
 1. Have a current Bests Rating not less than A.
 2. Have a current Bests Financial Size Category not less than Class IX.
 3. Be authorized to conduct and transact insurance and surety contracts in the State of Oregon.
 4. Be a U.S. Treasury Circular 570 listed company, if providing payment or performance bonds.
- b. **Failure to meet minimum requirements:** If the issuing company does not meet these minimal requirements, or for any other reason is unsatisfactory to the City, written notification will be made by the City to the Applicant, who must promptly obtain and submit to the City a new policy or bond issued by an insurer/surety acceptable to the City.

101.6.09 Indemnification

The applicant/contractor shall indemnify and hold harmless the City of Wilsonville and its officers, agents, and employees; Wilsonville City Council; City of Wilsonville Urban Renewal Agency and its officers, agents, and employees; and Wilsonville Urban Renewal Board from and against all claims, demands, penalties, damages, losses, expenses, including attorney’s fees, and causes of action of any kind or character, including the cost of defense thereof, arising or alleged to have arisen in favor of any person on account of personal injury, death, or damage to property arising out of or resulting from, or alleged to have arisen out of or resulted from, in whole or in part, any act or omission of the

applicant, the applicant's design engineer, the applicant's contractor, or anyone directly or indirectly employed by any of them or anyone for whose acts any of them may be liable.

101.7.00 CONSTRUCTION PROCEDURAL REQUIREMENTS

101.7.01 General Procedure and Requirements

- a. During the construction period, the City will maintain two sets of approved plans and specifications. The permit holder or contractor shall retain one set of approved, stamped, and signed plans and specifications at the construction site at all times. Any modification to the approved plans shall be first approved, stamped, and signed by the City's authorized representative prior to construction of the modification.
- b. A pre-construction conference with the City's authorized representative and the applicant, contractor, design engineer, and other parties requested to attend or having an interest in the project will meet to discuss the project before any construction begins. The pre-construction conference will discuss the role of the City's inspection team and the team's relation to the contractor and applicant.
- c. The permit holder or contractor shall submit material cut sheets to the City's authorized representative for review against City standard and project specific specifications. All material submittals must be approved by the City's authorized representative prior to the material's use or installation within the project.
- d. An inspection criteria checklist shall be provided to the contractor outlining the necessary inspections. The customary inspections are generally as follows:
 1. All underground utilities, including water, sanitary sewers, and storm sewers.
 2. All subgrade preparation, fill placement, base rock, and leveling rock.
 3. All concrete pours, such as driveways, sidewalks, curbs, catch basins, manholes, and cleanouts.
 4. Asphaltic or Portland cement concrete pavement.
- e. The City's authorized representative shall at all times have access to the project and will make routine inspections. Should any inspection reveal that the construction of the improvements is not proceeding according to the approved plans and the specifications in this document, the City Engineer may order all work stopped, all defective work removed, or both.
- f. The contractor shall give the City's authorized representative a minimum of 24 hours' (one working day) advance notice before a required inspection. It is the responsibility of the permit holder or contractor to obtain inspections and approvals for all work installed.

- g. Failure to give advance notice to the City's authorized representative for inspections, receive adequate inspections, or violation of other regulations, ordinances, resolutions, rules, and City codes as outlined in these standards can result in one or more of the following, as determined by the City:
 - 1. Stoppage of work until problem is resolved.
 - 2. Suspension of future inspections.
 - 3. Withholding certification of projects as complete, which will delay the start of the warranty period and City acceptance for maintenance and operation.
 - 4. Citation for violation of the Wilsonville Code and its penalties and provisions.
 - 5. Uncovering or removal of work not inspected.

101.7.02 Testing of Construction

- a. The applicant shall be responsible for providing the name of a compaction-testing firm that will be paid by the permit applicant and that will supply the City's authorized representative with the compaction tests needed to certify that the soils, aggregate, and surface materials meet the minimum requirements of these standards. The testing firm hired by the permit applicant shall be required to be under the direct supervision of a Professional Engineer registered in the State of Oregon whose area of expertise is geotechnical engineering.
- b. The applicant shall also be responsible for providing the name of a materials-testing firm that will be paid by the permit applicant and that will supply the City's authorized representative with the concrete-strength tests and other materials tests required to certify that the materials meet the minimum requirements of these standards. The testing firm hired by the permit applicant shall be required to be under the direct supervision of a Professional Engineer registered in the State of Oregon.
- c. City reserves the right to direct testing agency on frequency of testing.

101.7.03 Right of Entry to Work

Representatives of the City and any federal, state, or local agencies having jurisdiction over the work shall have right of entry to any and all parts of the work at reasonable times. The contractor shall cooperate in all respects with such agencies and shall provide proper facilities for access and inspection.

101.7.04 Suspension of Work

The City Engineer may suspend the work and give written notice to the applicant/contractor of such suspension when the contractor is using material that does not conform to the requirements of the contract documents or when the contractor is improperly performing the work, and neglects or refuses to replace or reconstruct such

work. The suspension shall remain in effect until appropriate corrections are made. Review of the City Engineer's decision shall be made, on request, by the City Manager within 48 hours of the initial suspension. Regardless of the decision, the City shall not incur pecuniary liability for an incorrect suspension of work, unless such suspension was a willfully malicious act of the City.

101.7.05 Protection of Existing Facilities

- a. The approximate location of underground City water, sewer, and storm drainage facilities are available at the City Engineer's office. The approximate locations of underground power, gas, telephone, and cable facilities are available from the serving utility companies. The location of existing facilities shall be shown on the construction drawings for public works projects.
- b. Appropriate and timely notice shall be given to all public and private utility companies in advance of construction, for the purpose of protecting or relocating existing facilities. The exact location of underground facilities shall be verified in advance of public works construction, in cooperation with the public or private utilities involved.
- c. When the contractor is physically locating underground utilities in roadways, the Portland cement concrete (PCC) or asphalt concrete (AC) roadway surfaces shall be cored and not square-cut. PCC roadway cores shall be repaired in accordance with [Section 201.7.04.b](#), "Coring." Asphalt roadway cores shall be repaired in accordance with [Section 201.7.02.d](#), "Asphalt Concrete Replacement."
- d. All existing underground and surface facilities shall be protected from damage or degradation during construction of public works facilities.
- e. Any existing facilities not specifically designated for alteration or removal that are damaged or degraded during construction shall be restored or replaced to an "in kind" or better condition at the contractor's expense.
- f. Turf damaged during utility construction shall be replaced with sod in a timely manner acceptable to the City's authorized representative.

101.7.06 Protection of Property

The contractor shall protect stored materials, cultivated trees and crops, and other items next to proposed construction. Property owners likely to be affected by the construction activities, as determined by the City's authorized representative shall be notified at least 48 hours in advance of the time construction begins. During construction, no person shall be without access to their place of residence or business for a period exceeding 8 hours, unless the contractor has made special arrangements in writing with the affected person(s).

101.7.07 Surveying and Land Monuments

- a. **NAVD 88 Datum:** All elevations on design plans and record drawings shall be based on NAVD 88 Datum. Each page of the plans and drawings shall state the benchmark datum information. Note that City of Wilsonville control points are based on NGVD 29 datum and that necessary adjustments will need to be made by the applicant's surveyor to meet NAVD 88 requirements.
- b. **Permanent Survey Markers:** Before beginning any construction activity, the applicant's engineer/surveyor shall adequately reference all permanent survey monuments, property corners, stakes, or benchmarks on the subject site, or markers that may be subject to disturbance in the construction area or during the construction of any off-site improvements. It shall be the responsibility of the contractor to protect survey monuments throughout the construction process. The contractor shall not disturb permanent survey monuments without written consent from the City's authorized representative.
- c. **Disturbed, Destroyed, or Lost Monuments:** If any survey monument is disturbed, moved, relocated, or destroyed as a result of construction activity, the contractor shall, at contractor's cost, retain the services of a Professional Land Surveyor registered in the State of Oregon to restore the monument to its original condition and shall file all documentation required by Oregon law. A copy of the recorded documentation shall be submitted to the City Engineer.

101.7.08 Railroad Crossings

- a. Crossings of railroad rights-of-way shall be done in a manner that conforms to the requirements of ODOT Rail Division and the railroad having jurisdiction. If any bonds or certificates of insurance protection are required, they shall be furnished by the contractor or applicant to the railroad company concerned, with the City as an additionally named insured. Costs for railroad flagging shall be the responsibility of the applicant, unless specifically stated otherwise in the City's Contract Documents.
- b. Permits or easements for such crossings shall be obtained by the applicant, unless specifically stated otherwise in the City's Contract Documents. All the terms of such permits or easement shall be met by the applicant and contractor. In some locations, the railroad may require casing pipe.

101.7.09 Criteria for Stream-Road Crossings

- a. Stream crossings shall be avoided whenever possible, whether by roads, utilities, or other development. If streams must be crossed, impacts shall be minimized by preferring bridges or arch spans to culverts, and by designing bridges and culverts to pass at least the 100-year flood and meet the Oregon Department of Fish and Wildlife (ODFW) *Fish Passage Criteria*, or latest edition.

- b. Before any work may be performed in any stream, the method of operation and the schedule of such work shall be approved in writing by the City's authorized representative. The timing of in-water work shall comply with the guidelines established by the ODFW. Mechanized equipment shall enter streams only when necessary and only within the immediate work area.
- c. The contractor shall comply with the regulatory requirements of the Oregon Department of State Lands, ODFW, U.S. Fish and Wildlife Department, U.S. Army Corps of Engineers, National Marine Fisheries Service, and any other state and federal agencies having jurisdiction.

101.8.00 CONSTRUCTION

101.8.01 Construction Commencement

- a. The contractor shall not undertake nor instruct the subcontractor(s) to undertake any portion of the work without notifying the City's authorized representative 24 hours in advance of beginning work. At the time of this notice to the City, unless otherwise specifically waived, in writing, by the City, the applicant shall have submitted to the City, as applicable, a performance, payment, and/or completion assurances (in the form of cash deposit, a letter of credit, or bonds approved as to form, content and issuer by the City), construction contract, development agreement, and/or public works permit, appropriate plan check and permit fee, certificate of insurance, and any necessary off-site easements.
- b. Contractor shall conduct construction activities only during the hours of work established by the City.

101.8.02 Scheduling

- a. **Sequence of Operations:** The contractor shall plan construction work and execute operations with a minimum of interference to the operation of existing City facilities and the traveling public. It may be necessary to do certain parts of the construction work outside normal working hours to avoid undesirable conditions, and it shall be the obligation of the contractor to make this change to the work schedule. Such scheduling, however, is subject to approval of the City's authorized representative, and does not relieve the contractor from making their work available for inspection.
- b. **Progress of Construction**
 - 1. Construction shall proceed in a systematic manner that will result in minimum inconvenience to the public.
 - 2. Contractor shall pothole and verify existing utilities and facilities prior to commencing proposed work.
 - 3. Tree protection fencing shall be installed and inspected prior to erosion control measure installation.

4. Erosion control measures shall be installed and inspected, as per [Section 101.9.06](#), “Inspection,” prior to commencing work.
5. Construction staking for the work being performed shall be completed before the start of excavation. The contractor shall limit their operations to a small work area per crew.
6. The trench shall be backfilled in conformance to [Section 6](#), “Trench Excavation and Backfill.” The length of open trench shall be limited to the requirements of [Section 601.3.01.e](#), “Open Trench Limit.”
7. Where Steel Plates are used as a temporary road surface they shall comply with the following:
 - (a) Steel Plates shall be minimum ¾” thick, A-36 steel meeting AASHTO HS-20 traffic loading specifications.
 - (b) Steel plates shall be centered over the cut and adequately secured to prevent any movement for the AASHTO HS-20 traffic loading specifications. No more than ½ of the plate shall span a trench that has been completely backfilled, or no more than ⅓ of the plate shall span a trench that has not been completely backfilled.
 - (c) At locations where an excavation will remain open for more than 24 hours, steel plates shall be installed with transition ramps manufactured specifically for the intended use per **Detail No. S-2146** of these standards.
 - (d) At locations where an excavation will remain open for less than 24 hours, steel plates shall be installed as follows:
 - i. Uneven pavement surfaces must first be leveled with cold mix before laying steel plates over trench.
 - ii. Steel plates shall be secured to the roadway with a minimum of two ½-inch or larger steel pins driven a minimum of 6 inches below the surface and at least 18 inches from the edge of the roadcut.
 - iii. Cold patch shall be used to ramp up to the steel plate edges; minimum 6-inch ramp per ½-inch difference in grade change between road surface and Steel Plate.
 - (e) Contractor is responsible for maintaining transition ramps and cold mix around Steel Plates.
 - (f) Use of plates in travel lanes shall require contractor to place a 30-inch by 30-inch “BUMP” warning sign for each affected travel direction.

- (g) Plates shall not be left in the travel lane for longer than 5 working days unless approved in writing by the City's authorized representative.
- c. **Connections:** Any connections to existing public utilities or newly constructed facilities proposed to be public utilities shall be made only with approval of the City's authorized representative. Public utilities shall be placed into service only after all testing is completed on the new work and it is found to conform in all respects to the requirements of the plans and specifications, unless otherwise approved by the City's authorized representative. Prior to making connection(s) to existing facilities, contractor shall have all necessary pipe and fittings available and on-site.
- d. **Cleanup:** Cleanup of all construction debris, excess excavation, and excess materials and complete restoration of all fences, mailboxes, ditches, culverts, signposts, and similar items shall be completed according to [Section 101.8.16](#), "Preservation, Restoration, and Cleanup."

101.8.03 City Inspection

- a. The City's authorized representative shall inspect the project as necessary and shall check materials, equipment, and the construction of the project to determine whether the work is proceeding in accordance with the City's standards. The contractor shall notify the City's authorized representative at least 24 hours (one working day) to request City inspection. No such inspection, however, shall relieve the contractor of their duties under these standards.
- b. The City's authorized representative shall have the authority to direct replacement of defective material and uncovering work not inspected as required. Material rejected by the City's authorized representative shall be removed from the job site by the contractor immediately after its rejection and shall not be used on the project.
- c. Instructions given by the City's authorized representative shall be respected and executed by the contractor. The City's authorized representative, however, shall not have the power to waive the obligations of the contractor to furnish high-quality equipment, supplies, and materials, or to perform good work.
- d. Should a contractor encounter a condition different than that indicated by the construction documents, the contractor shall notify the City's authorized representative in writing of the changed condition and shall not precede with any work associated with the changed condition until a written response is received from the City. The City's authorized agent shall review the change with the contractor and the Project Engineer and issue a written directive to the contractor. Any work commenced prior to the issuance of a written directive from the City will be at the contractor's risk.

101.8.04 Change in Plans or Standards

The City's authorized representative shall have the right to make changes in the plans or in these standards to protect the public interest or the normal operations of the City. Such changes shall be made at the sole discretion of the City's authorized representative and may include, but are not limited to, the allowance of new or different materials for products that are equivalent to, or better than, the products specified in the plans or standards.

101.8.05 Interferences, Obstructions, Abandoned Utilities

- a. **Utility Notification:** The contractor shall comply with the rules and regulations of the Oregon Utility Notification Center: OAR 952-001-0010 through 952-001-0090 and ORS 757.993. At least 48 hours' notice shall be given to all utility offices that may be affected by the construction operation.
- b. **General:** Various obstructions may be encountered during the course of the work. Maps and information regarding underground utilities shall be obtained from the utility owning and operating such utilities, but the location of such utilities is not guaranteed. If the services of any utility are interrupted because of the construction operation, the contractor shall notify the utility owner and the City's authorized representative immediately.
- c. **Protection:** The contractor shall exercise all due care in protecting existing underground and surface facilities and property along the route of the improvement in compliance with City of Wilsonville Code Chapter 4 and Ordinance 464. This protection shall include, but not be limited to, trees, yards, fences, drainage lines, mailboxes, driveways, shrubs, and lawns. Any existing facilities not specifically designated for alteration or removal that are damaged during construction shall be restored or replaced to an "in kind" or better condition, at the expense of the contractor.
- d. **Access:** The contractor shall maintain access to all mail boxes; access to all property entrances shall be in conformance with [Section 101.7.06](#), "Protection of Property."
- e. **Abandoned Utilities:** All abandoned utilities shall be properly removed, grouted, or plugged at the discretion of the City's authorized representative. Sewer facilities shall be abandoned in accordance with [Section 401.5.05](#), "Abandon Sewer Facilities." Water systems shall be abandoned in accordance with [Section 501.5.05](#), "Abandon Water Facilities." Storm facilities shall be abandoned in accordance with [Section 301.10.05](#), "Abandon Storm Facilities."

101.8.06 Contaminated Soil

If during construction contaminated soil, hazardous materials or chemicals are encountered, the Contractor shall follow the procedures specified in [Section 101.9.02](#), "Contaminated Soils or Hazardous Materials."

101.8.07 Guarantee

- a. The applicant/contractor shall furnish high-quality equipment, supplies, and materials and perform the work in accordance with these specifications. Any failure or omission by the City's authorized representative to condemn any defective equipment, supplies, materials, or work shall not be construed as an acceptance thereof nor release the contractor from their obligations.
- b. On notification of any deficiency by the City's authorized representative, the contractor shall properly reconstruct or replace any defective equipment, supplies, materials, or work at their own cost any time on discovery of the defect during the period of construction and for the full guarantee period after acceptance of the work, and shall indemnify the City from any claims resulting from the defect.
- c. The applicant/contractor shall guarantee all materials and equipment furnished and work performed in conformance with [Section 101.8.18](#), "Maintenance and Warranty."
- d. The applicant/contractor shall further warrant and guarantee that the completed system is free from all defects due to faulty materials or workmanship in conformance with [Section 101.8.18](#), "Maintenance and Warranty." The applicant/contractor shall promptly make such corrections as may be necessary by reason of such defects, including the repair of any damage to other parts of the system resulting from such defects.
- e. If the applicant/contractor, after notice, fails within 10 days to proceed to comply with the terms of this guarantee, the City may have the defects corrected, and the applicant and the applicant's surety shall be liable for all expense incurred. However, in case of an emergency where, in the opinion of the City Engineer, delay would cause serious loss or damage, repairs may be made without notice being given to the applicant/contractor and the applicant/contractor shall pay the cost thereof.

101.8.08 Substitution of Materials

Whenever any material, article, device, product, fixture, form, type of construction, or process is indicated or specified by patent or proprietary name, by name of manufacturer, or by catalog number, such specifications shall be for the purpose of establishing a standard of quality and facilitating the description of the material or process desired. Such specification is not to be construed as eliminating from competition other products of equal or better quality made by other manufacturers and that are fully suitable in design, and shall be deemed to be followed by the words "or as approved" or "approved equal." The contractor may, in such cases, submit complete data to the City Engineer for consideration of another material, type, or process that shall be substantially equal in every respect to the one indicated or specified. Substitute materials shall not be used unless approved in writing by the City's authorized representative.

101.8.09 Safety Requirements

- a. The contractor shall at all times conduct work in such a manner as to comply with all Occupational Safety and Health Administration (OSHA) requirements, shall minimize the possibility of accident or injury of any workers or the general public, and shall conduct the work, maintain operations, and provide all reasonable safeguards so as to protect public and private property as well as to protect persons from injury.
- b. If in the opinion of the City's authorized representative the contractor is in violation of the above safety practices, the City's authorized representative may issue and post a stop-work order if the contractor, after being informed of such violation, refuses to comply immediately. The City's authorized representative will also notify the OSHA of such action.
- c. The City's authorized representative's role is not one of supervision or safety management, but of observation only. Nothing contained in this section or elsewhere in this document shall be interpreted to obligate the City to act in any situation, nor shift the applicant's responsibility for safety compliance to the City. No responsibility for the safety of the work or for construction means, methods, techniques, sequences, or procedures shall attach to the City by virtue of its action or inaction.\

101.8.10 Traffic Maintenance and Safety

- a. The contractor shall comply with all rules and regulations of City, county, or state authorities and applicable fire protection and law enforcement agencies regarding the closure of public streets or highways to public traffic. No public road shall be closed to the public except by express permission of the public agency responsible for the road.
- b. The contractor shall conduct their operations so as to assure the least possible obstruction to traffic, including vehicular, bike, and pedestrian and normal commercial pursuits. Traffic control in work zones shall conform to the *Manual on Uniform Traffic Control Devices* (MUTCD, latest edition), published by the Federal Highway Administration, U.S. Department of Transportation.
- c. The contractor shall be required to submit a traffic control plan to the appropriate jurisdiction for review and approval before beginning construction.
- d. The contractor shall provide and be responsible at all times for flaggers, signs, and other devices not otherwise specified to be furnished by the applicant. The contractor shall erect and maintain all barricades, guards, lights, variable message boards, standard construction signs, warning signs, and detour signs as are necessary to warn and protect the public at all times from injury or damage as a result of work operations on highways, roads, streets, bike lanes, sidewalks, multi-use paths, or recreational trails affected by such operations.

- e. If the applicant or contractor fails to immediately provide the necessary flaggers or to provide, erect, maintain, and remove barricades, guards, lights, variable message boards, standard construction signs, warning signs, and detour signs when so ordered, the City's authorized representative shall be at liberty, without further notice to the contractor or applicant, to do so and to deduct all costs from the applicant's/contractor's performance assurance.
- f. When traffic will pass over backfilled trenches before they are paved, the top of the trench shall be maintained with cold patch or hot patch, to be removed later, and shall allow normal vehicular movement to continue. Access driveways shall be provided where needed. Cleanup operations shall follow immediately behind backfilling. The work site shall be kept orderly at all times.

101.8.11 Access for Police, Fire, and Postal Service

- a. No closure of a part of a street shall be made without first requesting and receiving approval from the City's authorized representative. Closure of public streets shall be in conformance with [Section 101.8.10.a](#), "Traffic Maintenance and Safety." The contractor shall conduct operations so as to cause the least interference with emergency vehicle access.
- b. The contractor shall comply with all requirements of the U.S. Postal Service with regard to the location of mailboxes that must be disturbed during construction. Mailboxes may be moved to temporary locations designated by the Postal Service. At the completion of work in each area, the contractor shall replace the mailboxes in their original location and in a condition satisfactory to the Postal Service.

101.8.12 Compliance with Applicable Laws

- a. The contractor shall keep fully informed of all local ordinances, including those of Tualatin Valley Fire and Rescue (TVF&R) and state and federal laws and regulations that in any manner affect the work specified herein.
- b. The contractor shall at all times comply with said ordinances, laws and regulations, and shall protect and indemnify the applicant and his/her officers and agents against any claim or liability arising from or based on the violation of any such laws, ordinances, or regulations.
- c. All permits, licenses, and inspection fees necessary for prosecution and completion of the work shall be secured by the applicant/contractor.

101.8.13 Work in Public Rights-of-Way

- a. Closure of public streets shall be in conformance with [Section 101.8.10.a](#), "Traffic Maintenance and Safety," and [Section 101.8.11.a](#), "Access for Police, Fire, and Postal Service." Construction operations and traffic control shall be in conformance with [Section 101.8.10.b](#), "Traffic Maintenance and Safety."

- b. The contractor shall use every reasonable precaution to safeguard the persons and property of the traveling public. It shall be the sole responsibility of the contractor to furnish, place, and maintain barricades, barriers, lights, flares, danger signals, signs, and security guards as necessary to protect the persons and property of the traveling public. All barricades and obstructions shall be protected at night by signal lights that shall be suitably distributed and kept burning from sunset to sunrise.
- c. When working in the public right-of-way, the contractor shall maintain the construction area in the interest of public health, safety and welfare, including, without limitation, maintenance of proper steel plates, trench backfill, patching, signage, and lighting. It is the City’s right, but not its obligation, to monitor contractor’s compliance with this subsection. Upon discovery of non-compliance, or upon notice by the City’s authorized representative, the contractor shall take immediate corrective action. If the contractor is not on site, and if, in the sole judgment of the City, conditions impose an immediate or eminent threat to public health, safety and welfare, the City has the right to perform emergency repairs or cause the repairs to be made, without notice and with all costs of such work being the responsibility of the contractor. Within sixty days of receipt of a detailed invoice for payment from the City, the contractor shall reimburse the City for costs incurred.
- d. In the event of interruption to domestic water, sewer, storm drain, or other utility services as a result of accidental breakage, or as the result of being exposed or unsupported, the contractor shall promptly notify the proper authority, cooperate with said authority in restoring the service as promptly as possible, and bear all costs of providing temporary service measures and repairs. In no case shall interruption of any water or utility services be allowed to exist outside working hours, unless prior approval by the City’s authorized representative is received.
- e. Work site cleanup shall conform to [Section 101.8.16](#), “Preservation, Restoration, and Cleanup.”

101.8.14 Easements

- a. Public utility easements shall be provided along all lot lines fronting a public street according to [Table 1.1](#).

Table 1.1 PUBLIC UTILITY EASEMENT WIDTH REQUIREMENT

Street Classification	Easement Width
Local	6-foot
Collector	8-foot
Arterial	10-foot

- b. When it is not possible or practical to install the public sanitary, storm sewer, or water line in a dedicated public street, a minimum 15-foot wide permanent, public pipeline shall be granted to the City for utilities that meet all of the following criteria:
 1. Single utility.
 2. Utility pipe less than 24" in diameter.
 3. Utility pipe less than 10 feet in depth.
 4. Utility located on a cross slope less than 10%.

Where the utility(s) do not meet the criteria above, the easement width shall be determined by the Engineer of Record and reviewed for approval by the City's authorized representative. The easement width determination shall consider the number, depth, and size of utilities, the ground cross slope, soil stability, required vertical and horizontal separation between utilities, work zone width, and all other relevant information.

- c. All easements shall be shown on the approved construction plans.
- d. No permanent structures shall be allowed within an easement area.
- e. Certain types of wooden fences, chain link fences, or other similar structure acceptable to the City's authorized representative may be allowed to be installed across and/or within easements.

101.8.15 Sanitation

Contractors shall provide and maintain adequate sanitary/sanitation facilities for employees.

101.8.16 Preservation, Restoration, and Cleanup

a. Site Restoration and Cleanup

1. The contractor shall keep the premises clean and orderly at all times during the construction period and leave the project free of rubbish or excess materials of any kind on completing the work. The contractor shall immediately replace mailboxes and signposts disturbed by construction activities.
2. During construction, the contractor shall stockpile the excavated trench materials so as to do the least damage to adjacent lawns, grassed areas, gardens, shrubbery, trees, or fences, regardless of the ownership of these areas. These surfaces shall be left in a condition equivalent to their original condition or better and free from all rocks, gravel, boulders, or other foreign material.

3. If damaged or altered during construction, existing trenches, drainage ditches, and culverts shall be re-graded, and original drainage tiles and sewer laterals shall be repaired expeditiously. Within 500 feet of pipe-laying and backfilling operations in any trench section, the contractor shall rake and drag all disturbed areas and leave them free of rocks, gravel, clay, or any other foreign material and ready, in all respects, for seeding. The finished surface shall conform to the original surface, and shall be free-draining and free from holes, rough spots, or other surface features detrimental to a seeded area.
4. After backfilling the trenches, the contractor shall restore all public and private irrigation and/or utility systems that were destroyed, damaged, or otherwise modified during construction to their original condition or better.
5. All areas disturbed by the contractor's operations inside dedicated rights-of-way or easements shall be returned to their original condition or better. Areas outside the easements or rights-of-way that are disturbed by the contractor's operations shall be returned to their original condition or better.
6. All site restoration and cleanup work as described above shall be performed by the contractor within 5 working days of substantial completion of the work associated with the disturbance.

b. Street Cleanup

1. The contractor shall clean spilled soil, mud, rock, gravel, or other foreign material caused by construction operations from all sidewalks, gutters, streets, and roads at the conclusion of each day's operation.
2. Cleaning shall be by grader and front-end loader, power brushing, vacuuming, and hand labor, unless otherwise approved by the City's authorized representative. At no time shall any such material be washed or flushed into any part of the stormwater and surface water system. If the contractor does not follow these standards, the City may exercise its option to have the street(s) cleaned and bill the contractor for such service.
3. When directed by the City's authorized representative, the contractor shall, within 5 working days of notice, remove all erosion-control materials and thoroughly remove all dirt, mud, rock, gravel, and other foreign material from sidewalks, gutters, catch basins, curb inlets, area drains, manholes, and paved surfaces.

c. Preservation of Irrigation and Drainage Ditches

1. The contractor shall arrange schedules so that construction will not interfere with the irrigation of cultivated lands or pasturelands. Construction may proceed during the irrigation season provided the contractor constructs, at their own expense, temporary irrigation ditches, turnouts, and miscellaneous structures

acceptable to the owner of the land in question that shall permit the land to be irrigated by others during construction.

2. After backfilling the trenches, the contractor shall restore all irrigation and storm drain ditches destroyed, damaged, or otherwise modified during construction to a condition equivalent, in the opinion of the City's authorized representative, to the condition of the ditches before construction. Ditches shall be built in their original locations, unless specified otherwise on the construction plans.

101.8.17 Project Closeout

At the conclusion of the project, the applicant shall notify the City's authorized representative in writing that the project is ready for final inspection. On receipt of this notice, the City's authorized representative will request the following:

- a. **Record Drawings:** At the completion of the installation of any required public improvements, and before final inspection, in accordance with [Section 101.8.17.b](#), "Final Inspection," is scheduled, the Project Engineer shall perform a record survey. The record survey shall be the basis for the preparation of record drawings that will serve as the physical record of changes made to the approved plans and/or specifications during construction. Using the record survey as a guide, the appropriate changes shall be made to the construction plans and/or specifications and a complete revised set, the record drawings, shall be submitted. The initial set of record drawings shall be submitted to the City for review and approval and consist of a set of paper drawings and an electronic copy in PDF format. Once the record drawings are approved, a final set of record drawings on approved 3 mil Mylar™ material, an electronic copy in the City's current edition of AutoCAD, and a digitally signed PDF shall be submitted to the City. The initial set of record drawings must be received before the City's authorized representative issues a project correction list (punch list) in accordance with [Section 101.8.17.c](#), "Project Correction List." Record drawings shall include all work done within the public right-of-way or public easements.
- b. **Final Inspection:** Once the City's authorized representative receives the initial set of paper and electronic PDF format record drawings, a final inspection of the project will be conducted by the City's authorized representative.
- c. **Project Correction List:** After this inspection, a project correction/repair list (punch-list) will be issued by the City's authorized representative to the applicant and contractor. The project correction/repair list will include any items either damaged or improperly placed during construction, and any item(s) that, in the opinion of the City's authorized representative, need repair.
- d. **Project Corrections:** Contractor shall perform correction/repair work as required on the project correction/repair list. The City encourages the contractor to complete all correction/repair work as expeditiously as possible, the City will retain the performance assurance until the project correction list has been completed, and

inspected and approved by the City's authorized representative, and the contractor submits all maintenance and landscape maintenance assurances to the City.

- e. **Completion:** The City's authorized representative will consider the project complete and shall so state in writing when all of the following items are complete.
1. All items of the project correction list are completed, inspected and approved by the City's authorized representative.
 2. Final set of Mylar, AutoCAD, and digitally signed PDF record drawings are submitted to the City and approved by the City's authorized representative.
 3. Confirmation that all easements and legal documents have been recorded with the County Recorder.
 4. Contractor submits approved maintenance assurances and warranty as specified in [Section 101.8.18](#), "Maintenance and Warranty."

At this time, the warranty period will go into effect on written notice from the Engineering Division.

101.8.18 Maintenance and Warranty

- a. **Maintenance Assurance Required:** Contractor shall fully warrant all work from defect, for a period of time as determined by the type of work. The warranty shall be required for work to ensure post-construction quality and landscape survivability. If defective or negligent work is discovered and repaired, this warranty will automatically be extended from the date the repair is made and accepted by the City. This warranty by the Contractor is in addition to and not in lieu of any other warranties provided by various suppliers or manufacturers. Such warranty shall be guaranteed in the form of maintenance assurance.. Assurances shall be in the form of a letter of commitment, letter of credit, assignment of deposit, bond, or cash deposit, in form and substance satisfactory to the City and meeting the requirements of [Section 101.6.08](#), "Qualifications of Insurance and Bonding Companies." Assurances shall remain in place until a written release is issued from the City. This provision of the Maintenance Assurance is to help secure the Contractor's performance of any corrective work that may need to be performed within the warranty period of the Project, but in no way limits the Contractor's liability therefore.
- b. **Construction Maintenance Assurance:** Maintenance assurance shall be required for all public improvements constructed by the Contractor. The construction maintenance assurance shall be for 10% of the cost to construct the public improvements and be in place for a period of not less than 2 years from the date of Final Acceptance. Prior to the end of the two-year assurance, the City will provide contractor with a maintenance project corrections list; the City reserves the option to video inspect the sanitary and/or storm sewer lines, if any were constructed, repaired or installed as part of the contract. Contractor shall make all necessary repairs and

replacements to remedy any and all defects, breaks, or failures of the public improvements as identified by the City and having occurred within two years following the date of Final Acceptance due to faulty or inadequate materials or workmanship, in a manner satisfactory to the City's authorized representative and at no cost to the City. Contractor shall repair damage or disturbances to other improvements under, within, or adjacent to the public improvements, whether or not caused by settling, washing, or slipping, when such damage or disturbance is caused, in whole or in part, from activities of the Contractor in performing his/her duties and obligations when such defects or damage occur within the warranty period. Construction maintenance assurance shall be released two years after acceptance of any corrective work performed during the maintenance assurance period.

- c. **Landscape maintenance assurance:** Landscape maintenance assurance shall be for 100% of the cost to install all required landscaping in water quality/quantity facilities and vegetated corridors, *plus* 100% of the cost to maintain the landscaping in these areas and be in place for a period of not less than 2 years from the date of Final Acceptance. The assurance shall be released two years after acceptance of construction, providing the landscaping meets the 90% survival level (see Section 301.15.02, "Landscape Inspection for Warranty").
- d. **Prompt Compliance:** If Contractor, after written notice, fails within 10 days to proceed to comply with the terms of this section, Owner may have the defects corrected, and Contractor and Contractor's Surety shall be liable for all expenses incurred. If the assurance is in the forms of cash or letter of credit, the City may immediately draw upon such amount. In case of an emergency where, in the opinion of the Engineer, delay would cause serious loss or damage, repairs may be made without notice being given to Contractor and Contractor or Surety shall pay the cost of repairs. Failure of the Engineer to act in case of an emergency shall not relieve Contractor or Surety from liability and payment of all such costs.
- e. **Water Lines:** In addition to provisions a and b above, City of Wilsonville water line facilities installed by the contractor under the Public Works Permit contract that require repair or replacement during the maintenance period shall be repaired by the City or under direct supervision of the City and the Contractor and Contractors surety will be liable for prompt reimbursement of all labor costs and expenses incurred by the City in making the repair.

101.9.00 ENVIRONMENTAL PROTECTION, EROSION PREVENTION, AND SEDIMENT CONTROL

101.9.01 Introduction

This section identifies requirements for erosion prevention and sediment control. The provisions are intended to prevent or reduce adverse impacts to the City's drainage system and water quality. In combination with other federal, state, and local laws and ordinances, the requirements are intended to protect the beneficial uses of state waters.

101.9.02 Contaminated Soils or Hazardous Materials

If construction reveals soils contaminated with hazardous materials or chemicals, or if soil is suspected to be contaminated, the contractor shall cease earthwork activity immediately, ensure that no contaminated material is hauled from the site, remove their workforce from the immediate vicinity of the contaminated area (leaving all machinery and equipment), and secure the area from access by the public until an OSHA certified HAZMAT response team has relieved them of that responsibility. The contractor shall immediately notify the City's authorized representative, the design engineer, and the Oregon Department of Environmental Quality (DEQ) of the situation.

101.9.03 General Policy

a. Erosion Prevention Techniques and Measures

1. The use of erosion prevention techniques shall be emphasized, rather than measures to control sediment. This shall be especially important on construction sites immediately before and during the rainy season. Erosion prevention techniques are designed to protect soil particles from the force of rain and wind so they shall not erode. When land is disturbed at a construction site, the erosion rate accelerates dramatically.
2. Erosion prevention techniques include, but are not limited to, construction scheduling, ground cover, and matting. Sediment control measures are designed to capture soil particles after they are dislodged and to retain the soil particles on site.
3. Erosion prevention measures include, but are not limited to, silt fences, sediment barriers, and settling basins. Both erosion prevention techniques and sediment control measures have appropriate uses. Studies have shown, however, that sediment control measures are less effective than erosion prevention techniques in preventing soil movement.
4. Permanent vegetation or seeding shall be established only between March 1 through May 15 and September 1 through October 15. If an irrigation system is installed, vegetation or seeding may be established from March 1 through November 15. If an area falls under definition of a wetland, permanent vegetation or seeding shall be established only between March 1 through April 30 and September 1 through October 15 and in a manner satisfying applicable local, state and federal requirements.
5. Permanent vegetation or seeding shall meet the 90% survival level as detailed in Sections 301.15.02.c and d, "Landscape Inspection for Warranty".

b. Existing Vegetation

1. Existing vegetation shall be protected and left in place whenever practicable. Work areas shall be carefully located and marked to reduce potential damage to

trees and existing vegetation. Trees shall not be used as anchors for stabilizing working equipment. Where required, trees and existing vegetation shall be protected with a non-movable, chain link fence (see **Detail No. RD-1230** of these standards).

2. Where existing vegetation has been removed, or the original land contours have been disturbed, the site shall be re-vegetated, and the vegetation established, as soon as practicable.

c. Enforcement

Failure to comply with any provision of this section or with any term of an erosion-prevention and sediment-control permit shall be deemed a violation and subject to enforcement action pursuant to applicable City ordinance and resolutions, and orders, including all implementing rules and regulations.

101.9.04 Erosion Prevention and Sediment Control

a. Application and Purpose

1. It is a City goal to eliminate or minimize to the extent feasible all sediment and other pollutants reaching the public storm and surface water system resulting from development, construction, grading, excavating, clearing, and any other activity that accelerates erosion, to the limits prescribed in these standards.
2. It is the policy of the City to require temporary and permanent measures for all construction projects to lessen the adverse effects of construction on the environment. All projects shall include properly installed, operated, and maintained temporary and permanent erosion-control measures as provided in these standards or in an approved plan, designed to protect the environment during the term of the project. Compliance with the measures prescribed here or in an approved plan does not lessen the necessity to provide effective and comprehensive erosion prevention and sediment control.
3. Nothing in this section shall relieve any person of the obligation to comply with the regulations or permits of any federal, state, or local authority.

b. Erosion Prohibited

1. Visible or measurable erosion that enters, or is likely to enter, the public or private stormwater and surface water system or other properties is hereby prohibited, and is a violation of these standards. An offsite sedimentation control facility may be utilized if it has been identified and approved in writing by the City's authorized representative, written approval is obtained from the respective property owner, and a written agreement for rehabilitation of the facility by the applicant or contractor is submitted to the City. The owner of the property or the applicant under a Public Works Permit, together with any person or persons, including but

not limited to the contractor or the design engineer causing such erosion, shall be held responsible for violation of the City's standards.

2. No person shall create physical erosion by dragging, dropping, tracking, or otherwise placing or depositing, or permitting to be deposited, mud, dirt, rock, or other such debris on a public street, or into any part of the public stormwater and surface water system, or into any part of a private stormwater and surface water system that drains or connects to the public stormwater and surface water system. Any such deposited material shall be immediately removed by hand labor or mechanical means. No material shall be washed or flushed into any part of the stormwater and surface water system until all mechanical means to remove the debris are exhausted and preventive sediment filtration is in place.
3. The owner of the property or the applicant under a Public Works Permit, together with any person or persons, including but not limited to the contractor or the design engineer who causes such erosion, shall be held responsible for violation of these Standards.

c. Erosion-Prevention Techniques and Methods

The techniques and methods described in the latest edition of the Clackamas County Water Environment Services "Erosion Prevention and Sediment Control Planning and Design Manual" (www.clackamas.us/wes/designmanual.html) shall be used to control and prevent erosion in addition to the following procedures:

1. Gravel Construction Entrance and Wheel Wash

- (a) A gravel construction entrance is required as per **Detail No. S-2240** of these standards. If there is more than one vehicle access point, a gravel construction entrance shall be required at each entrance.
- (b) For project sites 5 acres or greater in size, a wheel wash as per **Detail No. S-2235** of these standards will be required to be constructed. For sites less than 5 acres in size, a wheel wash may be required if, in the opinion of the City's authorized representative, excess tracking of soil occurs.
- (c) The responsibility for design and performance of the driveway remains with the applicant. Vehicles or equipment shall not enter a property next to a stream, watercourse, stormwater or surface water facility, or wetlands unless adequate measures are installed to prevent physical erosion into the water or wetland.

2. Erosion Control

- (a) During periods of wet weather, disturbed areas of the site and/or stockpiled soil shall be covered by tarps or straw at the end of each day's operations; all disturbed, unworked areas of the site shall be protected from erosion.

- (b) Temporarily seed disturbed soils and slopes that are not at finished grade and which will be exposed for two months or longer before being disturbed again.
- (c) Where seeding is used for erosion control, Regreen[®] or equivalent, or sterile wheat shall be used to stabilize slopes until permanent vegetation is established.
- (d) Temporary seeding shall establish a minimum of 90% coverage of the ground surface with uniform healthy plants. If this coverage is not achieved, or if the City determines that it is not effective in stabilizing the soil from erosion, the contractor, at their expense, shall stabilize the area with other temporary stabilization methods as approved by the City's authorized representative.
- (e) Biodegradable fabrics (Coir/Jute Matting), reinforced turf mats, or straw mulch can be used to stabilize slopes and channels. The fabrics can also be used to hold plugs in place and discourage floating upon inundation. Consult the *Erosion Prevention and Sediment Control (EPSC) Planning and Design Manual* for additional information.
- (f) Permanent vegetation shall be established as outlined in [Section 101.9.03.a.4](#), "Erosion Prevention Techniques and Measures."

3. **Bioengineering Techniques**

- (a) Any person performing work in a watercourse or in an environmentally sensitive area (e.g., essential salmonid habitat, wetlands, steep slopes) shall employ bioengineering techniques whenever feasible.
- (b) Bioengineering techniques include, but are not limited to, contour wattling, brush layering or matting, live cuttings, fascines, and stakes.

4. **Sediment filters/barriers**

- (a) Using straw bales as a sediment filter or barrier is not allowed.
- (b) A filter system may not be used on catch basins in public streets as part of erosion-prevention and sediment-control plans for single-family dwellings.

5. **Plastic Sheeting:** Plastic sheeting shall generally not be used as an erosion-control measure for single-family house construction. Plastic sheeting may be used to protect small, highly erodible areas or temporary stockpiles of material. If plastic sheeting is used, the path of concentrated flow from the plastic must be protected.

6. **Protection Measure Removal:** The erosion-prevention and sediment-control measures shall remain in place and be maintained in good condition until all

disturbed soil areas are permanently stabilized by installation and establishment of landscaping, grass, or mulching, or are otherwise covered and protected from erosion.

7. **Wet Weather Measures:** On sites where vegetation and ground cover have been removed, vegetative ground cover shall be planted on or before September 1, with the ground cover established by October 15. As an alternative if ground cover is not established by October 15, the open areas shall be protected through the winter with mulch, erosion blankets, or other method(s) approved by the City's authorized representative.
8. **Exceptions to Sediment Barrier Requirements:** Sediment barriers are not required on a site in the following circumstances:
 - (a) Where a Neighborhood Erosion Control Plan is in effect, for a maximum of four lots.
 - (b) Where there are no concentrated flows and the slope being protected has a grade of less than 2%.
 - (c) Where flows are collected by using temporary or permanent grading or other means, such that the flows are routed to an approved settling pond, filtering system, or sediment barrier.
 - (d) Where there are no concentrated flows, where slopes are less than 10%, and where the runoff passes through a grassed area that is either owned by the applicant or where such use is allowed, by written agreement, by the owner of the grassed area. The grass area shall be at least equal in dimension to the project area.
 - (e) Where the surface is protected by ground cover or matting approved by the City's authorized representative.

d. Dust Prevention

During all phases of the work, the contractor shall take precautions to abate any dust nuisance. Dust-prevention measures shall be continuous until final inspection by the City's authorized representative. Dust shall be minimized to the extent practicable, using all measures necessary to accomplish results satisfactory to the City's authorized representative, including, but not limited to:

1. Sprinkling haul and access roads and other exposed dust-producing areas with water.
2. Applying City-approved dust palliatives on access and haul roads.
3. Establishing temporary vegetative cover.

4. Placing wood chips or other effective mulches on vehicle- and pedestrian-use areas.
5. Maintaining proper moisture conditions on all fill surfaces.
6. Prewetting cut and borrow area surfaces.
7. Using covered haul equipment.

e. **Neighborhood Erosion Control Plan**

1. Any individual or group may submit an erosion-prevention and sediment-control plan for multiple lots. Plans shall be submitted to City of Wilsonville for review and approval. This shall be referred to as a “Neighborhood Erosion Control Plan.” In such case, the group of lots will be evaluated as if they were one lot.
2. If an individual lot in a Neighborhood Erosion Control Plan is sold to new owners, the new owners may either join the neighborhood plan (with the approval of the other neighborhood owners), or will need to submit their own erosion control plan if erosion potential still exists on the parcel. If a lot is sold and the new owner does not join the Neighborhood Erosion Control Plan, then the plan must be revised and the new owner must submit an individual plan.

101.9.05 Maintenance

- a. The applicant shall maintain the facilities and techniques contained in the approved erosion-prevention and sediment-control plan so they will continue to be effective during the construction phase, post construction phase, establishment of permanent vegetation, or any other permitted activity.
- b. If the facilities and techniques approved in an erosion-prevention and sediment-control plan are not effective or sufficient as determined by the City site inspection, the applicant shall submit a revised plan within three working days of written notification by the City's authorized representative. On approval of the revised plan by the City's authorized representative, the applicant shall immediately implement the additional facilities and techniques included in the revised plan.
- c. In cases where erosion is likely to occur, the City's authorized representative may require the applicant to install interim control measures before submitting a revised erosion-prevention and sediment-control plan.

101.9.06 Inspection

- a. **City Initial Inspection:** On a site development or any other type of project, the erosion-prevention and sediment-control measures shall be installed before the start of any permitted activity. The applicant shall schedule an inspection by using the City's 24-hour Inspection Request Line at (503) 682-4159, or submit a request online or by e-mail, for an initial inspection before beginning any site clearing or grading. If

- necessary, tree protection shall be installed and inspected by the Planning Division before any erosion-prevention and sediment-control measures are installed.
- b. **Applicant Inspections:** The applicant shall be required to inspect erosion-prevention and sediment-control measures as outlined in the approved Grading and Erosion Control Plan (as required by City's current erosion control ordinance) and to provide information to the City's authorized representative. Inspections shall be completed as required by the latest edition of the Clackamas County Water Environment Services "Erosion Prevention and Sediment Control Planning and Design Manual" and the minimum erosion prevention and sediment control plan monitoring requirements. Inspection information is to be maintained on-site and available to City's authorized representative on request.
 - c. **Final Inspection:** A final erosion control inspection shall be required before the sale or conveyance to new property owner(s) or before the removal of erosion-prevention and sediment-control measurements.

SECTION 2

TRANSPORTATION DESIGN AND CONSTRUCTION STANDARDS

201.1.00 ENGINEERING

201.1.01 Introduction

This section outlines design and construction requirements for all public transportation construction. The provisions and technical specifications herein set forth the requirements of the City of Wilsonville for constructing transportation facility improvements. Interpretations of such provisions and their application in specific circumstances shall be made by the City's authorized representative, unless specifically stated otherwise. Refer to [Section 1](#) of the "Public Works Standards" for general provisions and requirements.

201.1.02 Extension of Public Transportation Systems

- a. The extension, addition, or widening of public transportation facilities to serve any adjacent parcel or tract of land, shall be done by the property owner or permit applicant and may be subject to applicable System Development Charge (SDC) credits, as determined by the City's authorized representative.
- b. The City reserves the right to perform the work or cause it to be performed and bill the owner for the cost of the work or to pursue special assessment proceedings.
- c. The public transportation system shall extend to the most distant parcel boundary, to facilitate future extension, unless otherwise approved by the City's authorized representative.
- d. Where public infrastructure improvements paid for by the property owner or permit applicant directly benefit adjacent properties, the property owner or permit applicant may pursue establishment of a reimbursement district per Section 3.116 of the City Code.

201.1.03 Alternative Design and Construction Standards

- a. If approved by the Development Review Board and City Engineer, alternative roadway design standards may be substituted for the standards specified herein. Any requests for substitution must be in writing, stamped by a Professional Engineer registered in the State of Oregon at the time of submittal, and submitted as part of the Land Use process. The City Engineer may request submission of any additional information deemed necessary to properly evaluate an alternative roadway design standard.

- b. If approved by the City’s authorized representative, alternative construction standards may be substituted for the standards specified herein. Any requests for substitution must be in writing, stamped by a Professional Engineer registered in the State of Oregon, and submitted at least three weeks prior to the start of any work associated with the construction standard. The City’s authorized representative may request submission of any additional information deemed necessary to properly evaluate an alternative construction standard.

201.1.04 General Requirements

- a. **Functional Classification:** The functional classification of existing and proposed roads is established by the City of Wilsonville’s Transportation Systems Plan (TSP). Where the functional classification of a road is not defined by the TSP, the existing land use and existing operational characteristics shall be used by the City's authorized representative to determine the functional classification of the road in question.
- b. **Access:** Access to city, county, and public roads shall conform to the City of Wilsonville TSP and [Section 201.2.23](#), “Driveways.”
- c. **Width:** The width of the streets shall be in compliance with the City of Wilsonville TSP.
- d. **Number of Lanes:** The number of lanes for each class of road is defined by the City of Wilsonville TSP.
- e. **On-Street Parking:** Streets shall be provided with on-street parking strips as specified in the City of Wilsonville TSP and [Section 201.2.26](#), “On-Street Parking.”
- f. **Sidewalks and Planter Strips:** Streets shall be provided with sidewalks and planter strips as specified in the City of Wilsonville TSP and [Section 201.2.25](#), “Sidewalks.”
- g. **Design Speed:** Design speed is the maximum safe speed that can be maintained over a specified section of roadway when traffic, weather, and other conditions are so favorable that the design features of the roadway govern.
 - 1. The target design speed shall be as follows:

(a) Arterials	45 miles per hour
(b) Commercial/Industrial	35 miles per hour
(c) Collectors	35 miles per hour
(d) Local	25 miles per hour
 - 2. The City Engineer may approve a lower alternative design speed where it can be shown that the 85th percentile speed of traffic of traffic will be lower than the design speed standard during all hours. The design speed is the minimum speed

that shall be used in design of safe road geometry. The design speed shall not prohibit the use of traffic calming features or signing where approved to encourage lower traffic speed.

3. The City Engineer may approve a design speed of 20 miles per hour in accordance with Oregon Revised Statute (ORS) 810.180 (10) as follows:
 - (a) The section of roadway is located within a residential district.
 - (b) The section of roadway has an average volume of fewer than 2,000 motor vehicles per day.
 - (c) The section of roadway has more than 85 percent of motor vehicles traveling less than 30 miles per hour.
 - (d) The section of roadway includes traffic control devices that indicate the presence of pedestrians or bicyclists.
 - (e) The section of roadway is posted with speed zone signs giving notice of the designated speed at each end of the portion of roadway where the designated speed is imposed and at such other locations on the roadway as may be necessary to inform the public.
4. The roadway design speed is not the same as the posted speed. The posted speed shall be determined in accordance with the most current Oregon Department of Transportation Speed Zone Manual.

201.1.05 Street Plans

- a. It is the design engineer's responsibility to ensure that engineering plans are sufficiently clear and concise to construct the project in proper sequence, using specified methods and materials, with sufficient dimensions to fulfill the intent of the design guidelines in these standards.
- b. All elevations on design plans and record drawings shall be based on the NAVD 88 Datum, as specified in [Section 101.7.07.a](#), "NAVD 88 Datum."
- c. Existing conditions and facilities on design plans and record drawings shall be shown in light, gray print. Proposed conditions and facilities on design plans and record drawings shall be shown in bold, black print.
- d. All engineering street plans shall be stamped by a Professional Engineer registered in the State of Oregon. At a minimum the street plan shall contain the following:
 1. At least one sheet showing a plan view of the entire project site. If the project site is sufficiently large that detailed street plans on any given sheet do not encompass the entire project site, then a sheet showing the plan view of the entire site must serve as an index to subsequent detailed plans sheets.

2. A topographic map showing existing conditions for the site, including:
 - (a) Existing topography for the site. Plan views showing existing features may be required for a distance of up to 100 feet (or further if warranted) beyond the proposed improvement in order to prevent future grade conflicts and will be determined on a case-by-case basis by the City's authorized representative.
 - (b) Adjacent streets, trails, multi-use paths, and rail lines, including the respective names.
 - (c) Existing utilities, including franchised utilities located above or below ground and drainage facilities that transport surface water onto, across, or from the project site. Existing drainage pipes, culverts, and channels shall include the invert or flow line elevations.
 - (d) Existing vegetation, including denoting the type, DBH, and canopy size of trees within the construction limits.
 - (e) Existing environmentally sensitive areas (e.g., ravines, swales, steep slopes, wells, springs, wetlands, creeks, lakes). For natural drainage features, show direction of flow, drainage hazard areas, and 100-year floodplain boundary (if applicable).
 - (f) Adjacent existing features that are within 25 feet outside of the site boundary, including but not limited to construction activities that will potentially compromise the structural stability or condition of off-site features, such as cultivated vegetation, landscaping and trees, buildings, fences, decks, walls, slabs, and pavements. Denote the type, DBH, and canopy size of all trees.
3. Plans for proposed street improvements shall include the following:
 - (a) Grading and erosion control plan.
 - (b) Finished grades, showing the extent of cut and fill by existing and proposed contours, profiles, or other designations. Plan views showing existing features may be required for a distance of up to 100 feet (or further if warranted) beyond the proposed improvement in order to prevent future grade conflicts and will be determined on a case-by-case basis by the City's authorized representative.
 - (c) Horizontal stationing along centerline, showing points of tangency and curvature, including centerline stationing of all intersecting streets. Curve data shall show tangent length, radius distance, centerline curve length, and delta angle.

- (d) Curb alignment and elevation data, including table showing curve and segment station and offset, curb length, tangent length, radius distance, curve length, delta angle, and elevations. Curb elevations at all horizontal alignment break points, quarter-deltas, and low points.
 - (e) ADA ramp and driveway elevation data for all corners of the ramp and wings; also for connecting sidewalks up to a maximum distance of 15 feet out from ramp or driveway wing when running slopes exceed the general grade established for the adjacent street.
 - (f) Proposed structures, including roads and road improvements, parking surfaces, building footprints, walkways, landscaped areas, street lighting, public and private utilities, etc.
 - (g) Signing and striping plan.
 - (h) Lighting and illumination plan.
 - (i) Applicable detail drawings.
 - (j) Existing and proposed property lines, right-of-way lines, survey monuments, and easements.
 - (k) Setbacks from environmentally sensitive areas or resource areas protected within the Significant Resource Overlay Zone (SROZ).
 - (l) Any proposed phasing of construction. (Note: water quality and quantity facilities must be constructed before completion of any phased construction)
 - (m) Any additional information that the City's authorized representative deems necessary.
4. Profiles for construction plans will be provided at the same horizontal scale as the plan sheets and a 1" = 5' vertical scale. Profile drawings shall be drawn below the plan view or immediately following the associated plan view sheet. Profile views showing existing features may be required for a distance of up to 100 feet (or further if warranted) beyond the proposed improvement in order to prevent future grade conflicts and will be determined on a case-by-case basis by the City's authorized representative. The profiles shall include the following:
- (a) Existing ground along centerline and the edges of the right-of-way, if grade differences are significant.
 - (b) Existing street centerline and gutter flow lines, including intersecting streets.
 - (c) Proposed street centerline and gutter flow lines showing stationing, elevations, and slopes for beginning and end of vertical curves, point of vertical intersection, high and low points, and grade breaks. Vertical curves

shall be labeled with vertical curve length, algebraic grade difference, and K values.

- (d) Proposed vertical alignment for stub streets that may be extended in the future, a minimum 300 feet beyond the construction limits. The City's authorized representative may request additional design information deemed necessary to properly evaluate the vertical alignment design of future street extensions.
 - (e) Any additional information that the City's authorized representative deems necessary.
5. Detailed grading and landscape plans will be provided. The plans shall include the following:
- (a) Existing ground contours (shaded) and proposed ground contours at a minimum of a 2 foot contour interval. Slopes steeper than 6H: 1V shall be identified.
 - (b) Location of all drainage structures as well as any other piped utilities in vicinity (i.e., at 0.1-foot detail).
 - (c) Landscape planting plan. Show all sewer laterals, water services, fire hydrants, and street lighting as per **Detail No. RD-1240** of these standards.
 - (d) Irrigation plan to achieve the required plant survival rate.
 - (e) Maintenance access, as applicable.
6. Cross-sections shall be provided for at least the following:
- (a) All street sections or amended soil sections, as applicable.
 - (b) Proposed ditches and swales, including vegetated swales.

201.1.06 Surveying

- a. The design engineer shall be responsible for establishing the location of the street by means of reference stakes offset along the centerline. No construction shall be allowed to begin before construction staking. All staking shall be performed by or under the direction of a Professional Land Surveyor registered in the State of Oregon.
- b. Reference stakes shall be set at 25-foot station intervals along the centerline. Stakes shall, at a minimum, reference the following:
 - 1. Point of Curvature (PC), quarter-deltas, Point of Tangency (PT) for horizontal curves.

2. Begin Vertical Curve (BVC) point, low/high point, End Vertical Curve (EVC) point for vertical curves.
 3. Beginning and ending point of super-elevation.
 4. Beginning and ending of full super-elevation.
 5. Centerline of intersecting street.
 6. PC, quarter-deltas, and PT for curb returns.
 7. All corners of ADA ramps.
 8. Centerline of driveways.
 9. Curb scoring for match into concrete street joints.
- c. The design engineer shall also be responsible for identifying and staking easements during construction.

201.2.00 STREET DESIGN STANDARDS

Street design shall be documented in a Street Design Report prepared, stamped and signed by a Professional Engineer registered in the State of Oregon. The Street Design Report shall include pavement designs, including geotechnical investigations and testing, prepared by an Oregon registered Professional Engineer experienced in pavement design. The report shall include sufficient design documentation regarding site conditions, design assumptions and design parameters to allow for independent peer review of the design recommendations. Two copies of the stamped and signed Street Design Report shall be provided to the City.

201.2.01 Subgrade Evaluation

- a. Subgrade evaluation and recommendations shall be prepared, stamped and signed by a Professional Engineer registered in the State of Oregon whose area of expertise is geotechnical engineering and shall be included in the Street Design Report.
- b. Soil testing to obtain the strength of the soil is required for all roads to analyze and design the road structural section. Soil tests are needed on samples of subgrade materials that are expected to be within 3 feet of the planned subgrade elevation. At least one sample is needed for each 500 feet of roadway and for each visually observed soil type. Soil tests are required for at least three locations.
- c. The selected design structural strength of the soil must be consistent with subgrade compaction requirements. That is, the strength and compaction moisture content at optimum to slightly over optimum must be specified. The Street Design Report shall address subgrade drainage and groundwater considerations for year-round conditions.

Recommendations for both dry-weather and wet-weather construction shall be included.

- d. Test the subgrade and determine the modulus of subgrade reaction, k, or the resilient modulus (M_R) to design the street structure. The procedure for determining M_R is given in AASHTO T-292. Alternately, these soil strength criteria can be based on either the California Bearing Ratio (CBR) or H-veem resistance testing (R-value). The CBR will be determined in accordance with AASHTO T-193, based on the modified proctor (AASHTO T-180). R-values shall be determined at 300-psi exudation pressure in accordance to AASHTO T-190.

- 1. A correlation of M_R to CBR is given by the following relationship (Heukelom and Klomp, 1962):

$$M_R \text{ (psi)} = 1,500 \times \text{CBR}$$

- 2. A correlation of M_R to R-value is given by the following relationship (Asphalt Institute, 1982):

$$M_R \text{ (psi)} = A + B \times (\text{R-value})$$

$$\text{Where: } A = 772 \text{ to } 1,155, B = 369 \text{ to } 555$$

- 3. A correlation of M_R to R-value for fine-grained soils ($\text{R-value} \leq 20$) is given by the following correlation (AASHTO, 1993):

$$M_R = 1,000 + 555 \times (\text{R-value})$$

- 4. A correlation of CBR to k may be made using [Table 2.1](#).

Table 2.1. RELATIONSHIP BETWEEN k AND CBR

CBR Value	Modulus of Subgrade Reaction (k) (psi/in.)
3	100
5.5	150
10	200
20	250
50	500
80	710

SOURCE: Portland Cement Association (PCA).

201.2.02 Subsurface Drainage

Subsurface street drainage must be considered in the design of each street:

- a. Subsurface drains shall be designed and constructed according to the recommendations of the Street Design Report. Generally, subsurface drainage at the low point of each sag vertical curve shall be managed through the use of weep holes installed in adjacent catch basins. For pervious street sections, a transverse perforated drainpipe with a minimum diameter of 4 inches shall be installed below the base rock at the point of each sag vertical curve.
- b. The subsurface drains are for the purpose of collecting and conveying subsurface water only, not surface runoff. They are not to be considered part of the storm drainage system for purposes of sizing storm drain pipe.
- c. Subsurface drains shall connect and drain into the storm drainage system at catch basins, curb inlets, manholes, or roadside ditches. Surcharge from the storm drainage system shall not be allowed to back up into the subsurface drains.
- d. Alternative subsurface drainage measures may be used if approved by the City's authorized representative.

201.2.03 Structural Section

- a. Arterial or Collector Streets may be constructed of:
 1. AC with crushed aggregate base and/or treated bases, or
 2. PCC with crushed aggregate base.
- b. Residential Streets may be constructed of:
 1. AC with crushed aggregate base and/or treated bases, or
 2. Standard or permeable segmental concrete unit pavers, or
 3. A combination of the two methods above, with the concrete pavers separated from the AC by a flush curb.
 4. Arterial or Collector Roundabouts may be constructed of PCC with crushed aggregate base only.

201.2.04 Crushed Aggregate Design

- a. When crushed aggregate is included in the pavement design section, it shall consist of 2-inch thick leveling course of $\frac{3}{4}$ " – 0 crushed aggregate placed over 1 $\frac{1}{2}$ " – 0 crushed aggregate.

- b. Crushed aggregate shall meet the requirements of [Section 201.3.01](#) “Granular Fill” of these standards.
- c. Crushed aggregate shall be separated from native subgrade soils using a geotextile fabric to prevent fine material from migrating up into the base rock.

201.2.05 Asphalt Pavement Design

- a. AC pavement shall be designed using nationally recognized procedures: the AASHTO method or the Asphalt Institute method.
- b. The wearing surface of AC pavement shall conform to the Oregon Department of Transportation Standard Specifications for Construction (ODOT SSC) Section 00745, “Asphalt Concrete Pavement (ACP),” for ½” Hot Mix Asphalt Concrete, unless otherwise specified by the design engineer and approved by the City’s authorized representative.
- c. The base courses for AC pavement shall conform to ODOT SSC Section 00745, “Asphalt Concrete Pavement (ACP),” for ¾” Hot Mix Asphalt Concrete, unless otherwise specified by the design engineer and approved by the City’s authorized representative.
- d. Generally, Level 2 ACP mix design shall be used on local and collector streets. Level 3 ACP mix design shall be used on arterial streets. The City’s authorized representative shall make the final determination on mix design level on a case-by-case basis.
- e. Warm Mix Asphalt Concrete (WMAC) may be used as a substitute for Hot Mix Asphalt Concrete (HMAC) on all paving with approval by the City’s authorized representative. WMAC shall conform to all requirements for HMAC in [Section 2](#), “Transportation Design & Construction Standards” of these standards and ODOT SSC Section 00745, “Asphalt Concrete Pavement (ACP),” as modified in [Section 201.3.02](#), “Asphalt Concrete” and [Section 201.6.02](#), “Asphalt Pavement.”
- f. Asphalt thickness shall be determined by the approved Street Design Report. The minimum total thickness of AC shall be the following:
 - 1. Local Streets: 4 inches (4.5 inches winter construction)
 - 2. Collector Streets: 5 inches
 - 3. Arterial Streets: 6 inches
- g. The minimum total thickness of asphalt concrete constructed between October 15th and March 15th (winter construction) shall be 4.5 inches.
- h. The asphalt lift thickness shall be a minimum of 2-inch and a maximum of 3-inch.

- i. Pavement thickness design criteria shall be accomplished in accordance with the AASHTO method or the Asphalt Institute method, using soil strength criteria based on either the CBR or R-value (see [Section 201.2.01](#), “Subgrade Evaluation.”)
- j. Use a minimum 20-year design period. Design using an initial ride index of 4.2 and a terminal serviceability index of 2.5.

201.2.06 Portland Cement Concrete Design

- a. At the direction of the City's authorized representative, certain streets may be required to be designed and constructed using PCC.
- b. PCC pavement shall be designed using nationally recognized procedures: the PCA method or the AASHTO method.
- c. Use a minimum 40-year design period.
- d. Minimum thickness of PCC shall be 7 inches.
- e. Minimum thickness of crushed rock base shall be 6 inches.
- f. Design of concrete joints shall follow the guidelines and requirements outlined in the American Concrete Pavement Association (ACPA) publication, “Design and Construction of Joints for Concrete Streets,” except for the following:
 - 1. Maximum joint spacing shall be 12 feet.
 - 2. Joints shall be designed to be skewed 6:1 when meeting the edge of pavement.
 - 3. For doweled contraction joints, do not lubricate the dowels.
 - 4. Isolation joints shall be used around manhole covers. Isolation joints shall be circular with 2-foot spacing from the manhole cover.
- g. All castings for manholes in concrete streets shall be standard type.
- h. PCC for pavement, impact slab and concrete crosswalks construction shall conform to ODOT Class 4000 – 1½, Paving Concrete.
- i. PCC for curbs, sidewalks, driveways and miscellaneous construction shall conform to ODOT Class 3300 – ¾, Commercial Grade Concrete.

201.2.07 Segmental Concrete Paver Design

- a. Concrete Unit Pavers
 - 1. Provide the City with paver manufacturer’s/installation subcontractor’s drawings and details: indicate perimeter conditions, junction with other materials, expansion and control joints, paver layout, patterns, color arrangement,

installation and setting details. Indicate layout, pattern and relationship of paving joints to fixtures, and project formed details.

2. Furnish and install pavers meeting the ASTM C936 with an average compressive strength of 8,000 PSI with no less than 7,300 PSI when tested to ASTM C140 standards. The pavers shall be 3-1/8" (80mm), minimum thickness.
3. A submittal shall be provided to the City which includes:
 - (a) Paver manufacturer's catalog sheets with product specifications.
 - (b) Four representative full-size samples of each paver type, thickness, color, and finish. Submit samples indicating the range of color expected in the finished installation.
 - (c) Laboratory test reports certifying compliance of the concrete pavers with ASTM C 936.
 - (d) Minimum 3 lb. samples of subbase, base and bedding aggregate materials.
 - (e) Sieve analysis of aggregates for subbase, base and bedding materials per ASTM C 136.
 - (f) Project specific or producer/manufacturer source test results for void ratio and bulk density of the base and subbase aggregates.
4. Prior to beginning construction, the contractor shall provide to the City's authorized representative proof of representative tests confirming compliance to the minimum requirements. If the tests reflect failure to meet the requirements then the whole lot will be rejected.
5. The city reserves the right to determine the suitability of some concrete pavers for use on exposed faces, edges or corners.
6. Concrete containment edge restraints shall be required with all concrete paver street installations in compliance with **Detail No. RD-1290** of these standards.
7. Segmental Concrete Pavers shall be designed with a minimum 1" layer of bedding sand, over a minimum 8" layer base of 3/4"-0 fractured rock; a greater thickness may be required based on the soils conditions as provided in the Street Design Report. Crushed aggregate shall be separated from native subgrade soils using a geotextile fabric to prevent fine material from migrating up into the base rock
8. Sand for the leveling (bedding) course shall be sound, sharp, washed, natural sand or crushed stone complying with gradation requirements shown in [Table 2.2](#); sand for joint filler material shall comply with the gradation requirements shown in [Table 2.3](#).

Table 2.2. ASTM NO. 8 BEDDING & JOINT OPENING FILLER GRADING REQUIREMENTS

Sieve Size	ASTM No. 8 Percent Passing
1/2 in.	100
3/8 in.	85 – 100
U.S. No. 4 sieve	10 – 30
U.S. No. 8 sieve	0 – 10
U.S. No. 16 sieve	0 – 5

Table 2.3. ASTM No. 89 and No. 9 JOINT OPENING SAND GRADING REQUIREMENTS

Sieve Size	ASTM No. 89 Percent Passing	ASTM No. 9 Percent Passing
1/2 in.	100	--
3/8 in.	90 - 100	100
U.S. No. 4 sieve	20 - 55	85 - 100
U.S. No. 8 sieve	5 - 30	10 - 40
U.S. No. 16 sieve	0 - 10	0 - 10
U.S. No. 50 sieve	0 - 5	0 - 5

9. On large projects, a 10’ x 10’ mock up area may be used to review quality control. Upon acceptance of the mock up area, all future work will be compared to this mock up for acceptance on the project.

10. The contractor shall supply the City with a minimum of 100 s.f. of additional material of each type, color and/or thickness of pavers for use by the city for maintenance and repairs. The additional pavers shall be delivered on a pallet and be wrapped in plastic.

b. Permeable Concrete Unit Pavers

1. For Permeable Concrete Pavers the submittals shall be as outlined above.

2. Compliance shall generally follow the Concrete Unit Paver specification listed above with revisions as listed below.

3. Permeable Concrete Pavers shall be designed with a minimum 2” layer of bedding sand, over a minimum 4” base layer of ASTM No. 57 stone, over ASTM No. 2 stone sub-base of sufficient thickness to hold the design storm and as provided in

the Street Design Report. The No. 2 Stone shall be separated from native subgrade soils using a geotextile fabric to prevent fine material from migrating up into the rock.

4. The crushed stone shall have 90% fractured faces, LA Abrasion < 40 per ASTM C 131, with a minimum CBR of 80% per ASTM D1883.
5. Round river rock will not be allowed on applications subject to vehicular traffic.
6. All stone material shall be washed with less than 1% passing the No. 200 sieve.
7. Sand for the leveling/bedding course and for the joint/opening filler, shall conforming to ASTM No. 8 gradation as shown in [Table 2.2](#),
8. Gradation requirements for the ASTM No. 57 stone and ASTM No. 2 stone shall be in conformance with [Table 2.4](#), and [Table 2.5](#), respectively:

Table 2.4. ASTM NO. 57 BASE AGGREGATE GRADING REQUIREMENTS

Sieve Size	ASTM No. 57 Percent Passing
1 1/2 in.	100
1 in.	95 – 100
1/2 in.	25 - 60
U.S. No. 4 sieve	0 – 10
U.S. No. 8 sieve	0 – 5

Table 2.5. ASTM NO. 2 SUB-BASE AGGREGATE GRADING REQUIREMENTS

Sieve Size	ASTM No. 2 Percent Passing
3 in.	100
2 1/2 in.	90 – 100
2 in.	35 - 70
1 1/2 in.	0 – 15
3/4 in.	0 – 5

9. Gradation criteria for the bedding and base:
 - (a) D_{15} base stone / D_{15} bedding stone <5

- (b) D_{50} base stone / D_{50} bedding stone > 2

201.2.08 Subgrade Geotextile

Separate the base rock from native subgrade soils using a geotextile fabric to prevent fine material from migrating up into the base rock. Subgrade geotextile shall conform to Oregon Department of Transportation Standard Specifications for Construction (ODOT SSC) Section 00331.

201.2.09 Pavement Transition – Portland Cement Concrete to Asphalt

Where AC paving abuts PCC paving, concrete crosswalks, flush curbs or lateral concrete bands used as edge restraints for segmental concrete pavers, there shall be a lateral transition zone extending 3 feet, with a cross-section designed according to **Detail No. RD-1175** of these standards.

201.2.10 Pavement Overlay Design

Pavement overlays shall be designed using nationally recognized procedures: the Asphalt Institute method, PCA method, or AASHTO method.

201.2.11 Horizontal Alignment

Alignments shall meet the following requirements:

- a. Centerline alignment of improvements should be parallel to the centerline of the right-of-way. The centerline of a proposed street extension shall be aligned with the existing street centerline. Intersections shall align in accordance with [Section 201.2.15](#), “Intersections.”
- b. Horizontal curves in alignments shall meet the minimum radius requirements shown in [Table 2.6](#), unless otherwise directed by the City’s authorized representative.
- c. Cross-slope of the street section shall be no less than 2% and no greater than 4%, unless otherwise approved by the City’s authorized representative.
- d. The use of superelevation is subject to approval by the City’s authorized representative. Where superelevation is used, street curves should be designed for a maximum superelevation rate of 4 percent. If terrain dictates sharp curvature, a maximum superelevation of 6 percent is justified if the curve is long enough to provide an adequate super elevation transition.
- e. Off right-of-way runoff shall be controlled to prevent concentrated cross flow in superelevated sections.

Table 2.6. DESIGN SPEED / CENTERLINE RADIUS—MINIMUMS

Design Speed (mph)	Friction Factor (F)	Slope/R min.					
		(e*) - 4%	(e) - 2.5%	(e) 0%	(e) + 2.5%	(e) + 4%	(e) + 6%
15	.330	55'	50'	45'	45'	40'	40'
20	.300	105'	100'	90'	85'	80'	75'
25	0.252	195'	185'	165'	150'	145'	135'
30	0.221	330'	305'	270'	245'	230'	215'
35	0.197	520'	475'	415'	370'	345'	320'
40	0.178	775'	700'	600'	525'	490'	450'
45	0.163	870'	980'	830'	720'	665'	605'

NOTE: *e = rate of superelevation (tanB)

- f. On local streets, requests for design speeds less than 25 miles per hour shall be based on topography, right-of-way, or geographic conditions and in accordance with [Section 201.1.04.g.3](#), “Design Speed.” Requests must show that a reduction in centerline radius will not compromise safety.

201.2.12 Vertical Alignment

Alignments shall meet the following requirements:

- a. Minimum tangent street gradients shall be 1% along the crown and curb.
- b. Maximum street centerline gradients shall be 8% for collector and local streets, and 6% percent for arterial streets. Grades in excess of 8% but not more than 12% may be permitted for short distances and must be approved by the City’s authorized representative on an individual basis.
- c. At street intersections, the crown of the major (higher classification) street shall continue through the intersection. The roadway section of the minor street will flatten to match the longitudinal grade of the major street at the projected curb line.
- d. Local streets intersecting with a collector or greater functional classification street or streets intended to be posted with a stop sign shall provide a landing that averages 5% gradient or less. Landings are that portion of the street within 20 feet of the edge of the intersecting street at full improvement or from the extended curb line.
- e. Grade changes of more than 1% shall be accomplished with vertical curves.

- f. Street grades, intersections, and superelevation transitions shall be designed not to allow concentrations of storm water to flow over the pavement.
- g. Offset crowns may be allowed and must be approved by the City’s authorized representative on an individual basis.
- h. Streets intersected by streets not constructed to full urban standards shall be designed to match both present and future vertical alignments of the intersecting street. The requirements of these standards shall be met for both present and future conditions.
- i. Vertical curves shall conform to the values listed in [Table 2.7](#) and [Table 2.8](#).
- j. Slope easements shall be dedicated or obtained for the purposes of grading outside the right-of-way.

**Table 2.7. DESIGN CONTROLS FOR MINIMUM CREST VERTICAL CURVES
BASED ON STOPPING SIGHT DISTANCE**

Design Speed	K
15	3
20	7
25	12
30	19
35	29
40	44
45	61
50	84
55	114

Where: $K = L / A = \text{feet} / \text{percent}$.

L = length of vertical curve (feet).

A = algebraic difference in grades (percent).

Table 2.8. DESIGN CONTROLS FOR MINIMUM SAG VERTICAL CURVES BASED ON STOPPING SIGHT DISTANCE

Design Speed	Without Street Lighting - K	With Street Lighting - K
15	10	5
20	20	10
25	30	15
30	40	20
35	50	30
40	60	35
45	70	45
50	90	55
55	100	65

Where: $K = L / A = \text{feet} / \text{percent}$.

L = length of vertical curve (feet).

A = algebraic difference in grades (percent).

201.2.13 Transitions

The following specify the minimum requirements for street transitions:

- a. Street width transitions from a narrower width to a wider width shall be designed with a 5:1 taper. Delineators, as approved by the City's authorized representative, shall be installed to define the configuration.
- b. For street width transitions from wider to narrower, the length of the transition taper shall be determined as follows:

$$L = S \times W, \text{ for } S \geq 45 \text{ mph}$$

$$L = \frac{W \times S^2}{60}, \text{ for } S \text{ less than } 45 \text{ mph}$$

60

Where L = minimum length of taper (feet).

S = design speed (mph).

W = edge of pavement offset (feet).

- c. Delineators, as approved by the City's authorized representative, shall be installed to define the configuration. Maximum spacing of delineators shall be the numerical value of the design speed, in feet (i.e. 35-foot spacing for a 35 mph speed).
- d. In situations where tapered transitions occur on both sides of the roadway, both transitions will taper at the same rate in accordance with subsection b above, unless otherwise approved by the City Engineer.
- e. In situations where a tapered transition cannot be provided, a Type III barricade shall be installed at the end of the wider section of the street and a taper shall be appointed and delineated as approved by the City's authorized representative. The barricade shall conform to **Detail No. RD-1220** of these standards; diagonal striping shall slope down in the direction of the taper. If the wider section does not provide an additional travel lane, only a barricade is required without the transition.

201.2.14 Superelevation Cross-Sections

- a. Design elements for superelevation shall be based on AASHTO design guidelines.
- b. Offset crown cross-sections are not acceptable as superelevation sections.

201.2.15 Intersections

The following specifies the minimum requirements for intersections:

- a. The interior angle at intersecting streets shall be kept as near 90 degrees as possible, unless existing development or topography make it impracticable. Where intersecting streets cannot be kept at right angles, the interior angle shall in no case be less than 75 degrees. A tangent section shall be carried a minimum of 25 feet each side of intersecting right-of-way lines.
- b. Intersection spacing shall conform to the values in [Table 2.9](#). The distance between streets is measured from the centerline of the subject street to the centerline of the adjacent street.
- c. At intersections, including alleyways, opposing street centerlines shall be in the same alignment. If in the opinion of the City Engineer, opposing street centerlines cannot align due to topography, existing features, or geographic conditions, the opposing street centerlines shall be in alignment as close as possible. Offset intersections that create danger to the traveling public, such as over-lapping left turn movements, will not be allowed under any circumstances.
- d. The minimum curb radii at intersections shall be as shown in [Table 2.10](#) for the various function classifications with exceptions subject to approval by the City's authorized representative. The right-of-way radii at intersections shall be sufficient to maintain at least the same right-of-way-to-curb spacing as the lower classified street.

- e. The City Engineer may require turning radii larger than shown in [Table 2.10](#) in locations where larger design vehicles need to be accommodated.

Table 2.9. STREET INTERSECTION SPACING

Street Functional Classification	Distance Between Intersections Along The Street Shall be at Least	Distance Between Intersections Along the Street Shall Not Exceed
Major Arterial	1000 feet	N/A
Minor Arterial	600 feet	1000 feet
Collector	300 feet	600 feet
Local	100 feet	600 feet
Bike & Pedestrian Facilities	100 feet	300 feet

- f. The minimum turning curb radii shown in [Table 2.10](#) may be reduced by the distance between the edge of the travelled way and the adjacent curb face, up to 10 feet. The curb radii reduction is limited to the road width with the least distance between the edge of the travelled way and the adjacent curb face.

Table 2.10. MINIMUM TURNING RADII FROM EDGE OF PAVEMENT OR CURB (feet)

Street Classification	Arterial Street	Commercial Industrial	Collector Street	Residential* Street	Rural Street
Arterial Street	55'	40'	30'	28'	28'
Commercial Industrial	40'	40'	30'	28'	28'
Collector Street	30'	30'	30'	28'	28'
Residential* Street	28'	28'	28'	28'	28'
Rural Street	28'	28'	28'	28'	28'

* The Residential Streets classification includes collector streets that are located in residential neighborhoods

- g. Curbs shall be designed to minimize the length of pedestrian crossings. Streets with on-street parking shall have intersections designed with curb extensions to reduce pedestrian crossing lengths, where the design turning radius allows. The City Engineer may require/approve the use of compound curves and other methods to minimize intersection width.
- h. Sidewalk access (wheelchair) ramps shall be in conformance with [Section 201.2.25](#), “Sidewalks,” and to **Detail No. RD-1110 – Detail No. RD-1140** of these standards.

201.2.16 Cul-de-Sacs, Eyebrows, Turnarounds

The design engineer’s plans must be approved by TVF&R and the City’s authorized representative. The following specifies the minimum requirements for cul-de-sacs, eyebrows, and turnaround areas. Other turnaround geometrics for alternative design vehicles, such as a single-unit truck, garbage truck, street sweeper, etc., may be used when conditions warrant and when the City’s authorized representative approves the design and application of its use.

- a. Cul-de-sacs and other turnaround areas shall be allowed only on residential streets and commercial/industrial streets. Cul-de-sacs shall not be more than 200 feet long, unless approved by the Development Review Board. The length of cul-de-sacs shall be measured along the centerline of the cul-de-sac roadway from the nearside right-of-way of the nearest through-traffic intersecting street to the farthest point of the cul-de-sac right-of-way.
- b. The minimum curb radius for cul-de-sac bulbs shall be 48 feet, and the right-of-way radius shall be sufficient to maintain at least the same right-of-way-to-curb spacing as in the adjacent part of the road.
- c. Cul-de-sacs and other turnaround areas shall have a 6-foot public utility easement extending outside the right-of-way around the cul-de-sac continuously. The minimum curb radius for transitions into cul-de-sac bulbs shall be 28 feet. The right-of-way radius shall be sufficient to maintain the same right-of-way-to-curb spacing as in the adjacent part of the road.
- d. An eyebrow corner may be used on a local street where expected average daily traffic (ADT) counts will not exceed 500 vehicles. Eyebrow geometry shall be evaluated on the basis of turning requirements for Fire Department vehicles.

201.2.17 Stub Streets

Stub streets allow for future extension of the roadway. A note shall be added to the plat restricting access at the terminus of the right-of-way. The access restriction shall extend the full width of the right-of-way; access control shall be governed by the City. A Type III Street Barricade conforming to **Detail No. RD-1220** of these standards shall be erected at the edge of pavement of the stub street and “No Parking” signs installed on the barricade; a Type III Sidewalk Barricade conforming to **Detail No. RD-1220** of these standards shall be erected at the end of any sidewalks on the stub street. Additionally, a

sign shall be installed stating the street will be extended in the future, per **Detail No. RD-1225** of these standards. Streets 50 feet in length or greater shall provide a garbage/recycling vehicle turn around approved by the City's authorized representative.

201.2.18 Half-Streets

To allow for reasonable development, half-street improvements may be approved by the Planning Commission and the Development Review Board. Whenever a half-street improvement is approved, it shall conform to the following:

- a. Street section design and construction shall be in conformance with these standards
- b. Minimum pavement width shall be 24 feet for arterial and collector streets, and 20 feet for residential and rural streets as measured from face of curb.
- c. Intersectional improvements shall be adequate to provide turn lanes.
 1. Arterials and collectors: 40 feet paved for 250 feet as measured from centerlines of intersecting streets.
 2. Residential and rural: 36 feet paved for 150 feet as measured from centerlines of intersecting streets.
- d. A note shall be added to the plat restricting access at the limits of the right-of-way. The access restriction shall extend the full width of the right-of-way; access control shall be governed by the City.

201.2.19 Private Access Drives

With prior approval of the Development Review Board a private access drive may be allowed for ingress and egress to two to four residential units and where there is no possibility of future extensions of the drive.

- a. Private access drives shall meet the requirements of the City of Wilsonville Planning Division and TVF&R.
- b. Private access drives shall not be used for ingress and egress into mixed use developments.
- c. Private access drives shall be designed with the same structural section as the adjacent residential street, or designed in conformance with these Standards.
- d. Private access drives shall be constructed and inspected in conformance with these Standards.
- e. Private access drives shall be signed with a blue street name sign in conformance with [Section 201.8.01.b](#), "Street Name Signs" and **Detail No. RD-1255** of these standards;

in addition all private access drives shall be signed with a blue sign stating, “Not maintained by the City of Wilsonville.”

201.2.20 Raised Medians and Traffic Separators

The following specify the minimum requirements for raised medians:

- a. Raised center medians and landscape medians are allowed and encouraged where feasible on certain arterial and collector streets as defined in the City of Wilsonville TSP.
- b. Where raised medians are allowed, the following criteria must be met:
 1. Street lighting shall be sufficient to provide illumination of the raised median.
 2. Objects, such as trees, shrubs, signs, light poles, etc., shall not physically or visually interfere with vehicle or pedestrian traffic in the travel way.
 3. Raised medians shall incorporate pedestrian refuge areas at locations of pedestrian street crossings in order to reduce pedestrian crossing lengths.
 4. The style and design of the raised median shall be site specific. The raised median shall be safe for the design speed. Raised medians shall be designed in conformance with AASHTO guidelines.
 5. Design shall be in conformance to [Section 201.2.24.b](#), “Curb and Gutter Style” and consider the use of appropriate surface loading for emergency vehicle left-turn access. Raised median designs shall be subject to City approval.
- c. Concrete traffic separators shall be designed where they are needed as determined by the City’s authorized representative; concrete traffic separators shall conform to **Detail No. RD-1070** of these standards.

201.2.21 Transit Turnout Design

The need for transit turnouts shall be determined by South Metro Area Regional Transit (SMART) in coordination with the City Engineering Division. Transit turnouts shall be provided where required by the City Engineering Division

- a. Transit turnouts shall conform to **Detail No. RD-1160** of these standards.
- b. Transit pad sections shall be a minimum thickness of 9 inches of PCC over 6 inches of compacted base rock.
- c. Transit pad shall be reinforced with No. 4 reinforcement steel bar, placed 1-foot on center each way, 2 inches above base rock.

- d. Transit pad shall be doweled into adjacent PCC gutter; dowels spaced 3-feet on center and centered on face of gutter. If adjacent street is PCC, transit pad shall be doweled into the street as shown in **Detail No. RD-1180** of these standards.
- e. PCC for transit pad construction shall conform to ODOT Class 4000 – 1 ½, Paving Concrete.
- f. Base rock shall conform to [Section 201.3.01](#), “Granular Fill.”
- g. Design of concrete joints shall follow the guidelines and requirements outlined in the ACPA publication, “Design and Construction of Joints for Concrete Streets,” except for the following:
 - 1. Maximum joint spacing shall be 12 feet.
 - 2. Joints shall be designed to be skewed 6:1 when meeting the edge of pavement.
 - 3. For transit pads adjoining PCC streets, joints shall match street jointing.
 - 4. For doweled contraction joints, do not lubricate the dowels.
 - 5. Isolation joints shall be used around manhole covers. Isolation joints shall be circular with 2-foot spacing from the manhole cover.

201.2.22 Sight Distance

A clear vision area shall be maintained on each corner of property at the intersection of any two streets, a street and a railroad, or a driveway and a street. Clear vision area shall be in conformance with Section 4.177 of the City Code and this standard. The following specifies the minimum requirements for sight distance for roads that intersect each other, and for driveways that intersect roads:

- a. The minimum intersectional sight distances shall be based on the higher of the following: the design speed, the posted speed, or the measured 85% percentile speed of the road. The intersectional sight distance shall be
 - 1. Based on an eye height of 3.5 feet and an object height of 3.5 feet above the road surface.
 - 2. Measured at the center of the drive lane 15 feet from the nearest edge of the nearest travel lane of the intersecting street.
- b. No structures, plantings, or other obstructions shall be allowed that would impede visibility between the height of 30 inches and 10 feet, as measured from the top of curb, or in absence of a curb, from the established street centerline elevation.

- c. Trees placed in sidewalk planting areas must be located at least 30 feet from the nearest intersection and 10 feet from driveways per **Detail No. RD-1240** of these standards.
- d. Minimum intersectional sight distance for railroad and street intersections shall be in conformance with AASHTO design guidelines.
- e. Minimum intersectional sight distance shall be equal to 10 times the posted speed of the road for grades of 3% or less, as shown in **Table 2.11**. For grades in excess of 3%, sight distances must be adjusted and shall be in conformance with AASHTO design guidelines. For significant road improvement projects, the following intersectional standards shall be met in addition to the AASHTO remaining sight distance standards.

Table 2.11. INTERSECTIONAL SIGHT DISTANCE

Design Speed (mph)	Distance Along Crossroads (feet)
25	250
30	300
35	350
40	400
45	450
50	500

201.2.23 Driveways

Access to private property shall be permitted with the use of driveway curb cuts. The following specifies the minimum requirements for driveways:

- a. Driveways shall conform to **Detail No. RD-1090, Detail No. RD-1095, or Detail No. RD-1100** of these standards; or to **Detail No. RD-1085** of these standards on non-curbed streets.
- b. Driveways shall be designed to meet all applicable rules and regulations of Title III of the Americans with Disabilities Act of 1990 (ADA).
- c. Driveways shall not be permitted on streets with existing non-access reserve strips, or where plat restrictions limit access to the right-of-way, or as set forth in the TSP and Planning Code.
- d. For commercial or industrial developments, driveway access shall be a minimum of 100 feet from the nearest intersection (as measured from near edge of driveway drop

to near face of curb at intersection), unless otherwise approved in writing by the City’s authorized representative.

- e. For residential developments, driveway access from the nearest intersection shall be a minimum of 50 feet (as measured from near edge of driveway drop to near face of curb at intersection) unless otherwise approved in writing by the City's authorized representative.
- f. Driveways on arterial and collector streets shall be minimized, where practicable, and shall be placed first on a lower classification street.
- g. Access spacing, including driveways alleys, & streets, shall be in conformance with [Table 2.12](#).
 - 1. Spacing between driveways is measured between the nearest edges of driveway drops.
 - 2. The desired access spacing shall be adhered to unless otherwise approved by the City’s authorized representative. Deviating from the desired access spacing may be allowed by the City’s authorized representative when aligning with existing driveways, topography constraints, property limitations and safety related issues.

Table 2.12. ACCESS SPACING STANDARDS

Roadway Functional Classification	Access Spacing Desired	Access Spacing Minimum
Major Arterial	1320 feet	1000 feet
Minor Arterial	1000 feet	600 feet
Collector	300 feet	100 feet
Local Street	Access to Each Lot	

- 3. To modify the minimum access spacing, the City Engineer may require an access study prepared and certified by a professional Traffic Engineer registered in the State of Oregon. The access study shall include, at a minimum, the following:
 - (a) Review of site driveway spacing and design.
 - (b) Evaluation of traffic impacts adjacent to the site within a distance specified by the City Engineer.
 - (c) Review of all modes of transportation to the site.

- (d) Mitigation measures where access spacing standards are not met, including but not limited to medians, turning restrictions, driveway consolidation, and shared driveways.
- h. Driveways and alleys shall be constructed to align with existing or planned streets, if the driveway intersects with a street controlled with an existing or planned traffic signal, intersects with an existing or planned arterial or collector street, or would be an extension of an existing or planned street or major driveway. If in the opinion of the City's authorized representative, the driveway and opposing street cannot align due to topography, existing features, or geographic conditions, the driveway and opposing street shall be in alignment as close as possible. Offset alignment that creates danger to the traveling public, such as over-lapping left turn movements, will not be allowed under any circumstances.
- i. The City's authorized representative may limit the number or location of connections to a street, impose access restrictions where the roadway authority requires mitigation to alleviate safety or traffic operations concerns.
- j. Driveways shall not be wider than necessary to safely accommodate projected peak hour trips and turning movements, and shall be designed to minimize crossing distances for pedestrians in accordance with **Detail No. RD-1080, Detail No. RD-1085, Detail No. RD-1090, Detail No. RD-1095, and Detail No. RD-1100** of these standards. The City's authorized representative shall make the final determination of maximum driveway width on a case-by-case basis.
- k. The City's authorized representative may require a driveway to extend to one or more edges of a parcel and be designed to allow for future extension and inter-parcel circulation to allow access to adjacent parcels as part of future development. The owner(s) of the subject site may be required to record an access easement for future joint use of the approach and driveway.
- l. Access driveways shall have a minimum width of 12 feet for one-way traffic and 20 feet for two way traffic. Driveway widths shall meet requirements of TVF&R.
- m. Parking lot drive aisles shall align with the approved access driveway. A clear drive aisle, containing no parking spaces or intersecting drive aisles, shall be provided at all parking lot access driveways in accordance with **Detail No. RD-1105** of these standards and as follows:
 - 1. Within 50 feet of the back of sidewalk or right-of-way boundary, whichever is greater, for access driveways with less than 100 Average Daily Trips (ADT).
 - 2. Within 100 feet of the back of sidewalk or right-of-way boundary, whichever is greater, for access driveways with 100 or more Average Daily Trips (ADT).
 - 3. The clear drive aisle shall not have a width greater than the approved access driveway.

4. The City Engineer may reduce the clear drive aisle length to not less than 20 feet from the back of sidewalk or right-of-way boundary, whichever is greater. The City Engineer may require submission of additional information, including but not limited to a traffic study prepared and certified by a registered professional Traffic Engineer in the State of Oregon. Any reduction in the required clear drive aisle length shall be based on the following:
 - (a) Queuing areas are designed such that vehicles do not obstruct a driveway, fire access lane, walkway, or public right-of-way.
 - (b) On-site circulation is designed in such a way as to not create a safety hazard by reducing the clear drive aisle length.
- n. Detectable warning surfaces shall be provided at the junction between the pedestrian route and the vehicular route where driveways have yield or stop control or incorporate curb ramps or blended transitions into the driveway design.
- o. Grading on driveway approaches shall not exceed 5H:1V within the PUE.
- p. Concentrated surface runoff shall not be allowed to flow from private commercial/industrial property, private access drives, or private alley accessways across public sidewalk and into the public right-of-way.
- q. Driveways intersecting with roads shall meet the minimum sight distance requirements as specified in [Section 201.2.22](#), “Sight Distance.”
- r. Where the addition or modification of a driveway access requires the removal of center landscape median, a new center landscape median shall be constructed at a different location within the City of Wilsonville. The new center landscape median shall be equal in length to the removed center landscape median. The City’s authorized representative shall determine the appropriate location for construction of the new center landscape median.
- s. Where driveway requirements and standards cannot be met due to the location or configuration of an existing building, structure, topography or geographic feature, the existing driveway shall be brought into conformance to the greatest extent feasible as determined by the City’s authorized representative.

201.2.24 Curbs and Grading

The following specifies the requirements for curbs and cross-slope grading for streets:

- a. **Location and Design:** Arterial collector and residential streets shall include curb and gutters on both sides, except in some situations of interim width improvements. Interim designs shall be reviewed and approved on a case by case basis by the City’s authorized representative. Non-mountable curb and gutters shall be required on arterial, collector and residential streets.

- b. **Curb and Gutter Style:** On edges of streets or where designed to carry water, curb and gutter shall be designed in conformance to **Detail No. RD-1055** of these standards for AC streets or **Detail No. RD-1060** of these standards for PCC streets; at street medians or where designed to spill water, curb shall be provided for AC streets and curb and gutter shall be provided for PCC streets in conformance with **Detail No. RD-1065** of these standards. In all cases the gutter shall be a minimum depth of 6 inches or shall match the design depth of the AC or PCC street section.
- c. **Shoulders:** Rural streets or interim width urban streets shall have minimum 6-foot-wide shoulders next to the street, at 2% cross-slope, and roadside ditches next to the shoulders, with a maximum side slope of 2H: 1V. The 6-foot shoulder area shall consist of a minimum of 4 feet of pavement and 2 feet of crushed aggregate.
- d. **Gutter Stamping:** Newly constructed public or private curb and gutters or replaced curb and gutters shall be stamped on the outer face of the gutter pan with the capital letters “SS” at the location of each sanitary lateral crossing, the capital letters “SD” at the location of each storm drain lateral crossing, the capital letter “W” at the location of each water line crossing, the capital letter “C” at the location of each conduit crossing, and the capital letter “F” at the location of each City fiber crossing. Letters shall be 3 inches in height and embossed a minimum of 1/8-inch deep.
- e. **Root Barriers:** Where trees are located within 8 feet of public curbs, the curb shall be protected from root intrusion with a root control barrier system designed by a Professional Landscape Architect registered in the State of Oregon; root control barrier shall be approved by the City’s authorized representative before installation. Generally, the root control system should be installed a minimum of 24 inches deep, with a minimum 20-foot length centered on the root source. Installation of such systems shall be done so as to not disturb the existing finish materials or base rock previously installed. Provide landscaping plan showing location of root control barrier system.
- f. **Grading, Collector and Arterial Streets:** Grading outside the improved areas shall be as follows: Minor collector or higher functional classification shall have a 2% upward grading to the right-of-way line, a 5H:1V upward or downward grading within the public utility easement, and no steeper than 1½H:1V up or 2H:1V down outside the right-of-way. Retaining walls shall be used if slopes are greater than the 1½H: 1V to a height where the slope is no more than 1½H: 1V.
- g. **Grading, Residential and Rural Streets:** Residential streets and rural roads beyond the swale shall have a 2% upward grading to the right-of-way line, a 5H:1V upward or downward grading within the public utility easement, and no steeper than 1½H:1V up or 2H:1V down, outside the public utility easement. Retaining walls shall be used if slopes are greater than the 1½H: 1V to a height where the slope is no more than 1½H: 1V.
- h. **Cross- slope:** Cross-slope of the street section shall be in conformance with [Section 201.2.11.c](#), “Horizontal Alignment.”

201.2.25 Sidewalks

The following specifies the requirements for sidewalks:

- a. **Location and Design:** The location of sidewalks shall be based on the City of Wilsonville TSP, the City's Bicycle and Pedestrian Master Plan, and as required by the Planning Department, in accordance to subsection 4.177, "Street Improvement Standards," of the Wilsonville Code.
 1. A pedestrian access route shall be provided within sidewalks, pedestrian street crossings, curb ramps and other pedestrian circulation paths located in the public right-of-way. The pedestrian access route shall connect to all accessible elements, spaces, and facilities that connect building and facility entrances to public streets and sidewalks.
 2. The pedestrian access route shall be designed and constructed in accordance with the rules and regulations of Title III of the Americans with Disabilities Act of 1990 (ADA).
 3. Sidewalks shall be designed with a minimum width of 5 feet and clear width of 4 feet or as designated in the TSP, whichever is greater, exclusive of curb and obstructions. Sidewalk width may be required to be wider than 5 feet in Commercial Zones. Actual designed sidewalk width shall be determined by the City Engineer.
 4. Sidewalk thickness, slope, finish work, and location of expansion and contraction joints shall be as specified in **Detail No. RD-1075** of these standards.
 5. Final facility location and design are subject to the approval of the City's authorized representative, unless otherwise stated.
 6. Sidewalks shall have a light broom finish transverse to the line of travel.
 - (a) Sidewalk joints in new construction shall be finished with a 3-inch wide shine for sidewalks less than and including 6 feet in width.
 - (b) Sidewalk joints in areas of infill and replacement shall be finished to match existing adjacent sidewalk.
- b. **Separation:** Sidewalks shall be separated from the roadway through the use of landscape strips in accordance with the City of Wilsonville TSP. Sidewalk separation from the street shall be provided in accordance with [Table 2.13](#).
 1. The combined planter strip and sidewalk width shall not be less than the minimum provided in the Require Planter Strip + Sidewalk Width column of [Table 2.13](#).

2. In cases of extreme topography, protection of existing trees, and existing structures, the City Engineer may reduce the combined planter strip and sidewalk width to no less than the Minimum Sidewalk Width column of [Table 2.13](#) or require that the sidewalk to swing curb tight or outside of the right-of-way in a public easement. The length and reduction of the combined width and change in alignment shall be the minimum necessary to bypass the conflicting topography, tree, and/or structure,

Table 2.13. SIDEWALK SEPARATION FROM ROADWAY

Street Classification	Required* Planter Strip + Sidewalk Width	Minimum Sidewalk Width	Minimum** Planter Strip Width	Combine to Full Sidewalk Width with Tree Wells
Major Arterial	13.5' – 16.5'	5'	6'	Yes
Minor Arterial	13.5' – 15.5'	5'	6'	Yes
Collector	11.5' – 13.5'	5'	5'	Yes
Local	10.5' – 12'	5'	5'	No
LID Local	10.5' - 12'	5'	5'	No

* Width includes the width of the curb.

** The minimum planter width that incorporates a water quality swale is 6.5'.

- c. **Easements:** All public-owned pedestrian facilities shall be constructed within a public right-of-way or an easement. All new development or redevelopment shall consider access to adjacent properties in their development plans, especially schools, retail, and commercial areas. Easements shall be provided as necessary for compliance with the ADA Standards for Accessible Design.
- d. **Access Ramps:** Access ramps shall be included in the design of sidewalks at all corners of all intersections, regardless of curb type or terrain.
 1. A curb ramp shall connect the pedestrian access route to each pedestrian street crossing. For example, a street intersection with pedestrian street crossings in each direction shall have two separate curb ramps, one for each pedestrian street crossing.

2. The curb ramp, excluding flared sides, shall be contained wholly within the width of the pedestrian street crossing served.
 3. In alterations where existing physical constraints prevent compliance with this requirement, the City’s authorized representative may approve use of a single diagonal curb ramp to serve both pedestrian street crossings.
 4. Ramps shall conform to **Detail No. RD-1110 – Detail No. RD-1140** of these standards and shall have a smooth transition at the gutter line.
- e. **Pedestrian Street Crossings:** Pedestrian street crossings shall be included in the design of sidewalks and street intersections, regardless of terrain.
1. The location of a pedestrian street crossings shall be determined by the City’s authorized representative.
 2. Where pedestrian street crossings at intersections are prohibited, “No Pedestrian Crossing” signs shall be provided along with detectable features. Signage is not required where location of urban design features and/or landscaping clearly indicates a street crossing is not allowed.
 3. The pedestrian street crossing distance shall be minimized whenever possible through the installation of curb extensions, center median refuge, island refuge, and other devices as approved or required by the City’s authorized representative.
- f. **Thickened Design:** At all intersections adjacent to the curb radius, curb-tight sidewalks and sidewalk ramps shall be constructed with a similar section as shown for a residential driveway (see **Detail No. RD-1090** of these standards).
- g. **Root Barriers:** Where trees are located within 8 feet of public sidewalks, the sidewalk shall be protected from root intrusion with a root control barrier system in accordance with [Section 201.2.24.e](#) “Root Barriers”.
- h. **Urban Design Features:** Urban design features including, but not limited to street trees, furniture, kiosks, trash receptacles, directional signage, and bicycle amenities, shall be provided when required by the City Engineer. Urban design features will be provided, located, and installed in accordance with the rules and regulations of Title III of the Americans with Disabilities Act of 1990 (ADA).

201.2.26 On-Street Parking

The following specifies the requirements for on-street parking:

- a. The location of on-street parking shall be based on the City of Wilsonville TSP and where directed by the City’s authorized representative.
- b. On-street parking shall not be permitted on arterial roadways.

- c. On-street parking is permitted on one or both sides of collector roadways. The minimum width of an on-street parking strip on a collector road is 7 feet.
- d. On-street parking is required on local streets, on one or both sides, as determined by the City Engineer. The minimum street width (curb to curb) for a local street is 32 feet for parking on both sides and 28 feet for parking on one side.
- e. On-street parking is permitted on Low Impact Development (LID) local streets, on one or both sides, as determined by the City Engineer. The minimum street width (curb to curb) for a LID local street is 28 feet for parking on both sides, 24 feet for parking on one side, and 20 feet for no on-street parking.
- f. On-street parking shall be located outside the curb return radii of intersections and pedestrian street crossings, whichever is furthest from the intersection.
- g. Where on-street parking is provided on the block perimeter and the parking is marked or metered, accessible parking spaces shall be provided in accordance with [Table 2.14](#).

Table 2.14. ACCESSIBLE ON-STREET PARKING SPACES

Total Number Marked or Metered On-Street Parking Spaces	Minimum Required Number of Accessible On-Street Parking Spaces
1 to 25	1
26 to 50	2
51 to 75	3
76 to 100	4
101 to 150	5
151 to 200	6
201 and over	4% of total

201.2.27 Bicycle and Shared-Use Path Facilities

The following specifies the requirements for bicycle and shared-use path facilities:

- a. **Types:** Bicycle routes throughout the City shall consist of the following types of facilities.
 - 1. Bike lanes adjacent to motor vehicle travel lanes and local street bikeways that share the travel lane with motor vehicle traffic.
 - 2. Alternative bicycle facilities consist of buffered bike lanes, cycle tracks, and other bike facilities that provide buffers between bike and motor vehicle travel lanes typically on roadways with high traffic volumes.

3. Shared-use paths, including regional trails, consist of facilities for multiple non-motorized users, typically within a separate right-of-way, with minimal conflicts with automobile traffic.
- b. **Location:** The location of bicycle and shared-use path facilities shall be based on the City of Wilsonville TSP, the City’s Bicycle and Pedestrian Master Plan, and as required by the Planning Department, in accordance to subsection 4.177, “Street Improvement Standards,” of the Wilsonville Code.

Alternative bicycle facilities, such as buffered bike lane and cycle tracks, shall be considered for incorporation into design of Arterial streets in place of typical bike lanes. The City Engineer shall determine locations where alternative bicycle facilities will be utilized in consultation with the National Association of City Transportation Officials (NACTO) Urban Bikeway Design Guide.

- c. **Design Standards:** Bicycle and shared-use path facilities shall be designed in accordance with 2011 ODOT Bicycle and Pedestrian Design Guide, 2012 AASHTO Guide for the Development of Bicycle Facilities, NACTO Urban Bikeway Design Guide, and the City of Wilsonville Bicycle and Pedestrian Master Plan.

Bicycle and shared-use path facilities shall be designed and constructed in accordance with the rules and regulations of Title III of the Americans with Disabilities Act of 1990 (ADA). The City authorized representative may allow nature trails to be designed to Accessibility Guidelines for Outdoor Developed Areas when applicable.

- d. **Drainage Grates:** The following specify the minimum design requirements for drainage grates on bike facilities and shared use paths.
 1. Curb inlets shall be utilized to the extent possible on streets designated for bicycle facilities.
 2. Where grated inlets are necessary, the grates shall be installed flush with the adjacent street surface and drainage grates shall be bicycle safe and hydraulically efficient.
 3. Grate inlets shall be identified with a pavement marking in accordance with [Section 201.2.27.g](#), “Signage and Pavement Markings”.
- e. **Railroad Crossings:** The following specify the minimum design requirements for bike facilities and shared use paths crossing railroad tracks.
 1. Bicycle facilities and shared-use paths should be designed to cross railroad tracks at right angles.
 2. Where the crossing angle is less than 45 degrees, bicycle facilities and shared-use paths shall be designed with additional width to allow bicyclists to cross the tracks close to a 90 degree angle. The additional width can be provided within the

bike lane or by providing access onto an adjacent wide sidewalk to make the crossing.

3. Where additional lane width to provide a crossing close to a 90 degree angle cannot be provided, commercially available compressible flange fillers shall be installed.
- f. **Root Barriers:** Where trees are located within 8 feet of bicycle facilities and shared-use paths, the surface material shall be protected from root intrusion with a root control barrier system in accordance with [Section 201.2.24.e](#) “Root Barriers”.
- g. **Signage and Pavement Markings:** The following specify the minimum signage and pavement marking requirements for bike facilities and shared use paths.
 1. Signage and pavement markings for bicycle facilities and shared-use paths shall be provided in accordance with the most current edition of the MUTCD, Part 9.
 2. Shared-use paths shall be striped in accordance with **Detail No. RD-1165** of these standards.
 3. Striping and pavement markings shall be skid resistant.
- h. **Bicycle Facility Design:** The following specify the minimum design requirements for bicycle facilities.
 1. Bike Lanes
 - (a) Bike lanes shall be one-way facilities and carry bicycle traffic in the same direction as adjacent motor vehicle traffic.
 - (b) Bike lanes shall be 6 feet in width. In alterations of existing streets, the City’s authorized representative may reduce the required bike lane width to 5 feet when the existing street is physically constrained or when a bike buffer line is added.
 - (c) A minimum clear riding zone width of 4-feet shall be maintained between the longitudinal joint of the asphalt pavement and concrete gutter. In alterations of existing streets, the City’s authorized representative may reduce the required clear riding zone width to 3 feet when the existing street is physically constrained or when a bike buffer line is added.
 2. Local Street Bikeways
 - (a) Local street bikeways shall incorporate design elements recommended in the design standards referenced in [Section 201.2.27.c](#), “Design Standards.”

- (b) The City’s authorized representative shall determine the required design elements that include, but are not limited to, sharrows, traffic calming devices, and wayfinding signage.

3. Roadway Speed Reduction

On residential streets with designated pedestrian and/or bike facilities, the design and posted speed may be reduced to 20 miles per hour in accordance with [Section 201.1.04.g.3](#), “Design Speed.”

- i. **Shared-Use Path Design:** The following specify the minimum design requirements for shared use path facilities.

1. Dimensions

- (a) Shared-use paths located in exclusive right-of-way shall have a right-of-way or public easement a minimum width of 18 feet. In locations that are physically constrained, the City’s authorized representative may reduce the right-of-way / easement width to a minimum 14 feet.
- (b) Shared-use paths adjacent to roadways shall be separated by a minimum 5-foot wide landscaped buffer. The City Engineer may allow vertical separation between the shared-use path and adjacent roadway in lieu of the landscape buffer at locations that are physically constrained.
- (c) Shared-use paths shall be constructed of asphalt concrete or portland cement concrete surface, as determined by the City’s authorized representative.
- (d) Shared-use paths shall be 12 feet wide with a clear distance width of 3 feet on each side of the path. In locations that are physically constrained, the City’s authorized representative may reduce the shared-use path width to a minimum 10 feet and the clear distance width to 2 feet.
- (e) Natural trails shall be constructed of materials that are firm and stable, including asphalt concrete, portland cement concrete, compacted gravel and soil, and wood boardwalk.
- (f) Nature trails shall have a right-of-way or public easement width between 12 feet and 15 feet.
- (g) The surface of nature trails shall have a width between 3 feet and 12 feet, to be determined by the City Engineer based on the type and volume of expected uses.
- (h) The minimum overhead clearance, excluding trees and vegetation, along shared-use paths is 10 feet. Provide landscaping clearances in accordance with [Section 201.2.27.i.5.\(c\).ii](#), “Landscaping.”

- (i) Regional trails shall be constructed to the dimensions identified in the associated Master Plan for each individual trail.

2. Grade

- (a) The running grade of a shared-use path adjacent to a street shall not exceed the general grade established for the street.
- (b) The running grade of a shared-use path within an exclusive right-of-way or easement shall not exceed 5%. Compliance to the extent practicable is required when compliance with the maximum allowed grade is not practicable due to:
 - i. Existing terrain or infrastructure
 - ii. Right-of-way availability
 - iii. Notable natural feature
 - iv. Precluded by federal, state, or local laws the purpose of which is to preserve threatened or endangered species, environment, and archaeological, cultural, historical, or significant natural features, compliance is required to the extent practicable.
- (c) In areas of steep terrain, the shared-use path shall meander along the path alignment to attain reasonable grades for steep slope ascent. In no case shall the downhill approach grade of a shared-use path exceed 5% for a distance of 50 feet before an intersection.
- (d) The cross slope of a shared-use path shall not exceed 2%.
- (e) The gradient of the side clear areas shall not exceed 6H:1V.

3. Materials

- (a) The City Engineer may require subgrade to be sterilized with a suitable non-environmentally hazardous herbicide that is approved by the City of Wilsonville Public Works Department, in cooperation with the Natural Resources Program.
- (b) The wearing surface of AC pavement shall conform to the Oregon Department of Transportation Standard Specifications for Construction (ODOT SSC) Section 00745, “Asphalt Concrete Pavement(ACP),” for Level 2 - ½” Hot Mix Asphalt Concrete (HMAC). The pavement design shall be a minimum 3 inches of HMAC over a 4-inch thick base consisting of ¾”-0 crushed aggregate backfill, meeting the requirements of [Section 201.3.01](#), “Granular Fill”. Where shared-use paths provide occasional vehicular access, the City’s authorized representative shall require minimum 4-inches

of HMAC or thicker pavement design where anticipated loading conditions warrant.

- (c) The wearing surface of PCC pavement shall conform to the ODOT Class 3300 – ¾, Commercial Grade Concrete. The pavement design shall be a minimum 6 inches of PCC over a 6-inch base consisting of ¾”-0 crushed aggregate backfill, meeting the requirements of [Section 201.3.01](#), “Granular Fill”. At locations where shared-use paths provide occasional vehicular access, the City’s authorized representative shall require a thicker pavement design based on anticipated loading conditions
- (d) Shared-use path finish work and location of expansion and contraction joints shall be as specified in **Detail No. RD-1165** of these standards.
- (e) Where trees are located within 8 feet of a shared-use path, the shared use path shall be protected from root intrusion with a root control barrier system in accordance with [Section 201.2.24.e](#), “Root Barriers”.

4. Handrails

Shared-use paths constructed adjacent to slopes greater than 3H:1V and a change of elevation greater than 18 inches shall be protected with an approved system to be reviewed and approved by the City’s authorized representative.

5. Landscaping

- (a) Landscaping shall be provided along multi-use paths and recreational trails. Selection of trees, shrubs, and ground cover should include low-maintenance varieties that are drought tolerant and require little pruning. Shrubs should be low growing (under 3 feet at mature height). Location and placement of plant materials should not result in growth over or onto the path surface.
- (b) All proposed plant materials shall be approved by the City of Wilsonville. All landscaping, signs, and other potential obstructions shall be set back a minimum of 1 foot from the edge of the pathway surface. No exposed rock shall be permitted within 2 feet of the pathway surface. All exposed earth within 2 feet of the pathway surface shall be planted with grass, sod, or covered with 2” of bark dust.
- (c) A number of important design considerations should be reviewed when selecting materials and planning planting schemes. Trees are of primary concern regarding location and variety. Specifically, placement and selection of trees should evaluate the following:
 - i. Tree rooting characteristics - to avoid potential path surface upheaval.

- ii. Tree size - trees shall be of satisfactory caliper to permit a minimum vertical clearance of 8 feet to the lowest branch. The clearance shall be a minimum of 10 feet where vehicular traffic is expected.
- iii. Tree placement - to avoid creating hiding areas or permitting foliage to block path lighting, trees shall be located a minimum of 10 feet from path lighting fixtures.

6. Urban Design Features

Urban design features including, but not limited to street trees, furniture, kiosks, trash receptacles, directional signage, and bicycle amenities, shall be provided when required by the City Engineer. Urban design features will be provided, located, and installed in accordance with the rules and regulations of Title III of the Americans with Disabilities Act of 1990 (ADA).

7. Lighting

Lighting shall be provided on shared-use paths, excluding locations as determined by the City Engineer. The City Engineer shall determine when nature trails shall have lighting based on the type and volume of expected uses. Lighting shall meet the requirements of [Section 201.9.02](#), “Shared-Use Path Lighting.”

201.2.28 Street Trees

The following specify the minimum requirements for the location and placement of street trees:

- a. Street trees shall be provided in accordance with Section 4.176.06(D) of the Wilsonville Code.
- b. Street trees shall be located in accordance with **Detail No. RD-1240** of these standards.

201.2.29 Guardrails

The following specify the minimum requirements for the location and type of guardrails:

- a. The decision whether to install a guardrail shall be based on information in the AASHTO Roadside Design Guide.
- b. Guardrails shall be designed in conformance with AASHTO design guidelines and constructed according to ODOT SSC Section 00810, “Metal Guardrail.”

201.2.30 Roadside ditches

Roadside ditches shall be designed in conformance with [Section 301.6.02.i](#), “Channel Design.”

201.2.31 Utilities

The following specifies the minimum requirements for utilities:

- a. Franchised utilities shall be located underground, preferably in a public utility easement, outside the paved road and sidewalk if possible, to avoid future cuts in paved roads.
- b. A Public Utility Easement (PUE) shall be required adjacent to right-of-ways on all frontages to public roadways; PUE widths shall be as provided in [Section 101.8.14](#), “Easements,” and the detail drawings. PUE’s may cross or run parallel to City pipeline easements, but shall not coincide with a City pipeline easement. PUE’s shall be graded as per [Section 201.2.24](#), “Curbs and Grading,” from back of curb or sidewalk unless otherwise approved by the City’s authorized representative. Earthen berms or any other encroachments are not allowed within a PUE.
- c. On all phased (interim) road improvements, the necessary utilities shall be stubbed across the interim improvement to assure that cuts are not necessary when the road is expanded to its full width. A 5-year moratorium will prohibit street cuts on all projects. The moratorium begins when a project is complete and the warranty begins. Check with the City Engineering Division for a current list of streets on the 5-year moratorium.
- d. Except for sanitary sewers, storm drainage and water mains, underground utilities intended to provide direct service to adjacent properties with future connections shall not be located in the full-width paved section of a street to be constructed. If all service connections are installed and extended beyond the full-width section before the street is paved, franchised utilities can be located in the paved section, if approved by the City's authorized representative.
- e. Underground utilities being constructed along existing paved streets shall not be located under the existing pavement, unless approved by the City’s authorized representative. Underground utilities that must cross an existing paved street shall not be installed by any method that cuts the pavement, unless approved by the City’s authorized representative.
- f. Underground utilities shall be buried a minimum depth of 36 inches, measured from finished grade to top of utility.
- g. Streetlights shall be located as required to provide proper illumination but shall not physically or visually interfere with vehicle or pedestrian traffic. All installation of streetlights shall be done in accordance with [Section 201.9.00](#), “Lighting.”

201.2.32 Traffic Signals

Traffic signals shall be designed in accordance with Section 260.2 of the most current Clackamas County Roadway Standards. In addition to these standards, the Project

Engineer shall design traffic signal infrastructure to accommodate installation of the City's fiber/communications network.

201.3.00 MATERIAL SPECIFICATIONS

201.3.01 Granular Fill

- a. Crushed aggregate for base rock, leveling course, and surface replacement shall consist of an aggregate base as specified by the design engineer, with approval of the City's authorized representative, and shall be in conformance with ODOT SSC Section 02630, "Base Aggregate," for gradation, fractured faces, and durability.
- b. The leveling course shall consist of ¾"-0" grade crushed aggregate material, and be a minimum thickness of 2 inches when compacted.
- c. The aggregate shall consist of uniform-quality, clean, tough, durable fragments of rock or gravel, free from flat, elongated, soft, or disintegrated pieces, and other objectionable matter occurring either free or as a coating on the stone.
- d. Gradation requirements of the crushed aggregate shall be in conformance with ODOT SSC Section 02630, "Dense-Graded Aggregate," as indicated in [Table 2.15](#). Sieve analysis shall be determined according to AASHTO T-27.

201.3.02 Asphalt Concrete

- a. Courses of asphalt concrete pavement shall consist of the following unless otherwise specified by the design engineer and approved by the City Engineer.
 1. The wearing surface of AC pavement shall consist of ½" Warm Mixed Asphalt Concrete (WMAC), conforming to ODOT SSC Section 00745; "Asphalt Concrete Pavement (ACP)".
 2. The base courses for AC pavement shall consist of ¾" Warm Mixed Asphalt Concrete (WMAC) conforming to ODOT SSC Section 00745, "Asphalt Concrete Pavement (ACP)".
 3. The AC pavement shall be either Level 2 or Level 3 ACP, as determined by [Section 201.2.05](#), "Asphalt Pavement Design".
- b. Asphalt cement shall be 85-100 penetration paving asphalt conforming to ASTM D-946.
- c. Liquid asphalt for use as a prime coat under AC shall be RC-70 rapid-curing liquid asphalt conforming to AASHTO M-81, or MC-70 medium-curing liquid asphalt conforming to AASHTO M-82.
- d. Warm Mix Asphalt Concrete (WMAC) shall incorporate the additives or processes listed in [Table 2.16](#).

- e. Hot Mixed Asphalt Concrete (HMAC) shall not be used unless specifically permitted by the City Engineer.

Table 2.15. GRADATION REQUIREMENTS FOR GRANULAR FILL

Sieve Size	2 ½" - 0	2" - 0	1 ½" - 0	1" - 0	¾" - 0
	Percent Passing				
2 ½"	95 – 100	100			
2"	--	95 – 100	100		
1 ½"	--	--	95 – 100	100	
1 ¼"	55 – 75	--	--	--	
1"	--	55 – 75	--	90 – 100	100
¾"	--	--	55 – 75	--	90 – 100
½"	--	--	--	55 – 75	--
3/8"	--	--	--	--	55 – 75
¼"	30 – 45	30 – 45	35 – 50	40 – 55	40 – 60
U.S. No. 10 sieve	12 – 27	12 – 27	14 – 30	16 – 33	16 – 36
U.S. No. 40 sieve	0 – 16	0 – 16	3 – 18	8 – 24	8 – 24
U.S. No. 200 sieve (wet sieving)	0 – 9	0 – 9	0 – 8	0 – 8	0 – 10

Note: All percentages are by weight. Material passing the U.S. No. 200 sieve shall have a maximum plasticity index of 6 when tested according to AASHTO T-90.

Table 2.16. WMAC ADDITIVES AND PROCESSES

WMAC Technology	Process Type	Supplier
Advera (Synthetic Zeolite)	Foaming Process	PQ Corporation
Aspha-min (Synthetic Zeolite)	Foaming Process	Aspha-Min
Evotherm	Chemical Additive	Mead Westvaco Asphalt Innovations
Redi-Set WMX	Chemical Additive	Akzo Nobel Surfactants, Inc.
Sasobit	Organic Additive	Sasol Wax Americas, Inc.
Plant Foaming Equipment	Foaming Process	Various Suppliers

201.3.03 Portland Cement Concrete

- a. PCC for concrete pavement shall conform to [Section 201.2.06.h](#), “Portland Cement Concrete Design.”
- b. PCC for curbs, sidewalks, driveways and miscellaneous construction shall conform to [Section 201.2.06.i](#), “Portland Cement Concrete Design.”
- c. All forms for curbs and sidewalks shall be 2-inch dimensioned lumber, plywood, or metal forms. Forms for curb and sidewalk radii shall consist of bender board as approved by the City’s authorized representative. Forms on the face of the curb shall have no horizontal form joints within 7 inches of the top of the curb. All forms shall be approved by the City’s authorized representative.
- d. Reinforcement steel shall conform to ASTM A-615, Grade 40, deformed bars.

201.3.04 Segmental Concrete Pavers

Materials for segmental concrete paver streets shall be in conformance with [Section 201.2.07](#), “Segmental Concrete Paver Design.”

201.4.00 CONSTRUCTION SPECIFICATIONS

201.4.01 General Provisions

The specifications in this chapter and any other applicable requirements of the City shall govern the character and quality of material, equipment, installation, and construction procedures for roadway construction or improvements.

201.4.02 Scheduling

The contractor shall plan their construction work in conformance with [Section 101.8.02](#), “Scheduling.”

201.4.03 Environmental Protection, Erosion Prevention, and Sediment Control

The contractor shall take all appropriate measures and precautions to minimize their impact on the environment and control erosion, as outlined in [Section 101.9.00](#), “Environmental Protection, Erosion Prevention, and Sediment Control.”

201.4.04 Interferences and Obstructions

Various obstructions may be encountered during the course of the work. The contractor shall follow the guidelines established in [Section 101.8.05](#), “Interferences, Obstructions, Abandoned Utilities.”

201.4.05 Contaminated Soil or Hazardous Material

If during construction contaminated soil, hazardous materials or chemicals are encountered, the Contractor shall follow the procedures specified in [Section 101.9.02](#), “Contaminated Soils or Hazardous Materials.”

201.4.06 Trench Excavation, Preparation, and Backfill

Trench excavation, preparation, and backfill shall conform to the requirements of [Section 6](#), “Trench Excavation and Backfill.”

201.4.07 Steel Plates

Where excavated trenches located in the right-of-way are not backfilled at the end of the construction day, the trench shall be covered with Steel Plates, in accordance with **Detail No. S-2146** of these standards. Use of Steel Plates shall conform to [Section 101.8.02.b.7](#), “Progress of Construction.”

201.4.08 Preservation, Restoration, and Cleanup

Cleanup of all construction debris, excess excavation, and excess materials and complete restoration of all fences, mailboxes, ditches, culverts, signposts, and similar items shall be completed according to [Section 101.8.16](#), “Preservation, Restoration, and Cleanup.”

201.5.00 WORKMANSHIP

201.5.01 Demolition

Debris from the demolition of pavement, sidewalks, curbs, or gutters shall be ground and recycled or hauled off site and disposed of in a manner approved by the City’s authorized representative.

201.5.02 Clearing and Grubbing

- a. Brush shall be cut as near to the ground surface as practicable and removed to a disposal site approved by the City’s authorized representative. Under no condition shall excavated materials be permitted to cover brush before the brush is cleared and disposed of. Ground surface shall be stripped of all organic soil and unsuitable material as recommended in the Street Design Report. Stripping operations shall be approved by the City’s authorized representative prior to proceeding with any construction activity.
- b. Erosion-prevention and sediment-control measures shall be installed before the start of clearing and grubbing (see [Section 101.9.00](#), “Environmental Protection, Erosion Prevention, and Sediment Control”). The applicant shall call the City’s authorized representative for inspection and approval of all erosion-prevention and sediment-control measures before beginning any site clearing, grubbing, or grading.

201.5.03 Subgrade

Subgrade shall be prepared according to the recommendations in the Street Design Report and must be approved by the City's authorized representative.

- a. The subgrade shall be firm and free of roots and deleterious materials.
- b. A proof-roll of the subgrade using a 10 cubic yard dump truck, fully loaded with rock, or equivalent loaded vehicle shall be observed by the City's authorized representative and the geotechnical engineer of record. Soft areas shall be repaired or replaced and re-proof rolled until the subgrade is deemed satisfactory by the City's authorized representative and approved by the geotechnical engineer of record. During periods of wet weather, the proof-roll shall occur after placement of the base course material in accordance with [Section 201.5.04](#), "Base and Leveling Course."

201.5.04 Base and Leveling Course

Base and leveling course shall consist of crushed aggregate as specified in [Section 201.2.04](#), "Crushed Aggregate Design" and [Section 201.3.01](#), "Granular Fill."

- a. Base and leveling aggregate material shall be placed and compacted to the required depth of finished pavement and for proper matching with the adjacent existing pavement.
- b. Material shall be compacted to 95% of the maximum dry density, as determined by AASHTO T-180 and acceptable testing reports provided to the City.
- c. A proof-roll of the base and leveling courses using a 10 cubic yard dump truck, fully loaded with rock, or equivalent loaded vehicle shall be observed by the City's authorized representative. Soft areas shall be repaired or replaced and re-proof rolled until the base and leveling courses are deemed satisfactory by the City's authorized representative.

201.6.00 CONSTRUCTION PROCEDURE

- a. The geotechnical engineer reserves the right to vary the classes of backfill and the type of resurfacing as best serves the interest of the City, with the approval of the City's authorized representative. Subgrade shall be approved in conformance to [Section 201.5.03](#), "Subgrade". Base rock shall be approved by the City's authorized representative prior to placement of asphalt concrete, Portland cement concrete or Segmental Concrete Pavers.
- b. A state approved mix design for asphalt concrete or Portland cement concrete shall be submitted to the City's authorized representative for approval a minimum of seven calendar (7) days prior to placement taking place.
- c. PCC for concrete pavement shall conform to [Section 201.2.06.h](#), "Portland Cement Concrete Design."

- d. PCC for curbs, sidewalks, driveways and miscellaneous construction shall conform to [Section 201.2.06.i](#), “Portland Cement Concrete Design.”
- e. Testing shall be in conformance with [Section 201.6.07](#), “Testing.”
- f. Portland cement concrete whose batch time exceeds 90 minutes and has not yet been placed may be refused by the City’s authorized representative.
- g. Segmental concrete pavers, bedding sand, joint sand, base aggregate and sub-base aggregate shall conform to [Section 201.2.07](#), “Segmental Concrete Paver Design.”

201.6.01 Curb and Gutter

- a. Curb and gutter shall be installed as per **Detail No. RD-1055** of these standards with asphalt pavement, or **Detail No. RD-1060** of these standards with PCC pavement.
- b. When medians are specified, curb and gutter shall be installed as per **Detail No. RD-1065** of these standards.
- c. At no time shall construction equipment or traffic be allowed on new curb and gutter until laboratory tests indicate that at least 90% specified design strength ([Section 201.2.06.i](#), “Portland Cement Concrete Design”) has been attained; this includes installation of adjacent asphalt pavement.
- d. Curb and gutter jointing shall match adjacent PCC street pavement jointing. Joint locations shall be installed per **Detail No. RD-1060** of these standards and staked per [Section 201.1.06](#), “Surveying.”

201.6.02 Asphalt Pavement

- a. **Prime Coat:** After the leveling course is compacted, an asphalt prime coat, as specified in [Section 201.3.02](#), “Asphalt Concrete,” shall be applied to the edges of the existing pavement and curb and gutter. Also, cast iron manhole frames and cleanout frames shall be tack-coated below grade.
- b. **Temperature:** The temperature of the HMAC during mixing, placement, or while in storage shall not exceed 350°F and shall not be less than 240°F as per ODOT SSC Section 00745.43, “Drying and Heating Aggregates.”

For Warm Mix Asphalt Concrete (WMAC), complete breakdown and intermediate compaction before the WMAC temperature drops below the threshold recommended by the additive supplier or equipment manufacturer. The temperature of the WMAC shall not be less than 215°F as per ODOT SSC Section 00745.43, “Drying and Heating Aggregates.”

- c. **Storage:** Asphalt storage shall meet requirements of ODOT SSC Section 00745.44, “Asphalt Concrete Pavement Storage.”

- d. **Thickness:** Minimum total thickness of AC shall be 4 inches placed in two 2-inch lifts. Place AC after the prime coat has set. If the thickness is greater than 6 inches, place the asphalt in three lifts. Maximum lift thickness shall be 3 inches. Spread and level the AC with use of a self-propelled machine or hand tools, depending on the size of the area to be paved. Bring the AC to the proper grade and compact by rolling, or use hand tampers where rolling is not possible.
- e. **Placement:** Asphalt concrete shall be placed according to the following minimum requirements.
 - 1. Prior to placing asphalt concrete, all cold edges of existing asphalt concrete shall be sawcut to provide a clean joint to pave against.
 - 2. Lay the AC mixture in strips of such width as to hold to a practical minimum the number of longitudinal joints required. Joints shall not be located in wheel paths.
 - 3. The longitudinal joints in any layer of pavement shall be offset from those joints in layers below by not less than 1-foot.
 - 4. The lateral joints in any layer of pavement shall be offset from those joints in layers below by not less than 3 feet. Where new AC ties into existing asphalt concrete, the existing AC shall be ground the thickness of the new AC lift along the lateral joint a minimum of 3 feet in width for each lift of new AC installed.
- f. **Compaction:** Compact asphalt concrete in accordance with the following minimum requirements.
 - 1. Roll asphalt concrete with power rollers capable of providing compression of 350 pounds per linear inch.
 - 2. Begin rolling from the outside edge of the replacement and progress toward the existing surfacing, lapping the existing surface at least half the width of the roller. If the existing surfacing bounds both edges of the replacement, begin rolling at the edges of the replacement, lapping the existing surface at least half the width of the roller and progressing toward the center of the replacement area. Overlap each proceeding track by at least half the width of the roller and make sufficient passes over the entire area to produce the desired result.
 - 3. AC pavement shall be compacted to a minimum of 92% relative density, based on the theoretical maximum density determined in accordance with ASTM D-2041, "Rice Gravity."
- g. **Finished surface:** The finished surface of the new compacted paving shall be flush with the existing surface and shall conform to the grade and crown of the adjacent pavement.

201.6.03 Portland Cement Concrete Pavement

- a. Construction of PCC pavement shall be in conformance with the guidelines in ODOT SSC Section 00756, “Plain Concrete Pavement.”
- b. Construction of concrete joints shall follow the guidelines and requirements outlined in the ACPA publication, “Design and Construction of Joints for Concrete Streets,” except for the following:
 1. Maximum joint spacing shall be 12 feet.
 2. Transverse joints shall be designed to be skewed 6:1 when meeting the edge of pavement, at the gutter line.
 3. For doveled contraction joints, do not lubricate the dowels.
 4. Staking of curb joints shall be required and performed by or under the direction of a Professional Land Surveyor registered in the State of Oregon.
 5. Isolation joints shall be used around manhole covers. Isolation joints shall be circular with 2-foot spacing from the manhole cover.
- c. All joints shall be hot air lanced and moisture evaporated prior to sealing of joints.
- d. All joints shall be sealed in conformance with the ACPA publication, “Design and Construction of Joints for Concrete Streets.”
- e. The surface finishing and smoothness of PCC surfaces shall follow the guidelines outlined in ODOT SSC Section 00756.49, “Surface Finishing” and ODOT SSC Section 00756.55, “Surface Tolerance, Testing, and Correction.”
- f. At no time shall construction equipment or traffic be allowed on the new pavement until laboratory tests indicate that at least 90% specified design strength ([Section 201.2.06.h](#), “Portland Cement Concrete Design”) has been attained and the City’s authorized representative and the design engineer agree that the street is ready for traffic and construction loads.

201.6.04 Segmental Concrete Pavers Installation

- a. The installer shall have a minimum of two years of experience with similar installations and provide to the City job references from projects of a similar size and complexity. Provide Owner/Client/General Contractor names, postal address, phone, and email address and location of previous jobs. The contractor shall present this list of similar installations to the City for approval a minimum of seven days before starting work.
- b. The installer shall provide a written Method Statement and Quality Control Plan that describe material staging and flow, paving direction and installation procedures,

- including representative reporting forms that ensure conformance to the project specifications.
- c. The maximum allowable chipping on the paver edges and corners shall be ¼". The cumulative length of chips on the exposed face of a single unit shall not exceed 1 percent of the perimeter of the exposed face of the paver, and no single chip shall exceed ½- inch in length.
 - d. Other than chips, the paver shall be free of cracks, color and other imperfections detracting from the appearance of a designated sample when viewed from a distance of 5 feet away.
 - e. Installation shall include preparing the base by removing unstable or unsuitable material a minimum of 6", compacting and grading the soil, draining or stabilizing weak or saturated soils and taking measures to prevent water penetration and mitigation of bedding sand. The sub base shall be compacted to a minimum of 95% of the T-99 density value.
 - f. Preparation of the subgrade shall be as described for the Unit Pavers section above.
 - g. Install the concrete perimeter edge restraints.
 - h. Install the sub base in 4-6" lifts to the specified thickness. Moisten, spread and compact the base layer in 4" lifts. For segmental concrete pavers test compaction of the base lift in conformance to [Section 201.5.04](#), "Base and Leveling Course".
 - i. For permeable concrete pavers, install the sub-base and base rock per the manufacture's recommendation.
 - j. Check grade of base rock with a 10' straight edge. The tolerance shall be within 1" over 10'.
 - k. Install the bedding layer and compact making at least two passes, or per manufacturer's recommendation. Recheck grade and adjust as necessary. The tolerance shall be within 3/8 "over 10'. Place the pavers and begin infilling the gaps with the joint material. Sweep excess joint material away and compact with a plate compactor, making at least two passes, or per manufacturer's recommendation. Apply additional material in the low areas as needed and compact.
 - l. After sweeping the surface, check the grade. The final surface shall be within 1/8" of the adjacent drainage inlets, concrete collars or channels. Bond lines for pavers are +/- ½ inch. over a 50' string line

201.6.05 Driveways

- a. Construct residential driveways in accordance to [Section 201.2.06.i](#), “Portland Cement Concrete Design” and **Detail No. RD-1090** of these standards.
- b. Construct commercial driveways in accordance to [Section 201.2.06.i](#), “Portland Cement Concrete Design” and **Detail No. RD-1095** or **Detail No. RD-1100** of these standards.
- c. At no time shall construction equipment or traffic be allowed on the new concrete driveway until laboratory tests indicate that at least 90% specified design strength ([Section 201.2.06.i](#), “Portland Cement Concrete Design”) has been attained; this includes installation of adjacent asphalt pavement.

201.6.06 Sidewalks

- a. Construct new sidewalks in conformance with [Section 201.2.06.i](#), “Portland Cement Concrete Design” and **Detail No. RD-1075** of these standards.
- b. Sidewalk repairs, replacement or reconstruction shall be in conformance with [Section 201.2.06.i](#), “Portland Cement Concrete Design” and **Detail No. RD-1075** of these standards. Sidewalk shall be finished in accordance with [Section 201.2.25.a.6](#), “Sidewalks.”
- c. ADA ramp repairs, replacement or reconstruction shall be in conformance with [Section 201.2.25](#), “Sidewalks” and to **Detail No. RD-1110 – Detail No. RD-1140** of these standards.
- d. At all intersections adjacent to the curb radius, curb-tight sidewalks and sidewalk ramps shall be constructed with a similar section as shown for a residential driveway (see **Detail No. RD-1090** of these standards.)
- e. Root Barriers shall be installed in conformance with [Section 201.2.24.e](#), “Root Barriers.”

201.6.07 Testing

- a. **Asphalt pavement:** Asphalt pavement shall have minimum density testing performed every 100 ft. of each lift and panel width installed. The pavement shall be compacted to a minimum of 92% relative density, based on the theoretical maximum density determined in accordance with ASTM D-2041, “Rice Gravity.”
- b. **PCC pavement:** Portland cement concrete shall be tested at a minimum of once per every 4 hours of work or 100 cubic yards of concrete installed. Testing shall include temperature, slump, air content, and minimum of 4 test cylinders. If water or other additives are added to the concrete load after the testing samples have been taken, an additional 4 test cylinders of the modified concrete mix shall be taken and tested. The

28-day compressive strength shall exceed 4,000 psi; a minimum compressive strength of 3,600 psi is required to allow traffic on the pavement.

- c. **Curb, gutter, and driveways:** Portland cement concrete shall be tested a minimum of once per 4 hours of work. Testing shall include temperature, slump, air content, and minimum of 4 test cylinders. If water or other additives are added to the concrete load after the testing samples have been taken, an additional 4 test cylinders of the modified concrete mix shall be taken and tested. The 28-day compressive strength shall exceed 3,300 psi. A minimum compressive strength of 2,970 psi is required to allow traffic.
- d. **Testing Frequency:** City reserves the right to direct testing agency on frequency of testing.

201.6.08 Weather Conditions

- a. AC pavement shall not be placed during periods of rainfall, sand or dust storms, or any imminent storms that might adversely affect the finished pavement quality. AC material shall not be applied over frozen surfaces or standing water. AC shall be placed at temperatures not colder than the minimum atmospheric temperatures specified in [Table 2.17](#). Temperature of the AC material shall be in conformance with [Section 201.6.02.b](#), “Temperature.”

Table 2.17. ATMOSPHERIC TEMPERATURE REQUIREMENTS

Individual Lift Thickness	Atmospheric Temperature
2” to 2 ½”	50° F
2 ½”+ to 3”	40° F

- b. PCC pavement shall not be placed during periods of rain or on frozen bases. PCC placement shall not occur when descending air temperature falls below 40°F, nor shall it resume until ascending air temperature reaches 35°F. The contractor shall protect PCC from weather damage. The contractor shall protect unhardened PCC from precipitation with protective material. If PCC is being placed during cold weather, and the air temperature is forecast to drop below 35°F, the contractor shall prevent the PCC from freezing for at least 7 days.
- c. The base aggregate shall be thoroughly watered to the satisfaction of the City’s authorized representative immediately prior to the placement of PCC when the measured or forecasted ascending air temperature is 80°F or greater.

201.6.09 Protection of Structures

- a. Provide whatever protective coverings may be necessary to keep oil or asphalt from splashing on the exposed parts of bridges, culverts, curbs, gutters, posts, guardrails, road signs, and any other structures during paving operations. Remove any oil, asphalt, dirt, or any other undesirable matter from these structures that resulted from the paving operations.
- b. Where water valve boxes, manholes, catch basins, or other underground utility appurtenances are situated in the area to be surfaced, the resurfacing shall be level with the top of the existing finished elevation of the appurtenances. If it is evident that an appurtenance does not match the proposed finished grade, notify the proper authority to have the item altered before proceeding with the resurfacing around the obstruction, unless otherwise approved by the City's authorized representative. Protect all covers during asphalt application.

201.6.10 Excess Materials and Trench Settlement Repair

Contractor shall dispose of excess materials. Contractor shall be responsible for repairing all settlement of pavement over trenches for a 1-year period.

201.6.11 Rock Surfacing

Where gravel shoulders have been disturbed, place ¾"-0" crushed aggregate backfill (see [Section 201.3.01](#), "Granular Fill") as surfacing material for the full width of all streets, driveways, parking areas, street shoulders, and other areas disturbed by the construction. Spread the material by "tailgating" and supplement by hand labor when necessary. Level and grade the aggregate to conform to existing grades and surfaces.

201.7.00 SURFACE RESTORATION

201.7.01 Scope

This section covers the work necessary for all required replacement of pavement, curbs, sidewalks, rock surfacing, and drainage facilities that were removed during construction. Replacement pavement and base course thickness design shall conform to current City standards.

201.7.02 Asphalt Concrete Replacement

- a. Base, subbase, or subgrade material that has been removed shall be replaced with ¾"-0" crushed aggregate backfill (see [Section 201.3.01](#), "Granular Fill") or control density fill (CDF, minimum 28 day compressive strength shall be 200 psi). Bring the trench or excavation to a smooth, even grade at the correct distance below the top of the existing pavement surface so as to provide adequate space for AC pavement. Crushed aggregate trench backfill placed within 3 feet of finished grade shall be compacted to 95% of the maximum dry density, as determined by AASHTO T-180. Crushed aggregate backfill placed below 3 feet of finished grade shall be compacted

- to 90% of the maximum dry density. Place the leveling course for the full width of the trench where pavement was disturbed, including bituminous surface shoulders.
- b. Compact the base rock and leveling course material to 95% of the maximum dry density, as determined by AASHTO T-180. At the conclusion of each day's operation, the contractor shall patch or place steel plates in accordance with [Section 101.8.02.b.7](#), "Progress of Construction" over all trench or excavation areas. Cold-patch asphalt mix may be used as a temporary patch.
 - c. The contractor shall grind edges and make a minimum 1-foot T-cut in the existing pavement surrounding a trench or excavation as shown on **Detail No. S-2145** of these standards. Trim existing pavement to a straight line to remove any pavement that has been damaged or that is broken and unsound to create a smooth, sound edge for joining the new pavement.
 - d. Within 5 working days, weather permitting, after completion of all paving or utility work, the contractor shall repair all trench or excavation areas with asphalt concrete. AC pavement thickness shall be a minimum of 4 inches or match existing pavement depth, whichever is greater. AC pavement shall be compacted to a minimum of 92% relative density, based on the theoretical maximum density determined in accordance with ASTM D-2041, "Rice Gravity."
 1. When the pavement surface has been cored, the area shall be repaired as follows: At the conclusion of each day's operation, the contractor shall patch all cored areas. Cold-patch asphalt mix may be used as a temporary patch.
 2. Within 5 working days after completion of all paving or utility work, the contractor shall repair all cored areas with hot-patch asphalt mix.
 - e. All joints and sawcuts shall be sand sealed within 24 hours of trench and excavation areas repaired with asphalt concrete. Seal material shall consist of hot-applied emulsified asphalt slurry seal, supplied and installed in accordance with ODOT SSC Section 00706, "Emulsified Asphalt Slurry Seal Surfacing."

201.7.03 Asphalt Restoration for Streets Listed on 5-Year Moratorium

When emergencies or special circumstances require access to underground utilities, the City may allow street cuts in streets listed on the 5-year moratorium (see [Section 201.2.31.c](#), "Utilities"). In addition to the repair work outlined in [Section 201.7.02](#), "Asphalt Concrete Replacement," an additional minimum 1-foot wide, 2-inch grind out around the T-cut perimeter shall be required per **Detail No. S-2145** of these standards.

201.7.04 Portland Cement Concrete Replacement

- a. **Trenching or Excavation in Pavement and Driveways:** The City Engineer encourages directional boring under existing concrete streets and discourages trenching or excavation work in streets or driveways. When this is unavoidable, the contractor shall remove and replace all panels that have been cut or damaged within 5

working days, weather permitting, after completion of all paving or utility work. New panels shall be connected into the adjacent existing panels per **Detail No. RD-1180** of these standards. Tie-bars shall be epoxied in place using an epoxy bonding agent as provided in the ODOT QPL. Bring the trench to a smooth, even grade at the correct distance below the top of the existing pavement surface so as to provide adequate space for the base, leveling course, and PCC pavement.

- b. **Coring:** When the pavement surface has been cored, the area shall be repaired as follows:
 - 1. Base, subbase, or subgrade material that has been removed shall be replaced with ¾”-0” crushed aggregate backfill (see [Section 201.3.01](#), “Granular Fill”) or CLSM (see [Section 601.2.03.c](#), “Class E Backfill.” Bring to a smooth, even grade at the correct distance below the top of the existing pavement surface so as to provide adequate space for PCC pavement.
 - 2. At the conclusion of each day’s operation, the contractor shall patch all cored areas within roadways with concrete having a minimum 4,000-psi compressive strength at 28 days (concrete with a minimum 3,300-psi compressive strength may be used in driveways).
- c. **Surface Smoothness:** The surface smoothness of the replaced pavement shall be such that when a straightedge is laid across the patched area between the edges of the old surfaces and the surface of the new pavement, the new pavement shall not deviate from the straightedge by more than ¼ inch.
- d. **Curbs and Gutters:** Remove existing damaged curbs and gutters to the nearest joint, unless otherwise directed by the City’s authorized representative. Replace concrete curbs and gutters to the same section, width, depth, line, and grade as that removed or damaged. Cut the ends of existing curb to a vertical plane. Before replacing the sections, properly backfill and compact the trench to prevent subsequent settlement. Where the section of curb and/or gutter replacement is less than 10 feet in length, connect new curbs and gutters to existing curbs and gutters with No. 4 reinforcement tie-bars. A minimum of 2 tie bars shall be used for curbs and a minimum of 2 tie bars used for gutters. Tie bars shall be epoxied in place to a minimum depth of 1 foot using an epoxy bonding agent as provided in the ODOT QPL.
- e. **Catch Basins:** Reinstall catch basins as a curb inlet in their original locations and reconnect them to the drainage system in a manner equal to the original. If the existing catch basins are damaged beyond repair by operations, construct new basins in accordance with these specifications. The new basin shall have a volume equal to or greater than the damaged catch basin, unless otherwise approved by the City’s authorized representative.

201.7.05 Sidewalk Replacement

- a. Construct sidewalks in accordance to [Section 201.2.06.i](#), “Portland Cement Concrete Design” and **Detail No. RD-1075** of these standards

- b. Match finish work to existing panels; re-compact base rock if disturbed. Replace base rock if insufficient depth or contaminated with soil.
- c. Replacement ADA ramps shall meet current standards as per **Detail No. RD-1110 – Detail No. RD-1140** of these standards.

201.8.00 STREET NAMES AND TRAFFIC CONTROL SIGNAGE AND STRIPING

201.8.01 Street Name Signs and Posts

All newly platted streets shall be signed with the name as shown on the approved or proposed county plat; proposed county plats shall show street names as approved by the Design Review Board (DRB). Signs are to conform to **Detail No. RD-1250** and **Detail RD-1255** and to these standards, as follows.

a. Posts

1. Materials

- (a) A minimum of 2 x 2-inch x 10-foot, 14-gauge galvanized “quick-punch” or 12-gauge perforated posts, or approved equal, shall be used.
- (b) A 2 x 2-inch x 12-foot, 14-gauge galvanized “quick-punch” or 12-gauge perforated posts, or approved equal, shall be used when a combination of signs is more than 36 inches high.
- (c) Signposts are made of 2-inch square tubing and must be embedded 18 inches into the base.

2. Base

The breakaway post base shall consist of a 2.25 x 2.25 inch (I.D.) x 36-inch galvanized base with a 2.5 x 2.5 inch (I.D.) x 18-inch sleeve placed flush with the base. All sleeves and bases shall be 14-gauge “quick punch” or 12-gauge perforated material, or approved equivalent.

3. Fastening

Drive rivets shall be used to fasten signs onto metal signposts, except for street name signs, which shall be attached by hex nuts. Washers shall be used behind all drive rivets used to affix signs to posts. Two drive rivets at right angles shall be used to fasten the post to the base.

b. Street Name Sign

- 1. In business districts and on principal arterials, street name signs shall be placed in diagonally opposite corners so that they will be on the right hand side of the intersection for traffic on the major street.

2. To optimize visibility at signaled intersections, street name signs shall be mounted overhead. In residential districts, at least one street name sign shall be mounted at each intersection.
3. On T-intersections, the street name signs shall be designated at two locations. One street name sign shall be placed at the end of a T- intersection, and the second placed at the right-hand corner of the intersecting street.
4. Signs naming both streets shall be installed at each street sign location.

201.8.02 Traffic Control Signage and Striping

Traffic control signing and striping shall be in conformance with **Detail No. RD-1265, Detail No. RD-1270, Detail No. RD-1275, Detail No. RD-1280, and Detail No. RD-1285** of these standards and the MUTCD. A “Signage and Striping Plan” shall be included with plan submittals for new street construction and street improvements.

201.9.00 LIGHTING

201.9.01 Roadway and Intersection Lighting

- a. Street lighting shall be designed in accordance with the most current American National Standard Practice for Roadway Lighting (RP-8-00) prepared by the Illuminating Engineering Society (IES).
- b. Installation of streetlights shall be in accordance with the City’s most current policies/agreements regarding the installation and maintenance of street lights.
- c. In addition to these requirements the air gap between the top of pedestal and bottom of light pole shall be grouted with a high-strength, non-shrinking grout meeting ODOT SSC Section 02440.50(b), “Non-Shrink Grout,” such as Alcrete Twenty Minute Fast Setting Grout[®], or approved equal.
- d. Selection and installation of street lighting luminaires shall be in conformance with the City’s most current “Dark Sky” policies.
- e. The warranty for public works projects shall include streetlights.

201.9.02 Shared-Use Path Lighting

- a. Lighting of shared-use paths, including pedestrian tunnels shall be designed in accordance with the Maintained Illuminance Values for Walkways/Bikeways of the most current American National Standard Practice for Roadway Lighting (RP-8-00) prepared by the Illuminating Engineering Society (IES). Designs shall meet the recommended horizontal and vertical illuminance and uniformity values.
- b. The City Engineer may reduce the lighting standards or not require lighting of shared-use paths in designated natural resource and wildlife areas.

- c. Lighting provided along shared-use paths shall be pedestrian scale with a mounting height no greater and no less than 10 feet. A clearance of 10 feet shall be provided from the path surface for street lighting overhanging a shared-use path. Pedestrian level lighting, such as bollards, shall not be permitted.
- d. Installation of shared-use path streetlights shall be in accordance with the City’s most current policies/agreements regarding the installation and maintenance of street lights.
- f. In addition to these requirements the air gap between the top of pedestal and bottom of light pole shall be grouted with a high-strength, non-shrinking grout meeting ODOT SSC Section 02440.50(b), “Non-Shrink Grout,” such as Alcrete Twenty Minute Fast Setting Grout[®], or approved equal.
- g. Selection and installation of street lighting luminaires shall be in conformance with the City’s most current “Dark Sky” policies.
- h. The warranty for public works projects shall include streetlights.

201.10.00 STREET ACCEPTANCE POLICY

The City of Wilsonville will accept new public street installations or systems built to the “Public Works Standards,” providing that the following conditions are met.

201.10.01 Legal Recordings

All plats are recorded with the County Surveyor, all easements and dedications are recorded with the County Recorder and the Engineering Department receives a reproducible copy of the recorded documents.

201.10.02 Project Completion

After completion of construction of the total project, and after all testing has been satisfactorily completed, project closeout shall proceed as outlined in [Section 101.8.17](#), “Project Closeout.”

201.10.03 Maintenance Period

- a. The Contractor or Applicant shall be responsible for providing Maintenance Assurance for Public Improvements as outlined in [Section 101.8.18](#), “Maintenance and Warranty.”
- b. At any time during the warranty period, the City’s authorized representative has reason to believe the public street improvements have defects that were the result of faulty workmanship or flaws in construction material, the responsible party shall be required, at that party’s own cost, to repair any faults to the public street improvements deemed necessary by the City’s authorized representative.

- c. Before the end of the Construction Maintenance period, the City's authorized representative shall inspect the project for any remaining deficiencies. If the deficiencies that remain are determined to be the responsibility of the contractor or the applicant, the contractor or applicant shall then make such repairs.

SECTION 3

STORMWATER & SURFACE WATER DESIGN AND CONSTRUCTION STANDARDS – Bound Separately

The Storm Drainage Design & Construction Standards with Appendices A and B are bound in a separate document.

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SECTION 4

SANITARY SEWER DESIGN AND CONSTRUCTION STANDARDS

401.1.00 ENGINEERING

401.1.01 Introduction

This section outlines design and construction requirements for all public sanitary sewers. The provisions and technical specifications herein set forth the requirements of the City of Wilsonville for constructing sanitary sewer improvements. Interpretations of such provisions and their application in specific circumstances shall be made by the City's authorized representative, unless specifically stated otherwise. Refer to [Section 1](#) of the "Public Works Standards" for general provisions and requirements.

401.1.02 Extension of Public Sewer Systems

- a. The extension or upsizing of the public sewerage facilities in excess of 8 inches in diameter or as shown in the Wilsonville Wastewater System Master Plans to serve the ultimate development density of the contributing area shall be done by the property owner or permit applicant and may be subject to applicable System Development Charge (SDC) credits.
- b. The City reserves the right to perform the work or cause it to be performed and bill the owner for the cost of the work or to pursue special assessment proceedings.
- c. The public sanitary sewer system shall extend to the most distant parcel boundary and be designed at a size and grade to facilitate future extension to serve development of the entire contributing area.
- d. Where public infrastructure improvements paid for by the property owner or permit applicant directly benefit adjacent properties, the property owner or permit applicant may pursue establishment of a reimbursement district per Section 3.116 of the City Code.

401.1.03 Sanitary Plans

- a. It is the design engineer's responsibility to ensure that engineering plans are sufficiently clear and concise to construct the project in proper sequence, using specified methods and materials, with sufficient dimensions to fulfill the intent of these design standards.
- b. All elevation on design plans and record drawings shall be based on the applicable NAVD 88 Datum specified in [Section 101.7.07.a](#), "NAVD 88 Datum."

- c. Existing conditions and facilities on design plans and record drawings shall be shown in light, gray print. Proposed conditions and facilities on design plans and record drawings shall be shown in bold, black print.
- d. All engineering sanitary plans shall be stamped by a Professional Engineer registered in the State of Oregon. At a minimum, the sanitary plans shall contain the following:
 1. At least one sheet shall show a plan view of the entire project site. If the project site is sufficiently large that detailed sanitary plans on any given sheet do not encompass the entire project site, then a sheet showing the plan view of the entire site must serve as an index to subsequent detailed plan sheets.
 2. A topographic map showing existing conditions for the site, including the following:
 - (a) Existing topography for the site. Plan views showing existing features may be required for a distance of up to 100 feet (or further if warranted) beyond the proposed improvement in order to prevent future grade conflicts and will be determined on a case-by-case basis by the City's authorized representative.
 - (b) Adjacent streets, trails, multi-use paths, and rail lines, including the respective names.
 - (c) Existing utilities, including franchised utilities located above or below ground and drainage facilities that transport surface water onto, across, or from the project site. Existing drainage pipes, culverts, and channels shall include the invert or flow line elevations.
 - (d) Existing vegetation, including denoting the type, DBH, and canopy size of trees within the construction limits.
 - (e) Existing environmentally sensitive areas (e.g., ravines, swales, steep slopes, wells, springs, wetlands, creeks, lakes). For natural drainage features, show direction of flow, drainage hazard areas, and 100-year floodplain boundary (if applicable).
 - (f) Adjacent existing features that are within 25 feet outside of the site boundary, including but not limited to construction activities that will potentially compromise the structural stability or condition of off-site features, such as cultivated vegetation, landscaping and trees, buildings, fences, decks, walls, slabs, and pavements. Denote the type, DBH, and canopy size of all trees.
 3. Plans for proposed sanitary improvements shall include the following:
 - (a) Grading and erosion control plan.
 - (b) Finished grades, showing the extent of cut and fill by existing and proposed contours, profiles, or other designations. Plan views showing existing

features may be required for a distance of up to 100 feet (or further if warranted) beyond the proposed improvement in order to prevent future grade conflicts and will be determined on a case-by-case basis by the City's authorized representative.

- (c) Horizontal stationing along centerline, showing points of tangency and curvature, including centerline stationing of all intersecting streets.
 - (d) Proposed structures, including roads and road improvements, parking surfaces, building footprints, walkways, landscape areas, etc.
 - (e) Sanitary facilities, including pipe sizes, pipe types and materials, lengths, and all sanitary system structures and appurtenances, including but not limited to manholes, clean outs, and service laterals. Notes shall be included for referencing details, cross-sections, profiles, etc.
 - (f) Existing and proposed utilities, showing exact line and grade of all utilities crossing the proposed sanitary system.
 - (g) Applicable detail drawings.
 - (h) Existing and proposed property lines, right-of-way lines, survey monuments, and easements.
 - (i) Setbacks from environmentally sensitive areas or resource areas protected within the Significant Resource Overlay Zone (SROZ).
 - (j) Maintenance access, as applicable (see [Section 401.2.03](#), "Access").
 - (k) Any proposed phasing of construction.
 - (l) Any additional information that the City's authorized representative deems necessary.
4. Profiles for proposed sanitary improvements will be provided at the same horizontal scale as the plan sheets and a 1" = 5' vertical scale. Profile drawings shall be drawn below the plan view or immediately following the associated plan view sheets. Profile views showing existing features may be required for a distance of up to 100 feet (or further if warranted) beyond the proposed improvement in order to prevent future grade conflicts and will be determined on a case-by-case basis by the City's authorized representative. The profiles shall include the following:
- (a) Existing and proposed ground along the proposed sanitary main alignment.
 - (b) Sanitary facilities, including pipe sizes, pipe types and materials, lengths, backfill material, and all sanitary system structures and appurtenances, including but not limited to manholes, fittings, and clean outs. Notes shall be included for referencing details, cross-sections, etc.

- (c) Existing and proposed utilities, showing exact line and grade of all utilities crossing the proposed sanitary system, specifically water lines. The vertical separation from existing and proposed utilities shall be labeled for all proposed utility crossings.
- (d) Any additional information that the City's authorized representative deems necessary.

5. Design Submittals

- (a) A manhole detail may be required to be submitted for each new manhole and each existing manhole being worked on. The manhole details shall include rim elevation, number and size of grade rings, manhole frame type, cone or flat slab top with dimensions, each manhole section with dimensions, manhole base type with dimensions, step location, ledge elevation, and invert elevation(s), pipe size(s), pipe direction(s) with angle(s) noted for each pipe connection.
- (b) Where a manhole pipe connection is larger than 24 inches or where more than four mainline connections are approved, the manufacturer or design engineer shall submit supporting calculations, stamped by a Professional Engineer registered in the State of Oregon, documenting the structural integrity of the manhole. The supporting documents shall be submitted with the manhole detail submittal.

401.1.04 Surveying

- a. The design engineer shall be responsible for establishing the location of the sewer line by means of reference stakes offset along the centerline of the sewer line. No construction shall be allowed to begin before construction staking. All staking shall be performed by or under the direction of a Professional Land Surveyor registered in the State of Oregon.
- b. Stakes shall locate all public tees, cleanouts, manholes, water line crossings, and pump stations. Maximum spacing for reference stakes is 50 feet. Stakes shall reference cuts or fills to all invert elevations and rim grades. The design engineer shall also be responsible for identifying and staking easements during construction.

401.1.05 Sewage Flow Determination

- a. A map is required that shows the drainage basin in which the project is located. The map shall show the major basin that is consistent with the City's current Wastewater Collection System Master Plan and any applicable amendments and updates to it
- b. Population density figures shall be obtained from the most recent information available for use by the Planning Division of the City of Wilsonville. If those figures vary from those of the applicable master plan estimates, the difference must be noted in the design calculation.

- c. When required by the City's authorized representative, the design engineer shall prove to the City that all necessary methods of determining present and future capacity of the sanitary sewer have been considered. For flow parameters and peaking factor, accepted flow design practice must be employed. The flow parameters and peaking factor must coincide with the method used in the City's Sanitary Sewer Master Plan unless directed by the City's authorized representative to use more current information particular to the basin in which the project is located is available. Infiltration and inflow must be represented in flow calculations in the design of the sanitary system. Infiltration and inflow figures shall be obtained from the City's Sanitary Sewer Master Plan or more current data as approved by the City's authorized representative.
- d. Sewage flows must reflect any reasonably anticipated increase due to the development of the drainage basin upstream of the project being considered. Design engineers are cautioned not to specify sewers of sizes that are obviously larger than necessary to achieve satisfactory carrying capacity, but which are specified to meet grade requirements.

401.1.06 Interference with City Sewer System Prohibited

No person shall block, obstruct, or interfere with any portion of the City sanitary sewer system without a diversion plan being submitted and approved by the City's authorized representative. This prohibition includes, but is not limited to, the obstruction of the flow of sewage from, and to any point within, the City sewer system.

401.2.00 SANITARY SEWER DESIGN STANDARDS

The following design standards are intended only as a guide for the design of sanitary sewer improvements. All designs shall conform to the most current requirements of the Oregon state plumbing laws and rules of the Oregon DEQ, except where the City's standards exceed those of the state. All facilities shall comply with odor requirements in chapter 4 of the City Code.

401.2.01 Manhole Design

- a. Manholes shall be provided at least every 400 feet, unless otherwise approved by the City's authorized representative. Manholes shall be located at every grade change, change in pipe size, change in alignment, and at the end of main lines not to be extended in the future. Manhole lids shall be located as indicated in the street detail drawings of these standards unless an exception is approved by the City's authorized representative.
- b. A shallow manhole with precast grooves shall be provided for manholes 4 feet deep from crown of pipe and less. The shallow manhole top shall consist of a short eccentric cone as shown in **Detail No. S-2025** of these standards. Where the short eccentric cone top is not feasible as determined by the City's authorized representative, a flat slab top may be permitted as shown in **Detail No. S-2030** of these standards.

- c. Flat-top manholes shall be designed to be installed at an elevation to permit construction of the full street section, allowing for the design gradients.
- d. Manholes shall be designed such that the manhole cover is flush with the surrounding grade in paved areas, set 1-foot above grade in landscape areas unless otherwise directed by the City's authorized representative, and set at an elevation of at least 2 feet greater than the 100-year storm event in designated floodplain areas.
- e. Manhole grade rings shall be concrete, key-lock joint designed to withstand AASHTO H-20 loadings. Grade rings shall not exceed 12 inches in height.
- f. The minimum manhole size shall be as follows:
 - 1. 48-inch diameter manhole for pipe equal to or less than 24 inch diameter
 - 2. 60-inch diameter manhole for pipe between 27-inch and 36-inch diameter
 - 3. 72-inch diameter manhole for pipe equal to or greater than 42-inch diameter.
- g. Suburban style manholes frames shall not be used in PCC streets.
- h. There shall be a maximum of 4 pipes entering/exiting a manhole unless otherwise approved by City's authorized representative.
- i. Sewer lateral connections to manholes are prohibited except where required under [Section 401.2.02.a.3](#), "Pipe Size" or where constrained by manhole placement as determined by the City's authorized representative.
- j. The manufacturer or design engineer shall provide supporting structural calculations for manholes with pipe connections larger than 24 inches or where more than four mainline connections are approved, in accordance with [Section 401.1.03.d.5](#), "Design Submittals."
- k. All precast manhole bases and sections shall be manufactured with smooth, clean openings at the design inlet and outlet points for the size of pipe specified. Manholes shall be core drilled to field adjust the design connection points. Openings shall not be sawcut or broken out.
- l. A minimum of 8 inches shall separate connections, measured from the outside diameter of the core holes.
- m. All manhole bases shall be properly channelized.
- n. All manholes shall have inlets at a minimum 90-degree angle in relation to the outlet, as measured from the center of the manhole base.
- o. The crowns of all incoming pipes shall be at least as high as the crown of the outgoing pipe.

- p. Manholes shall have a minimum free drop of 0.20 feet. Any drop greater than 0.20 feet shall only be allowed when existing utilities or physical obstructions prevent a connection from being made within this specification as determined by the City's authorized representative. Where allowed, the maximum free-drop shall be 1.5 feet.
- q. Where services lateral connections to manholes are allowed in accordance with 401.2.01(i), "Manhole Design", service laterals 6" and less in diameter shall have an invert elevation a minimum 0.50 feet above the main line outlet invert elevation.
- r. When more than 18 inches of drop is allowed, an inside drop manhole shall be provided in accordance with **Detail No. S-2042** of these standards. Outside drop manholes are not allowed.
- s. All manholes shall be provided manhole cover inserts in accordance with **Detail No. S-2005** of these standards.

401.2.02 Sanitary Pipe Design

a. Pipe size:

1. Pipe size shall be determined by the design depth of flow (d) over the pipe inside diameter (D) is 0.67.

$$D = d / 0.67$$

2. Public sanitary sewers shall be 8 inches in diameter or larger, unless otherwise specified by the City's authorized representative. Sewer laterals for residential service shall be 4-inch inside diameter. All other sewer laterals shall be sized to accommodate the anticipated flow, but no less than a 4-inch inside diameter.
3. Sewer laterals tapped into existing sanitary lines shall be no larger than 50% of the diameter of the main line, unless otherwise approved by the City's authorized representative. Sewer laterals larger than 50% of the diameter of the main line shall be connected through the installation of a manhole in accordance with [Section 401.4.01.c.2](#), "Pipe Connections."

b. Materials:

1. Generally, sanitary sewer mains and laterals shall be Polyvinyl Chloride Pipe (PVC) pipe, ASTM D-3034, SDR 35 or lower, unless otherwise recommended by the Engineer of Record and directed by the City's authorized representative.
2. Pipe materials shall conform to the specifications in [Section 401.4.02.b](#) "Materials" unless otherwise approved by the City's authorized representative.
3. Pipe and fittings shall consist of one type of material throughout and no interchanging of pipe and fitting material is allowed.

- c. **Location:** Sanitary sewers will normally be placed on the north and west side of the street, outside the bike lane and vehicle wheel path, as indicated in the street detail

drawings of these standards. Sanitary pipe shall be located not closer than 5 feet to face of curb, unless an exception is approved by the City's authorized representative. In any event, all sewer locations shall be approved by the City's authorized representative.

- d. **Easements:** Piped sewer systems shall generally be located in the right-of-way. When it is not possible or practical to install Public sewer facilities in a dedicated public street, the facilities shall be located within a sanitary sewer easement granted to the City. Sanitary sewer easements typically be exclusive and conform to [Section 101.8.14](#), "Easements."
- e. **Alignment:** Public sanitary pipe shall be laid on a straight alignment and at uniform grade.
- f. **Connections:** Lateral connections on new construction work shall be done using manufactured tees installed at surveyed locations. Lateral connections to existing sanitary lines may be done using either saddle tees as per [Section 401.4.02.b.5\(a\)](#), "PVC Tee Saddle" or by using Inserta Tee[®] as per [Section 401.4.02.b.5\(c\)](#), "Inserta Tee." Lateral connections to manholes are prohibited in accordance with [Section 401.2.01\(i\)](#), "Manhole Design."
- g. **Laterals:** Sanitary laterals shall be provided as shown in **Detail No. S-2175** of these standards.
- h. **Curb Marking:** Newly constructed curbs or replaced curbs shall be stamped with the capitol letter "SS" at the location of each sanitary lateral crossing. Letters shall be 3 inches in height and embossed a minimum of 1/8-inch deep.
- i. **Locating Wire and Tape:** Sanitary mains and laterals shall have tracer wire installed beside the pipe and plastic caution tape installed 1-foot above the pipe crown as shown in **Detail No. S-2175** of these standards. Main line tracer wire shall be connected to service lateral tracer wire using solderless connection kit suitable for direct burial that joins wires mechanically and electrically and seals out moisture, GelCap or approved equal. Tracer wire shall be 12-gauge stranded or solid copper insulated High Molecular Weight Polyethylene (HMW-PE) with a green insulated cover a minimum 45 mil in thickness and the wire UL rated for 140°F. Surface locating wire at cleanouts; tape shall be tied off to the 2 x 4 marker.
- j. **Grade:** Sanitary sewers shall be laid on a grade that maximizes the serviceable area to facilitate future extension of the sanitary sewer system as determined by the City's authorized representative. The maximum serviceable area shall be based on the future development within the contributing area as identified by the Wilsonville Wastewater System Master Plans. The use of drop manholes in the design of new sanitary sewers shall be restricted as necessary to maximize the serviceable area.

All sanitary sewers shall be laid on a grade that will produce a mean velocity of at least 2 feet per second when flowing full or half-full. The minimum grades for various sizes of pipe are listed in [Table 4.1](#).

Table 4.1. MINIMUM GRADIENT FOR SANITARY SEWERS

Inside Pipe Diameter (inches)	Grade (%) (feet per 100 feet)
Sanitary Laterals	
4	2.00
6	2.00
Sanitary Mains	
8	0.40
10	0.28
12	0.22
15	0.15
18	0.12
21	0.10
24	0.08
27	0.07
30	0.06

The minimum slope of sanitary sewer laterals may be reduced to 1.00% in unusual conditions upon review and approval of a sewer lateral report by the City’s authorized representative. The report shall be prepared by the Engineer of Record and shall include documentation of the unusual conditions causing the need for slope reduction and analysis documenting the reduced slope will not impact the function of the sewer lateral for the intended use.

- k. **Steep Slopes:** Sewers pipes on slopes in excess of 20% gradient shall be secured with approved concrete anchor walls as shown in **Detail No. S-2195** of these standards or other approved anchor systems as approved by the City’s authorized representative. Where construction access is limited as determined by the City’s authorized representative, steel anchor systems as shown in **Detail No. S-2196** may be used. Spacing for concrete anchors shall be as shown in [Table 4.2](#).

Table 4.2. SECURING SEWERS ON SLOPES

Minimum Anchor Spacing Sewer Gradient >20%	
Grade (%)	Center to Center (feet)
<35	35
35-50	25
>50	15 (or concrete encasement)

- l. Pipe Cover:** All sanitary sewer pipes shall be laid at a depth sufficient to drain building sewers, including basements where practical. Typically, sanitary sewers shall be placed with mains at 8 feet of cover and service laterals at property lines at 6 feet of cover. The City's authorized representative may approve shallow sanitary sewers upon verification that the typical depths cannot be met. Where shallow sewers are approved and a cover of 5 feet is not possible, ductile iron pipe, AWWA C-900, or concrete encasement or other material approved by the City's authorized representative shall be used.
- m. Sewer in Vicinity of Water Supplies:** No existing or proposed pressured sanitary sewer shall be permitted within 100 feet of any well, spring, or other source of domestic water supply. No existing or proposed gravity sewer line shall be permitted within 50 feet of any well, spring, or other source of domestic water supply.
- n. Water and Sewer Lines**

 1. Sanitary sewers and domestic water lines shall not be laid in the same trench and shall comply with OAR 333-061-0050(9).
 2. Parallel water and sewer lines shall have a minimum horizontal clearance of at least 5 feet when the bottom of the water pipe is higher in elevation than the top of the parallel sewer pipe. Parallel water and sewer lines shall have a minimum horizontal clearance of at least 10 feet horizontally when the bottom of the water pipe is lower in elevation than the top of the parallel sewer pipe. See Zone 1 of **Detail No. S-2150** of these standards.
 3. When there is more than 18 inches of vertical clearance between water and sewer, but less than 5 feet of horizontal clearance, then pressure pipe with watertight joints, such as class 50 ductile iron pipe, C-900 PVC pipe, reinforced concrete encasement, or other pipe approved by the City's authorized representative shall be required. See Zone 2 of **Detail No. S-2150** of these standards.
 4. Wherever it is necessary for sewer and water lines to cross each other, the crossing shall be at an angle of approximately 90 degrees. The sewer line shall have a minimum vertical clearance of 18 inches below the water line and one full length of water pipe shall be centered on the crossing.
 5. Where a sewer line has less than 18 inches of vertical clearance below a crossing water line, the water line shall be replaced with one full length of water pipe centered on the crossing. Also, the sewer line shall be encased in a reinforced concrete jacket 10 feet on each side of the crossing. In lieu of a concrete jacket, the sewer line may be replaced with one full length of sewer pipe centered on the crossing. The sewer pipe shall be pressure pipe, such as class 50 ductile iron pipe, C-900 PVC pipe, or other pipe approved by the City's authorized representative.

401.2.03 Access

Access roads are for maintenance and inspection purposes. All-weather access shall be provided to every manhole. Access roads shall be constructed as per Section 301.11.05, "Access Road Design."

401.3.00 WASTEWATER PUMP STATION DESIGN STANDARDS

401.3.01 General Provisions

a. Applicability

These standards are applicable to construction, installation, or modification of any wastewater pump station system requiring a City of Wilsonville Public Works Permit.

b. Scope

Pursuant to City of Wilsonville Development Code Section (July 2013) 4.262.04 Sanitary Sewers:

In order to accomplish the orderly and desirable development of land within the corporate limits of the City and to limit the costs associated with the operation and maintenance of wastewater pump stations borne by the City, the City Engineer deems it reasonable and necessary to restrict the installation of the wastewater pump stations. Therefore, wastewater pump stations will not be allowed in areas: where gravity sewer service is programmed for construction in an applicable capital improvement plan, where improvements are recommended in the City of Wilsonville Wastewater Collection System Master Plan, or where sewers are available within three thousand (3,000) feet.

Temporary pump stations will be allowed in areas where future development will require extension of gravity sewers and the City's authorized representative determines that the temporary station is economically justified. Design life must be less than ten (10) years, as determined in the preliminary design report, and have a capacity requirement of less than four hundred (400) gallons per minute (gpm).

Permanent pump stations will be allowed in areas where future development does not require extending gravity sewers, as determined in the design report and the applicable master plan for the area.

c. Reviewing Authority

The Oregon Department of Environmental Quality is the final reviewing authority. All plans and specifications for a wastewater pump station shall be reviewed and approved by the Oregon Department of Environmental Quality (DEQ). The basis for review by DEQ review engineers is Oregon Administrative Rule 340 Division 52 (OAR 340-52), Review of Plans and Specifications. To that extent, all plans and specifications shall follow the guidelines and criteria set forth in *the Oregon Standards for Design and Construction of Wastewater Pump Stations*, Oregon Department of Environmental Quality, May 2001 (DEQ Standards). (The DEQ

Standards may be found at:

<http://www.deq.state.or.us/wq/rules/div052/guidelines/designwwps.pdf>)

The standards in this Wastewater Pump Station Design Standards chapter (City Standards) of the Public Works Standards are developed as supplemental standards to address local needs, preferences, and existing equipment. Conflicts between the City Standards and the DEQ Standards shall be resolved by first following that standard which is more stringent and/or specific; second, by the determination by the City's authorized representative as to which standard or guideline is advantageous to or in the best interests of the City.

d. Variance

When engineering justification satisfactory to the City's authorized representative is provided that substantially demonstrates that variation from the DEQ Standards or City Standards will result in either: at least equivalent effectiveness while significantly reducing costs, or improved effectiveness, such a variation from the DEQ Standards or City Standards may be accepted as determined by the City's authorized representative.

401.3.02 General Requirements

a. Administration

The design engineer in charge must be a Professional Engineer registered in the State of Oregon and have had previous experience designing similar facilities, including but not limited to; mechanical piping and appurtenances, pumps, buildings, site improvements, odor control, plumbing, HVAC, electrical, telemetry, and control systems. The engineer's qualifications shall be submitted prior to initiation of the preliminary design report and shall be acceptable to the City's authorized representative. An authorized representative of the City may be available for construction observation during construction of the project. The design engineer's responsibilities for construction management, inspections, testing, start-up and project closeout are outlined in the DEQ Standards. The availability of the City's on-site representative does not relieve the design engineer of any responsibilities as required in the DEQ standards.

b. Flood Protection

The pump station building finish floor elevation and electrical and mechanical equipment shall be located at an elevation that is at least two feet above the FEMA one-hundred (100) year flood elevation and shall be located above the FEMA five-hundred (500) year flood elevation. In addition, the rim elevation of the wet well and any vault or structure that drains back to the wet well shall also meet the requirements listed above. The station shall be designed to remain operational and accessible during the one-hundred (100) year flood. In the absence of official FEMA maps to establish the one-hundred (100) year and five-hundred (500) year flood elevations, the best available local information should be used.

c. Siting

Pump stations shall be located as far as practical from present or proposed built-up residential areas and off the traffic way of streets and alleys. Noise control, odor control, station architectural design and other aesthetic items shall be taken into consideration and reviewed by the Design Review Board. Sites for stations shall be of sufficient size for future expansion or addition, if applicable.

d. Safety

It is the design engineer's responsibility to ensure that the Occupational Safety and Health Administration (OSHA), the National Electric Code (NEC), and all other applicable building and construction codes and requirements are met during construction. Adequate provision shall be made to protect construction and, subsequently, maintenance and operation personnel from hazard. Equipment and training for confined space entry in accordance with OSHA and regulatory agency requirements shall be provided for all wastewater pumping stations.

401.3.03 Preliminary Design Report

A preliminary design report prepared and stamped by the design engineer as a basis for design for the wastewater pumping station shall be submitted to the City's authorized representative and DEQ for review and approval. The report shall follow the design report guidelines listed in section IV of the DEQ Standards. Additional requirements are listed below:

a. Site Selection

1. The City of Wilsonville's comprehensive plan designation shall be considered during pump station site selection, in addition to guidelines in the DEQ and City Standards.
2. If the selected location is not currently owned by the City, the City's acquisition process must be started as soon as the parcel is selected and approved by City. In the case of a pump station being planned/designed as a condition of a private development, it shall be the developer's obligation to see that the appropriate site needs are acquired and conveyed to the City. If the pump station is a City-led project, the City will pursue all necessary property acquisition.

b. Preliminary Design Report Contents

1. Population: Present and future population and/or industrial/commercial usage projections for present, design and ultimate buildout of all areas that could be served by the pump station.
2. Average and, peak flow, daily and peak instantaneous calculations, unit for present, design and ultimate flows. Average residential per capita flows and, peaking factors and infiltration/inflow allowances for present and future design

conditions shall follow the recommendations of the City's current Wastewater Collection System Master Plan and/or subsequent sewer basin studies.

3. Wet well configuration and size.
4. Number, type, capacity, motor horsepower and Net Positive Suction Head (NPSH) requirement of proposed pumping units.
5. System head curve and head computations for design conditions of pumping system. System head calculations shall include the size and length of force main, static head, and all dynamic losses. System curves shall be developed using the Hazen-Williams equation, and for assumed "c" factors of 100, 120, and 150.
6. Description of primary and back-up power sources.
7. Other hydraulic computations to include, but not be limited to, pump cycling time, wet well capacity, flushing velocity, force main detention time and surge analysis.
8. Downstream collection system analysis as described herein.

c. Preliminary Plans

Shall be in conformance with [Section 401.1.03](#), "Sanitary Plans", and, in addition, shall show the following:

1. A contour map of the proposed site, service area, and force main with elevations referenced in accordance with [Section 101.7.07.a](#), "NAVD 88 Datum."
2. Proposed pump station, including structure, site layout and piping, landscaping, street connection, and provisions for future pumps, if necessary.
3. Demolition or modifications to existing pump station, if applicable.
4. The 100-year and 500-year flood plain elevation at the site.
5. Location and elevation of sewage overflow point in the collection system and the location of the receiving stream for sewage overflow.
6. Process and Instrumentation diagrams for electrical and control systems. Electrical site plan and one line diagrams.
7. Force main in both plan and profile views to the connection at the receiving location.

d. Final Design Report

Final design report and final construction plans shall be prepared and stamped by the design engineer, reviewed and approved by the City prior to submittal to DEQ for review and approval. Final design shall be in conformance with preliminary design

report as approved by the City and DEQ, and shall conform to applicable land use decisions.

401.3.04 Construction Plans

Construction drawings shall be in conformance with [Section 401.1.03](#), “Sanitary Plans,” and include, but not be limited to, the following as applicable by the design engineer unless otherwise directed by the City’s authorized representative:

- a. General sheets - Cover sheet, Symbols & Legend, Location and Vicinity Map, General Notes and Abbreviations.
- b. Civil Sheets - Demolition plan, Site Layout, Grading, Drainage, Paving, Site Piping Plans and Profiles, and Details.
- c. Landscaping Sheets - Landscaping, Planting, and Irrigation.
- d. Architectural Sheets - Architectural Plans, Roof Plans, Door and Window Schedules, Elevations, Sections and Details.
- e. Structural Sheets – Structural Plans, Foundation Plans, Sections, and Details.
- f. Mechanical Sheets – Mechanical Pump and Piping Plans, Pump Station Design Data, Temporary Pumping Plan, Piping Schematics, HVAC and Plumbing, Sections, and Details.
- g. Electrical Sheets – Electrical Symbols and Legend, Electrical Site Plan and Power Plan, One-Line Diagrams, Lighting Plans, Motor Control Center Elevations, Miscellaneous Devices/Panels One-Line Diagrams, Panel Schedules and Layout, Circuit Schedule.
- h. Instrumentation Sheets - Instrumentation Symbols and Legend, Instrumentation Plan, Process and Instrumentation Diagram.
- i. Other construction drawings as may be required.

401.3.05 Pump Station Design Criteria

The design criteria shall follow the guidelines in Section III of the DEQ Standards, except as additionally required or modified below:

- a. **General**
 1. All sewage pump stations shall be designed as submersible pump style pump stations with an above grade control building to house electrical equipment, instrumentation and control equipment, odor control equipment, backup power equipment, and other applicable equipment, unless otherwise approved by the City.

2. The electrical and mechanical equipment systems, including but not limited to pumps, motors, valves, electrical and instrumentation equipment shall be designed and specified for a minimum 25-year design life. Structures and piping shall be designed for a minimum 75-year service life.
3. The pump station shall be designed with a firm capacity to continuously pump the peak instantaneous flow associated with the 10-year, 24-hour storm intensity (see **Table 3.3. Rainfall Distribution**) of its service area, without overflow from the station or the contributing collection system. Firm capacity is defined as the ability to continuously discharge the design flow with the largest pump unit out of service. The design flows shall be based on projected development of the service area associated with the 25-year design life of the pumping equipment.
4. Future pumping capacity requirements and potential changes to the force main configuration required for ultimate buildout of the pump station service area shall be considered in sizing the wet well and pumping equipment. The pump station facility shall be capable of accommodating future components that may be needed for projected growth in the service area beyond the identified design period. The wet well shall be sized for ultimate buildout, with space available for installation of additional pumps or larger pumps as needed to meet ultimate buildout flows.
5. Design shall be consistent with EPA Class I reliability standards for mechanical and electrical components and alarms.
6. A paved access road for maintenance vehicles shall be provided. The access road shall be at least 12 feet wide. Access roads longer than 50 feet shall be provided with an additional paved area for turning around maintenance vehicles. The maximum access road grade shall be 12 percent and the maximum turning area grade shall be 2 percent. Pavement section shall be approved by City's authorized representative.
7. The site shall be fenced with a minimum six (6) foot high chain link fence. A minimum of one locking access gate shall be provided, consisting of rolling gates 16 feet in width or as required by site constraints and approved by the City's authorized representative. Fence shall be galvanized steel fabric with bonded vinyl coating. Vinyl coating shall be a color designed to blend with the surrounding area (green, brown, or black), as approved by the City. All fence posts, cross bars and gates shall be painted or coated same color as the fence. The access gate shall be provided with an intrusion alarm that is tied into the City's SCADA notification system.
8. Landscaping shall be provided around the pump station building and associated site improvements and shall be compatible with the character of the surrounding properties. The landscaping shall be designed by a registered landscape architect and include low maintenance and low irrigation type trees and shrubs. Permanent automatic irrigation shall be provided to all planted areas, unless otherwise approved by the City. Landscaping shall meet all applicable City Codes and Standards.

9. The existing downstream sanitary sewer collection system shall be evaluated by the design engineer to determine the impact of the increase in flow (i.e. peak pumping capacity) from the proposed pump station. Evaluation shall be performed under the design flow condition for all pumped and gravity connections to the receiving system. Sanitary sewer system shall be evaluated downstream to a point where no surcharging (caused by the increase in flow from the pump station) above the top of the pipe occurs. Hydraulic profile and downstream collection system analysis shall be provided in the design report. The City reserves the right to require upgrades to the downstream receiving system to mitigate the impact of the increased flow.
10. Adequate piping, valves, and appurtenances for isolation and removal of equipment shall be provided. A bypass pumping port on the force main shall be provided to allow for temporary bypass pumping operations. The bypass connection shall be located downstream of the common force main isolation valve, and be provided with an independent isolation valve.
11. Capability for pig launching and retrieval shall be included at all pump stations for cleaning of the force main. The system shall utilize the station's sewage pumps to propel the pig, unless otherwise approved by the City.
12. Federal and State OSHA regulations and guidelines, and any other relevant state, federal and local safety regulations and guidelines shall be followed and adhered to.
13. An emergency overflow path shall be provided as necessary to prevent property damage and sewer backups, or as required by the City and DEQ. The overflow point shall be reviewed and approved by the City and DEQ. A dedicated overflow alarm shall be provided in the wet well or collection system and tied to the City's SCADA notification system.
14. All wastewater pump stations shall be supplied with a back-up standby generator or alternate power source.

b. Submersible Pumps and Wet Well

1. Submersible pumps and motors shall be designed specifically for raw wastewater use, including totally submerged operation during a portion of the pump cycle.
2. Pumps shall be sized to pump the required flow when the force main is in a degraded condition, with a Hazen-Williams 'C' value of 120 for force mains with no sags in its profile, or 110 for force mains with a sag in the profile. The pumps shall be selected so as to operate within the manufacturer's recommended operating range under the full range of normal operating conditions anticipated during the service life of the pump.
3. Submersible pumps shall be readily removed and replaced on two stainless steel guide rails without de-watering the wet well or disconnecting any piping in the wet well. Guide rails shall be secured to the wet well lid. Guide rail supports shall

be as recommended by pump manufacturer and shall not interfere with pump removal or re-installation.

4. Each pump assembly shall be provided with a stainless steel lifting chain and stainless steel lifting knuckles of adequate strength to support 150% of the entire assembly weight. Chain links shall be minimum 5/16-inch inside diameter and lifting knuckles shall be provided every 3 feet.
5. Wet well and vault access shall be provided through a minimum double door with 3-foot square opening. The door shall be aluminum, diamond plated, H20 rated, and spring assisted. The door shall be provided with a recessed padlock hasp for locking with a standard padlock.
6. An on-site hoist and crane shall be provided for pump assembly and removal. The crane shall be load rated for 150% of the maximum weight of the pump assembly.
7. Check valves and isolation valves for submersible pumps shall be located in a separate valve vault chamber. The check valve shall be located between the pump and the shutoff valve. Check valves shall be suitable for the material being handled, and shall be placed on the discharge line in a horizontal position. Swing check valves shall have outside levers.
8. Vaults shall be no deeper than five feet from the rim to the vault floor, unless otherwise approved by the City's authorized representative. Vaults shall be large enough to allow for a worker to enter and perform routine maintenance. Accumulated water shall drain to the wet well with a minimum 2-inch diameter drain line and shall be primed and trapped as required plumbing codes. Wastewater and gases from the wet well shall be prevented from entering the valve vault.
9. Valves shall not be located in the wet well.
10. The wet well shall have sufficient operating volume to maintain individual pump cycle times that comply with NEMA and pump manufacturer requirements for motor starts per hour. In addition, additional wet well space shall be provided for future pumps, as applicable. The floor shall be sloped for proper installation and function of the pumps inlets. Influent flow shall enter the wet well above the pump operating level.
11. Wet well shall be provided with a corrosion resistant cementitious coating, Strong Seal or approved equal. Corrosion resistant coating shall be reviewed and approved by the City's authorized representative.
12. Motors shall be protected from over-current, over-temperature and voltage imbalance. Minimum number of pumps shall be two, unless otherwise approved by the City.

c. Control Building Features

1. The control building shall consist of a control room that houses all electrical and control equipment, and the generator. As applicable, an additional space may be required for odor control chemical feed or air compressor equipment.
2. Building shall be a low-maintenance above-grade structure that is architecturally compatible with the surrounding area and constructed using materials meeting City Code and approved by the City's authorized representative. The building shall be of adequate size with equipment clearances provided that meet applicable code requirements and for operation and maintenance of all systems. Building structure and site layout shall be designed in accordance with the current International Building Code (IBC) and applicable energy codes and noise codes.
3. Pump station building shall generally consist of reinforced-concrete floor slab and foundation and be constructed of durable materials that accommodate the intended uses of the building. Doors shall be metal and any glazing shall be safety glass. The structure shall be secure and provided with intrusion alarms on all doors and shall otherwise be resistant to vandalism. All exterior building materials and colors shall be approved by the City's authorized representative.
4. Doors shall be sized, as applicable based on equipment sizes, for removal of all equipment located within the control building. Where required, overhead doors shall be of heavy-duty construction, roll-up style, with insulated panels, and shall provide a minimum of 9-feet of vertical clearance. Adequate clearances, sufficient anchorage, and hoists must be provided to remove, replace and maintain all major and minor equipment.
5. Pump station noise sources that may create noise problems include, but are not limited to, electrical equipment, engine-generator sets, fans and air compressors. Design engineer shall provide at minimum acoustic style louvers and sound dampeners at all wall and/or roof penetrations. Noise suppression mufflers shall be provided for the generator. The design engineer shall incorporate all applicable and reasonable control measures to and comply with all applicable noise regulations.

d. Electrical and Instrumentation

1. Permanent back-up standby power shall be provided for each pump station and shall be approved by the City's authorized representative. Alternatively a secondary power source may be acceptable, as approved by the City's authorized representative. Generator systems shall be as required by the DEQ Standards.

For pump stations located in residentially zoned areas the generator shall be housed inside the pump station control building, unless otherwise approved by the City's authorized representative. In commercial or industrial zoned areas, the generator may be allowed outside based on City Code requirements and approval by the City's authorized representative.

Where required by the City, the generator shall be located in a separate room from the control and electrical equipment. The generator room shall be provided with a

louver sized for removal of the generator from the building. The room shall be sized adequately for maintenance access to the generator.

2. Electrical supply, power, control, alarm circuits, and lines shall be designed to provide strain relief and to allow for disconnection and de-energizing outside the wet well. Terminals and connectors shall be protected from corrosion by location outside the wet well. All penetrations of the wet well shall be watertight. Provisions shall be made to prevent wet well gases from entering cabinets and equipment located in the control building. The design shall provide a method to allow for disconnection of the pump from the motor control center without destroying conduit seals.
3. A remote telemetry unit shall be installed and integrated with the City's programmable logic controller/SCADA system. The telemetry panel shall be designed and programmed by the City's systems integrator, unless otherwise approved by the City, and furnished and installed by the pump station electrical contractor. Local control shall be provided in case of telemetry failure.

At a minimum, the following alarm signals shall be made available from the pump station control panel to the telemetry/SCADA system: pump #1 on, pump #2 on, pump #1 fail, pump #2 fail, motor #1 high temperature, motor #2 high temperature, phase fail, low water alarm, high water/pumps call (float), overflow alarm, intrusion and smoke detection. For stations with more than two pumps, alarm signals shall be expanded to include all pumps. All appropriate alarms shall be wired and tested for accuracy before they are accepted.

4. Pump station level sensing and control shall be provided by an integrated controller and level sensor in addition to back-up control system. All pump station control systems must be listed as intrinsically safe by a nationally recognized testing laboratory.
 - (a) Primary controls shall include a pulse radar level sensor to measure wet well levels. The radar level sensor shall be a Vegapuls 65, unless otherwise approved by City's authorized representative. Sensor shall be rated for explosive environments and an accuracy of +/- 8mm.
 - (b) Controller for primary controls shall be designed to operate integrally with the level sensor. Controller shall have a minimum of 5 relay contacts assignable as alarms and pump controls. Controller shall be provided with an LCD display.
 - (c) Backup level control shall be provided with floats for high level wet well and low level wet well for use in the event of primary level control system failure. High level float shall signal high water alarm and a call for both pumps; low level float shall signal low water alarm and turn both pumps off. Alternatively, a timed relay can be provided in lieu of the low level float. Intrinsically safe relays shall be supplied in a separate enclosure.

5. Pump stations shall be provided with a red alarm lamp mounted to and visible from the nearest public roadway. Red alarm lamp shall be energized in conjunction with any pump station alarm. No local audible alarms shall be installed. A red light test switch shall also be installed.
6. Control panel construction, electrical wiring, and equipment shall be in strict conformance with the National Electric Code, State and Local Codes, and in conformance with applicable specifications of NEMA, ANSI, UL, and ICEA. Inside panels shall be NEMA 12; outside panels shall be NEMA 4X.
7. All electrical equipment shall be mounted inside an electrical panel that is placed at safe operating levels and shall not be subject to flooding. Panels shall be located so they are out of the way of maintenance operations for equipment. Control panel shall include the following monitoring devices: phase monitor (with switch to allow for checking all three phases); elapsed time meter; pump start counter; voltmeter and ammeter. Uninterruptible Power Supply (UPS) – Install a UPS in the control panel to prevent control system failure in the event of a voltage dip (up to 35%) at generator startup. The UPS must be compatible with the generator operations.

401.3.06 Operation and Maintenance Manual

- a. The design engineer shall prepare an Operations and Maintenance (O&M) Manual for the completed project. All required information shall be provided in both hard-copy and electronic format. Three copies of the O&M is required to provided, reviewed and accepted by the City's authorized representative and DEQ prior to initial station startup. The City project number and the name/address of the pump station shall be noted on each manual. Binding of each hard-copy shall be by locking three-ring binder. System operation and equipment literature shall be in separate volumes. A table of contents shall be included.
- b. The design engineer shall shall include, but not be limited to, the following information that is to be provided in the O&M:
 1. Sequence of operations including description of the operation and interaction of systems and subsystems during startup, operation in automatic mode, operation in manual mode, and operation with backup power. This includes, but is not limited to, equipment, pumps, piping, valves, HVAC, generator, electrical, controls, and instrumentation. Provide both simplified and detailed system schematics, as required.
 2. List of contacts including, but not be limited to, design engineer, contractors and subcontractors, utility companies, pump equipment supplier, instrumentation equipment supplier.
 3. Station operation and controls, including updated information on the actual pumps installed.
 4. On-site utilities.

5. A consolidated summary of required routine maintenance and scheduled preventative and predictive maintenance for all station equipment along with references to the location within the manual where detailed information may be found.
 6. Safety procedures.
 7. Emergency plans and procedures.
 8. Design engineer's certification of construction.
- c. The Contractor shall be required by the project specifications to include, at a minimum, the following information in the equipment literature section of the O&M:
1. Disassembly and reassembly instructions.
 2. Parts list including part numbers.
 3. Name, location, and telephone number of nearest supplier and spare parts warehouse.
 4. Manufacturer's certifications, including calibration data sheets and specified calibration procedures and/or methods for installed equipment.
 5. Warranty forms and information for all installed equipment as provided by the contractor.
 6. Test results of all equipment installed and tested.

401.4.00 MATERIAL AND TECHNICAL SPECIFICATIONS

401.4.01 Manholes and Structures

a. General

Manholes shall be constructed at locations shown on the plans and in compliance with the design requirements of [Section 401.2.01](#), "Manhole Design", or as required by the City's authorized representative.

b. Materials

1. **Aggregate and Cement:** Aggregate shall meet the standards set forth in ODOT SSC Section 02690, "PCC Aggregates"; Portland cement shall meet the standards set forth in ODOT SSC Section 02010, "Portland Cement."
2. **Concrete:** PCC for poured in place manholes and structures shall conform to ODOT Class 3000 – 1½, Commercial Grade Concrete. Slump shall be between 2 and 4 inches.
3. **Manhole Frames and Covers:**

- (a) Casting shall be of new material, tough, close-grained gray iron conforming to ASTM A-48, Class 30B and AASHTO M 105, Class 30B. Where the ASTM and AASHTO specifications differ, the more stringent shall apply. Casting shall be smooth and clean, free of blisters, blowholes, and all defects. Bearing surfaces shall be planed or ground to ensure flat, true surfaces. Covers shall be true and set within rings at all points.
 - (b) Rings shall be grouted in place and made watertight with a high-strength, non-shrink grout meeting ODOT SSC Section 02440.50(b), “Non-Shrink Grout,” such as Alcrete Twenty Minute Fast Setting Grout[®], or approved equal. Unused grout shall be discarded after 20 minutes and shall not be used. Rings shall not be brought to grade with lumber.
 - (c) Frames and covers shall be standard or suburban, depending on the manhole location and as approved by the City’s authorized representative. Suburban style manhole frames shall not be installed in PCC streets or arterial roadways.
 - (d) Manholes installed outside of paved street or sidewalk areas shall be installed with a tamperproof frame and cover as shown in **Detail No. S-2060** of these standards.
4. **Manhole Types:** Manholes shall be preformed rubber O-ring gasket design only and conform to the following:
- (a) **Precast 48-Inch-Diameter Manholes:** Materials shall conform to the requirements of ASTM C-478. Minimum wall thickness shall be 5 inches.
 - (b) **Precast Large-Diameter (60-inch or larger) Manholes:** Materials shall conform to the requirements of ASTM C-478. Manhole structural dimensions shall be reviewed and approved on a case by case basis in accordance with [Section 401.1.03.d.5](#), “Design Submittals.”
 - (c) **Precast Manhole Tops:** Standard eccentric cone, short eccentric cone, and flat slab tops shall be provided in accordance with [Section 401.2.01.b](#), “Manhole Design” Eccentric cones shall conform to all requirements of ASTM C-478, with the exception of the steel reinforcement requirement. Precast manhole tops shall be designed to withstand AASHTO H-20 loadings.
 - (d) **Permeability Testing:** Before precast manhole sections of any size are delivered to the job site, the sections shall meet the permeability test requirements of ASTM C-14 and ASTM C-497.
 - (e) **Precast Bases:** Precast manhole bases shall be used, except when placing a manhole over existing pipe. Precast bases shall conform to the requirements of ASTM C-478. The base riser section shall be integral with the base slab.

(f) **Poured-in-place Bases:** Poured-in-place manhole bases may only be used when placing a manhole over an existing pipe.

5. **Manhole Pipe Connectors:** Connections to manholes shall be made with an approved flexible connector specifically manufactured for the intended use, conforming to ASTM C923, and in accordance with **Detail No. S-2010** of these standards. Field fabricated waterstops or improvised adapters, such as gaskets stretched over the pipe, will not be allowed.

Connections to existing manholes may be made with a sand collar fabricated of the same material as the connecting pipe by an approved manufacturer in accordance with **Detail No. S-2010**. Sand collars shall be constructed with a gasketed joint located within 12” or half the pipe diameter, whichever is greater, from the manhole wall. Sand collars shall not be fabricated in the field.

6. **Pipe Stub outs for Future Sewer Connections:** Pipe stub outs shall be the same type as approved for use in the lateral, main, or trunk sewer construction. Strength classifications shall be the same class as in adjacent trenches. Where two or more different classes of pipe exist at a manhole, the City’s authorized representative shall determine the strength classification. Connect stub outs to manholes as specified in [Section 401.4.01.e.1](#), “Connection to Existing Manholes.” Rubber-gasketed, watertight plugs shall be furnished with each stub out and shall be adequately braced against air test pressures.
7. **Gaskets:** Manhole sections shall be installed with preformed rubber O-ring gaskets only. Rubber gaskets shall conform to AASHTO M 315 and ASTM C-443.
8. **Manhole Steps:** Steps shall be required and shall be constructed as specified and shown in **Detail No. S-2080** of these standards, unless otherwise approved by the City’s authorized representative. When pipe is 24 inches in diameter or smaller, steps shall be located as indicated in **Detail No. S-2065** of these standards. For pipe larger than 24 inches in diameter, steps shall be located over a bench as coordinated with the City’s authorized representative.

c. Workmanship

1. **Foundation Stabilization:** If, in the opinion of the geotechnical engineer or the City’s authorized representative, unstable subgrade material exists that will not support the manhole or other structure, the contractor shall excavate below grade and backfill with foundation-stabilization material in accordance with the standards of [Section 601.3.02.d](#), “Trench Foundation.”
2. **Pipe Connections:** All rigid pipes, such as concrete, entering or leaving the manhole shall be provided with flexible joints within 1 foot or half the pipe diameter, whichever is greater, of the manhole structure and shall be placed on firmly compacted bedding. All flexible pipe, such as PVC, shall connect to manholes using connectors as specified in [Section 401.4.01.b.5](#), “Manhole Pipe

Connectors.” Special care shall be taken to see that the openings through which pipes enter the structure are completely watertight.

3. **Flexible Joints:** At rigid pipe connections, such as concrete, where a flexible joint cannot be provided within the greater of 1 foot or half the pipe diameter from the manhole, a 6-inch concrete encasement shall be constructed around the entire pipe, from the manhole base to within 1 foot of the pipe joint, at the discretion of the City’s authorized representative. The pipe encasement shall be constructed integrally with the manhole base. Pipes laid out of the manhole shall be shortened to ensure that the first flexible joint is no more than 1 foot from the manhole base.
4. **Manhole Connections:** The contractor shall connect sewer pipe to manholes as specified in [Section 401.4.01.e](#), “Types of Connections.”
5. **Concrete Bases (Poured-in-Place):** Poured-in-place bases shall be used over existing pipelines in accordance with **Detail No. S-2015** of these standards for 48” diameter manholes. For manholes greater than 48” in diameter, poured-in-place bases shall be provided in accordance with **Detail No. S-2040** of these standards. The contractor shall remove water from the excavated area, place the compacted, aggregate base, construct the concrete base, and set the first precast manhole section before the concrete has set. The first precast manhole section shall be properly located and plumb and have a uniform bearing throughout the full circumference. The contractor shall deposit sufficient concrete on the base to assure a watertight seal between base and manhole wall. Twenty-four hours shall be allowed to elapse before the remaining manhole sections are placed on the base, unless otherwise approved by the City’s authorized representative. Where poured-in-place concrete bases are used to construct manholes over existing sewers, comply with [Section 401.4.01.e.2](#), “Manholes Over Existing Sewers.”
6. **Drop Manholes**
 - (a) The maximum free drop in a manhole shall be 18 inches. See [Section 401.4.01.e.3](#), “Shallow Inside Drop Manhole,” for construction of this connection.
 - (b) When more than 18 inches of drop exists, a drop manhole shall be provided in accordance with [Section 401.2.01.r](#), “Manhole Design.”
7. **Placing Manhole Section:** The contractor shall clean the end of each sections of foreign material. Manholes shall be installed with watertight rubber O-ring gaskets only. The inside seams shall be grouted with a high-strength, non-shrink grout meeting ODOT SSC Section 02440.50(b), “Non-Shrink Grout,” such as Alcrete Twenty Minute Fast Setting Grout[®], or approved equal. Unused grout shall be discarded after 20 minutes and shall not be used. All grouted joints and pick holes shall be troweled smooth. Manholes will be visually inspected for water leakage by the City’s authorized representative. Any leakage observed shall be repaired at the contractor’s expense, and the manhole re-inspected.

8. **Manhole Inverts:** The contractor shall construct manhole inverts in conformance with **Detail No. S-2005** or **Detail No. S-2015** of these standards. Inverts shall have smooth transitions to ensure an unobstructed flow through the manhole. The contractor shall remove all sharp edges or rough sections that tend to obstruct flow.
 9. **Manhole Stub outs:** The contractor shall install stub outs from manholes for sewer extensions, as shown in these standards or as required by the City's authorized representative. A watertight flexible connection shall be provided in all new manholes. The contractor shall construct invert channels in accordance with **Detail No. S-2005** or **Detail No. S-2015** of these standards. The minimum length of stub outs in existing manholes shall be 12 inches outside the manhole wall. Pipes shall be grouted in precast walls or the manhole base to create a watertight seal around the pipes. The contractor shall install compacted base rock, as specified in these standards, over undisturbed earth under all stub outs.
- d. **Manhole Extensions, Rings, and Covers:** The contractor shall install rings and covers on top of manholes to positively prevent all infiltration of surface water or groundwater into manholes. Rings shall be set in a bed of high-strength, non-shrink grout meeting ODOT SSC Section 02440.50(b), "Non-Shrink Grout," such as Alcrete Twenty Minute Fast Setting Grout[®], or approved equal, with the grout carried over the flange of the ring, and shall be set so that tops of covers are flush with the surface of the adjoining pavement, or 1 foot above the natural ground, unless otherwise directed by the City's authorized representative. Unused grout shall be discarded after 20 minutes and shall not be used. Grouted surfaces shall be troweled smooth. Total thickness of grade rings shall not exceed 12 inches; rings shall be grouted watertight. Drop from rim to first manhole step shall not exceed 27 inches.
 - e. **Types of Connections**
 1. **Connection to Existing Manholes:** The contractor shall connect sewers to existing manholes at the locations shown on the plans. Contractor shall submit a plan for diversion control and receive written approval from the City's authorized representative before proceeding with construction. The contractor shall provide all diversion facilities, and shall perform all work necessary to maintain sewage flow in existing sewers while connections are being made to the manholes. Connections to existing manholes shall be core-drilled, and the bases shall be grouted as necessary to allow a smooth flow into and through the existing manholes.
 2. **Manholes Over Existing Sewers:**
 - (a) The contractor shall construct manholes over existing operating sewer lines at the locations shown on the plans.
 - (b) Manholes constructed over existing sanitary sewers shall have all portions of the pipe to be in contact with the manhole cleaned and:

- i. **Concrete Pipe Connections:** An approved commercial concrete bonding agent shall be applied to the pipe prior to placement of concrete.
 - ii. **PVC Pipe Connections:** A dense coating of clean mortar sand shall be applied to the pipe using PVC solvent cement. After the cement has cured, an approved commercial concrete bonding agent shall be applied to the sand prior to placement of concrete. Water as a substitute for commercial bonding agent will not be allowed.
- (c) The contractor shall construct a poured-in-place base under the existing sewer and the precast sections as specified.
 - (d) The contractor shall not cut into any existing lines until the new manhole(s) are grouted and pressure tested, the new lines are balled, cleaned, deflection tested, and pressure tested, and all portions of the sewer have been approved and accepted by the City's authorized representative.
 - (e) After acceptance, the contractor shall saw cut into the existing line; cut edges of concrete pipe shall be covered with grout and troweled smooth; with ductile iron or plastic pipe, grout shall be applied up to cutout and troweled smooth.
3. **Shallow Inside Drop Manhole:** Where the invert of the connecting pipe is above the manhole shelf and less than 18 inches above the outlet, an inside drop shall be constructed utilizing Portland cement concrete. The sewage entering the manhole shall follow a smooth concrete channel transitioning evenly from the invert of the inlet pipe into the main channel. Sewage shall not be allowed to fall freely to the manhole base.

401.4.02 Gravity Sewer Pipe

a. General

- 1. It is not intended that the materials listed herein are to be considered equal or to be generally interchangeable for all applications. The material suitable for project conditions shall be determined by the Engineer of Record and approved by the City's authorized representative.
- 2. Sanitary sewer pipe shall have flexible gasket joints. Joints on all fittings shall be the same as the joints used on the pipe. Caps or plugs shall be furnished with each fitting, outlet, or stub, as required, and shall have the same type of gasket or joint as the pipe.
- 3. Each piece of pipe and fitting shall be clearly identified as to strength, class, and date of manufacture.

b. Materials

Materials shall be the following types or approved equal:

1. Reinforced Concrete Pipe

- (a) Reinforced concrete, non-pressure pipe shall conform to the requirements of ASTM C-76 and shall be of the class specified. Unless otherwise specified, pipe shall meet the design requirements of Wall B.
- (b) Gaskets shall conform to the requirements of ASTM C-443.
- (c) All steam-cured concrete pipes must be at least seven days old before it can be used. If the pipe has not been steam-cured, it must not be used before it has cured for 28 days.
- (d) Fittings shall be manufactured integrally and be of a class at least equal to that of the adjacent pipe. Field taps shall be machine-drilled.
- (e) Mortar used shall be standard nonshrink premixed mortar conforming to ASTM C-387 or in a proportion of one part Type II Portland cement to two parts clean, well-graded sand that will pass a 1/8-inch screen. Mortar mixed for longer than 30 minutes shall not be used.

2. Ductile Iron Pipe (D.I.)

- (a) Ductile iron pipe shall be cement mortar lined with push-on joints conforming to the requirements of AWWA C-151/ ANSI A21.51 and AWWA C-104/ANSI A21.4. The minimum thickness class shall be Class 50 (up through 12-inch diameter pipe) and Class 51 (for 14-inch diameter and larger pipe).
- (b) Fittings shall be mechanical or push-on and be of a class at least equal to that of the adjacent pipe. Mechanical joint ductile iron fittings shall conform to AWWA C-110/ANSI A21.10. Push-on joint fittings shall be gray iron, with body thickness and radii of curvature conforming to ANSI A-21.10. Rubber gasket joints shall conform to AWWA C-111/ ANSI A-21.11.

3. Polyvinyl Chloride Pipe (PVC)

Polyvinyl Chloride Pipe (PVC) pipe and fittings shall conform to ASTM D-3034 (SDR 35 or lower) and ASTM F-679. Where added pipe strength is required, PVC pipe shall conform to AWWA C-900 and AWWA C-905.

4. Fittings

- (a) General
 - i. Manufactured tee fittings shall be provided in the sewer main for side sewers. Fittings shall be of sufficient strength to withstand all handling and load stresses encountered.
 - ii. Fittings shall be of the same materials as the pipe. Material joining the fittings shall be of the same material as the pipe.

- iii. Material joining the fittings to the pipe shall be free from cracks and shall adhere tightly to each joining surface.
 - iv. All fittings shall be capped or plugged, and shall be gasketed with the same gasket material as the pipe joint, fitted with an approved mechanical stopper, or have an integrally cast knockout lug. The plug shall be able to withstand all test pressures without leaking. When later removed, the plug shall permit continuation of piping with jointing similar to joints in the installed line.
- (b) Mechanical Couplings: Mechanical couplings shall be wrought steel. Installation procedures must meet the manufacturers' recommendations.

5. Line Tap Saddle

- (a) PVC Tee Saddle: manufactured in accordance with ASTM D-3034 (SDR 35 or lower) with minimum cell classification of 12454B-C or 12364-C as defined in ASTM D-1784. Elastomeric seals shall meet ASTM F-477 specifications; locate seals at both the lead and skirt ends of the saddle. Saddles shall be banded to pipe with #316 Stainless Steel bands, 9/16-inch wide. This saddle is allowed on PVC, clay, IPS, concrete, asbestos cement, and PE pipe.
- (b) Romac Style "CB" Saddle shall be made of casting of ductile iron, which meets ASTM A-536, grade 65-45-12. Rubber gaskets shall conform to AWWA C-111/ANSI A21.11. The band shall be stainless steel with Teflon coated nuts and bolts. This saddle is not allowed on plastic pipe except C-900.
- (c) Inserta Tee[®], or approved equal: hub adaptor shall be manufactured in accordance with ASTM D-3034; elastomeric seals shall meet ASTM F-477 specifications. This connection is allowed only on thick wall pipe material, e.g., concrete, ductile iron, rib type plastic. Connection point shall be core drilled. The hole diameter shall be cut to manufacturer's specifications. Hub adaptor shall be connected to rubber sleeve with #316 Stainless Steel band (9/16-inch wide), screw, and housing. Inserta Tee[®] connection shall have a gasketed bell for use with sanitary sewers.

c. Proof Tests

The intent of this requirement is to prequalify a joint system, components of which meet the joint requirements, for water tightness capability of the joint system. The proof test shall be understood to apply to sanitary sewers that are to be tested for water tightness before acceptance. Material and test equipment for proof-testing shall be provided by the manufacturer. When approved, internal hydrostatic pressure may be applied by a suitable joint tester. Each pipe material and joint assembly may be subject to the following three proof tests, at the discretion of the City's authorized representative:

1. **Pipe in Straight Alignment:** No less than three or more than five pipes selected from stock by the City’s authorized representative shall be assembled according to the manufacturers' installation instructions, with the ends suitably plugged and restrained against internal pressure. The pipe shall be subjected to 10-psi hydrostatic pressure for 10 minutes. Free movement of water through the pipe joint wall shall be grounds for rejecting the pipe.
2. **Pipe in Maximum Deflected Position:** A test section is described below for each pipe material. The pipe shall be subjected to 10-psi hydrostatic pressure for 10 minutes. Free movement of water through the pipe joint or pipe wall shall be grounds for rejecting the pipe.
3. **Joints Under Differential Load:** The test section shall be supported on blocks or otherwise, as described below for each pipe material. There shall be no visible leakage when the stressed joint is subjected to 10-psi internal hydrostatic pressure for 10 minutes.
 - (a) **Concrete Pipe:** For a deflected position, a position ½ inch wider than the fully compressed position shall be created on one side of the outside perimeter. For a differential load, one pipe shall be supported so that it is suspended freely between the adjacent pipe, bearing only on the joints. In addition to the weight of the suspended pipe, a test load shall be added, as shown in [Table 4.3](#).

Table 4.3. TEST LOADS FOR CONCRETE PIPES UNDER DIFFERENTIAL LOAD

Pipe Size (inches)	Load per Foot, Laying Length Up to 4 Feet (pounds)	Total Load, Pipe 4 Feet and Over (pounds)
Sanitary Laterals		
4	650	2,600
6	1,000	4,000
Sanitary Mains		
8	1,300	5,200
10	1,400	5,600
12	1,500	6,000
15	1,850	7,400
18	2,200	8,000
21	2,500	10,000
24 and over	2,750	11,000

- (b) **Ductile Iron Pipe:** For the deflected position, a position ½ inch wider than the fully compressed section shall be created on one side of the outside perimeter. For a differential load, one of the pipes shall be supported so that it is suspended freely between the adjacent pipe, and bearing only on the

joints. A force shall be applied along a longitudinal distance of 12 inches beside one of the joints, as specified in [Table 4.4](#).

- (c) **PVC Pipe:** For the deflected position, two 12½-foot lengths shall be joined, then deflected along an arc of 720-foot radius (0.11 feet offset at the end of each length from a tangent at the joint). For a differential load, two lengths shall be joined and uniformly supported for at least 2 feet on both sides of the joint and the adjacent pipe to 95 percent of its vertical diameter.

Table 4.4. TEST LOADS FOR DUCTILE IRON PIPES UNDER DIFFERENTIAL LOAD

Pipe Size (inches)	Load (pounds)	Pipe Size (inches)	Load (pounds)
4	600	15	3,700
6	900	18	4,400
8	1,200	21	5,000
10	1,500	24 and over	5,500
12	1,800	--	--

d. Workmanship

1. **Line and Grade**

- (a) Survey control hubs for both line and grade shall be provided by the design engineer in accordance with [Section 401.1.04](#), “Surveying.”
- (b) Variance from the established line and grade shall not be greater than ¼ inch for grade and ½ inch for line, provided that such variation does not result in a level or reverse-sloping invert.
- (c) The contractor shall check line and grade as necessary. If the limits prescribed in these standards are not met, the work shall be immediately stopped; the City’s authorized representative notified, and the cause remedied before proceeding with the work.
- (d) Variation in the invert elevation between adjoining ends of pipe, due to non-concentricity of joining surface and pipe interior surfaces, shall not exceed 1/64 per inch of pipe diameter, or ½ inch maximum.

2. **Pipe Handling**

- (a) The contractor shall unload pipe only by approved means. Pipe shall not be unloaded by dropping it to the ground and shall not be dropped or dumped into trenches.

- (b) Pipe shall not be unloaded or stored within the public right-of-way unless approved by the City's authorized representative.
- (c) The contractor shall inspect all pipe and fittings before lowering them into trenches to ensure that no cracked, broken, or otherwise defective materials are used.
- (d) The contractor shall clean the ends of pipe thoroughly, remove foreign matter and dirt from inside the pipe, and keep it clean during laying and joining.
- (e) The contractor shall lower the pipe into the trench in such a manner as to avoid any physical damage to the pipe.
- (f) The contractor shall remove all damaged pipe from the job site.

3. **Tying In**

- (a) Where poured-in-place manhole bases are installed, the contractor shall not break into an existing sewer line until just before the project is finalized and the manhole has been tested and approved by the City's authorized representative.
- (b) When a contractor ties into a "live" line, the contractor shall keep the new line plugged at the downstream end of the construction to prevent groundwater from entering the City's sewage system.

4. **Foreign Material**

- (a) The contractor shall take all necessary precautions to prevent excavated or other foreign material from entering the pipe during the laying operation.
- (b) At all times, when laying operations are not in progress, the contractor shall use a mechanical plug at the open end of the last laid section of pipe, to prevent entry of foreign material or creep of the gasketed joints.

5. **Pipe Laying**

- (a) Trench excavation shall be in accordance with [Section 6](#), "Trench Excavation and Backfill."
- (b) Pipe laying shall proceed upgrade, with the spigot ends pointing in the direction of flow.
- (c) After a section of pipe is lowered into the prepared trench, the contractor shall clean the end of the pipe to be joined, the inside of the joint, and the rubber ring (if required) immediately before joining the pipe.

- (d) At the location of each joint, dig bell (joint) holes of ample dimensions in the bottom of the trench and at the sides, where necessary, to permit the joint to be made properly.
 - (e) The joint shall be assembled according to the recommendations of the manufacturer. The contractor shall provide all special tools and appliances required for the jointing assembly. The contractor shall take care to properly align the pipe before forced entirely home.
 - (f) Upon completion of pipe laying, all pipe joints shall be in the “home” position, which is defined as the position where the least gap (if any) exists when the pipe components that comprise the joint are fitted together as tightly as the approved joint design will permit. Gaps at pipe joints shall not exceed that allowed by the manufacturer’s recommendations.
 - (g) Joints that exceed the manufacturers allowed gap shall be repaired as required by the City’s authorized representative at no cost to the City. Where 3 or more joint gaps between two structures exceed that recommended by the manufacturer, then all pipe from the first gap to the structure shall be properly re-laid at the Contractor’s sole expense.
 - (h) After the joint is made, the pipe shall be checked for alignment and grade.
 - (i) The trench bottom shall form a continuous and uniform bearing and support for the pipe at every point between joints.
 - (j) After installation, the contractor shall backfill the trench to the extent necessary to prevent pipe movement from any cause, including uplift or floating. Upon inspection and approval by the City’s authorized representative, the contractor shall complete backfill of the trench.
 - (k) Do not lay pipe in water or when, in the opinion of the City’s authorized representative, trench conditions are unsuitable.
6. **Movable Shield:** When pipe is laid in a movable trench shield, the contractor shall take all necessary precautions to prevent the pipe joints from pulling apart when the shield is moved ahead. The bottom of the shield shall not extend below the spring line of the pipe without recompacting the pipe zone.
7. **Cutting Pipe:** When cutting or machining the pipe is necessary, the contractor shall use only the tools and methods recommended by the pipe manufacturer and approved by the City’s authorized representative. The contractor shall cut ductile iron pipe using a method approved by the City’s authorized representative; all burrs or rough edges shall be removed before joining pipe. The contractor shall not flame-cut the pipe.
8. **Transition Fittings:** When joining different types of pipes, the contractor shall use approved ridged fittings. Where ridged fittings are not available, flexible fittings with No. 305 stainless steel bands, such as Fernco, Caulder, or approved

equal, may be considered upon approval of the City's authorized representative; flexible fittings may require additional support under the coupling. Bell type couplings are considered flexible.

- (a) Shear ring/ridge transition couplings meeting the ASTM C-564 or equal shall be used.
- (b) PVC couplers or adapters shall meet the specifications for ASTM D-3034, SDR 35 pipe fittings.
- (c) Ductile iron transition couplings shall be manufactured from ductile iron conforming to ASTM A-536, grade 65-45-12, for center and end rings. Rubber gaskets, bolts, and nuts shall conform to AWWA C-111/ANSI A21.11.

9. **Concrete Closure Collars**

- (a) The contractor shall pour closure collars against undisturbed earth, remove all water from the excavation, and construct suitable forms to create shapes that will provide full bearing surfaces against undisturbed earth, as indicated in **Detail No. S-2190** of these standards.
- (b) Closure collars shall be used only when approved by the City's authorized representative, and then only to make connections between dissimilar pipe and where standard rubber-gasketed joints are impractical.
- (c) Before the closure collars are installed, the contractor shall wash the pipe to remove all loose material and soil from the surface where they will be placed.

10. **Trench Backfill:** The contractor shall place trench backfill in accordance with [Section 6](#), "Trench Excavation and Backfill."

11. **Sanitary Sewer Laterals and Tees**

- (a) Lateral sewers shall be connected to new sanitary sewer mains with manufactured tee fittings per [Section 401.4.02.b.4](#), "Fittings", except where sewer laterals are larger than 50% of the diameter of the main line. Such sewer laterals shall be connected to the main line through the installation of a manhole. Line taps in new mains are not permitted.
- (b) Install sanitary sewer laterals and tee fittings in accordance with **Detail No. S-2175** of these standards.
- (c) Lateral pipe and fittings shall consist of one type of material throughout and no interchanging of pipe and fitting material is allowed.

12. **Line Taps**

- (a) Line taps are allowed on existing sanitary lines only and shall be core drilled unless approved otherwise by the City's authorized representative. Core drilled holes shall be done using a cylinder-style hole saw for only plastic pipe material or a diamond core bit for concrete and D.I. pipes.
- (b) Line tap connections to sanitary lines shall be located a minimum 12" from the sanitary mainline pipe bell.
- (c) Line tap connections to existing sanitary lines may be done using either saddle tees as per [Section 401.4.02.b.5.\(a\)](#), "PVC Tee Saddle" or by using Inserta Tee[®] as per [Section 401.4.02.b.5.\(c\)](#), "Inserta Tee[®]".
- (d) PVC tee saddles shall be installed in accordance with **Detail No. S-2155** of these standards. Inserta Tee[®] shall be installed in accordance with **Detail No. S-2160** of these standards.
- (e) The area around the line tap installation site shall be cleaned and free of all rough edges before installing fittings.
- (f) While installing the connection, no rock, dirt, or debris shall be allowed to enter the main sewer line from the core hole.
- (g) The contractor shall install ¾"-0" crushed aggregate in the pipe zone around the line tap, from 6 inches below the pipe to 12 inches above the pipe.
- (h) Laterals shall have tracer wire installed beside the pipe and plastic caution tape installed 1-foot above the pipe crown as shown in **Detail No. S-2175** of these standards.

401.4.03 Pressure Mains

a. General Provisions

These specifications, together with all other applicable requirements of federal, state, and local law, shall govern the character and quality of material, equipment, installation, and construction procedures for pressurized sanitary sewer work.

b. Materials

1. **Ductile Iron Pipe:** Ductile iron pipe shall be lined with cement mortar and seal-coated and shall conform to applicable portions of the following specifications: ASTM A-536, AWWA C-104/ANSI A21.4, AWWA C-111/ANSI A21.11, and AWWA C-151/ANSI A21.51.
2. **PVC Pipe:** PVC pipe with diameters of 4 inches through 12 inches shall conform to the requirements of AWWA C-900. Joints shall be elastomeric gasketed and shall conform to the requirements of ASTM D-3139.
3. **High Density Polyethylene Pipe (HDPE):** HDPE pipe with diameters of 4 inches through 63 inches shall conform to the requirements of AWWA C-906.

Joints shall be joined by thermal heat fusion and shall conform to the requirements of ASTM D-2683 for socket-type fittings, ASTM D-3261 for butt-type fittings, or ASTM F-1055 for electrofusion-type fittings.

c. Workmanship and Pipe Installation

1. All pipe shall be laid to the specified lines and grades. The minimum depth of the pipe cover shall be as specified in [Section 401.2.02.1](#), “Pipe Cover.” Pipes shall not be deflected either horizontally or vertically beyond the limits established and recommended by the pipe manufacturer.
2. Pipeline shall be laid to a grade that results in the minimum number of high points, based on terrain and economic considerations. Abrupt transitions and sharp peaks shall be avoided.
3. All tees, elbows, or other fittings shall be produced by the pipe manufacturer and shall be properly braced, anchored, or blocked.
4. Automatic air and vacuum release valves with a bleed-off port shall be installed at all high points or locations in the pipeline where air pockets would be expected to accumulate. Valves shall be installed in a vault, so as to provide accessibility for service and repair. Sumps shall be required for holding excess liquid discharged from the bleed-off port.

401.5.00 CONSTRUCTION SPECIFICATIONS

401.5.01 General Provisions

The specifications detailed here, together with the standards established by the Oregon DEQ, the U.S. Environmental Protection Agency, and any other applicable requirements of the City, shall govern the character and quality of material, equipment, installation, and construction procedures for mainline sanitary sewer work of gravity-flow systems.

401.5.02 Scheduling

- a. The contractor shall plan their construction work in conformance with [Section 101.8.02](#), “Scheduling.”
- b. Newly installed sanitary sewer lines shall not be placed in service until necessary testing is complete and system has been approved by the City’s authorized representative.

401.5.03 Environmental Protection, Erosion Prevention, and Sediment Control

The contractor shall take all appropriate measures and precautions to minimize the work’s impact on the environment and shall control erosion, as outlined in [Section 101.9.00](#), “Environmental Protection, Erosion Prevention, and Sediment Control.”

401.5.04 Interferences and Obstructions

Various obstructions may be encountered during the course of the work. The contractor shall follow the guidelines established in [Section 101.8.05](#), “Interferences, Obstructions, Abandoned Utilities.”

401.5.05 Abandon Sewer Facilities

- a. **Sanitary Sewer Pipe:** Sanitary sewer pipe facilities to be abandoned shall be cut off and completely removed at 48-inches minimum below finish grade, unless specifically stated otherwise. Sanitary sewer pipe to be abandoned shall be removed or completely filled with a flowable, Controlled Low-Strength Material (CLSM) as directed by the City’s authorized representative.
- b. **Manholes:** Manholes to be abandoned shall have manhole frame, cover, grade rings, cone section or flat slab top removed and manhole sections cut and removed at 48-inches minimum below finish grade, unless specifically stated otherwise. The manhole base shall be rubblized or perforated to prevent the entrapment of water. The remaining portion of manhole shall be backfilled with Class B material in accordance with [Section 6](#), “Trench Excavation and Backfill.”

401.5.06 Contaminated Soil or Hazardous Material

If during construction contaminated soil or hazardous materials or chemicals are encountered, the Contractor shall follow the procedures specified in [Section 101.9.02](#), “Contaminated Soils or Hazardous Materials.”

401.5.07 Trench Excavation, Preparation, and Backfill

Trench excavation, preparation, and backfill shall conform to the requirements of [Section 6](#), “Trench Excavation and Backfill.”

401.5.08 Preservation, Restoration, and Cleanup

Cleanup of all construction debris, excess excavation, and excess materials and complete restoration of all fences, mailboxes, ditches, culverts, signposts, and similar items shall be completed according to [Section 101.8.16](#), “Preservation, Restoration, and Cleanup.”

401.5.09 Bores

Bores shall conform to the requirements of [Section 301.10.09](#), “Bores.”

401.6.00 TESTING PROCEDURES

401.6.01 General

- a. **Locate Wire Testing:** Prior to paving, the contractor shall notify the City’s authorized representative that the sanitary sewer locate wire is ready for testing. City personnel shall connect to the locate wire and attempt to locate sanitary sewer main line and services. The sewer main line and sewer services shall be located from at

least two connection points to be considered to have adequate coverage. The contractor will be required to locate and repair any gaps in the locate wire coverage. Failed sections shall be retested until adequate coverage is obtained.

- b. **Testing Order:** Prior to the start of sanitary system testing, all manholes shall be re-numbered as assigned by the City’s authorized representative. All testing shall reference the City assigned manhole numbers.

Sanitary systems and appurtenances shall pass a deflection test and an air test before acceptance, and shall be free of visible leakage. Information about air testing may be obtained from the City’s authorized representative. Individual joints on pipe 54 inches in diameter or larger may be tested by an approved joint-testing device. All details of testing procedure shall be subject to approval of the City’s authorized representative. Testing of sanitary systems shall be conducted in the following order.

1. Deflection testing of pipelines.
 2. Air pressure testing of pipelines.
 3. Video-inspection of pipelines.
 4. Vacuum testing of manholes
- c. If repair work is required on a section of the system, that portion of the system shall be retested in the testing order given above.
 - d. Deflection testing, air pressure testing, and video-inspection shall be done only after backfill has passed the required compaction test(s) based on AASHTO T-180 and roadway base rock has been placed, compacted, and approved.
 - e. The sanitary system must pass deflection testing, air pressure testing, and video-inspection before paving of overlying roadways will be permitted.
 - f. Vacuum testing of manholes shall be performed only after paving is completed and approved, or finish grading is completed and approved for manholes installed outside of paved areas. If paving occurs around existing manholes, those manholes shall be vacuum tested and repaired, as needed, in accordance with [Section 401.6.03.a](#), “Vacuum Testing” after paving is completed and approved.

401.6.02 Gravity System Testing

- a. **Cleaning Before Test:** Before testing and City inspection of the system, the contractor shall plug the closest downstream manhole, ball and flush, and clean all parts of the system. The contractor shall remove all accumulated construction debris, rocks, gravel, sand, silt, and other foreign material from the system at the plugged manhole using a vacuuming process. At no time, shall any material be flushed into the downstream city sewer system. When the City’s authorized representative inspects the system, any foreign matter still present shall be removed from the system by repeating the cleaning process. **Test Equipment:** The contractor shall furnish all necessary test equipment and perform the tests in a manner satisfactory to the City’s

authorized representative. Any arrangement of test equipment shall be permitted that will provide observable and accurate measurements of air leakage under the specified conditions. Gauges for air testing shall be calibrated with a standardized test gauge.

b. **Deflection Test for Flexible Pipe:** Sanitary sewers constructed of flexible pipe shall be deflection-tested by pulling an approved mandrel through the completed pipeline. The diameter of the mandrel shall be 95% of the nominal pipe diameter, unless otherwise specified by the City's authorized representative. The mandrel shall be a rigid, nonadjustable, odd-numbered leg (9 legs minimum) mandrel having an effective length of not less than its nominal diameter. Testing shall be done manhole-to-manhole after the line has been completely balled and flushed with water and after compaction tests of backfill have been completed and accepted. Testing shall be conducted in the presence of the City's authorized representative. The contractor will be required to locate and repair any sections that fail the test and to retest those sections. All repairs shall follow, and be in compliance with, the manufacturer's recommendations.

c. **Air Pressure Testing**

1. **General:** After the system is complete, including service connections and backfilling, the contractor shall conduct a low-pressure air test. The contractor shall provide all equipment and personnel for the test. The method, equipment, and personnel shall be subject to approval of the City's authorized representative. Testing shall be conducted in the presence of the City's authorized representative. The City's authorized representative may, at any time, require a calibration check of the instrument used. The pressure gauge shall have minimum divisions of 0.10 psi and an accuracy of 0.0625 psi (one ounce per square inch). All air shall pass through one control panel.

2. **Safety Precautions:** All plugs used to close the sewer for the air test must be capable of resisting the internal pressures and must be securely braced. All air-testing equipment must be placed above ground. No one shall be permitted to enter a manhole or trench where a plugged line is under pressure. All pressure must be released before the plugs are removed. The testing equipment must include a pressure-relief device designed to relieve pressure in the line under test at 10 psi or less, and must allow continuous monitoring to avoid excessive test pressure. The contractor shall use care to prevent the air inlet from flooding with infiltrated groundwater. The contractor shall inject air at the upper plug if possible. Only qualified personnel shall be permitted to conduct the test.

3. **Method:** Air testing shall be by the time pressure drop method, as follows:

(a) Clean the lines to be tested and remove all debris.

(b) Wet the lines before testing (optional).

(c) Plug all open ends with suitable test plugs; brace each plug securely.

- (d) Check the average height of groundwater over the line. Add air slowly to the section of the system being tested until the internal air pressure is 3.5 psi higher than the average pressure of groundwater (0.433 psi for each foot of average water depth over the line).
 - (e) After the internal test pressure is reached, allow at least two minutes for the air temperature to stabilize, adding only the amount of air required to maintain pressure.
 - (f) After the temperature stabilization period, disconnect the air supply.
 - (g) Determine and record the time (in seconds) required for the internal air pressure to drop from 3.5 psi to 2.5 psi.
 - (h) Compare the time recorded in step (g) above with the time required, as determined below.
4. **Passing test:** A passing test shall be based on meeting or exceeding the requirements below. The test method depends on the type of pipe material. If a line fails to meet the requirements, the contractor shall repair or replace all defective materials or workmanship.

(a) Concrete pipe

Air pressure drop method: The tested section, when tested by the air pressure drop method, will be acceptable if the time required for the pressure to drop from 3.5 psi to 2.5 psi is not less than the time (T) in seconds ([Table 4.5](#)) computed by the following formula:

$$T = K/C$$

Where: $K = 0.011 \times d^2L$.

$C = 1$ or $0.0003882 \times dL$, whichever is greater.

$d =$ inside diameter of pipe (inches).

$L =$ length of pipe (feet).

(b) PVC, HDPE, and ductile iron pipe

The minimum duration for the prescribed low-pressure exfiltration pressure drop between two consecutive manholes shall not be less than that shown in [Table 4.6](#) or [Table 4.7](#). The Tables list test duration values for pressure drops of 1.0 psi and 0.5 psi in excess of groundwater pressure above the top of the sewer pipe. Values accommodate both an allowable average loss per unit of surface area and an allowable maximum total leakage rate.

- (c) Record the diameter (inches), length (feet), end manhole number, time, pressure drop, and groundwater level of the test on an inspection form. The form shall become part of the permanent record for the project.

Table 4.5. AIR TESTING OF CONCRETE PIPE

Pipe Diameter (inches)											
Pipe Length (ft)	4.0	6.0	8.0	10.0	12.0	15.0	18.0	21.0	24.0	30.0	36.0
	Time (sec)	Time (sec)	Time (sec)	Time (sec)	Time (sec)	Time (sec)	Time (sec)	Time (sec)	Time (sec)	Time (sec)	Time (sec)
10	1.8	4.0	7.0	11.0	15.8	24.8	35.6	48.5	63.4	99.0	142.6
20	3.5	7.9	14.1	22.0	31.7	49.5	71.3	97.0	126.7	198.0	285.1
30	5.3	11.9	21.1	33.0	47.5	74.3	106.9	145.5	190.1	297.0	427.7
40	7.0	15.8	28.2	44.0	63.4	99.0	142.6	194.0	253.4	396.0	570.2
50	8.8	19.8	35.2	55.0	79.2	123.8	178.2	242.6	316.8	495.0	712.8
60	10.6	23.8	42.2	66.0	95.0	148.5	213.8	291.1	380.2	594.0	855.4
70	12.3	27.7	49.3	77.0	110.9	173.3	249.5	339.6	443.5	693.0	997.9
80	14.1	31.7	56.3	88.0	126.7	198.0	285.1	388.1	506.9	792.0	1020.1
90	15.8	35.6	63.4	99.0	142.6	222.8	320.8	436.6	570.2	850.1	same.
100	17.6	39.6	70.4	110.0	158.4	247.5	356.4	485.1	633.6	same.	after
110	19.4	43.6	77.4	121.0	174.2	272.3	392.0	533.6	680.1	after	72 ft.
120	21.1	47.5	84.5	132.0	190.1	297.0	427.7	582.1	same.	86 ft.	
130	22.9	51.5	91.5	143.0	205.9	321.8	463.3	595.1	after		
140	24.6	55.4	98.6	154.0	221.8	346.5	499.0	same.	108 ft.		
150	26.4	59.4	105.6	165.0	237.6	371.3	510.0	after			
160	28.2	63.4	112.6	176.0	253.4	396.0	same.	123 ft.			
170	29.9	67.3	119.7	187.0	269.3	420.8	after				
180	31.7	71.3	126.7	198.0	285.1	425.0	144 ft.				
190	33.4	75.2	133.8	209.0	301.0	same.					
200	35.2	79.2	140.8	220.0	316.8	after					
210	37.0	83.2	147.8	231.0	332.6	172 ft.					
220	38.7	87.1	154.9	242.0	340.0						
230	40.5	91.1	161.9	253.0	same.						
240	42.2	95.0	169.0	264.0	after						
250	44.0	99.0	176.0	275.0	215 ft.						
260	45.8	103.0	183.0	283.4							
270	47.5	106.9	190.1	same.							
280	49.3	110.9	197.1	after							
290	51.0	114.8	204.2	258 ft.							
300	52.8	118.8	211.2								
310	54.6	122.8	218.2								
320	56.3	126.7	225.3								
330	58.1	130.7	226.7								
340	59.8	134.6	same.								
350	61.6	138.6	after								
360	63.4	142.6	322 ft.								
370	65.1	146.5									
380	66.9	150.5									
390	68.6	154.4									
400	70.4	158.4									
410	72.2	162.4									
420	73.9	166.3									
430	75.7	170.0									
440	77.4	same.									
450	79.2	after									
460	81.0	430 ft.									
470	82.7										
480	84.5										
490	86.2										
500	88.0										

Table 4.6. AIR TESTING OF PVC, HDPE, AND DUCTILE IRON PIPE – 1.0 PSIG PRESSURE DROP¹.

**Specification Time Required for a 1.0 psig Pressure Drop for Size and Length of Pipe
Indicated for Q = 0.0015***

Pipe Diameter (inches)	Minimum Time (min:sec)	Length for Minimum Time (feet)	Time for Longer Length (sec)	Specified Minimum for Length (L) Shown (min:sec)								
				100 ft	150 ft	200 ft	250 ft	300 ft	350 ft	400 ft	450 ft	
4	3:46	597	0.380L	3:46	3:46	3:46	3:46	3:46	3:46	3:46	3:46	3:46
6	5:40	398	0.854L	5:40	5:40	5:40	5:40	5:40	5:40	5:40	5:42	6:24
8	7:34	298	1.520L	7:34	7:34	7:34	7:34	7:36	8:52	10:08	11:24	
10	9:26	239	2.374L	9:26	9:26	9:26	9:53	11:52	13:51	15:49	17:48	
12	11:20	199	3.418L	11:20	11:20	11:24	14:15	17:05	19:56	22:47	25:38	
15	14:10	159	5.342L	14:10	14:10	17:48	22:15	26:42	31:09	35:36	40:04	
18	17:00	133	7.692L	17:00	19:13	25:38	32:03	38:27	44:52	51:16	57:41	
21	19:50	114	10.470L	19:50	26:10	34:54	43:37	52:21	61:00	69:48	78:31	
24	22:40	99	13.647L	22:47	34:11	45:34	56:58	68:22	79:46	91:10	102:33	
27	25:30	88	17.306L	28:51	43:16	57:41	72:07	86:32	100:57	115:22	129:48	
30	28:20	80	21.366L	35:37	53:25	71:13	89:02	106:50	124:38	142:26	160:15	
33	31:10	72	25.852L	43:05	64:38	86:10	107:43	129:16	150:43	172:21	193:53	
36	34:00	66	30.768L	51:17	76:55	102:34	128:12	153:50	179:29	205:07	230:46	
42	39:48	57	41.883L	69:48	104:42	139:37	174:30	209:24	244:19	279:13	314:07	
48	45:34	50	54.705L	91:10	136:45	182:21	227:55	273:31	319:06	364:42	410:17	

*Q is the allowable leakage rate in cubic ft/min/ft² of inside surface area of pipe.

1. Data from the UNI-Bell[®] PVC Pipe Association.

Table 4.7. AIR TESTING OF PVC, HDPE, AND DUCTILE IRON PIPE – 0.5 PSIG PRESSURE DROP¹.

**Specification Time Required for a 0.5 psig Pressure Drop for Size and Length of Pipe
Indicated for Q = 0.0015***

Pipe Diameter (inches)	Minimum Time (min:sec)	Length for Minimum Time (feet)	Time for Longer Length (sec)	Specified Minimum for Length (L) Shown (min:sec)								
				100 ft	150 ft	200 ft	250 ft	300 ft	350 ft	400 ft	450 ft	
4	1:53	597	0.190L	1:53	1:53	1:53	1:53	1:53	1:53	1:53	1:53	1:53
6	2:50	398	0.427L	2:50	2:50	2:50	2:50	2:50	2:50	2:50	2:51	3:12
8	3:47	298	0.760L	3:47	3:47	3:47	3:47	3:48	4:26	5:04	5:42	5:42
10	4:43	239	1.187L	4:43	4:43	4:43	4:57	5:56	6:55	7:54	8:54	8:54
12	5:40	199	1.709L	5:40	5:40	5:42	7:08	8:33	9:58	11:24	12:50	12:50
15	7:05	159	2.671L	7:05	7:05	8:54	11:08	13:21	15:35	17:48	20:02	20:02
18	8:30	133	3.846L	8:30	9:37	12:49	16:01	19:14	22:26	25:38	28:51	28:51
21	9:55	114	5.235L	9:55	13:05	17:27	21:49	26:11	30:32	34:54	39:16	39:16
24	11:20	99	6.837L	11:24	17:57	22:48	28:30	34:11	39:24	45:35	51:17	51:17
27	12:45	88	8.653L	14:25	21:38	28:51	36:04	43:16	50:30	57:42	64:54	64:54
30	14:10	80	10.683L	17:48	26:43	35:37	44:31	53:25	62:19	71:13	80:07	80:07
33	15:35	72	12.926L	21:33	32:19	43:56	53:52	64:38	75:24	86:10	96:57	96:57
36	17:00	66	15.384L	25:39	38:28	51:17	64:06	76:55	89:44	102:34	115:23	115:23
42	19:54	57	20.942L	34:54	52:21	69:49	87:15	104:42	122:10	139:37	157:04	157:04
48	22:47	50	27.352L	45:35	68:23	91:11	113:58	136:46	159:33	182:21	205:09	205:09

*Q is the allowable leakage rate in cubic ft/min/ft² of inside surface area of pipe.

1. Data from the UNI-Bell[®] PVC Pipe Association.

- d. **Video Inspection of Gravity Systems:** All sanitary systems shall be video-inspected and approved prior to City acceptance. Video inspection shall take place after trench backfill and compaction has been completed and accepted, and channels have been poured in manholes. All pipes shall be thoroughly cleaned in accordance with [Section 401.6.02.a](#), “Cleaning Before Test” immediately prior to the video inspection; only that water remaining from cleaning shall be present in the system. Video inspection shall be continuous from manhole to manhole without breaks or interruptions in the recording. The camera shall have the ability to tilt up to 90 degrees and rotate 360 degrees on the axis of travel. An inspection of all lateral connections shall be conducted using the tilt capabilities of the camera. A 1/2-inch target ball shall be placed in front of the camera. There shall be no observed infiltration and observed sags must be less than 0.5 inch.

The City’s authorized representative shall be notified and shall be present during video-inspection of the system, unless otherwise approved by the City’s authorized representative. A copy of the video and a written video inspection report, on a City-approved form, shall be supplied to the City’s authorized representative. The video shall be recorded in color CD or DVD format. Video shall include a visual footage meter recording. Problems revealed during the inspection shall be noted on the video and in the written report. After repairs have been made, the line shall be re-inspected and re-tested. If excessive foreign material, in the opinion of the City’s authorized representative, is encountered during video inspection, the line shall be cleaned in accordance with [Section 401.6.02.a](#), “Cleaning Before Test” and re-video inspected.

401.6.03 Manhole Testing

Sanitary sewer manholes shall be tested for acceptance after the trench is backfilled, compaction requirements are met, the road base rock is installed and the street paved, and chimney seals or concrete manhole closure collars are installed. If the manholes pass the tests but the castings were disturbed by construction and must be reinstalled, the manholes shall be retested.

- a. **Vacuum Testing:** All manholes being constructed or rehabilitated shall be vacuum-tested. The test shall consist of plugging all inlets and outlets. The test head shall be placed at the inside of the top of the cone, and shall include grade rings and casting. The seal shall be inflated in accordance with the manufacturer’s recommendations. A vacuum of 10 inches of mercury shall be drawn and the vacuum pump shut off. With the valves closed, the time shall be measured for the vacuum to drop to 9 inches. The manhole shall pass if the time for the vacuum reading to drop to 9 inches meets or exceed the values listed in [Table 4.8](#). The contractor shall repair all manholes that fail to pass the vacuum test; manholes shall be retested to verify the repair.

Table 4.8. VACUUM TESTING OF MANHOLES

Depth of Manhole (feet)	Diameter of Manhole		
	48 Inch	60 Inch	72 Inch
	Allowable Time (seconds)		
8	20	26	33
10	25	33	41
12	30	39	49
14	35	46	57
16	40	52	65
18	45	59	73
20	50	65	81
22	55	72	89
24	59	78	97
26	64	85	105
28	69	91	113
30	74	98	121

- b. **Hydrostatic Testing:** When, in the opinion of the City’s authorized representative, the groundwater table is too low to visually detect leaks, manholes may be hydrostatically tested. The test shall consist of plugging all inlets and an outlet, then filling the manhole with water to a height determined by the City’s authorized representative. Leakage in each manhole shall not exceed 0.2 gallons per hour per foot of head above the invert. Leakage will be determined by refilling to the rim using a calibrated or known volume container. A manhole may be filled 24 hours before the test, if desired, to permit normal absorption into the pipe walls to take place. The contractor shall repair all manholes that fail to pass the leakage test; manholes shall be retested to verify the repair.

401.6.04 Pressure Main Testing

Field testing of the force main and appurtenances shall be completed by a hydrostatic test that meets the following requirements. Contractor shall be responsible for making all necessary provisions for conveying water to the points of use and for disposal of the test water, including temporary taps and plugs.

- a. Prior to the start of the hydrostatic test, all trenching shall be backfilled, compacted, and accepted per the requirements of Chapter 6, “Trench Excavation and Backfill.”
- b. When concrete thrust blocks are used, the hydrostatic test shall be conducted after at least five days elapse from when the concrete thrust blocking was installed. If high-

early cement is used for the concrete thrust blocking, the time may be cut by two days.

- c. Seal pipe ends and secure pipe with temporary thrust restraint, as required, to maintain line and grade and to prevent damage.
- d. Fill the test section with water and allow it to stand at two-thirds of the test pressure for a minimum of 12 hours. All air shall be purged from the pipeline before it is checked for leaks or pressure or acceptance tests are performed on the system.
- e. Furnish all equipment and materials and perform testing in conformance with [Section 501.9.01](#), “Hydrostatic Testing.”
- f. If a large amount of water is required to increase the pressure during testing, entrapped air, leakage at joints, or a broken pipe can be suspected. In such cases, tests shall be discontinued until the source of trouble is identified and corrected.
- g. Visible leaks in the wet well and vaults shall be eliminated regardless of the leakage amount.

401.7.00 SANITARY SEWER LINE ACCEPTANCE POLICY

The City of Wilsonville will accept new sanitary installations or systems built to the “Public Works Standards,” providing that the following conditions are met.

401.7.01 Legal Recordings

Dedication of any required easements or rights-of-way have been recorded with the County Recorder and the Engineering Department receives a reproducible copy of the recorded documents.

401.7.02 Project Completion

After completion of construction of the total project, and after all testing has been satisfactorily completed, project closeout shall proceed as outlined in [Section 101.8.17](#), “Project Closeout.”

401.7.03 Maintenance Period

- a. The Contractor or Applicant shall be responsible for providing Maintenance Assurance for Public Improvements as outlined in [Section 101.8.18](#), “Maintenance and Warranty.” Public sanitary improvements shall be warranted for a minimum of two years.
- b. At any time during the warranty period, the City’s authorized representative has reason to believe the public sanitary improvements have defects that were the result of faulty workmanship or flaws in construction material, the responsible party shall be required, at that party’s own cost, to video-inspect the sewer line and repair any

problems or faults revealed during video inspection by replacing those sections. The video inspection shall be done during the winter, if possible, or during the wet weather months, to identify all leaks.

- c. Before the end of the Construction Maintenance period, the City's authorized representative shall inspect the project for any remaining deficiencies. If the deficiencies that remain are determined to be the responsibility of the contractor or the applicant, the contractor or applicant shall then make such repairs.

SECTION 5

WATER SYSTEM DESIGN AND CONSTRUCTION STANDARDS

501.1.00 ENGINEERING

501.1.01 Introduction

This section outlines design and construction requirements for all public water system improvements. These provisions and technical specifications set forth the requirements of the City of Wilsonville for constructing water system improvements. Interpretations of such provisions and their application in specific circumstances shall be made by the City's authorized representative, unless specifically stated otherwise. Refer to [Section 1](#) of the "Public Works Standards" for general provisions and requirements.

501.1.02 Extension of Public Water Systems

- a. Except as to meet minimum fire flow requirements, the extension or upsizing of the public water systems in excess of 8 inches in diameter or as shown in the Wilsonville Water System Master Plan to serve any adjacent parcel or tract of land, shall be done by the property owner or permit applicant and may be subject to applicable System Development Charge (SDC) credits.
- b. The City reserves the right to perform the work or cause it to be performed and bill the owner for the cost of the work or to pursue special assessment proceedings.
- c. The public water system shall extend to the most distant parcel boundary, to facilitate future extension, unless otherwise approved by the City's authorized representative.
- d. Where public infrastructure improvements paid for by the property owner or permit applicant directly benefit adjacent properties, the property owner or permit applicant may pursue establishment of a reimbursement district per Section 3.116 of the City Code.

501.1.03 Water Plans

- a. It is the design engineer's responsibility to ensure that engineering plans are sufficiently clear and concise to construct the project in proper sequence, using specified methods and materials, with sufficient dimensions to fulfill the intent of these design standards.
- b. All elevations on design plans and record drawings shall be based on the applicable NAVD 88 Datum specified in [Section 101.7.07.a](#), "NAVD 88 Datum."

- c. Existing conditions and facilities on design plans and record drawings shall be shown in light, gray print. Proposed conditions and facilities on design plans and record drawings shall be shown in bold, black print.
- d. All engineering water plans shall be stamped by a Professional Engineer registered in the State of Oregon. At a minimum, water plans shall contain the following:
 - 1. At least one sheet shall show a plan view of the entire project site. If the project site is sufficiently large that detailed water plans on any given sheet do not encompass the entire project site, then a sheet showing the plan view of the entire site must serve as an index to subsequent detailed plan sheets.
 - 2. A topographic map showing existing conditions for the site, including the following:
 - (a) Existing topography for the site. Plan views showing existing features may be required for a distance of up to 100 feet (or further if warranted) beyond the proposed improvement in order to prevent future grade conflicts and will be determined on a case-by-case basis by the City's authorized representative.
 - (b) Adjacent streets, trails, multi-use paths, and rail lines, including the respective names.
 - (c) Existing utilities, including franchised utilities above or below ground and drainage facilities that transport surface water onto, across, or from the project site. Existing drainage pipes, culverts, and channels shall include the invert or flow line elevations.
 - (d) Existing vegetation, including denoting the type, DBH, and canopy size of trees within the construction limits.
 - (e) Existing environmentally sensitive areas (e.g., ravines, swales, steep slopes, wells, springs, wetlands, creeks, lakes, etc.). For natural drainage features, show direction of flow, drainage hazard areas, and 100-year floodplain boundary (if applicable).
 - (f) Adjacent existing features that are within 25 feet outside of the site boundary, including but not limited to construction activities that will potentially compromise the structural stability or condition of off-site features, such as cultivated vegetation, landscaping and trees, buildings, fences, decks, walls, slabs, and pavements. Denote the type, DBH, and canopy size of all trees.
 - 3. Plans for proposed water improvements shall include the following:
 - (a) Grading and erosion control plan.

- (b) Finished grades, showing the extent of cut and fill by existing and proposed contours, profiles, or other designations. Plan views showing existing features may be required for a distance of up to 100 feet (or further if warranted) beyond the proposed improvement in order to prevent future grade conflicts and will be determined on a case-by-case basis by the City's authorized representative.
 - (c) Horizontal stationing along centerline, showing points of tangency and curvature, including centerline stationing of all intersecting streets.
 - (d) Proposed structures, including roads and road improvements, parking surfaces, building footprints, walkways, landscape areas, etc.
 - (e) Water facilities, including pipe sizes, pipe types and materials, lengths, joint restraints, and all water system appurtenances, including, but not limited to valves, hydrants, fittings, vaults, meters and thrust blocks. Notes shall be included for referencing details, cross-sections, profiles, etc.
 - (f) Existing and proposed utilities, showing exact line and grade of all utilities crossing the proposed water system.
 - (g) Connection details at all locations of water system appurtenances, including the size, type, spacing, and connection style of valves, bends, tees, crosses, reducers, thrust blocks and other water system appurtenances as required by the City's authorized representative.
 - (h) Applicable detail drawings.
 - (i) Existing and proposed property lines, right-of-way lines, survey monuments, and easements.
 - (j) Setbacks from environmentally sensitive areas or resource areas protected within the Significant Resource Overlay Zone (SROZ).
 - (k) Any proposed phasing of construction.
 - (l) Any additional information that the City's authorized representative deems necessary.
4. Profiles for proposed water improvements will be provided at the same horizontal scale as the plan sheets and a 1" = 5' vertical scale. Profile drawings shall be drawn below the plan view or immediately following the associated plan view sheets. Profile views showing existing features may be required for a distance of up to 100 feet (or further if warranted) beyond the proposed improvement in order to prevent future grade conflicts and will be determined on a case-by-case basis by the City's authorized representative. The profiles shall include the following:
- (a) Existing and proposed ground along the proposed water main alignment.

- (b) Water facilities, including pipe sizes, pipe types and materials, lengths, backfill material, joint restraints, and all water system appurtenances, including, but not limited to valves, hydrants, fittings, vaults, meters and thrust blocks. Notes shall be included for referencing details, cross-sections, etc.
- (c) Existing and proposed utilities, showing exact line and grade of all utilities crossing the proposed water system. The vertical separation from existing and proposed utilities shall be labeled for all proposed utility crossings.
- (d) Any additional information that the City’s authorized representative deems necessary.

501.1.04 Surveying

- a. The design engineer shall be responsible for establishing the location of the water line by means of reference stakes offset along the centerline of the water line. No construction shall be allowed to begin before construction staking. All staking shall be performed by or under the direction of a Professional Land Surveyor registered in the State of Oregon.
- b. Stakes shall locate all public tees, crosses, bends, fire hydrants, blow offs, isolation valves, vaults, and booster pump stations. Maximum spacing for reference stakes is 50 feet. Stakes shall reference cuts and fills to the finished grade of the ground, asphalt, or concrete surface at that location to maintain minimum cover requirement. The design engineer shall also be responsible for identifying and staking easements during construction.

501.2.00 WATER DESIGN STANDARDS

The following design standards are intended only as a guide for the design of water system improvements. All designs shall conform to the latest adopted revision of the Oregon Administrative Rules, Chapter 333, “Public Water Systems,” except where the City’s standards exceed those of the state.

501.2.01 Pipe Location

- a. Water lines are considered public, and are subject to these standards, up to the backflow prevention device or to the backside of a City of Wilsonville issued water meter. Beyond such point the contractor shall follow the adopted Oregon State Plumbing Specialty Code for domestic water services and the National Fire Protection Association (NFPA) standard 24 for private fire Service Protection piping, which is under the jurisdiction of City of Wilsonville Building Division.
- b. Easements: Piped water systems shall generally be located in the right-of-way. When it is not possible or practical to install Public water distribution facilities in a dedicated public street the facilities shall be located within a water system easement granted to the City. Water system easements shall typically be exclusive and conform to [Section 101.8.14](#), “Easements.”

- c. Where water lines are planned in the vicinity of sanitary sewer lines, design engineer and contractor shall follow guidelines established in [Section 401.2.02.n](#), “Water and Sewer Lines.”
- d. Water mains will normally be placed on the south and east side of the street, outside the bike lane and vehicle wheel path, as indicated in the street detail drawings of these standards.
- e. Valves shall be installed a minimum of 3 feet off face of curb and 6 feet off face of curb for streets with bike lanes.
- f. Fire hydrants shall be located in compliance with TVF&R fire prevention ordinance. Generally, fire hydrants shall be placed as follows:
 - 1. The radius point of curb returns at street intersections.
 - 2. At the end of a water line to be extended in the future in place of a blow-off.
 - 3. Midblock installations are not preferred, but where necessary, place at a property line between adjacent lots.
 - 4. Locate as shown, or as directed, to provide complete accessibility and to minimize the possibility of damage from vehicles or injury to pedestrians.
 - 5. The maximum distance from a TVF&R approved driving surface to a fire hydrant is 15 feet.

501.2.02 Pipe Size

- a. Minimum-size mains shall be 8 inches; all water mains shall be sized at 8, 12, 18, or 24 inches or as approved by the City’s authorized representative. With prior approval of the City’s authorized representative, 4-inch or 6-inch lines may be permitted provided there is no possibility of future extensions; 4-inch lines shall be limited to runs of less than 300 feet, no more than eight services, and no need for a fire hydrant.
- b. An approved water system capable of supplying the required fire flow for fire protection shall be provided to all premises on which buildings are to be constructed.
 - 1. For areas of single-family residential, the required fire flow shall be a minimum of 1,500 gallons per minute (gpm) while maintaining a minimum residual pressure of 20 pounds per square inch (psi)
 - 2. For all other areas the required fire flow shall be a minimum of 3,000 gpm while maintaining a minimum residual pressure of 20 psi.
 - 3. The City’s authorized representative may require modifications for a particular project.

- c. The engineer for the project should meet with the City Engineering Department before design to discuss the size of mains and any other matters specific to the project. The City Engineer will make the final determination on the size of new water mains.
- d. All water system tees and crosses shall be of the same size as the larger of the connecting water mains. The connecting water main shall not reduce to a smaller diameter to connect to a water system tee, cross, valve, or other water system fitting.
- e. No fire hydrant shall be connected to a main of less than 8 inches diameter.

501.2.03 Pipe Material

Generally, all pipe shall be ductile iron (D.I.) restrained joint pipe.

- a. All water mains 12-inch or less shall be minimum class 52 ductile iron pipe.
- b. All water mains 18-inch to 36-inch shall be minimum class 51 ductile iron pipe.
- c. All water mains larger than 36-inch shall be of material as required by the City's authorized representative.

501.2.04 Dead End Mains

- a. Generally, permanent dead-end water mains will not be allowed. Water mains shall be looped wherever possible as determined by the City's authorized representative.
- b. Water mains to be extended in the future shall have a fire hydrant installed at the temporary dead-end.
- c. Water mains will be required to extend to the boundaries of new subdivisions.

501.2.05 Water System Appurtenances

- a. Fittings shall be mechanical joint, unless otherwise specified.
- b. Vertical bends shall be avoided for 12" water lines and larger.
- c. Valves 12 inches and larger shall be butterfly valves.
- d. Valves shall be the same size as the connecting water main.
- e. Valves shall be located at intersections whenever possible. In general, spacing between isolation valves shall not exceed 800 feet.
- f. Valves shall be required on all branches of tees and crosses on mainline intersections. At service line connections, valves shall be required at the service line connection only.
- g. Valves shall be flanged by mechanical joint; valves shall be flanged to all tees and crosses.

- h. Automatic air and vacuum release valves with a bleed-off port shall be installed at all high points or locations in the pipeline where air pockets would be expected to accumulate. Valves shall be installed as indicated in **Detail No. WT-3090** of these standards.

501.2.06 Thrust Restraint

- a. All pipe joints shall be restrained by the installation of restraining gaskets, as approved by the pipe manufacturer.
- b. All mechanical joints shall be restrained by a joint restraint system such as Megalug[®] Series 1100 retainers as manufactured by EBAA Iron, Inc., or approved equal.
- c. Thrust blocks shall be provided for additional thrust restraint at all fire hydrants, wet tap locations, and existing water system appurtenances. In all other cases where flange connections, mechanical joint restraint systems and restrained gaskets are not feasible, thrust blocks may only be used with prior authorization by the City's authorized representative.

501.2.07 Water Service

Separate, individual water services and meters are required for domestic and irrigation water service, excluding individual single-family residences. Water services shall be connected to the main line per **Detail No. WT-3030** for ¾" – 1" water services and **Detail No. WT-3045** for 1 ½" – 2" water services. Deduct meters will not be allowed.

501.2.08 Cathodic Protection

The City's authorized representative may require cathodic protection of pipelines of certain sizes and materials or for pipe and fittings.

- a. Prior to pipeline design and construction, the City's authorized representative may require soil sampling and testing for corrosivity.
- b. Testing requirements shall be determined on a case-by-case basis.
- c. If soil conditions are found to be possibly corrosive to buried pipe and fittings, cathodic protection measures such as bonded pipe coatings, bonded pipe joints, sacrificial anodes, alternate pipe materials, or other measures may be required by the City's authorized representative.

501.3.00 OPERATION OF VALVES IN CITY

Contractor shall request City operation of valves at least 2 business days in advance. At no time shall the contractor undertake to close off or open valves or take any other action that would affect the operation of the existing water system, unless specifically approved by City's authorized representative.

501.4.00 MATERIALS AND TECHNICAL SPECIFICATIONS

501.4.01 Push-On Ductile Iron Pipe

Push-on joint D.I. pipe shall be cement mortar lined and shall conform to AWWA C-104/ANSI A21.4 and AWWA C-151/ANSI A21.51 as manufactured by U.S. Pipe and Foundry Company, American Pipe, or approved equal. All pipe and fittings shall be manufactured in the U.S.A. Rubber ring gaskets shall conform to [Section 501.4.06](#), "Gaskets," and shall be furnished with the pipe. A nontoxic vegetable soap lubricant (meeting the requirements of AWWA C-111/ANSI A21.11) shall be supplied with the pipe in sufficient quantities for installing the pipe furnished.

501.4.02 Joints

Pipe joints shall be push-on joints with joint restraints such as U.S. Pipe Tyton™, American Fastite™ or approved equal, except where specifically shown or detailed otherwise.

- a. Fitting joints shall be mechanical joint ends, except where specifically shown or detailed otherwise.
- b. All valves joined to tees and crosses shall be flanged by mechanical joint.

501.4.03 Ductile Iron Fittings

Ductile iron fittings shall conform to AWWA C-110 / ANSI A21.10 and/or AWWA C-153 / ANSI A21.53. All ductile iron fittings shall be Class 350. Fittings shall be furnished with flanged or mechanical joints as specified on the plans.

501.4.04 Mechanical Joint Fittings

Mechanical joint D.I. fittings shall conform to the latest revision of AWWA C-110/ANSI A21.10 and shall be of a class at least equal to that of the adjacent pipe. Bolts and nuts shall conform to AWWA C-111/ANSI A21.11. Mortar lining for fittings shall be the same thickness specified for pipe.

501.4.05 Flanged Ductile Iron Fittings

- a. Flanged fittings shall be ductile iron conforming to ANSI/AWWA C-110/A21.10 and shall be faced and drilled Class 125 flanges that match ANSI B16.1 fittings. Flanges shall have flat faces and attached with bolt holes straddling the vertical axis of the pipe.
- b. Bolts for assembly of flanged joints shall be of the size and quantity shown in the latest version of AWWA C-110. As stated in AWWA C-110, bolts shall conform to ANSI B18.2.1, Square and Hex Bolts and Screws Inch Series, Including Hex Cap Screws and Lag Screws. Nuts shall conform to ANSI B18.2.2, Square and Hex Nuts. Threads shall conform to ANSI B1.1 Standard for Unified Inch Screw Threads (UN and UNR Thread Form), Class 2A external and Class 2B internal. Bolts and nuts shall be of low-carbon

steel conforming to the requirements of ASTM A-307 Standard Specifications for Carbon Steel Bolts and Studs, 60,0000 psi Tensile Strength Grade B.

- c. The fittings shall be cement-mortar lined to same thickness specified for pipe.

501.4.06 Gaskets

- a. **Restraining gaskets:** Push-on joints shall utilize restraining gaskets as approved by the pipe manufacturer. The restraining gaskets shall consist of stainless steel locking segments vulcanized into the gasket to grip the pipe and prevent joint separation, such as U.S. Pipe Field Lok™, American Fast-Grip®, or approved equal. Gaskets shall conform to AWWA C-111/ ANSI A21.11 and shall be suitable for the specified pipe size and pressures.
- b. **Flanged gaskets:** Gaskets shall be suitable for the specified pipe sizes and pressures. Flanged gaskets shall consist of 1/8-inch thick, full-face one-piece rubber gaskets, full-cut with holes to pass bolts conforming to ANSI/AWWA C-207 and ANSI B16.21. Gasket material shall be free from corrosive alkali or acid ingredients.

501.4.07 Mechanical Couplings

Mechanical couplings, clamps, or sleeves, not part of the pipe itself, shall be D.I. or steel with rubber rings or gaskets. Gaskets, bolts, and nuts shall conform to AWWA C-111/ANSI A21.11. Couplings, clamps, or sleeves shall be Dresser®, or approved equal.

501.5.00 CONSTRUCTION SPECIFICATIONS

501.5.01 General Provisions

All installation and testing of water system improvements shall conform to the latest adopted revision of the Oregon Administrative Rules, Chapter 333, “Public Water Systems,” except where the City’s provisions exceed those of the state.

501.5.02 Scheduling

- a. The contractor shall plan their construction work in conformance with [Section 101.8.02](#), “Scheduling.”
- b. Newly installed water lines shall not be placed in service until necessary testing and sterilization are complete and system has been approved by the City’s authorized representative.

501.5.03 Environmental Protection, Erosion Prevention, and Sediment Control

The contractor shall take all appropriate measures and precautions to minimize their impact on the environment and control erosion, as outlined in [Section 101.9.00](#), “Environmental Protection, Erosion Prevention, and Sediment Control.”

501.5.04 Interferences and Obstructions

Various obstructions may be encountered during the course of the work. The contractor shall follow the guidelines established in [Section 101.8.05](#), “Interferences, Obstructions, Abandoned Utilities.”

501.5.05 Abandon Water Facilities

Water facilities to be abandoned shall be cut off and completely removed at 24-inches minimum below finish grade, unless specifically stated otherwise. Water valves shall be cut and completely removed from abandoned lines, unless otherwise directed by the City’s authorized representative. Water mains to be abandoned shall be removed or completely filled with a flowable, Controlled Low-Strength Material (CLSM) as directed by the City’s authorized representative.

501.5.06 Contaminated Soil or Hazardous Material

If during construction contaminated soil or hazardous materials or chemicals are encountered, the Contractor shall follow the procedures specified in [Section 101.9.02](#), “Contaminated Soils or Hazardous Materials.”

501.5.07 Trench Excavation, Preparation, and Backfill

Trench excavation, preparation, and backfill shall conform to the requirements of [Section 6](#), “Trench Excavation and Backfill.”

501.5.08 Preservation, Restoration, and Cleanup

Cleanup of all construction debris, excess excavation, and excess materials and complete restoration of all fences, mailboxes, ditches, culverts, signposts, and similar items shall be completed according to [Section 101.8.16](#), “Preservation, Restoration, and Cleanup.”

501.6.00 DUCTILE IRON PIPE—INSTALLATION

501.6.01 Suitable Conditions for Laying Pipe

- a. Provide and maintain ample means and devices at all times to remove and dispose of water seepage and runoff entering the trench excavation during the process of laying pipe. Water in the trench shall not be allowed to enter the pipe and fittings.
- b. Do not lay pipe in water or when, in the opinion of the City’s authorized representative, trench conditions are unsuitable.

501.6.02 Handling

- a. **Distributing Pipe:** Distribute material on the job from cars, trucks, or storage yard no faster than it can be used to good advantage. In general, distribute no more than one week’s supply of material in advance of the laying.

- b. **Handling Pipe and Fittings:** Provide and use proper implements, tools, and facilities for safe and proper work. Lower all pipe, fittings, and appurtenances into the trench, piece by piece, by means of a crane, sling, or other suitable tool or equipment, to prevent damage to the pipeline materials and protective coatings and linings. Do not drop or dump pipeline materials into the trench.

501.6.03 Cleaning Pipe and Fittings

- a. Remove all lumps, blisters, and excess coating from the bell and spigot ends of each pipe. Wire-brush the outside of the spigot and the inside of the bell and wipe them clean, dry, and free from oil and grease before the pipe is laid.
- b. Wipe clean all dirt, grease, and foreign matter from the ends of mechanical joint and rubber gasket joint pipe and fittings.

501.6.04 Placing Pipe in Trench

- a. At the location of each joint, dig bell (joint) holes of ample dimensions in the bottom of the trench and at the sides, where necessary, to permit the joint to be made properly and to permit easy visual inspection of the entire joint.
- b. Unless otherwise directed, lay pipe with the bell end facing in the direction of the laying.
- c. For lines on slopes greater than 20%, face bells upgrade, unless otherwise directed by the City's authorized representative.
- d. Do not allow foreign material to enter the pipe while it is being placed in the trench. At the end of each work day or during suspension of the work, securely close the pipe ends by means of a secure plug or approved equivalent.
- e. Lay and join pipe with push-on, restrained type joints in strict accordance with the manufacturer's recommendations. Provide all special tools and devices, such as jacks, chokers, and similar items required for the installation. Lubricant for the pipe gaskets shall be furnished by the pipe manufacturer, and no substitutes shall be permitted under any circumstances.
- f. After the first length of push-on, restrained joint pipe is installed in the trench, secure the pipe in place with approved backfill material that is tamped under and along the spring line to prevent movement. Keep the ends clear of backfill. After each section is joined, place backfill as specified in [Section 6](#), "Trench Excavation and Backfill" to prevent movement.
- g. Mechanical joint fittings vary slightly with different manufacturers. Install the furnished fittings in accordance with the manufacturer's recommendations. In general, the procedure shall be as specified here.

1. Clean the ends of the fittings of all dirt, mud, and foreign matter by washing with water and scrubbing with a wire brush.
2. Slip the gland and restraining gasket on the plain end of the pipe. If necessary, lubricate the end of the pipe to ease sliding the gasket in place.
3. Guide the fitting onto the spigot of the laid pipe.

501.6.05 Cutting Pipe

- a. Cut pipe for inserting valves, fittings, or closure pieces in a neat and workmanlike manner, without damaging the pipe or lining and leaving a smooth end at right angles to the axis of the pipe.
- b. The contractor shall cut ductile iron pipe using a method approved by the City’s authorized representative; all burrs or rough edges shall be removed before joining pipe. The contractor shall not flame-cut the pipe.
- c. Dress cut ends of push-on joint pipe by beveling with a heavy file or grinder as recommended by the manufacturer.

501.6.06 Permissible Deflection of Joints

Wherever it is necessary to deflect the pipe from a straight line either in a vertical or horizontal plane, to avoid obstructions, or where long-radius curves are permitted, the amount of deflection allowed shall not exceed the values shown in [Table 5.1](#) or the manufacturer’s recommendations, whichever is less.

Table 5.1. MAXIMUM PERMITTED DEFLECTION, 18-FOOT-LONG PIPE

Diameter (inches)	Mechanical Joint		Push-On Joint	
	Max. Defl. Angle (degrees-minutes)	Deflection ¹ (inches)	Max. Defl. Angle (degrees)	Deflection ¹ (inches)
4	4° – 09’	15	3°	10
6	3° – 33’	13	3°	10
8	2° – 40’	10	3°	10
12	2° – 40’	10	3°	10

Note: Maximum deflection shall be the lesser value between the deflection table and recommendations by the pipe manufacturer.

¹Safe deflection shown is for 150 psi of pressure. For higher pressure, reduce tabulated deflection 10% for each 150 psi of added pressure.

501.6.07 Alignment

Pipelines intended to be straight shall not deviate from the straight line at any joint in excess of 1 inch horizontally or 1 inch vertically.

501.6.08 Anchorage and Restraint

All pipelines 4 inches in diameter or larger shall be secured with a suitable mechanical joint restraint system (such as Megalug® Series 1100 as manufactured by EBAA Iron, Inc or approved equals) at all tees, plugs, caps, and bends, and at other locations where unbalanced forces exist. Where required, provide thrust restraint as specified in [Section 501.2.06](#), “Thrust Restraint.” Gaskets shall be installed in accordance with [Section 501.4.06](#), “Gaskets.”

501.6.09 Construction of Blow-offs

Blow-offs shall be constructed as shown in **Detail No. WT-3075** or **Detail No. WT-3085** of these standards. Straddle blocks shall be constructed of reinforced concrete; the concrete mix shall be commercially produced and have a compressive strength of not less than 3,000 psi at 28 days, unless otherwise approved by the City’s authorized representative. Blow-offs shall not be flushed or pressurized until a minimum of 7 days after concrete is installed. If high-early cement is used for the straddle block, the time may be cut by two days. Fire hydrants shall be installed in place of blow-offs at dead end water lines intended to be extended in the future.

501.6.10 Locating Wire Specifications

- a. Install tracer wire beside the pipe and plastic caution tape 1-foot above the pipe crown.
- b. Tracer wire connections shall occur at all junctions and be connected using a solderless connection kit suitable for direct burial that joins wires mechanically and electrically and seals out moisture, GelCap or approved equal.
- c. Surface tracer wire at fire hydrants, blow-offs, and water services only. Tracer wire shall not be accessed through water valves.
- d. Tracer wire shall be 12-gauge stranded or solid copper insulated High Molecular Weight Polyethylene (HMW-PE) with a blue insulated cover a minimum 45 mil in thickness and the wire UL rated for 140°F.

501.7.00 VALVES AND VALVE BOXES

501.7.01 Scope

This section covers the work necessary for furnishing and installing gate valves, butterfly valves, and valve boxes, complete.

501.7.02 Materials

a. Gate Valves:

1. Gate valves shall be resilient seated with ductile iron body, sized 3 inches through 8 inches, and shall conform to AWWA Standard C-509 and C-515 for ductile iron body valves. The manufacturer's name, the model, and the year of manufacture are to be cast on each valve.
2. Valve ends are to be flanged or mechanical joint by flanged, as shown on the plans, and conform to AWWA C-111 and ANSI Class 125. Buried service valves shall open with a counterclockwise rotation of a 2-inch operating nut.
3. All internal parts shall be accessible without removing the body from the line. The one-piece wedge shall be completely encapsulated by resilient material. The resilient sealing material shall be permanently bonded to the wedge with a rubber tearing bond meeting the requirements of ASTM D-429.
4. Valves shall have nonrising stems (NRS) and shall be cast bronze with integral collars in compliance with AWWA C-509 and C-515. The NRS shall have two O-ring seals above the thrust collar and one below. The two top O-rings are to be field replaceable (in the full open position) without removing the valve from service. Low-friction thrust bearings shall be placed above and below the stem collar. The stem nut shall be bronze and independent of the wedge.
5. Outside screw and yoke valves shall have a bronze stem attached to the disc assembly. An adjustable follower gland shall be incorporated to compress braided packing and seal the stem.
6. The waterway in the seat area shall be smooth, unobstructed, and free of cavities. The ductile iron body and bonnet shall be fully coated, both interior and exterior, with a fusion-bonded, heat-cured thermo setting material meeting all the application and performance requirements of AWWA C-550.
7. Gate valves shall meet the testing requirements as presented in AWWA C-509 and C-515.

b. Butterfly Valves:

1. Butterfly valves shall be the rubber-seated type, suitable for direct-burial service. They shall withstand 250 psi working pressure and a 250 psi pressure differential across the valve. Except as noted, the butterfly valve shall conform to AWWA C-504 for Class 250B.
2. Valve ends are to be flanged or flanged by mechanical joint, as shown on the plans, and conform to AWWA C-111 and ANSI Class 125.
3. All joint accessories shall be furnished with valves.

4. Valves shall be equipped with an ASTM A536 ductile iron body and 304 stainless-steel circular shaft. Shaft and disc seals shall be designed for a bubble-tight seal. The valve disc shall be ductile iron ASTM A536 and a stainless-steel edge with Buna N rubber seat bonded to the valve body.
 5. The butterfly valve shall be furnished with a totally enclosed, integral valve operator design to withstand a minimum of 300 foot-pound input torque without damage to the valve or operator. Operators shall be fully gasketed and greased-packed and designed to withstand submersion in water to a pressure of 10 psi. Valves shall open with a counterclockwise rotation of a 2-inch operating nut. A minimum of 30 turns of the operating nut shall be required to move the disc from a fully opened position to a fully closed position.
 6. Butterfly valves shall meet the testing requirements as presented in AWWA C-504.
- c. **Extension Stems for Valve Operators:**
1. Where the depth of the operating nut is more than 3 feet, operating extensions shall be provided to bring the operating nut to a point 18 inches below the surface of the ground or pavement (see **Detail No. WT-3015** of these standards).
 2. Where the depth of the operating nut is more than 6 feet, install a second rock guard plate equidistant between the first rock guard plate and the 2-inch operating nut.
 3. The extension shall be constructed of solid steel rod and approved by the City's authorized representative. Cut extensions to the proper length so the valve box does not ride on the extension when set at grade.

501.7.03 Workmanship

a. **Valves:**

1. Valves shall be installed in accordance with **Detail No. WT-3020** of these standards. Valves shall be flanged by mechanical joint; valves shall be flanged to all tees and crosses.
2. Before installation, the valves shall be thoroughly cleaned of all foreign material. Valves shall be inspected for proper operation, both opening and closing, and to verify that the valves seat properly.
3. Valves shall be installed so that the stems are vertical, unless otherwise directed.
4. Jointing shall conform to AWWA C-600 or AWWA C-603, whichever applies. Joints shall be tested with the adjacent pipeline. If joints leak under test, valves shall be disconnected and reconnected, and the valve or the pipeline or both shall be retested.

b. **Valve Boxes:**

1. Valve boxes shall be installed in conformance with **Detail No. WT-3020** of these standards.
2. Center the valve boxes and set plumb over the wrench nuts of the valves. Set valve boxes so they do not transmit shock or stress to the valves. Set the valve box covers flush with the surface of the finished pavement, as shown in **Detail No. WT-3020** of these standards or to another level as may be required.
3. Where the depth of the operating nut is more than 3 feet, operating extensions shall be provided in accordance to [Section 501.7.02.c](#), “Extension Stems for Valve Operators.”
4. Valve boxes shall be cast iron “Vancouver” pattern with 18-inch tall casting. The letter W shall be cast into the top of the lid. Valve riser pipe from the valve to the cast iron top shall be 6-inch PVC sewer pipe ASTM D3034, SDR35. The valve riser pipe shall be one-piece and have sufficient length depending on the depth to the operating nut.
5. Backfill shall be the same as specified for the adjacent pipe. Place backfill around the valve boxes and thoroughly compact it to a density equal to that specified for the adjacent trench and in such a manner that will not damage or displace the valve box from the proper alignment or grade. Misaligned valve boxes shall be excavated, plumbed, and backfilled at the contractor’s expense.
6. In non-paved areas, the valve box shall be set in a concrete collar as shown in **Detail No. WT-3020** of these standards.

501.8.00 FIRE HYDRANTS

501.8.01 Scope

This section covers the work necessary for furnishing and installing the fire hydrants, complete. Fire hydrants shall be installed as shown in **Detail No. WT-3060** of these standards.

501.8.02 Hydrants

- a. Hydrants shall have a nominal 5¼-inch main valve opening with 6-inch bottom connections. The main valve shall be equipped with O-ring seals and shall open when turned counterclockwise.
- b. The operating nut shall be a 1½-inch national standard pentagon nut.
- c. Hydrants shall be equipped with two 2½-inch hose nozzles and one 4½-inch pumper nozzle with a Storz HPHA50–45NH permanent hydrant adapter.
- d. Hydrants shall conform to AWWA C-502 and have a self-lubricating rising stem. The normal depth of bury shall be 4 feet. Nozzle threads shall be American National

Standard. The inlet connection shall be mechanical joint, restrained by a mechanical joint restraint system such as Megalug[®] Series 1100 as manufactured by EBAA Iron, Inc., or approved equal.

- e. Hydrants shall be Mueller Centurion, Waterous Pacer, or approved equal.
- f. Hydrant Painting:
 - 1. Fire hydrants shall be painted with durable, oil base paint suitable for outdoor environments, formulated to resist corrosion and adhere directly to metal surfaces with a smooth, gloss finish.
 - 2. Apply paint by any means necessary (spray gun, brush, sponge, etc.) to achieve a smooth finish, free of brush strokes.
 - 3. Apply paint to entire fire hydrant assembly down to and including the entire first flange and flange bolts. Do not apply paint to fire hydrant identification numbers and warning stickers.
 - 4. Private fire hydrants shall be painted with Low VOC, DTM Alkyd Enamel paint in SAFETY RED or FIRE ENGINE RED.
 - 5. Public fire hydrants shall be painted with Low VOC, DTM Alkyd Enamel paint in SAFETY YELLOW in accordance with Detail No. WT-3060 of these standards.

501.8.03 Base Block

The base block shall be solid precast concrete pier block with nominal dimensions of 8-inch thickness and 12-inch-square base.

501.8.04 Workmanship

Construction and installation shall conform to these standards and to the provisions of AWWA C-600, except where otherwise specified.

501.8.05 Location and Position

- a. Fire hydrants shall be located in compliance with TVF&R requirements. Improperly located hydrants shall be disconnected and relocated at the contractor's expense.
- b. When the hydrant is placed behind the curb or sidewalk, set the hydrant barrel so that no part of the pumper or hose nozzle cap is less than 24 inches from the face of the curb or the backside of the sidewalk.
- c. Set all hydrants plum with nozzles parallel with the curb, or at right angles to it. With the pumper nozzle facing the curb, set hydrants so that the safety flange is at least 3 inches and at most 6 inches above the finished ground or sidewalk level, to clear bolts and nuts.

- d. No concrete, fencing, or other obstructions interfering with the hydrant operation shall be installed in the hydrant clear zone. The clear zone is a triangular area that extends 3 feet behind a hydrant, 5 feet on each side.
- e. Bollards may be required to be placed around hydrants located in areas exposed to vehicular traffic at the direction of the City's authorized representative.
- f. Install an approved blue bi-directional, reflectorized button in the center of the near travel lane using an approved fast-setting bonding agent.

501.8.06 Excavation

Do not carry excavation below the subbase grade. Refill over excavated areas with Class "B" Backfill material in accordance with [Section 6](#), "Trench Excavation and Backfill" compact to create a firm foundation.

501.8.07 Base Rock

Place Class "B" Backfill material in accordance with [Section 6](#), "Trench Excavation and Backfill" on a firm, level subbase or subgrade to assure uniform support.

501.8.08 Installation of Hydrants

- a. Fire hydrants shall be connected to the main with 6-inch ductile iron pipe in accordance with per the same requirements for water main pipe of [Section 5](#). The connecting pipe shall be continuous piping with no sleeves allowed.
- b. Fire hydrants installed on existing mains shall be installed with a standard wet tapping sleeve and gate valve per **Detail No. WT-3025** of these standards. Tapping sleeve shall be flange x MJ gate valve and shall match hydrant line size.
- c. Fire hydrants installed with new main construction shall be connected to the main with MJ x MJ x flange tee fitting and flange x MJ gate valve.
- d. Place the hydrant carefully on the base block to prevent the base block from breaking. After the hydrant is in place and is connected to the pipeline, place temporary blocks to maintain the hydrant in a plumb position during subsequent work.

501.8.09 Gravel for Drainage

Gravel for drainage shall be washed 1½" – ¾" aggregate or graded river gravel free of organic matter, sand, loam, clay, or other small particles that will restrict water flow through the gravel. Place gravel around the base block and hydrant bottom after the hydrant is blocked in place. Top of gravel shall be not less than 6 inches above the hydrant drain opening. Do not connect the drainage system to the sewer.

501.8.10 Thrust Blocking and Restraint

- a. Fire hydrants shall be secured by thrust blocking. Provide reaction or thrust blocking, as shown in **Detail No. WT-3060** of these standards, or as directed. Place blocking between the undisturbed ground and the fitting to be anchored. Blocking bearing surface shall be as shown in **Detail No. WT-3000** of these standards.
 1. Place the blocking so that the pipe and fitting joints will be accessible to repairs by wrapping all joints and fittings in new plastic sheeting (minimum 8 mil thickness).
 2. The concrete mix shall be commercially produced and have a compressive strength of not less than 3,000 psi at 28 days, unless otherwise approved by the City’s authorized representative.
- b. Mechanical joint fittings at all hydrants, valves, and bends shall be restrained by a joint restraint system such as Megalug® Series 1100 retainers as manufactured by EBAA Iron, Inc., or approved equal.
- c. Push-on joints shall utilize restraining gaskets in accordance with Section 501.4.06.a “Restraining Gaskets.”

501.8.11 Thrust Ties

Stainless Steel thrust ties may be used with concrete thrust blocking, with prior approval of the City’s authorized representative, when the top of the existing ground behind the fire hydrant is less than 2 feet above the top of the hydrant base or where unsuitable ground prevents proper anchorage.

501.9.00 HYDROSTATIC TESTING AND STERILIZATION OF NEWLY INSTALLED PIPE

501.9.01 Hydrostatic Testing

- a. Contractor shall make pressure and leakage tests on all newly laid pipe; follow the procedures specified in AWWA C-600, Section 5.2, “Hydrostatic Testing.” The new mains being tested shall remain isolated from the existing water system.
- b. Contractor shall furnish all necessary equipment and material, make all taps in the pipes as required, and conduct the tests.
- c. Contractor shall notify the City’s authorized representative a minimum of 2 business days prior to testing. The City’s authorized representative will monitor the tests and assure that all taps are installed and service pipe extended.
- d. Furnish equipment and materials for the tests as shown in [Table 5.2](#).

Table 5.2. HYDROSTATIC TESTING EQUIPMENT & MATERIALS

Amount	Description
2	Pressure gauges
1	Hydraulic force pump approved by the City's authorized representative
1	Suitable hose and suction, as required

- e. Conduct the tests after the trench is backfilled and compacted to required specifications and approved by the City's authorized representative. Where any section of pipe has concrete thrust blocking, do not take the pressure tests until at least five days elapse after the concrete thrust blocking is installed. If high-early cement is used for the concrete thrust blocking, the time may be cut by two days.
- f. Conduct pressure tests in the following manner, unless otherwise approved by the City's authorized representative. After the trench is backfilled or partially backfilled as specified here, fill the pipe with water, expelling all air during the filling. The minimum test pressure shall be 150 psi. For lines working with operating pressures in excess of 100 psi, the minimum test pressure shall be 1½ times the operating pressure at the point of testing. The test pressure shall not exceed pipe or thrust-restraint design pressures. The duration of each pressure test shall be 2 hours, unless otherwise directed by the City's authorized representative.
1. **Procedure:** Fill the pipe with water and apply the specified test pressure by pumping, if necessary. Then valve off the pump and hold the pressure in the line for the test period. Test pressure shall not vary by more than ±5 psi for the duration of the test. At the end of the test period, operate the pump until the test pressure is again attained. The pump suction shall be in a barrel or similar device, or metered so that the amount of water required to restore the test pressure can be measured accurately.
 2. **Leakage:** Leakage shall be defined as the quantity of water necessary to restore the specified test pressure at the end of the test period. No pipe installation will be accepted if the leakage is greater than the number of gallons per hour, as determined by the following formula:

$$L = \frac{SD(P)^{1/2}}{148,000}$$

Where: L = allowable leakage (gallons per hour).

S = length of pipe to be tested (feet).

D = nominal diameter of pipe (inches).

P = average test pressure during the leakage test (psi).

3. **Correction of Excessive Leakage:** Should any test of laid pipe disclose leakage greater than that allowed, locate and repair the defective joints or pipe until leakage in a subsequent test is within the specified allowance.
4. **Valve Testing:** Once the system has passed the pressure test, the Contractor shall proceed testing each individually closed valve within the tested system. Individually closed valves shall be pressure tested for a minimum of 15 minutes using the same rate of loss criteria stated above. If any valves are found to not hold pressure, they shall be operated, repaired or replaced, and retested until they pass.

501.9.02 Sterilization

Pipeline intended to carry potable water shall be sterilized before it is placed in service. Disinfection by chlorination for pipelines shall be accomplished according to AWWA C-651, as modified or expanded below, and City requirements. Disinfection of water-storage facilities, water treatment plants, and wells shall be accomplished according to the appropriate sections of AWWA C-652, AWWA C-653, and AWWA C-654.

- a. **Flushing:** Before sterilizing, flush all foreign matter from the pipeline. Contractor shall provide hoses, temporary pipes, ditches, etc., as required to dispose of flushing water without damaging adjacent properties. The Contractor shall provide the minimum temporary blowoff/inlet sizes as shown in [Table 5.3](#) to adequately flush the pipeline. If flushed into a sewer system, the contractor shall provide screening and remove all accumulated construction debris, rocks, gravel, sand, silt, and other foreign material from the system at or near the closest downstream manhole; no material shall be flushed into the downstream city sewer system. Flushing velocities shall be at least 2.5 feet per second (fps). For large-diameter pipe that is impractical or impossible to flush at 2.5 fps, clean the pipeline in place from the inside by brushing and sweeping, then, flush the line at a lower velocity.

Table 5.3. REQUIRED OPENINGS TO FLUSH PIPELINES

Nominal Pipe Size (inches)	Flow Required to Produce 2.5 FPS Velocity (GPM)	Minimum Inlet & Outlet Pipe Size Required (inch)
4	110	2
6	240	2
8	430	4

12	950	4
18	2140	6
24	3800	6

b. Sterilizing Mixture:

1. Sterilizing mixture shall be a chlorine-water solution having a free chlorine residual of 40 to 50 parts per million (ppm). The sterilizing mixture shall be prepared by injecting (a) a liquid chlorine-water mixture or (b) a calcium sodium hypochlorite and water mixture into the pipeline at a measured rate, while fresh water is allowed to flow through the pipeline at a measured rate so that the chlorine-water solution is of the specified strength.
2. The liquid chlorine-water mixture shall be applied by means of an approved solution-feed chlorinating device. Chlorinating devices for feeding solutions of the chlorine itself must provide a means of preventing the backflow of water.
3. If the calcium hypochlorite procedure is used, first mix the dry powder with water to make a thick paste, then, thin to approximately a 1% solution (10,000 ppm chlorine). If the sodium hypochlorite procedure is used, dilute the liquid with water to obtain a 1% solution. Add the 1% solution to water to obtain a final sterilizing solution of 40 to 50 ppm. [Table 5.4](#) shows the correct proportions of hypochlorite to water.

Table 5.4. RATIO OF HYPOCHLORITE TO WATER

Product	Quantity	Water
Calcium hypochlorite ¹ (65%-70% Cl)	1 lb.	7.5 gal
Sodium hypochlorite ² (5.2% Cl)	1 gal	4.25 gal

¹Comparable to commercial products known as HTH[®], Perchloron[®], and Pittchlor[®].

²Liquid laundry bleach, such as Clorox[®] or Purex[®].

501.9.03 Point of Application

- a. Inject the chlorine mixture into the pipeline to be treated within 5 feet of the beginning of the line through a corporation stop or a suitable tap in the top of the pipeline. Water from the existing system or other approved source shall be controlled to flow slowly into the

newly laid pipeline during the application of chlorine. The proportion of the flow rate of the chlorine mixture to the rate of water entering the pipe shall be such that the combined mixture shall contain 40 to 50 ppm of free available chlorine.

- b. Valves shall be manipulated so that the strong chlorine solution in the line being treated will not flow back into the line supplying the water. Use check-valves if necessary.
- c. Operate all valves, hydrants, services and other appurtenances during sterilization to assure that the sterilizing mixture is dispersed into all parts of the line, including dead ends, new services, and similar areas that otherwise may not receive the treated water.
- d. Do not place the concentrated quantities of commercial sterilizer in the line before it is filled with water.
- e. After chlorination, flush the water from the line (see [Section 501.9.05](#), “Disposal of Flushing and Sterilizing Water”) until the water through the line is equal chemically and bacteriologically to the permanent source of supply.

NOTE: When testing and sterilizing procedures are complete, remove the testing corporation stop and replace it with a threaded brass plug.

NOTE: The practice of adding a small amount of chlorine powder or tablets at each joint as the main is being laid is *not* an acceptable method of chlorinating a pipeline. The procedure does not permit preliminary flushing, nor does it distribute chlorine uniformly.

501.9.04 Retention Period

Treated water shall be retained in the pipeline long enough to destroy all non-spore-forming bacteria. With proper flushing and the specified solution strength, 24 hours is adequate. At the end of the 24-hour period, the sterilizing mixture shall have a strength of at least 10 ppm of chlorine. To minimize damage to cement mortar lining in ductile iron pipe and fittings, chlorine solution contact time shall not exceed 60 hours.

501.9.05 Disposal of Flushing and Sterilizing Water

- a. Dispose of flushing and sterilizing water in a manner approved by the City’s authorized representative. If the volume and chlorine concentration is such as to pose a hazard to the City’s Wastewater Treatment Plant operation, the sterilizing water shall be metered into the system per direction of the City’s authorized representative. Notify the City of Wilsonville Utility Division 2 business days before disposing of sterilizing water into the City sanitary system.
- b. Do not allow sterilizing water to flow into a waterway or storm line without reducing the chlorine to a safe level via adequate dilution or another neutralizing method, as approved by the City’s authorized representative.

501.9.06 Bacteriological Testing

- a. City Utility staff, with the assistance of the contractor's representative, will obtain water samples for the first of two bacteriological samples 24 hours after the contractor flushes the water line.
- b. Following a 24-hour retention period, City Utility staff will obtain the second bacteriological sample.
- c. Both water samples must pass the bacteriological tests before the water facilities will be accepted.
- d. Contractor shall request the City Utility staff to sample lines at least 2 business days in advance. Applicant shall reimburse the City for the cost of collecting and testing each water sample. Fee for water collection and testing is provided on the Engineering Department's Public Works Permit.

501.10.00 WATER SERVICE CONNECTIONS

501.10.01 Scope

The work includes trench excavation and backfill, furnishing and installing service saddles, corporation or valves, meter vaults or boxes, meters, service connection piping, fittings, and appurtenances within the designated limits, testing, flushing, and other incidental work as required for a complete installation.

501.10.02 Hydrostatic Test and Leakage

Test service connections and service connection pipe in conjunction with the main, as detailed in [Section 501.9.00](#), "Hydrostatic Testing and Sterilization of Newly Installed Pipe."

501.10.03 Materials

- a. **Service lines: ¾- and 1-inch:** Service connections shall be tapped directly into the ductile iron pipe. Corporation stops for ¾-inch (single service) and 1-inch copper service lines shall have AWWA thread inlet and compression connect outlet.
- b. **Service lines: 1 ½-inch and 2-inch:** Service connections shall attach to the water main using a 2-inch tee or service saddle, 2-inch gate valve and 2-inch copper tubing to the angle valve per **Detail No. WT-3045** of these standards.
- c. **Meter Boxes and Covers:** Generally, meter boxes and covers are installed in landscape areas and shall be pedestrian rated per **Detail No. WT-3035** through **Detail No. WT-3037** of these standards for ¾" and 1" water meters and **Detail No. WT-3050** through **Detail No. WT-3052** of these standards for 1 ½" and 2" water meters. Occasionally, with the approval of the City's authorized representative, installation of meter boxes in driveway areas may be allowed. In these cases, meter boxes and covers shall be traffic rated per **Detail No. WT-3038** through **Detail No. WT-3040** of these standards for ¾"

and 1” water meters and **Detail No. WT-3053** through **Detail No. WT-3055** of these standards for 1 ½” and 2” water meters.

- d. **Corporation Stops:** Corporation stops for ¾-inch and 1-inch services shall be provided per **Detail No. WT-3030** of these standards.
- e. **Angle Valves:** Angle valves shall be provided per **Detail No. WT-3030** of these standards for ¾-inch and 1-inch service lines and **Detail No. WT-3045** of these standards for 1½-inch and 2-inch service lines.
- f. **Copper Tube:** Copper tube used for ¾-inch to 1-inch service connections shall be soft temper Type K, conforming to ASTM B-88. Copper pipe used for 1½-inch to 2-inch service connections shall be (hard) drawn temper Type K, conforming to ASTM B-88. If sleeved in a rigid casing, use soft temper, type “K” copper tubing.

501.10.04 Workmanship

- a. **Trench Excavation, Preparation, and Backfill:** Trench excavation, preparation, and backfill shall conform to the requirements of [Section 6](#), “Trench Excavation and Backfill. The trench shall be backfilled to within 6 inches of the service connection pipe or line. Cover over pipe shall be as indicated in **Detail No. S-2140** of these standards.
- b. **Connection to Main:** The City’s authorized representative shall be notified and shall be present during tapping of City water main, unless otherwise approved by the City’s authorized representative. Service connections shall be installed as shown in **Detail No. WT-3030** or **Detail No. WT-3045** of these standards and as follows:
 - 1. Taps shall be made in the pipe by experienced workmen, using tools in good repair, with proper adapters for the size of pipe being tapped.
 - 2. Line taps shall be 30° above the horizontal for ¾-inch or 1-inch service connections
 - 3. Line taps shall be centered on the spring line of the pipe being tapped for 1½-inch or 2-inch service connections.
 - 4. Tap shall be made no closer than 18 inches from the outside edge of the sleeve to the beginning of the bell flare or end of the MJ fitting.
- c. **Copper Tubing:** The copper tubing shall be cut with square ends, reamed, cleaned, and made up tightly. Care shall be taken to prevent the tube from kinking or buckling on short radius bends. Kinked or buckled sections of copper tube shall be cut and the tube spliced with the proper brass fittings, at the contractor’s expense.
- d. **Installation of Meters and Meter Boxes:**

1. Meters and meter boxes or vaults shall be installed as shown in **Detail No. W-3030** or **Detail No. W-3045** of these standards, or as directed by the City's authorized representative.
2. City of Wilsonville Utility Division shall install all meters 2 inches in diameter or less. Meters larger than 2 inches in diameter shall be installed by the contractor under the supervision of City of Wilsonville Utility Division.
3. Meters shall not be installed until the entire water system is ready for operation, the system has been tested and approved, and water meter permit(s) have been obtained from the City of Wilsonville Building Division.
4. The remainder of the service connection, excluding the meter, may be installed at any time during or after construction of the main. Before the meter is connected, the angle valve shall be opened and the service line flushed of all foreign materials, and shall be properly tested and chlorinated.
5. The finish grade of the completed meter enclosure shall allow a minimum of 6 inches and a maximum of 12 inches of clearance from the top of the meter to the meter box. Meter boxes or vaults shall be set or constructed plumb, with the top set horizontally. Lightly compacted earth backfill shall be placed inside the meter boxes to the bottom of the meter stop. Grade adjustments of the meter boxes or vaults shall be made by using standard extension sections for the specified box or vault. Backfill around meter vaults shall be as specified for adjoining pipe. Provide adequate space to allow for sidewalk installation. Under no circumstances shall meter boxes be placed in the sidewalk.
6. Depending on the elevation difference between the meter and the main line water system working pressure, the City may require a backflow-prevention valve and/or a pressure reducing valve on the customer side of the meter, at the meter box. Installation shall be approved by the City's authorized representative.

501.11.00 WATER LINE ACCEPTANCE POLICY

501.11.01 Water Line Activation

The City of Wilsonville will provide water to the project when the following are complete.

- a. Compliance with these standards.
- b. Installation of the materials and workmanship as described herein.
- c. A successful hydrostatic pressure tests, as witnessed and approved by the City's authorized representative.
- d. Adequate flushing and chlorination of mains, as witnessed and approved by the City's authorized representative.

- e. Acceptable results of samples taken for bacteriological examination by an Oregon Environmental Laboratory Accreditation Program (ORLAP) accredited drinking water laboratory.

501.11.02 Locate Wire Testing

Prior to paving, the contractor shall notify the City's authorized representative that the water system locate wire is ready for testing. City personnel shall connect to the locate wire and attempt to locate water main line, services, and connections to water system appurtenances. All points of the water system shall be located from at least two connection points to be considered to have adequate coverage. The contractor will be required to locate and repair any gaps in the locate wire coverage. Failed sections shall be retested until adequate coverage is obtained.

501.11.03 Water Line Acceptance

The City of Wilsonville will accept new water installations or systems built to the "Public Works Standards," provided that the following conditions are met.

- a. Dedication of any required easements or rights-of-way have been recorded with the County Recorder and the Engineering Department receives a reproducible copy of the recorded documents.
- b. After completion of construction of the total project, and after all testing has been satisfactorily completed, project closeout shall proceed as outlined in [Section 101.8.17](#), "Project Closeout."
- c. The Contractor or Applicant shall be responsible for providing Maintenance Assurance for Public Improvements as outlined in [Section 101.8.18](#), "Maintenance and Warranty." Public water improvements shall be warranted for a minimum of two years.
- d. At any time during the warranty period, the City's authorized representative has reason to believe the public water improvements have defects that were the result of faulty workmanship or flaws in construction material, the responsible party shall be required, at that party's own cost, to repair any faults to the public water improvements deemed necessary by the City's authorized representative.
- e. Before the end of the Construction Maintenance period, the City's authorized representative shall inspect the project for any remaining deficiencies. If the deficiencies that remain are determined to be the responsibility of the contractor or the applicant, the contractor or applicant shall then make such repairs.

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SECTION 6

TRENCH EXCAVATION AND BACKFILL

601.1.00 DEFINITIONS

- a. **Trench Excavation:** Trench excavation is the removal of all material encountered in a trench to the depths shown on the plans or as directed by the City’s authorized representative. Trench excavation shall be classified as either common or rock excavation.
 1. “Common excavation” is defined as the removal of all material that is not classified as rock excavation. The term “rock excavation” shall be understood to indicate a method of removal and not a geological formation.
 2. “Rock excavation” is defined as the removal of material that cannot, in the City Engineer’s judgment, be reasonably excavated with equipment comparable in machine weight and rated horsepower to a hydraulic hoe excavator with a minimum weight of 45,000 pounds and a net horsepower rating of 130 to 140. Rock excavation is also the removal of material by drilling and blasting (see [Section 601.3.01.i](#), “Explosives” for blasting restrictions) or power-operated rock-breaking equipment. Boulders or concrete pieces larger than ½ cubic yard encountered in the trench excavation shall be classified as rock excavation if removing them requires any of the above excavation methods, in the opinion of the City’s authorized representative.
- b. **Trench Foundation:** The bottom of the trench where the pipe bedding will lie. The trench foundation supports the pipe bedding.
- c. **Pipe Bedding:** The furnishing and placing of specified materials on the trench foundation to uniformly support the barrel of the pipe, from the trench foundation to the spring line of the pipe.
- d. **Pipe Zone:** The full width of the trench, from 12 inches above the top outside surface of the barrel of the pipe to the spring line of the pipe.
- e. **Spring Line:** Halfway up the sides of the pipe (horizontal centerline) when the pipe is laid on the pipe bedding.
- f. **Haunch:** That portion of the pipe below the spring line.
- g. **Trench Backfill:** The furnishing, placing, and compacting of material in the trench between the top of the pipe zone material and the bottom of the pavement base rock, ground surface, or surface materials.

- h. **Native Material:** Earth, gravel, rock, or other common material free of humus, organic matter, vegetative matter, frozen material, clods, sticks, and debris, isolated points or areas, or larger stones that would fracture or dent the structure or subject it to undue stress.

601.2.00 MATERIALS

601.2.01 Trench Foundation

Trench foundation (as defined in [Section 601.1.00.b](#), “Trench Foundation”) shall be native material in all areas except where groundwater or other conditions exist and, in the opinion of the City’s authorized representative, the native material cannot support the bedding and pipe. Under those conditions, geotextile fabrics approved by the City’s authorized representative shall be installed, or the unsuitable material shall be removed, as determined by the City’s authorized representative, and the trench foundation backfilled with Class B backfill in accordance with [Section 601.2.03](#), “Trench Backfill”.

601.2.02 Pipe Area

- a. **Pipe Bedding:** Pipe bedding material shall be Class B backfill in accordance with [Section 601.2.03](#), “Trench Backfill”, or as approved by the City’s authorized representative.
- b. **Pipe Zone:** The pipe zone material shall consist of Class B backfill in accordance with [Section 601.2.03](#), “Trench Backfill.”

601.2.03 Trench Backfill

Above the pipe zone, trench backfill will be divided into the following classifications:

- a. **Class A Backfill:** Class A backfill shall be native or common material, which in the opinion of the City’s authorized representative meets the characteristics required for the specific surface loading. Selected trench backfill material shall contain no frozen soil, gravel, or cobbles larger than 6 inches in diameter, and shall be free of organic or other deleterious material.
- b. **Class B Backfill:** Class B backfill shall be ¾”-0” granular grade crushed aggregate material, unless otherwise approved by the City’s authorized representative. The aggregate shall conform to the following.
 1. The aggregate shall consist of uniform-quality, clean, tough, durable fragments of rock or gravel and shall be free of flat, elongated, soft, or disintegrated pieces, or other objectionable matter occurring either free or as a coating on the stone.
 2. The aggregate shall meet the requirements for fractured faces and durability as specified in ODOT SSC Section 02630.10 “Dense-Graded Aggregate.”

3. Gradation and plasticity index requirements of the crushed aggregate shall be as shown for ¾”-0” rock in [Table 2.15](#), “Gradation Requirements of Granular Fill.” Sieve analysis shall be determined according to AASHTO T-27.
 4. Class B backfill material shall be approved by the City’s authorized representative prior to placement.
- c. **Class E Backfill:** Class E backfill shall be commercially mixed Controlled Low-Strength Material (CLSM) made up of a mixture of fly ash, cement, fine aggregate, water and admixtures, if necessary. Fine aggregate shall consist of commercial quality concrete sand. CLSM shall attain a 28-day compressive strength of 100 psi – 200 psi.

601.3.00 CONSTRUCTION

601.3.01 Excavation

- a. **Clearing and Grubbing:** When clearing the right-of-way is necessary, clearing shall be completed before the start of trenching. Clearing and grubbing shall follow the procedures outlined in [Section 201.5.02](#), “Clearing and Grubbing.” Under no condition shall excavated materials be permitted to cover brush before the brush is cleared and disposed of. Excavated material shall be stockpiled where and so it does not create a hazard to pedestrian or vehicular traffic; nor shall it interfere with the function of existing drainage facilities.
- b. **Erosion Control:** The contractor shall be responsible for erosion prevention and sediment control on the jobsite and shall use appropriate prevention measures as outlined in [Section 101.9.04](#), “Erosion Prevention and Sediment Control.” The contractor shall maintain the erosion-prevention and sediment-control facilities as specified in [Section 101.9.05](#), “Maintenance.”
- c. **Interferences and Obstructions:** Various obstructions may be encountered during the course of the work. The contractor shall follow the guidelines established in [Section 101.8.05](#), “Interferences, Obstructions, Abandoned Utilities.”
- d. **Contaminated Soils:** If during construction soils contaminated with hazardous materials or chemicals are encountered, the Contractor shall follow the procedures specified in [Section 101.9.02](#), “Contaminated Soils or Hazardous Materials.”
- e. **Open Trench Limit**
 1. Construction shall proceed in a systematic manner that will result in minimum inconvenience to the public. Construction staking for the work being performed shall be completed before the start of excavation.
 2. The contractor shall limit their operations to a small work area per crew. The length of the excavated trench shall always be kept to a minimum. At no time shall the trenching equipment be farther than 100 feet ahead of the pipe-laying

crews, unless advance written permission is given by the City's authorized representative.

3. Trenches shall be backfilled so that no section of trench is left open at the end of each work day, unless the trench is covered with Steel Plates. Use of Steel Plates shall conform to [Section 101.8.02.b.7](#), "Progress of Construction."
4. Trenches with unstable trench walls shall be backfilled immediately upon verification by the City's authorized representative.
5. Trenches located outside of an active right-of-way (e.g. roadways closed to all modes of access, subdivision construction), may be left open at the request of the City's authorized representative of a sufficient length of time to perform necessary inspections. Open trenches shall be protected with the use of an adequate number of cones, construction tape, and/or construction fencing.

f. Trench Width

1. The trench width at the surface of the ground shall be kept to the minimum necessary to safely install the pipe. All aspects of excavation, trenching, and shoring shall meet current OSHA standards and regulations. In all cases, trenches must be wide enough to allow for shoring and to permit proper joining of the pipe and backfilling and compaction of material along the sides of the pipe.
2. The trench width in the pipe zone must include a clear working space outside the maximum outside diameter of the pipe as follows.
 - (a) For pipe less than and including a 12-inch interior diameter, the clear working space shall be 6 inches.
 - (b) For pipe greater than a 12-inch interior diameter, the clear working space shall be ½ the inside pipe diameter up to a maximum of 24 inches.
 - (c) For manholes and other structures, the clear working space shall be wide enough to provide 12 inches between the face of the structure and the sides of the excavation or shoring.

See Table A in **Detail No. S-2145** for the required clear working space for each size of pipe.

3. Maximum width of the trench at the top of the pipe shall be 12 to 24 inches plus the width of the pipe bell. When required by the project design, the maximum trench width shall be shown on the plans.
4. If the contractor exceeds the maximum trench width without written authorization, the contractor shall be required to contact the design engineer or the geotechnical engineer and obtain written approval allowing installation of the pipe as specified, or contractor shall provide, at their cost, pipe of a higher strength

designation, a higher class of bedding, or both, as recommended by the design engineer or the geotechnical engineer, and approved by the City's authorized representative.

5. Where circumstances require extending the trench width at ground surface beyond the right-of-way or easement boundary, the applicant shall obtain written agreements with the affected property owner(s), and provide them to the City's authorized representative before commencing excavation.

g. Grading

1. The bottom of the trench shall be graded to the line and grade to which the pipe is to be laid, with proper allowance for pipe thickness and bedding material, or for greater base when specified or indicated. Before laying each section of the pipe, check the aggregate grade and correct any irregularities.
2. The trench bottom shall form a continuous and uniform bearing surface and support the pipe on solid and undisturbed ground at every point between bell holes, except that the grade may be disturbed for removing lifting tackle.

h. Rock Excavation

1. Where the bottom of the trench encounters ledge rock, boulders, or large stones that meet the definition of "rock excavation," rock excavation shall be performed to create six inches of clearance on each side and below all pipe and accessories.
2. Excavations below subgrade in rock shall be backfilled to subgrade with Class B backfill material, in accordance with [Section 601.2.03](#), "Trench Backfill" and compacted to not less than 90% of its maximum dry density as determined by AASHTO T-180.

i. Explosives

Explosives shall not be used in the City of Wilsonville without prior written approval from the City Engineer.

601.3.02 Installation

a. Shoring

1. The contractor shall provide all materials, labor, and equipment necessary to adequately shore trenches to protect the work, existing property, utilities, pavement, etc., and to provide safe working conditions in the trench.
2. Cribbing or sheeting that extends below the spring line of rigid pipe or below the crown elevation of flexible pipe shall be left in place, unless a satisfactory means can be demonstrated for reconsolidating bedding or side support that would be disturbed by removing the cribbing or sheeting.

3. If a movable box is used instead of cribbing or sheeting and the bottom cannot be kept above the spring line of the crown elevation of the flexible pipe, the bedding or side support shall be carefully reconsolidated behind the movable box before backfill is placed.
4. The use of horizontal strutting below the barrel of pipe, or the use of pipe as support for trench bracing, will not be permitted.

b. Dewatering

1. The contractor shall provide and maintain ample means and devices for promptly removing and disposing of all water entering the trench excavation while the trench is prepared for pipe laying, during the laying of the pipe, and until the backfill is placed and compaction is complete.
2. Groundwater shall be controlled to keep it from softening the bottom of the excavation. Dewatering systems shall be designed and operated to prevent removal of the natural soils and to keep the groundwater level outside the excavation from being reduced to an extent that would damage or endanger adjacent structures or property.
3. Dewatering systems shall be discharged to a storm water detention/retention facility unless otherwise approved by the City's authorized representative.
4. Sediments shall be settled and filtered before discharge. All settling systems shall be engineered and adequately sized for site conditions. In general, settling and filtering options, which shall be approved by the City's authorized representative, include but are not limited to:
 - (a) Containment in a pond structure until water is clear. Place the pump in a gravel bed at the bottom of the pond.
 - (b) Pumping to a Baker tank or other settling tank with sampling ports.
 - (c) Filtering through a sieve or other filter media.
 - (d) Manufactured bags or other systems. These systems do not always work on fine clay soils and will be allowed for use only where approved.
 - (e) Application of a polymer/flocculant where its use has been approved.
5. Filtering devices need to be inspected frequently to make sure they are functioning properly.
6. Filtering devices shall be filled in or otherwise removed when they are no longer necessary.

c. Grade

The contractor shall excavate the trench a minimum of 6 inches plus the pipe wall thickness below the specified pipe grade, or as established by the geotechnical engineer. The subgrade on which the bedding is to be placed shall be firm, undisturbed, and true to grade.

d. Trench Foundation

1. When in the judgment of the geotechnical engineer or the City's authorized representative, the existing material in the bottom of the trench is unsuitable to support the pipe, the contractor shall excavate below the pipe, as directed.
2. The contractor shall backfill the trench to the subgrade of the pipe bedding with Class B backfill in accordance with [Section 601.2.03](#), "Trench Backfill", over the full width of the trench, and shall compact in layers not exceeding 6 inches deep.
3. Fill material shall be compacted to not less than 90% of its maximum dry density, as determined by AASHTO T-180.

e. Pipe Bedding

1. Class B backfill in accordance with [Section 601.2.03](#), "Trench Backfill", shall be placed under all pipes.
2. Pipe bedding consists of leveling the bottom of the trench on the top of the foundation material and placing bedding material to the horizontal centerline of the pipe, unless otherwise specified.
3. Granular base shall be placed in the trench to a depth of 6 inches, loose, for the full width of the trench. The contractor shall spread the bedding smoothly to the proper grade so the pipe is uniformly supported along the barrel.
4. The contractor shall excavate bell holes at each joint to permit proper assembly and inspection of the entire joint. Bedding under the pipe shall provide firm, unyielding support along the entire pipe length.
5. Contractor shall be aware of the importance in proper placement and compaction of backfill material placed below the spring line of the pipe (haunch area). Proper backfilling ensures that adequate stability and support is provided to the pipe during final backfilling of the pipe zone. Backfill material shall be worked under the haunches by hand to ensure intimate contact between the backfill material and the pipe.

f. Backfill in Pipe Zone

1. After the pipe is in place and ready for backfilling, place Class B backfill, in accordance with [Section 601.2.03](#), "Trench Backfill", to a minimum depth of 12 inches over the top of the pipe. The material shall be placed at approximately the

same rate on each side of the pipe, so that the elevation of the aggregate on each side of the pipe is always equal.

2. Particular attention shall be given to the backfilling and tamping procedure to assure that there are no unfilled or uncompacted areas around the pipe.

g. Trench Backfill

1. Backfill shall be placed in the trench in such a way as to **not** permit material to freefall until the top of the pipe is covered by at least 2 feet of material. Under no circumstances shall the contractor allow sharp, heavy objects to drop directly onto the pipe or pipe zone material around the pipe.
2. If the required compaction density cannot be obtained, the contractor shall remove the backfill from the trench and recompact. The process shall be repeated until the contractor establishes a procedure that will provide the required density. The contractor will then be permitted to proceed with backfilling and compaction of the rest of the pipeline under the approved compaction procedure.
3. Within the public right-of-way, trench backfill shall consist of Class B backfill.
4. The City's authorized representative may approve the use of Class E backfill, CLSM, material for trench backfill above the pipe zone.

h. Native or Select (Class A) Backfill

1. Backfill the entire depth of the trench above the pipe zone with excavated trench materials placed in 12-inch layers. Remove all cobbles and stones 2 inches in diameter and larger from material used for backfill in the upper 12 inches of the trench.
2. Compact each layer using mechanical tampers or vibratory compactors to 85% of its maximum dry density, as determined by AASHTO T-180. Bring the fill to the required surface grade, and compact so that no settlement will occur.

i. Granular (Class B) Backfill

1. Granular backfill material shall meet the requirements of [Section 201.3.01](#), "Granular Fill." Granular backfill shall be tested at a minimum of every 200 feet of trench length and at depths specified by the City's authorized representative.
2. Compact the trench backfill material within 2 feet of road base rock grade to not less than 95% of its maximum dry density, as determined by AASHTO T-180. Compact trench backfill material placed more than 2 feet from road base rock grade to not less than 90% of its maximum dry density.

j. Controlled Low-Strength Material (Class E) Backfill

1. Controlled Low-Strength Material (CLSM) shall meet the requirements of [Section 601.2.03.c](#), “Class E Backfill.”
2. Backfill the trench above the pipe zone with CLSM to the bottom of the proposed surfacing. No compaction of the CLSM is allowed.
3. Use steel plates to protect the CLSM from traffic a minimum of 24 hours. After 24 hours, the CLSM may be paved. Use of Steel Plates shall conform to [Section 101.8.02.b.7](#), “Progress of Construction.”

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SECTION 7

FIBER OPTIC DESIGN AND CONSTRUCTION

701.1.00 ENGINEERING

701.1.01 Introduction

This section outlines the design and construction requirements for all fiber optic communication lines. The provisions and technical specifications herein set forth the requirements of the City of Wilsonville for constructing fiber optic communication lines. Interpretations of such provisions and their application in specific circumstances shall be made by the City's authorized representative, unless specifically stated otherwise. Refer to Section 1 of the "Public Works Standards" for general provisions and requirements.

701.1.02 Extension of Fiber Optic Communication Line

- a. Vaults and conduit for fiber optic communication shall be constructed with all development along Major and Minor Arterials and Collector streets.
- b. The extension or upsizing of the vault and conduit to serve the existing and future City infrastructure the contributing area shall be done by the property owner or permit applicant.
- c. The City reserves the right to perform the work or cause it to be performed and bill the owner for the cost of the work or to pursue special assessment proceedings.

701.1.03 Fiber Optic Communication Plans

- a. It is the design engineer's responsibility to ensure that engineering plans are sufficiently clear and concise to construct the project in proper sequence, using specified methods and materials, with sufficient dimensions to fulfill the intent of these design standards.
- b. All elevations on design plans and record drawings shall be based on the applicable NAVD 88 Datum specified in Section 101.7.07.a, "NAVD 88 Datum."
- c. Existing conditions and facilities on design plans and record drawings will be shown in light, gray print. Proposed conditions and facilities on design plans and record drawings will be shown in bold, red print.
- d. All engineering fiber optic communication plans at a minimum, will contain the following:
 1. At least one sheet shall show a plan view of the entire project site. If the project site is sufficiently large that detailed fiber optic communication plans

on any given sheet do not encompass the entire project site, then a sheet showing the plan view of the entire site must serve as an index to subsequent detailed plan sheets.

2. A topographic map showing existing conditions for the site, including the following:

(a) Existing topography for the site. Plan views showing existing features may be required for a distance of up to 100 feet (or further if warranted) beyond the proposed improvement in order to prevent future grade conflicts and will be determined on a case-by-case basis by the City's authorized representative.

(b) Adjacent streets, trails, multi-use paths, and rail lines, including the respective names.

(c) Existing utilities, including franchised utilities above or below ground and drainage facilities that transport surface water onto, across, or from the project site. Existing drainage pipes, culverts, and channels shall include the invert or flow line elevations.

(d) Existing vegetation, including denoting the type, DBH, and canopy size of trees within the construction limits.

(e) Existing environmentally sensitive areas (e.g., ravines, swales, steep slopes, wells, springs, wetlands, creeks, lakes, etc.). For natural drainage features, show direction of flow, drainage hazard areas, and 100-year floodplain boundary (if applicable).

(f) Adjacent existing features that are within 25 feet outside of the site boundary, including but not limited to construction activities that will potentially compromise the structural stability or condition of off-site features, such as cultivated vegetation, landscaping and trees, buildings, fences, decks, walls, slabs, and pavements. Denote the type, DBH, and canopy size of all trees.

3. Plans for proposed fiber optic communication line shall include the following:

a) Grading and erosion control plan.

b) Finished grades, showing the extent of cut and fill by existing and proposed contours, profiles, or other designations. Plan views showing existing features may be required for a distance of up to 100 feet (or further if warranted) beyond the proposed improvement in order to prevent future grade conflicts and will be determined on a case-by-case basis by the City's authorized representative.

- c) Horizontal stationing along centerline, including centerline stationing of all intersecting streets.
- d) Proposed structures, including roads and road improvements, parking surfaces, building footprints, walkways, landscape areas, etc.
- e) Existing fiber optic communication lines, including the size, type, and material of all fiber optic system appurtenances, including, but not limited to fiber optic cable, conduit size, manholes, vaults, and pull boxes. Notes shall be included for referencing details, cross-sections, profiles, etc.
- f. Existing and proposed utilities, showing exact line of all utilities crossing proposed fiber optic communication lines.
- g. Applicable detail drawings
- h. Existing and proposed property lines, right-of-way lines, survey monuments, and easements.
- i. Setbacks from environmentally sensitive areas or resource areas protected within the Significant Resource Overlay Zone (SROZ).
- j. Any proposed phasing of construction.
- k. Any additional information that the City’s authorized representative deems necessary.

701.1.04 Surveying

- a. Where conflicts with existing utilities occur and at locations where fiber optic infrastructure placement may be difficult to determine, the City’s authorized representative may require the design engineer to establishing the location of the fiber optic infrastructure by means of reference stakes offset along the centerline of the fiber optic conduit. Where required, no construction shall be allowed to begin before construction staking. All staking shall be performed by or under the direction of a Professional Land Surveyor registered in the State of Oregon.

701.1.05 As-built Verification of Existing Conduit

- a. The design engineer shall be responsible for establishing the location of existing fiber optic communication lines and vault locations. Fiber optic communication lines will be located and marked with orange paint. Rodding and proofing of existing ducts will be performed where required.
- b. As-built verification designs will at a minimum, contain the following:
 - 1. Plan view of the entire site project.

2. Existing and proposed property lines, right-of-way lines, survey monuments, and easements.
3. Horizontal stationing along centerline, including centerline stationing of all intersecting streets.
4. Fiber Optic Communication vault location, type, dimensions, and photo of inside.
5. Fiber Optic Communication conduit location, type, size, including any fiber or inner duct, pull line, or locatable line located within.
6. Any additional information that the City's authorized representative deems necessary.

701.2.00 VAULT AND CONDUIT DESIGN STANDARDS

The following design standards are intended only as a guide for the design of fiber optic communication lines. All designs shall conform to the most current requirements of the State of Oregon, except where the City's standards exceed those of the state.

701.2.01 Vault Design

- a. Vaults shall be placed at least every 600 feet, unless otherwise approve by the City's authorized representative.
- b. Vaults shall be designed such that upon final grade, the vault lid is flush with surrounding grade in landscape or paved areas unless otherwise directed by the City's authorized representative.
- c. The minimum vault size for fiber optic communication mainline shall be 24"X36"X24" Deep.
- d. Vault lids to be non-slip, 20K rated and recessed.

701.2.02 Conduit Design

a. Conduit Size

1. Minimum of (1) 4" conduit will be placed for all main fiber optic communication lines.
2. Minimum of (1) 2" conduit will be placed for all lateral business fiber optic communication lines.
3. Minimum of (1) 1 ¼" conduit will be placed for all lateral residential fiber optic communication lines.

b. Materials

- 1. Generally, conduit will be PVC pipe, unless otherwise directed by the City’s authorized representative.
- 2. PVC pipe materials shall consist of one type of material throughout.
- c. Location: Fiber optic communication lines will normally be placed in the right-of – way. When it is not possible or practical to install fiber optic communication lines in the right-of-way the facilities may be located in the public utility easement.
- d. Alignment: Fiber optic communication lines shall be placed on a straight alignment and at uniform grade.
- e. Locating Wire: All fiber optic communication mainlines and laterals shall have tracer wire installed with-in the conduit.
- f. Pipe Cover: All fiber optic communication mainlines shall be laid at a minimum depth of 30 inches with optimum depth being 36 inches. Lateral fiber optic communication lines shall be laid at a minimum 24 inch depth with optimum depth being 36 inches. The City’s authorized representative may approve shallow fiber optic communication lines upon verification that the typical depths cannot be met.
- g. Caution Ribbon shall be installed above the conduit, a foot below finished grade.
- h. Ends of conduit shall be capped/plugged during construction to prevent entrance of foreign matter.
- i. Conduit shall terminate not more than 1” inside of vault. When possible, conduit should run straight into vault without sweeps or bends.
- j. Maximum of three 90 degree bends between pulling points. All bends to be long sweeping bends with a minimum 36” radius.

701.3.00 MATERIAL AND TECHNICAL SPECIFICATIONS

701.3.01 Vaults and Pull Boxes

a. General

Vaults and pull boxes shall be constructed at locations shown on the plans and in compliance with the design requirements or as required by the City’s authorized representative.

b. Materials

Vaults shall be Old Castle Precast 233-PGE (32”x44”x42”) or approved equal.

701.3.02 Conduit and Inner Duct

a. General

1. The material suitable for project conditions shall be determined and approved by the City's authorized representative.

b. Materials

Materials shall be the following types or approved equal:

- PVC Pipe-4 Inch-Schedule 40 PVC or other corrosion resistant duct
- PVC Pipe-3 Inch-Schedule 40 PVC or other corrosion resistant duct
- PVC Pipe-2 Inch-HDPE (High Density Polyethylene)
- PVC Pipe- 1 ¼"-HDPE (High Density Polyethylene)
- Inner Duct-1 ¼"-HDPE (High Density Polyethylene) Corrugated

701.3.04 Fiber Optic Cable

a. General

1. All fiber optic cable shall be single mode loose tube, suitable for the type of installation indicated in the Plans and in the Special Provisions.
2. Fiber optic cable(s) shall be able to withstand bending to a minimum radius of 10 times the cable outer diameter without tensile load applied and 20 times the cable outer diameter with maximum load applied (during installation only), without damage to the cable components or degradation of the optical fiber performance.
3. The optical fibers shall be contained within loose buffer tubes. The loose buffer tubes shall be stranded around an all dielectric central member in a Reverse Oscillation Lay with Aramid yarn as the primary strength member and a polyethylene sheath for overall protection. Each buffer tube shall contain twelve (12) fibers except six fiber branch cable.

b. Material

1. All glass shall be from the same manufacturer. The manufacture shall be ISO 9001 certified. The glass used shall be compatible with the existing single mode fiber optic cable used by the County.
2. All fibers in the buffer tube shall be factory attenuation tested at 1310nm and 1550nm averaged bi-directionally. Fibers shall be usable and shall be sufficiently free of surface imperfections and inclusions to meet the optical, mechanical, and

environmental requirements of these Specifications. The attenuation of each fiber shall be provided with each cable reel.

3. The central member shall be a glass reinforced plastic rod with similar expansion and contraction characteristics as the optical fibers. A linear overcoat of Low Density Polyethylene shall be applied to the central member of the main trunk fiber cable to achieve the optimum diameter to provide the proper spacing between buffer tubes during stranding.
4. Fillers may be included in the cable to lend symmetry to the cable cross-section where needed. Filler rods shall be solid medium or high-density polyethylene. The diameter of filler rods shall be the same as the outer diameter of the buffer tubes.
5. Completed buffer tubes shall be stranded around the over-coated central member using stranding methods, lay lengths and positioning such that the cable shall meet mechanical, environmental and performance specifications. A polyester binding shall be applied over the stranded buffer tubes to hold them in place. Binders shall be applied with sufficient tension to secure the buffer tubes to the central member without crushing the buffer tubes. The binders shall be non-hygroscopic, non-wicking (or rendered so by the flooding compound), and dielectric with low shrinkage.
6. Tensile strength shall be provided by high tensile strength Aramid yarns and fiberglass that shall be helically stranded evenly around the cable core.
7. The outer jacket or sheath shall be marked with the manufacturer's name, the words "Fiber Optic Cable", date of manufacture, and sequential foot markers. The markings shall be repeated approximately every foot. The actual length of the cable shall be within 0 ± 1 percent of the length marking. The marking shall be in a contrasting color to the cable jacket. The height of the marking shall be approximately 3 mm (1/8 in.).

c. Splicing

1. Fiber Optic Connector - All connectors must be factory installed. Connectors shall be of the ceramic ferrule LC/UPC type for single mode. Outdoor LC/UPC connector body housing shall be glass reinforced polymer. The associated coupler shall be of the same material as the connector housing. Fiber optic connectors shall be the 2.5 mm LC/UPC connector ferrule type with Zirconia Ceramic material with a PC (Physical Contact) pre-radiused tip. The connector operating temperature range shall be -40o C to +70o C.
 - a) Insertion loss shall not exceed 0.35 dB (bi-directional sum) for a single mode connector and 0.75 dB for a single mode connector pair, and the return reflection loss on single mode connectors shall be at least -55 dB.

b) Connection durability shall be less than a 0.2 dB change per 500 mating cycles per EIA-455-21A (FOTP-21). All terminations shall provide a minimum 50lbf (222 N) pull out strength.

c) Single mode connectors shall have a yellow color on the body and/or boot that renders them easily identifiable.

2. Fiber Optic Cable Lubricant - Fiber optic cable lubricant shall be as follows:

- Compatible with the cable jacket
- Non-combustible
- Water-based leaving little or no residue

3. Fiber Optic Splice Closure - The fiber optic field splices shall be enclosed in splice closures which shall be complete with splice organizer trays, brackets, clips, cable ties, seals and sealant, as needed. The splice closure shall be suitable for a direct burial, pull box or aerial application.

a) Manufacturer's installation instructions shall be supplied to the City's representative prior to the installation of any splice closures.

b) Fiber optic splice closures that conform to the following: The fiber optic splice closure shall consist of an outer closure and splice trays, and shall conform to the following requirements:

- Non-filled thermoplastic case
- Rodent proof, water proof, re-enterable and moisture proof
- Expandable from 2 cables per end to 8 cables per end by using adapter plates
- Cable entry ports shall accommodate 10mm to 25 mm diameter cables
- Multiple grounding straps
- Accommodate up to 8 splice trays
- Suitable for "butt" or "through" cable entry configurations
- Place no stress on finished splices within the splice trays

4. Splice Tray- Splice trays will accommodate a minimum of 12 fusion splices and must allow for a minimum bend radius of 2-inches. Splice trays shall be of the same manufacturer as the splice closure or fiber distribution unit.

5. Fiber Optic Patch Cords and Pigtails – Patch cords and pigtails shall meet the following requirements:

- Patch cords minimum 3 feet in length/Pigtails minimum 1 feet in length
- Aramid yarn strength member

- Rugged 0.12 inch (approximate) PVC sheathing
- Minimum bend radius of 12.5 inch following installation, 25 inch during installation

- Comply with NEC requirements for indoor cable when used indoors
- Rated by the manufacturer for use in outdoor field cabinets as needed.

701.3.05 Locate Wire and Pull Line

a. General

1. All fiber optic communication mainlines and lateral line shall have a locatable wire and pull line placed with in the duct or PVC pipe.

b. Materials

Materials shall be the following types or approved equal:

- Locatable wire- 12-gauge stranded or solid copper insulated High Molecular Weight Polyethylene (HMW-PE) with an orange insulated cover a minimum 45 mil in thickness and the wire U rated for 104°F.

- Pull Line- 1800 lb. minimum

701.4.00 CONSTRUCTION SPECIFICATIONS

701.4.01 General Provisions

The specifications detailed here, together with the standards established by the Counties of Clackamas and Washington, and any other applicable requirements of the City, shall govern the character and quality of the material, equipment, installation and construction procedures for fiber optic line installation.

701.4.02 Scheduling

a. The contractor shall plan construction work in conformance with section 101.8.02, “Scheduling”

b. Newly installed fiber optic communication line shall not be placed in service until all necessary testing is complete and has been approved by the City’s authorized representative.

701.4.03 Environmental Protection, Erosion Prevention, and Sediment Control

The contractor shall take appropriate measures and precautions to minimize the work's impact on the environment and shall control erosion, as outlined in Section 101.9.00, "Environmental Protection, Erosion Prevention, and Sediment Control."

701.4.04 Interferences and Obstructions

Various obstructions may be encountered during the course of the work. The contractor shall follow the guidelines established in Section 101.8.05, "Interferences, Obstructions, Abandon Utilities."

701.4.05 Abandon Fiber Optic Communication Facilities

Fiber optic communication facilities to be abandoned shall be cut off and completely removed at 24-inches minimum below finish grade, unless specifically stated otherwise. Conduit abandoned in place shall have all cable and pull line removed and each end plugged with a water tight plug.

Manholes and vaults to be abandoned shall have frame, cover, grade rings, cone section or flat slab top removed and manhole/vault sections cut and removed at 48-inches minimum below finish grade unless specifically stated otherwise. The manhole/vault base shall be rubberized or perforated to prevent entrapment of water. The remaining portion of manhole/vault shall be backfilled with Class B material in accordance with Section 6, "Trench Excavation and Backfill."

701.4.06 Contaminated Soil or Hazardous Material

If during construction contaminated soil or hazardous material or chemicals are encountered, the Contractor shall follow the procedures specified in Section 101.9.02, "Contaminated Soils or Hazardous Materials."

701.4.07 Trench Excavation, Preparation, and Backfill

Trench excavation, preparation, and backfill shall conform to the requirements of Section 6, "Trench Excavation and Backfill."

701.4.08 Preservation, Restoration, and Cleanup

Cleanup of all construction debris, excess excavation, and excess materials and complete restoration of all fences, mailboxes, ditches, culverts, signposts, and similar items shall be completed according to Section 101.8.16, "Preservation, Restoration, and Cleanup."

701.4.09 Bores

Bores shall conform to the requirements of Section 301.10.09, "Bores."

701.5.00 TESTING PROCEDURES

701.5.01 General

a. Locate Wire testing: Prior to final surfacing, the contractor shall notify the City's authorized representative that the fiber optic communication main line locate wire is ready for testing. City personnel shall connect to the locate wire and attempt to locate the fiber optic communication main line. The fiber optic communication main line will be located from at least two connection points to be considered to have adequate coverage. The contractor will be required to locate and repair any gaps in the locate wire coverage. Failed sections shall be retested until adequate coverage is obtained.

b. Testing Order: Testing shall include the tests on elements of the passive fiber optic components: (1) at the factory, (2) after delivery to the project site, but prior to installation, (3) after installation, but prior to connection to any other portion of the system. Provide all personnel, equipment, instrumentation and materials necessary to perform all on-site testing.

701.5.02 Fiber Testing

a. Optical Time Domain Reflectometer (OTDR) Testing-Testing shall be performed with an OTDR (optical time domain reflectometer) and/or optical power meter and light source, as directed below, and testing shall be done at the following stages in the system construction:

- OTDR test at cable delivery (arrival on-site test)
- OTDR test following cable installation prior to connection, termination or splicing
- OTDR post-connection test, following installation of all splices, pigtails, connectors and termination devices. This test shall be performed end-to-end, on all strands that are spliced or onto which optical equipment is terminated.

b. Test Results- The test results shall include the following measurements:

- Total measured length of the optical link (m)
- Total end-to-end attenuation of the optical link (dB), not including launch cable
- End-to-end attenuation per unit length (dB/km), not including launch cable
- Mean attenuation of each splice in the optical link under test (dB)
- Wave length of the measurement (nm)
- Date and time of the test
- Cable ID number

- Fiber color or ID
- Refractive index setting of the OTDR
- Averaging interval of the test

c. Power Meter and Light Source - At the conclusion of the OTDR testing, test all connected fiber links end-to-end with a power meter and light source, in accordance with EIA Optical Test Procedure 171 and in the same wavelengths specified for the OTDR tests. Conduct these tests in both directions at the 1310 and 1550 nanometer wavelength. The differential in test results shall not exceed 0.5 DB.

d. Test results shall be recorded, compared, and filed with the other recordings of the same links. Submit test results to the City's representative. The following information shall be documented for each fiber test measurement:

- Wavelength
- Fiber type
- Cable, tube and fiber IDs
- Near end and far end test locations
- End-to-end attenuation
- Date, time, and operator

Attenuation shall be calculated by the insertion method. Normalization between the light source and the power meter shall be performed at the beginning of each day of testing.

e. Fiber Cable Testing Documentation-The following information shall be included in each test result submittal:

- Contract number, contract name, contractor name and address.
- Dates of cable manufacture, installation, and testing.
- Cable specifications.
- Location of all splices.
- OTDR test results.
- Attenuation test results.

f. Test Failures-If the link loss measured from the power meter and light source exceeds the calculated link loss, or the actual location of the fiber ends does not agree with the expected location of the fiber ends (as would occur with a broken fiber), the fiber optic

link will not be accepted. Replace the unsatisfactory segments of cable, or splices with a new segment of cable or splice at the Contractor's expense. Complete the OTDR Testing, Power Meter and Light Source Testing and Cable Verification Worksheet for the repair to determine acceptability. Submit copies of the test results to the City's representative. The removal and replacement of a segment of cable shall be interpreted as the removal and replacement of a single continuous length of cable connecting two splices or two connectors. The removal of only the small section containing the failure and therefore introducing new unplanned splices will not be allowed.

701.6.00 FIBER OPTIC COMMUNICATION LINE ACCEPTANCE POLICY

The City of Wilsonville will accept new fiber optic communication installations or systems built to the "Public Works Standards," providing that the following conditions are met.

701.6.01 Legal Recordings

Dedication of any required easements or rights-of-way have been recorded with the County Recorder and the Engineering Department receives a reproducible copy of the recorded documents.

701.6.02 Project Completion

After completion of construction of the total project, and after all testing has been satisfactorily completed, project closeout shall proceed as outlined in Section 101.8.17, "Project Closeout."

701.6.03 Maintenance Assurance

The Contractor or Applicant shall be responsible for providing Maintenance Assurance for Public Improvements as outlined in Section 101.8.18, "Maintenance and Warranty." Fiber optic improvements shall be warranted for a minimum of two years.

701.6.04 Warranty Period Defects

At any time during the warranty period, the City's authorized representative has reason to believe the fiber optic improvements have defects that were the result of faulty workmanship or flaws in construction material, the responsible party shall be required, at that party's own cost, to repair any faults to the fiber optic improvements deemed necessary by the City's authorized representative.

701.6.05 Maintenance Period Inspection

Before the end of the Construction Maintenance period, the City's authorized representative shall inspect the project for any remaining deficiencies. If the deficiencies that remain are determined to be the responsibility of the contractor or the applicant, the contractor or applicant shall then make such repairs.

