2015

Public Works Design and Construction Standards

City of Newberg

May 2015

PUBLIC WORKS DESIGN AND CONSTRUCTION STANDARDS - 2015

Revised May 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 Tualatin Public Works Standards
City of Wilsonville Public Works Standards
Clean Water Services Agency of Washington County
Oregon Department of Environmental Quality
Oregon Department of Transportation
Oregon Health Division
Portland Cement Association
Portland General Electric
Stormwater Management Manual for Western Washington

FOREWORD

The 2015 edition of the City of Newberg Public Works Design and Construction 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 Newberg. These Public Works Design and Construction Standards - 2015 will supersede all previously issued Standard Specifications.

Interpretation and enforcement of these standards shall be the responsibility of the City of Newberg Engineering Services Department.

All federal, state, county (Yamhill) 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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0.0 to 5.0 139
33 139
6 139
5.1 to 10.0 139
30 139
5 139
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27 139
4 139
15.1 to 20.0 139
24 139
3 139
20.1 to 25.0 139
21 139
2 139
Over 25.0 139
21 139

0 or NP 139
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Designated Size 139
Minimum % Retained on the ¼" Sieve 139
1 ½" – 0 and larger 139
50 139
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70 139
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Section 1 General

1.0 Authority and Purpose

The purpose of these Public Works Design and Construction Standards is to provide a consistent policy under which certain physical aspects of public facility design will be implemented. Most of the elements contained in this document are Public Works oriented and it is intended that they apply to both public improvements under City contract and public improvements under private contract designated herein.

These Standards cannot provide for all situations. They are intended to assist but not to substitute for competent work by design professionals. It is expected that engineers will bring to each project the best of skills from their respective disciplines.

The Public Works Design and Construction Standards are also not intended to limit unreasonably any innovative or creative effort which could result in better quality, better cost savings, or both. Any proposed departure from the Public Works Design and Construction Standards will be judged on the likelihood that such departure will produce a compensating or comparable result in every way adequate for the user and the public.

Interpretation and enforcement of these standards shall be the responsibility of the City of Newberg Engineering Services Department.

1.1 Engineering Policy

It shall be the policy of the City of Newberg to require compliance with Oregon Revised Statute 672 for professional engineers.

All engineering plans, reports, or documents shall be prepared by a registered professional engineer, or by a subordinate employee under the engineer's direction, and shall be signed by the engineer and wet stamped with the engineer's seal to indicate the engineer's responsibility for them. It shall be the engineer's responsibility to review with the City any proposed public facility extension, modification, or other change prior to any proposed design work to determine any special requirements or to determine whether the proposal is permissible. A "Preliminary Review" and/or a "Plans Approved for Construction" stamp of the City on the plans for any job does not in any way relieve the engineer of responsibility to meet all requirements of the City or obligation to protect life, health, and property of the public. The plan for any project shall be revised or supplemented at any time it is determined that the full requirements of the City have not been met.

Public improvement permit application(s) for any work within current or future right-of-way and/or easements including but not limited to; public street, storm drainage, waterworks, and/ or wastewater improvements shall be approved/ issued by the City before commencement of any onsite building, grading, or construction activities.

1.2 Contractor Qualifications

All contractors performing work in the Public Right of Way and/ or on City owned infrastructure shall be pre-approved with the City of Newberg, and shall apply and possess a current City Business License. The contractor shall submit the City's Pre-Qualification Application to the Engineering Services Department at least 10 calendar days prior to any proposed construction.

1.3 Fees

Reference the Engineering Services Department Fee Schedule, for the most current and updated rates. Fees are based on the Engineer's Estimate of Contractor's Bid for the public work. A two percent plan review fee is due upon the initial plan submittal for review. Applicant may incur additional plan review fees for plans/ submittals and/ or length review periods considered unacceptable by the City. A three percent inspection fee is due upon completion of the plan review process. Additional inspection fees may be incurred due to items such as failed inspections e.g. unprepared at the time of City arrival, unacceptable construction practices/timeframes, etc.

1.4 Intent of Public Works Design and Construction Standards

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

I. Setting forth uniform material and workmanship standards
II. Supplementing and completing the public health and safety requirements of Chapter 13 of the Newberg Municipal Code.
III. Streamlining the administration and construction of public facilities in the City and minimizing repairs and allowing for the long term maintenance of the public facilities

1.4.1 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.

1.4.2 Order of Precedence

All federal, state, county 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:

I. Permits from other agencies or jurisdictions, as may be required by law.
II. City of Newberg Planning and Land Development Ordinance, Chapter 15 of the Newberg Municipal Code.
III. Land use decision-making authority's Conditions of Approval.
IV. City of Newberg master plans (latest editions): Transportation Systems Plan, Storm Water Master Plan, Wastewater Collection System Master Plan, Water System Master Plan. ***NOTES:*** *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 Drawing No. 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.*
V. City of Newberg Public Works Design and Construction Standards.

VI. City of Newberg Standard Drawings.
VII. Erosion and Sedimentation Control Manual.
VIII. Oregon Standard Specifications for Construction (current edition).
IX. 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.
X. ODOT Pavement Design Guide.
XI. Uniform Fire Code.
XII. Uniform Building Code and City-issued building, mechanical, electrical, and plumbing permits.
XIII. Americans with Disabilities Act latest approved standards or guidelines as referenced in the Standard Drawings of these standards.
XIV. Plans and drawings prepared by the design engineer.
XV. 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.

Specific plans shall have precedence over general plans. In any event, the determination of the City Engineer shall be final.

1.5 Revisions to Public Works Design and Construction Standards

This standards may be amended or updated periodically to protect the public health, safety and welfare. The City Engineer shall have the authority to modify the Standard Drawings as needed to maintain conformance with national and state design requirements, guidelines, and specifications and industry standards.

The date appearing on the title page is the date of the latest revision. Users shall apply the latest edition to the work contemplated at the time of actual construction and design, and it shall be each user's responsibility to maintain his/her copy of these Public Works Design and Construction Standards with the latest changes.

1.6 Definitions

Alley: A public way not over 30 feet wide providing a secondary means of access for vehicular or service access to property.

Applicant: The owner or authorized agent acting on behalf of the owner.

Approved Backflow Prevention Device: A device that has been investigated and approved by the City and the Oregon State Health Division for preventing backflow.

Arterial Street: A major facility for moving intra-area traffic and for moving traffic to and from the freeway/expressway system.

As built Plans: Plans signed, dated, and stamped by the project engineer indicating that the plans have been reviewed and revised, if necessary, to accurately show all as-built construction drawings of the public facilites.

Backflow: The reverse of flow from its normal or intended direction of flow. Backflow can be caused by back-pressure or back-siphonage.

Backflow Preventer: An approved device or means to prevent backflow into the potable water system.

Back-siphonage: Backflow that results from negative or reduced pressure (partial vacuum) in the supply piping system.

Bike Lanes: A designated travel way for bicyclists that is established within the roadway directly adjacent to the outside vehicular lane or on the shoulder.

Bike Path: A designated travel way for bicyclists which is completely separated from the vehicular travel lanes and is within independent rights of way.

Bike Route: A designated travel way for bicyclists that is shared with vehicular traffic. The roadway is designated with signs for bicycling (no pavement markings for the bike route or delineation of parking spaces used).

Building Service Lateral: A public wastewater or stormwater sewer beginning at the property line or public easement line and extending to the collector sewer.

Building Sewer: A private wastewater sewer beginning five (5) feet outside the building and extending to the property line or public easement line connecting to the building service lateral.

Building Supply: The pipe carrying potable water from the water meter or other source of water supply to a building or other point of use or distribution on the lot. Building supply shall also mean customer line.

Channel Morphology: The stream channel type and the physical characteristics of the streambed.

City: The City of Newberg, Oregon.

City Engineer: The individual designated by the City Manager to have the authority for review and approval on all projects subject to these Public Works Design and Construction Standards. The Public Works Director may act in this role when the City Engineer position is not filled.

Collection Systems: Facilities maintained by the City of Newberg for the collecting, pumping, conveying, and controlling of wastewater.

Collector Sewer: The portion of the public wastewater conveyance system which is primarily installed to receive wastewater directly from individual residences and other individual public or private structures.

Collector Street: A facility that allows traffic within an area or neighborhood to connect to the arterial system.

Common Development Plan: All lands included within the boundary of a certified survey map or subdivision plat created for the purpose of development or sale of property where integrated, multiple, separate and distinct land developing activity may take place at different times by future owners.

Control Vault: a chamber used for pretreatment to reduce/eliminate the amount of pollutants or alter the nature of pollutants to a less harmful state or concentration prior to discharge.

Core: To cut and remove a portion of pipe, manhole, or pavement with a circular hollow drill.

Cross Connection: Any actual or potential physical connection between a potable waterline and any pipe or vessel containing a non-potable or potable (i.e., well) fluid (suspended solid or gas) so that it is possible to introduce the non-potable fluid into the potable fluid by backflow.

Cul-de-sac: A dead end street that has a vehicular turnaround area at the end.

Cut Sheets: Sheets of tabulated data, indicating stationing, structures, fittings, angle points, beginning of curve, points on curve, end of curves, storm drain slope, staking offset, various elevations, offset cuts, and storm drain depths for streets, waterlines, wastewater sewers, and storm drains.

Datum: The vertical elevation control for the City of Newberg is "The North American Vertical Datum of 1988."

Dead end Street: A street or series of streets which can be accessed from only one point. Dead end streets can be either temporary (intended for future extension as part of a future street plan) or permanent. New construction of permanent dead end streets (including cul-de-sacs) must provide adequate turnaround capability, and be publicly maintained.

Definition of Words: That, whenever, in these Standards, the words "directed", "required", "permitted", "ordered", "designated", or words of like importance are used, they shall be understood to mean the direction, requirement, permission, or order of designation of the City Engineer. Similarly, the words "approved," "acceptable," or "satisfactory," shall mean approved by, acceptable to, or satisfactory to the City Engineer.

Demolition: Any act or process of wrecking or destroying a building, improvement, or structure.

DEQ: Oregon Department of Environmental Quality

Designated Arterial or Collector Street: A street designated as an arterial or collector in the Comprehensive Plan or the Newberg Transportation System Plan.

Public Works Design and Construction Standards Manual: The current version of the City of Newberg Public Works Design and Construction Standards manual and specifications.

Design Storm: A hypothetical discrete rainstorm characterized by a specific duration, temporal distribution, rainfall intensity, return frequency and total depth of rainfall.

Detention: Area used to temporarily contain stormwater and reduce the peak velocity and volume of runoff to provide additional system capacity and to reduce erosion in surface and/or conveyance facilities.

Director: The City of Newberg's director of public works or their authorized representative.

Development: Residential, commercial, industrial or institutional construction, alteration, or other improvement which alters the characteristics of a property or properties.

Domestic Wastewater: The liquid and water borne waste derived from the ordinary living processes, free from industrial wastes, and of such character to permit satisfactory disposal without special treatment into the public sewer or by means of private wastewater disposal system.

Double Check Valve Assembly: An assembly composed of two single, independently acting, approved check valves, including tightly closing shut off valves located at each end of the assembly and fitted with properly located test cocks.

Double Detector Check Valve Assembly: A line sized, approved, double check valve assembly with a parallel meter and meter sized, approved, double check valve assembly. The purpose of this assembly is to prevent backflow contamination to the distribution system and, at the same time, provide a metering of the fire system showing any system leakage or unauthorized use of water.

Drainage Facilities: Pipes, ditches, detention basins, creeks, culvert bridges, etc., used singularly or in combination with each other for the purpose of conveying or storing storm water runoff.

Driveway: A vehicular connection between private on-site parking and the public right-of way.

Driveway Apron: A portion of the driveway connecting a street to the right-of-way; also known as driveway approach or driveway ramp.

Easement: Areas located outside of dedicated right-of-way, which are granted to the City for special uses. Easements may also be granted to non-City entities such as franchise utility companies for their uses.

Engineer: The engineer, including the City's engineer, licensed by the State of Oregon as a Professional Engineer under whose direction plans, profiles, and standards for the work are prepared and submitted to the City for review and approval, or who is in charge of and responsible for construction of the improvement.

Expansion Joint: A joint to control cracking in the concrete surface structure. Felt or fabric type expansion joint is not allowed.

Fill: A deposit of soil or other earth material placed by artificial means.

Fire Hydrant Assembly: The fire hydrant, with restraint devices, spool and attached auxiliary valve in valve box. Refer to 300 series drawings. Mechanical joint restraint shall be made using Field Lok® Gaskets and/or Megalugs® (no thrust blocks in new construction).

Fire Protection Service: A backflow protected connection to the public water main intended only for the extinguishment of fires and the flushing necessary for its proper maintenance. All fire services shall have a detector check assembly.

Food Service Establishment (FSE): means any place where food and/or drink that is intended for individual service and consumption is routinely provided completely prepared. The term includes any such place regardless of whether consumption is on or off the premises and regardless of whether there is a charge for the food and/or drink. The term includes a restaurant, commercial kitchen, food stand, food cart, beverage shop, caterer, hotel, school, religious institution, hospital, prison, correctional facility, or care installation. The term does not include private home where food is prepared for individual family consumption, and it does not include the location of food vending machines.

Georeference: To associate with location in physical space, containing spatial information – coordinate system (Coordinate System: NAD83 Oregon North; Datum: North American 1983**).**

GIS: Geographic Information System

GPS: Global Positioning System

Grade: The degree of inclination of a street or slope.

Grading: Any act by which soil is cleared, stripped, stockpiled, excavated, scarified, filled, or any combination thereof.

Gravity Grease Interceptor (GGI): A plumbing appurtenance or appliance hat is installed in a sanitary drainage system to intercept nonpetroleum fats, oils, and greases (FOG) from a wastewater discharge and is identified by volume, thirty (30) minute retention time, baffle(s), not less than two (2) compartments, a total volume of not less than three-hundred (300) gallons, and gravity separation. Gravity grease interceptors are generally installed outside.

Grease Interceptor: A plumbing appurtenance or appliance that is installed in a sanitary drainage system to intercept nonpetroleum fats, oil and greases from a wastewater discharge.

Grease Removal Device (GRD): means any hydro-mechanical or gravity grease interceptor that automatically, mechanically removes non-petroleum fats, oils and grease form the interceptor, the control of which are either automatic or manually initiated.

Half-Street: Means a minimum 50 percent portion of the ultimate width of the street (but not less than 22 feet with no parking on either side, or 28 feet with parking on one side.) Usually along the edge of a subdivision where the remaining portion of the street shall be provided when adjacent property is developed per the Newberg Development Code.

Hydrant Spool: The waterline connecting the fire hydrant to the auxiliary valve on the City distribution main.

Hydro-mechanical Grease Interceptor (HMI): A plumbing appurtenance or appliance that is installed in a sanitary drainage system to intercept nonpetroleum fats, oil, and grease (FOG) from a wastewater discharge and is identified by flow rate, and separation and retention efficiency. The design incorporates air entrainment, hydro-mechanical separation, interior baffling, and/or barriers in combination or separately, and one of the following: A – External flow control, with air intake (vent): directly connected; B – External flow control, without air intake (vent): directly connected; C – Without external flow control, directly connected; D – Without external flow control, indirectly connect. Hydro-mechanical grease interceptors are generally installed inside.

Illicit Connections: A situation that the director determines would cause harm to the public, environment, or downstream stormwater facilities before the situation can be alleviated or repaired.

Illicit Discharge: Any direct or indirect non-stormwater discharge to the stormwater system except discharges regulated under NPDES permit or exempted by this chapter.

Immediate Threat: A situation that the director determines would cause harm to the public, environment, or downstream stormwater facilities before the situation can be alleviated or repaired.

Impervious: The hard surface area either prevents or greatly retards infiltration and causes water to runoff the surface in greater quantities or at an increased rate of flow from that present in undeveloped conditions. Surfaces which would ordinarily be considered pervious are considered impervious if they do not allow natural infiltration of stormwater.

Industrial Waste: Solid, liquid, or gaseous waste resulting from any industrial, manufacturing, trade, or business processes; or development, recovery, or processing of natural resources.

Infiltration: The passage or movement of water into the soil subsurface.

Interceptor Sewer: The primary public wastewater sewer line which conveys wastewater directly into the Wastewater Treatment Plant.

Irrigation Service: A metered connection intended for seasonal use and delivering water which is not discharged to the wastewater collection and treatment system.

Lateral Sewer: A building sewer service line.

Local or Residential Street: A facility designated to serve primarily direct access to abutting land and offers the lowest level of traffic mobility. Through traffic movement is deliberately discouraged.

Longitudinal Joint: A joint that follows a course approximately parallel to the centerline of the roadway.

Low Impact Development Approaches (LIDA): A stormwater management approach that mimics pre-development hydrology through design techniques that infiltrate, filter, store, evaporate, or detain runoff close to its source.

Maintenance Agreement: An agreement between the City and a maintenance organization for private stormwater facilities specifying the operation and maintenance requirements of the facilities.

Maintenance Organization: The person(s), company, or nonprofit organization(s) responsible for long-term operation and maintenance of stormwater facilities recorded in the maintenance agreement.

Major Trees: Trees within the right-of-way which have a 12" caliper or larger. Street improvement plans should identify major trees by location, caliper, and species.

Major tree species are those that contribute to the landscape character of the area to include: e.g. Douglas fir, cedar, redwood, sequoia, oak, ash, birch, walnut, and maple. The identification of major trees should distinguish species generally suitable for retention adjacent to streets and those species with growth habits that create nuisances, unusual maintenance problems, or hazards to the public. Major trees exist in clusters, groves, or rows within the right-of-way. Check with City's Planning Department for a list of approved tree planting species.

Manager: The City Manager (or designee) of the City of Newberg acting either directly or through authorized representatives.

Manufacturer's Name: Any manufacturer's name, specification, catalog, number or type used herein is specified by 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.

Natural Grade: The grade of the land in an undisturbed state.

Net Impervious Area: The increase in impervious area on a property after a project is completed.

Non-Stormwater Discharge: Any discharge to the stormwater system that is not composed entirely of stormwater.

Owner: The owner of record of real property as shown on the latest tax rolls or deed records of Yamhill County, and includes a person who purchases a parcel of property and furnishes evidence of the purchase under a written recorded land sale contract.

Partition: To divide an area or tract of land into two or three parcels within a calendar year when such area or tract of land exists as a unit or contiguous units of land under a single ownership at the beginning of such year. Partition does not include divisions of land resulting from the creation of cemetery lots; and partition does not include any adjustment of a lot line by the relocation of a common boundary where an additional parcel is not created and where the existing parcel reduced in size by the adjustment is not reduced below the minimum lot size established by any applicable code. Partition does not include the sale of a lot in a recorded subdivision, even though the lot may have been acquired with other contiguous lots or property by a single owner.

Peak Run Off: The maximum stormwater runoff rate (in cubic feet per second) as determined for the design storm.

Person: Individual firm, corporation, association, agency, or other entity.

Plans: Construction plans, including any applicable system plans, sewer plans, profiles, cross sections, elevations, project specific standard drawings, standard drawings, etc., or reproductions thereof, signed by the Engineer of Record, approved or to be approved by the City Engineer, which show the location, character, dimensions, and standards of the work to be performed, and which constitute part of the construction contract documents for privately financed development projects or publicly financed infrastructure improvement projects.

Potable Water: Water which is satisfactory for drinking, culinary, and domestic purposes and meets the requirements of the health authority having jurisdiction over it.

Pretreatment: means the reduction of the amount of pollutants, the elimination of pollutants, or the alteration of the nature of pollutant properties in wastewater to a less harmful state or concentration prior to or in lieu of discharging or otherwise introducing such pollutants into the city wastewater system.

Private Wastewater Collection System: A privately owned and maintained lateral wastewater conveyance system installed to serve multi-unit structures on single ownership properties which cannot legally be further divided.

Private Storm Drain: A storm drain located on private property or serving private parking lot catch basins.

Project: An activity that creates impervious area.

Project Summary: A narrative that includes the project description, location, emergency contacts, and other information determined by the public works director such that the project can be located and a determination made regarding methods of stormwater management.

Public Wastewater System: Any sewer in public right-of-way or easement operated and maintained by the City for carrying wastewater and industrial wastes.

Public Storm Drain: Any storm sewer in public right-of-way or easement operated and maintained by the City.

Reclaimed Water: Wastewater that is treated sufficiently for reuse but not for drinking purpose.

Record Survey Monument: Any physical marker, such as an iron rod with a plastic, brass, or aluminum cap, set in place by a professional land surveyor to indicate the location of a land boundary, street centerline, elevation, or other legal or physical land features as noted on a survey recorded in the County Surveyor's Office.

Regional Water Quality Facility: A water quality facility that treats more than 15,000 square feet of impervious area runoff.

Release Rate: The controlled rate of release of drainage, storm, and runoff water from property, storage pond, runoff detention pond, or other facility during and following a storm event.

Responsible Party: A person or entity holding fee title to the property, tenant, lessee, or a person or entity who is acting as an owner's representative including any person, company, nonprofit organization or other entity performing services that are contracted, subcontracted, or obligated by other agreement to meet the requirements of this code.

Right-of-Way: All land or interest therein which (by deed, conveyance, agreement, easement, dedication, usage, or process of law) is reserved for or dedicated to the use of the public for sidewalk, utility, and/or roadway purposes.

Roadway: That portion of the right-of-way used or to be used for vehicular traffic, which exists typically between curbs, proposed curb lines or ditches.

Sediment: Soil or other surficial materials held in suspension in surface water or stormwater.

Sedimentation: The process or action of sediment being deposited as a result of decreased surface water or stormwater velocity.

Sidewalk: A walk or raised path along the side of a street for pedestrians. A right-of-way deeded, dedicated, and designated for the use of non-motorized vehicles (as allowed) and pedestrians.

Silt: Fine clay and silt textured soil particles, including clay that is easily erodible and remains in suspension even at low stream velocities.

Site: Any property or combination of properties where a project is being proposed or completed.

Slope: The change in elevation of a ground surface expressed as a ratio of horizontal distance to vertical distance, e.g. 3H:1V.

Standard Drawings: The drawings of structures and/or devices commonly used on public improvements and referred to on construction plans.

Stop Work Order: An order issued by the director or Building Official which requires all project activity, except those specifically stated in the stop work order, to cease on the site.

Stormwater: Water that originates as precipitation on a particular site, basin, or watershed and flows over land or impervious surfaces without infiltrating into the ground.

Stormwater Facility: A location to filter, retain, or detain stormwater for the purpose of water quality or quantity management. The facility may be structural or non-structural, has been designed and constructed according to city Public Works Design and Construction Standards, and has been required by the city to control post-construction stormwater.

Stormwater Facility Operations and Maintenance Plan: The required steps to be undertaken by an owner or maintenance organization to ensure proper functioning of a stormwater facility.

Stormwater Management: Techniques or structures intentionally used to temporarily or permanently reduce or minimize the adverse effects of stormwater velocities, volumes, and water quality on receiving watercourses. A series of techniques or structures constitute a stormwater system or treatment train.

Stormwater System: The combination of both artificial and natural system of drains, ditches, canals, culverts, detention ponds, retention ponds, dams, and other water control facilities used for collecting and transporting stormwater.

Storm drain: Inlets, outlets, manholes, catch basins, pipes, and other structures used to convey stormwater to its ultimate discharge point.

Stormwater: Water that originates as precipitation on a particular site, basin, or watershed and flows over land or impervious surfaces without infiltrating into the ground.

Streets or Roads: Any public highway, road, street, avenue, boulevard, lane, alley, way, easement, or right-of-way used or to be used for vehicle movement.

Structures: Anything constructed or built, an edifice or building of any kind, or any piece of work artificially built up or composed of parts joined together in some definite manner.

Subdivision: To divide an area or tract of land into four or more lots within a calendar year when such area or tract of land existed as a unit or contiguous units of land under a single ownership at the beginning of such year.

Super elevation: The tilting of the pavement that helps vehicles travel around a horizontal curve is measured as a vertical distance between the heights of the inner and outer edges of pavement surface. Design of super elevation shall follow the latest AASHTO (American Association of State Highway and Transportation Officials) design guide

Three-Quarter Street: Means a minimum 75 percent portion of the ultimate width of the street (but not less than 24 feet with no parking on either side, 28 feet with parking on one side.) Usually along the edge of a subdivision where the remaining portion of the street shall be provided when adjacent property is developed (per Newberg Development Code).

TMDL: Total Maximum Daily Load

Transverse Joint: A joint which follows a course approximately perpendicular to the centerline of the roadway.

Traveled Way: That portion of the roadway for the movement of vehicles, exclusive of shoulder and auxiliary lanes.

Trunk Sewer: A wastewater sewer which is primarily intended to receive wastewater from a collector sewer, another trunk sewer, an existing major discharge of raw or inadequately treated wastewater, or water pollution control facility.

Turnaround Area: A paved area of sufficient size and configuration that a motor vehicle may maneuver so as to travel in the opposite direction. The City Fire Marshall may require the turnaround to be sized to accommodate turning movements of their specified design vehicle.

Uniform Plumbing Code: The Uniform Plumbing Code adopted by the International Association of Plumbing and Mechanical Officials (current edition), as revised by the State of Oregon, called the "Oregon State Plumbing Specialty Code."

Wastewater: The total fluid flow in the conveyance and treatment system which includes industrial waste, water carried wastes from residences, business buildings, institutions, and industrial establishments, or any other waste (including that which may be combined with any ground water, surface water, or stormwater) that may be discharged into the conveyance and treatment system.

Water Distribution System: Water distribution pipelines, pumping stations, reservoirs, valves, and ancillary equipment used to transmit potable water from the supply source to the service line.

Water Main: The water supply pipe for public or community use.

Water Service Line: The pipe connection from the City water main to the users' water meter, hydrant, backflow prevention device, or fire sprinkler double check valve.

Watercourse: Any natural or artificial stream, river, creek, ditch, channel, canal, conduit, culvert, drain, gully, ravine, swale, wetlands, or wash in which water flows either continuously or intermittently. The width of the watercourse includes any adjacent area that is subject to inundation from overflow or floodwaters from the design storm

Wetlands: Transitional lands where the water table is usually at or near the land surface or the land is covered by shallow water. Wetlands have one or more of the following attributes:

I. Support, at least periodically, plants that thrive in saturated conditions,
II. Contains predominately un-drained hydric soil, or
III. The area is saturated or covered with shallow water at some time during the growing season of each year.

1.7 Private Development Process Requirements

1.7.1 Pre-Application Conference

The City of Newberg will hold a pre-application conference with the applicant (owner/developer), before formal application for public improvement 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 be discussed before the applicant makes a substantial investment in the project or proceeds with a formal application unaware of the issues.

1.7.2 Plan Check and Permits

I. 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 Services Department, except as provided by City Ordinance.

II. Plan checks and/or permits are required and issued on all construction projects within public rights-of-way, or easements, or on public infrastructure, which will eventually be maintained and operated by the City of Newberg. Any permits required by federal, state, and other local jurisdictions shall be obtained by the person proposing the improvements, prior to issuance of the City's permit.

III. Public Improvement Permit: Projects requiring Public Improvement 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 Newberg.

IV. Right of Way 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 Right of Way Permit.

1.8 Construction Plans

Construction plans shall follow the outline of plan submittal checklist. Prior to any construction work and plan approval, complete construction plans, specifications and all other necessary submittals shall be submitted to the City Engineer for review.

Construction plans and specifications shall be prepared by a professional engineer licensed in the State of Oregon. All construction plans shall be based on the current vertical datum for the City of Newberg, NAVD 88. City benchmark locations are available from the City Engineering department.

1.8.1 Sheet Size

All construction plans shall be clearly and legibly drawn in ink on sheets measuring 22 x 34 inches (11x17", half-size reduction). Sheets shall have a 1½ inch clear margin on the left edge and a ½ inch margin on all other edges.

1.8.2 Scale of Plans

When plans are prepared for developer financed projects, the following scale of full-sized drawings is suggested.

Plan/Scale	Horizontal	Vertical
Street	1” = 20’*	1” = 2’
Wastewater	1” = 40’	1” = 4’
Storm	1” = 40’	1” = 4’
Water	1” = 20’ or 40’**	1” = 4’
Demolition	1” = 40’	N/A
Erosion Control	1” = 40’	N/A
Grading	1” = 40’	N/A
Landscape	1” = 40’	N/A
Signing & Striping	1” = 40’	N/A
Street Lighting	1” = 40’	N/A
Topographic Survey	1” = 40’	N/A

- Subdivision street plans, when combined with other proposed facilities listed above, may be drawn at 1" = 40' scale.
- When a scale is used which is smaller than 1" = 20' (i.e., 1" = 40') intersection drawings showing fittings and valves shall be provided at a larger scale.
- A horizontal scale of 1” = 20’ (or 1” =30’) for all drawings is recommended when half-sized drawings are utilized for bid solicitation or for field reference.
- Architectural scales (e.g., 1/4" = 1'0") are not permitted.

1.8.3 Required Plans

Construction plan submittals shall contain the following minimum sheets: title sheet (unless not required by the City Engineer), plan and profile sheet(s) for street, storm sewer, water, and wastewater sewer, overall utility plan (existing and proposed), proposed grading, temporary and permanent erosion control, and Drawing No. sheet(s) plus any other relevant construction standards.

1.8.4 Title Sheet

All subdivision projects and multiple sheet improvement projects shall have a title sheet as the first page of the construction plans. This sheet shall contain the following minimum information:

I. Site plan of entire project with street right-of-way and/or subdivision layout at a 1" = 100’ scale. A 1” = 200’ scale may be used if project size is too large. The site plan shall also be a composite utility plan showing all properties served by proposed sewer, water, and storm facilities, in addition to the proposed facility.
II. Vicinity map at a 1” = 1000’ scale or greater.
III. Index of sheets.
IV. Complete legend of symbols used.
V. General and construction notes pertinent to project, including one-call locate note.
VI. Temporary and/or permanent benchmarks used along with their descriptions, elevations of benchmark, and datum. (When topographic survey is presented separately, show this information on that sheet.)
VII. Engineer's name, address, phone number including emergency contact information, fax number, email, and seal.

VIII. Developer/owner's name, address and phone number including emergency contact information.
IX. Statement referencing City of Newberg Standard Specifications.
X. Provide contact phone number for all affected utility companies including the City.
XI. Show tax lot numbers or lot and block designations, land use designations, gross site area, and site address.
XII. Date of last plan revision (large/bold).
XIII. Land Use Planning case file number(s).

1.8.5 Plan Sheet

The plan view of each sheet shall be drawn at the appropriate scale showing the following minimum information:

I. Adjacent street curbs, property lines, right-of-way lines, utility easements referenced to property lines, street centerlines, and intersections. Show property corner and curb elevations to determine water service level, serviceability of lot/property for wastewater sewer, points of disposal for building storm drains, and how new curbs will join to existing curbs.
II. Location of all underground utilities within 100 feet of project (if they are affected by the project), existing power/telephone poles and guy anchors, valves, manholes, catch basins, fire hydrants, meter boxes and vaults, signs, etc. location of nearest street light(s) and fire hydrant(s) (distance could be greater than 100').
III. Location of all water courses, railroad crossings, culverts, bridges, large water transmission pipes and gravity sewers, and/or storm drains within 200 feet of proposed gravity sewer and storm drain extensions if they affect the design of the project. All water courses shall show the 100 year flood plain as indicated on the U.S. Army Corps of Engineers and Federal Emergency Management Agency (FEMA) maps, any current or proposed wetlands and the City's Stream Corridor.
IV. On sewer and storm drain plans, each manhole, catch basin, and cleanout shall be numbered and stationed. Stationing shall tie to existing street monuments, property corners, or manholes. Stationing for each line shall increase from left to right on the plan sheet and shall be consistent throughout the plan set. This should result in north pointing to the top or to the left of the sheet. Each separate line shall be separately designated (e.g., sewer line 'A', storm line 'A', etc.).
V. On street plans, horizontal stationing shall show points of tangency and curvature for centerline; curve data shall show tangent length, radius distance, centerline curve length, and delta angle. Centerline intersection stationing, in both directions, shall be shown. Provide ¼ point elevations for curb returns.
VI. Where streets are being widened, edge of pavement elevations shall be shown to determine pavement cross slope to new curb or pavement edge.
VII. On water plans, all fittings and valves shall be shown and identified by type (i.e., MJ x MJ, FLG x MJ, etc.); fire hydrants shown; intersection drawings for valves and fittings are required when scale of plans is smaller than 1" = 20' (i.e., 1" = 40').

1.8.6 Profile Sheet

Profiles for construction plans shall be the same horizontal scale as the plan sheet. Profiles are drawn on the same sheet as the plan view and shall be immediately below the plan view. Stationing shall increase from left to right with lower stations to the left.

The following minimum information shall be shown:

I. For sewers and storm drains, show locations of manholes, catch basins, and cleanouts, with each numbered and stationed.
II. Existing profile at centerline of proposed utility or street.
III. Proposed profile grade, as appropriate, for all sewers, storm drains, and waterlines, giving pipe size, length between structures or fittings, slope, backfill and pipe material, sewer inverts, rim elevations, etc.
IV. Existing underground utility that crosses the alignment of the proposed facility.
V. Beginning of all vertical curves, points of vertical intersection, end of vertical curve, low point of sag curve, and length of vertical curve. Profiles of existing centerline grade shall extend a minimum of 250 feet beyond the end of the improvement.
VI. Clearly show all potential conflicts with existing public and private utilities (i.e., pipes, conduits, vaults, cathodic protection systems, etc.) that impact proposed design.
VII. Future street extensions to undeveloped sites shall be designed/profiled a minimum of 150' off-site.

NOTE: *City of Newberg as-built records are only to be used as an aid to the engineer. The engineer shall field locate, or cause to be located, and verify the alignment, depth, and inverts of all existing facilities shown on the plans that will be crossed by the proposed facility.*

1.8.7 Erosion Control Plans

The erosion control plan shall address the measures as required by the Department of Environmental Quality (DEQ) erosion control standards and policies and the Willamette Total Maximum Daily Load (TMDL) Implementation Plan. Construction activity is assumed as "active" until all permanent vegetation and/or erosion protection is established.

Refer to the City of Newberg Erosion & Sedimentation Control Manual for additional information.

1.8.8 Standard Drawing Sheets

Specific drawings shall be included with all construction plans where City of Newberg Standard Specifications and Standard Drawings do not exist. If a Standard Drawing, such as sewer manholes, must be modified to fit existing or unique conditions, the modified drawing shall be shown on the plans. When appropriate, due to required Drawing No. complexity, a separate Drawing No. sheet shall be drawn. When City Standard Drawing appurtenances or construction installations are to be used, a reference to the specific Standard Drawing number shall be made on the relevant sheet.

1.8.9 Supporting Information

The engineer shall submit sufficient supporting information to justify the proposed design. Such information shall include, but not be limited to, the following:

I. Design calculations.
II. Storm drainage report with all hydrology and hydraulic calculations, storm water quantity and quality calculations, basin maps and downstream analysis as required in Section 4, Storm Drainage.
III. Alternate materials specifications including manufacturer's design application recommendation.
IV. Intersection sight distance certification as outlined in Section 5, Streets.
V. Grading plan support information to include as appropriate:
    a. Soils engineering report
    b. Hydrology report
    c. Engineering geology report
    d. Arborist report
VI. Water model calculations and fire flow calculations for waterline systems.
VII. Documentation of proper protection and/or replacement of Record Survey Monuments. If, in the course of construction of the proposed development, a record survey monument shall be removed, disturbed, or destroyed, the Engineer shall cause a registered professional land surveyor to reference and replace the monument within 90 days in accordance with ORS 209.

1.9 Plan Submittal

Construction plans for all privately financed public works facility improvements shall be submitted to the City Engineer or the designee. The City Engineer will coordinate the plan review and approval of all construction plans which will include review for compliance with all Newberg Specifications, the Newberg Development Code, and other City Codes and Ordinances.

All plan submittals shall include information required in these Public Works Design and Construction Standards along with all other information requested by the City Engineer. This information is to include, but not be limited to, construction cost estimates, intersection sight distance certifications, easement documents, right-of-way dedications, executed agreements, and a plan check and inspection fee. All submittals will be reviewed for completeness and the engineer notified if required information is missing. Submittals should be made in a timely manner as lack of information to the City may impede the review process.

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.

1.10 As-built Plan Requirements

For all public works facility improvements the engineer shall submit a record drawing of as-built drawings for all plans that were approved for construction. As-built drawings shall meet the requirements of these Public Works Design and Construction Standards and shall be of archival quality.

At the time of the final as-built plan approval submittal, the applicant shall provide the City with as-built drawings of the public improvements as follows:

I. 3 mil mylar of the complete construction plan set(s).
II. Georeferenced .dwg and/or .dxf complete plan set on CD/DVD.

III. Georeferenced .pdf format on CD/DVD of the complete plan set.
IV. Shapefiles containing all of the infrastructure, structure, underground and/or any visible asset to be compatible with the City's GIS and asset management system.
V. As-built drawings must show actual design numbers, "~~crossed out~~", and updated with actual as-built numbers.

The words "As-built Drawing" shall appear as the last entry in the revision block of the plans, along with the month, day, and year the as-built drawing was prepared.

NOTE: *Actual location and depth from finish grade of any other utilities encountered during construction shall be shown and noted on both plan and profile of the as-built plans.*

The following minimum information shall be noted on as-built drawings:

Street

I. Change in horizontal alignment, curve data, and stationing of primary control points (e.g., PC, PI, PT, PRC, and PCC).
II. Vertical curve or grade changes; change in location of low point in sag vertical curve.
III. Change to approved thickness for street structural section components. Show station limits where changes in structural section have occurred including subgrade stabilization rock section.
IV. Change to driveway locations or widths, or construction materials.
V. Other change(s) altering the approved plans.

Storm Drains

I. Station of wye or tee connection into main line; tie end of branch line to nearest property corner at right-of-way line and distance back from the face of curb.
II. Show alignment changes, grade changes, and changes in construction materials. If changed alignment results in station changes, a station equation shall be shown as appropriate at a manhole.
III. Other change(s) altering the approved plans.
IV. Actual location and depth, from finish grade of street and City datum, of any other utilities encountered during construction.

Wastewater

I. Station of wye or tee into main line. Tie end of service lateral to nearest property corner at right-of-way line and distance back from the face of curb.
II. Depth at the end of service lateral measured from existing ground to invert of pipe. When required by the City Engineer, invert elevations shall be noted.
III. Length of service lateral measured from centerline of sewer main to end of pipe.
IV. Show alignment changes, grade changes, and changes in construction materials. If changed alignment results in station changes, a station equation shall be shown as appropriate at a manhole.
V. Other change altering the approved plans.
VI. Type of pipe, backfill material and location.

VII. Actual location and depth, from finish grade of street and City datum, of any other utilities encountered during construction.

Water Main

I. Station and/or property line/corner to valves (not at standard location), all fittings, blow-offs, and dead ended lines.
II. All changes from standard 36 inch depth cover. Limits shall be shown on plan with annotated reason for change. Actual pipe elevation shall be specified at regular intervals by engineer of record.
III. Show alignment changes, grade changes, and changes in construction materials. If changed alignment results in station changes, a station equation shall be shown as appropriate at a valve.
IV. Provide manufacturer of all valves and hydrants; identify types of fittings (i.e., MJ x MJ, FLG x MJ, etc.).
V. Other change altering the approved plans.

Actual location and depth, from finish grade of street and City datum, of any other utilities encountered during construction.

1.11 Approval of Alternate Materials, Methods, or Design

Any substitute material or alternate method not explicitly approved herein will be considered for approval as set forth in this section. Persons seeking such approvals shall make application in writing. Approval of any major deviation from these Public Works Design and Construction Standards will be in written form. Approval of minor matters will be made in writing if requested.

Any alternate must meet or exceed the minimum requirements set in these Public Works Design and Construction Standards.

The written application for an alternate approval is to include, but is not limited to, the manufacturer's specifications and testing results, Public Works Design and Construction Standards, design drawings, calculations, and other pertinent information.

1.11.1 General

The City Engineer may approve a design exception request so long as it does not conflict with the City Development and/or Municipal Codes, the County or City Land Development Permit Decision, or any other relevant approvals, except as expressly provided herein. If the requested exception involves public safety, the City will rule in the direction of safety.

1.11.2 Submittal

All requests shall state the applicable standard, the desired exception, the reason for the request and a comparison between the applicable specification or standard and the exception as to function, performance and safety. If an exception is requested due to economic hardship, the request shall contain a statement on the impact to project cost with and without the exception. The request for exception shall be prepared by an Engineer and shall be stamped and signed by the Engineer. Multiple

design exception requests shall be separated, individually prepared, and submitted to the City as separate requests.

Any approved exception to these Standards shall be documented and should reference nationally accepted guidelines, specifications, or standards. The approval of an exception shall not compromise public safety or the intent of these standards. An exception shall be approved only if the City Engineer finds that the alternative proposed by the Engineer meets the criteria addressed in this section and will provide equivalent or better function, performance, and safety.

Each exception shall be reviewed on a case by case basis and approved or denied by the City Engineer. All exception requests granted are considered unique to each request and project, do not set a precedent, and are not uniformly applicable.

When requested by the City, complete full size plans and design calculations shall be submitted for review with the request for approval.

1.11.3 Special Facility Designs

These standards are not intended to address the requirements for all possible public or private facilities. Facilities not addressed in these standards are considered unique and must be designed to meet site specific criteria. For these types of facilities, the design engineer must request a pre-design meeting to review the appropriate design, operating and maintenance criteria that will apply to the specific project prior to submittal any design reports or plans.

The following are examples of facilities that will require special review and approval:

- Sewer Force Mains
- Water Distribution Pump Stations
- Relining of Existing Sewers
- Relining of Existing Water Mains
- Internal Sealing of Existing Sewers
- Water Pressure Regulating Devices
- Wastewater Regulatory Devices
- Energy Dissipaters
- Wastewater Pump Stations
- Water Reservoirs
- Sewer Siphons
- Water Treatment Plants
- Wastewater Treatment Plants
- Water Flow Measurement/Monitoring/Telemetry Devices
- Wastewater Flow Measurement/Monitoring Devices

1.11.4 Review

The request for design exception will be reviewed by the City Engineer who will make one of the following decisions within fourteen days:

I. Approve as requested;
II. Approve with changes; or
III. Deny with an explanation

Approval of a request in one project shall not constitute a precedent for other projects.

1.11.5 Appeal

The Applicant may appeal the City Engineer's decision to deny an exception to the Director. The appeal shall be submitted in writing within fourteen (14) days of the City Engineer's decision.

The appeal shall be in writing, state the relevant facts, applicable provisions of these Standards, specific grounds for appeal, the relief sought, and shall include all information on which the applicant relies. The applicant shall have the burden of proving that an error was committed, or that the requested exception meets the criteria and equals or exceeds the applicable standard as to function, performance, and safety.

The Director shall review all the information submitted with an appeal. The Director may request additional information from the Engineer, the City Engineer, or both, and may meet with the parties. The Director shall render a decision in writing. The Director's decision shall be final.

1.11.6 Responsibility for Exceptions

The Engineer shall be responsible for requesting, in writing, any anticipated exceptions to these standards at the time of submittal of plans. Only those exceptions so noted and expressly approved by the City Engineer, shall be lawful and permitted, notwithstanding approval of the overall "red-line" or "as-builts".

1.12 Permit and Assurances

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 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.

When all requirements stipulated here are met and the construction plans are stamped and signed by the City's authorized representative, a Public Improvement or Right of Way Permit can be issued on payment of the permit fee.

The 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 Design and Construction Standards, including any newly approved codes and/or regulations.

1.12.1 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. The Certificate shall specify all of the parties who are Additional Insured. 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.

1.12.2 Indemnification

The applicant/contractor shall indemnify and hold harmless the City of Newberg and its officers, agents, and employees; Newberg City Council; 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 risen 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 risen 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.

1.13 Inspection and Scheduling

1.13.1 Inspection

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.

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.

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.

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.

1.13.2 Scheduling

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.

Contractor shall conduct construction activities only during the hours of work established by the City. 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.

1.14 Interferences and Obstructions

I. 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.

II. 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.

III. Protection: The contractor shall exercise all due care in protecting existing underground and surface facilities and property along the route of the project. 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.

IV. Access: The contractor shall maintain access to all mail boxes and access to all property.

V. Abandoned Utilities: All abandoned utilities shall be properly removed, grouted, or plugged at the discretion of the City's authorized representative.

1.15 Preservation and Restoration

1.15.1 Site Restoration and Cleanup

I. 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.

II. 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.

III. 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.

IV. 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.

V. 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.

VI. 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.

1.15.2 Street Cleanup

I. 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.

II. 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.

III. 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.

1.15.3 Preservation of Irrigation and Drainage Ditches

I. 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.

II. 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.

1.16 Easements

Mains placed in easements along a property line, shall have a minimum easement width of ten feet (10') on the side of the property line where the main is placed (the remaining required easement width may be on the adjacent property) and the main shall be offset 36 inches from the property line. Mains placed in easements along a right-of-way line shall be offset a minimum 3 feet from the right-of-way line. For mains placed in easements located other than along a property or right-of-way line, the main shall be placed in the center of the easement. Easements, when required, shall be exclusive and conform to the dimension specified in Standard Drawing No. 109. The conditions of the easement shall be such that the easement shall not be used for any purpose that would interfere with the unrestricted use for water main purposes. Under no circumstances shall a building or structure be placed over a water main or water main easement. This includes overhanging structures with footings located outside the easement.

Easement locations for public mains serving a PUD, apartment complex, or commercial/industrial development shall be in parking lots, private drives, or similar open areas which will permit unobstructed vehicle access for maintenance by City personnel.

1.17 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:

I. Record Drawings

II. 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.

III. 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.

IV. 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.

The City's authorized representative will consider the project complete and shall so state in writing when all of the following items are complete:

I. All items of the project correction list are completed, inspected and approved by the City's authorized representative.
II. Final set of Mylar, AutoCAD, and digitally signed PDF record drawings are submitted to the City and approved by the City's authorized representative.
III. Confirmation that all easements and legal documents have been recorded with the County Recorder.
IV. Contractor submits approved maintenance assurances and warranty as specified in Section 1.16.1.

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

1.17.1 Maintenance and Warranty

I. 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. 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.

II. 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.

III. Landscape maintenance assurance: Landscape maintenance assurance shall be for 100% of the cost to install all required landscaping in water quality/quantity facilities, 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.

IV. 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.

Section 2 Wastewater

2.1 Performance Standards

Wastewater system design shall meet the policies and guidelines of the current City of Newberg Wastewater Master Plan and the Oregon Department of Environmental Quality wastewater design guidelines and shall be designed with a 75 year life expectancy.

Public wastewater systems within the public right of way shall be designed to provide gravity service to all areas of development.

Wastewater system capacity shall be designed for ultimate development density of the tributary area. The system shall allow for future system extension and for future development.

Stormwater, including street, roof, or footing drainage, shall not be discharged into the wastewater system but shall be removed by a system of storm drains or by some other method separate from the wastewater system.

Unpolluted or non-contact cooling waters shall not be discharged into wastewater systems. The overflow drains and filter backwash lines of swimming pools and "hot tubs" shall drain into a wastewater sewer.

As a condition of wastewater service, all developments will be required to provide public wastewater lines to adjacent upstream parcels in order to provide for an orderly development of the drainage area. This shall include the extension of waste mains in easements across the property to adjoining properties, and across or along the street frontage of the property to adjoining properties when the main is located in the street right-of-way. This shall include trunk sewers that are oversized to provide capacity for upstream development.

All wastewater lines shall be located within the public right-of-way for ease of maintenance and access, control of the facility, operation of the facility, and to provide required replacement and/or repair. Exceptions may be made on a case by case basis as approved by the City Engineer.

2.2 Pipe Materials and Size

2.2.1 General

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.

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.

Pipe and fittings shall consist of one type of material throughout and no interchanging of pipe and fitting material is allowed.

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.

Each piece of pipe and fitting shall be clearly identified as to strength, class, and date of manufacture.

2.2.2 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 02001, "Portland Cement."

2.2.3 Concrete

PCC for poured in place manholes and structures shall conform to ODOT Class 3000 - DA, Commercial Grade Concrete. Slump shall be between 2 and 4 inches.

2.2.4 Manhole Frames and Covers

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.

Rings shall be grouted in place and made watertight with a high-strength, non-shrink grout meeting ODOT SSC Section 02080.40, "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.

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 and shall be pre-approved by the City Engineer.

Manholes installed outside of paved street or sidewalk areas shall be installed with a tamperproof frame and cover as shown in Drawing 209 of these standards and 18" above finish grade.

2.2.5 Manhole Types

Manholes shall be pre-formed rubber O-ring gasket design only and conform to the following:

I. Precast 48-Inch-Diameter Manholes
    a. Materials shall conform to the requirements of ASTM C-478. Minimum wall thickness shall be 5 inches.
II. Precast Large-Diameter (60-inch or larger) Manholes
    a. Materials shall conform to the requirements of ASTM C-478. Manhole structural dimensions shall be reviewed and approved on a case by case basis.
III. Precast Manhole Tops
    a. Standard eccentric cone, and short eccentric cone tops shall be provided. 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.

IV. Precast Bases

a. 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.

V. Poured-in-place Bases

a. Poured-in-place manhole bases may only be used when placing a manhole over an existing pipe.

VI. 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 Drawing 204, 205, & 206 of these standards. Field fabricated water stops or improvised adapters, such as gaskets stretched over the pipe, will not be allowed.

VII. 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.

VIII. 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.

IX. Manhole Steps

Steps shall be required and shall be constructed as specified and shown in Drawing 204, 205, & 206 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 Drawing 206 of these standards. For pipe larger than 24 inches in diameter, steps shall be located over a bench and above the inlet side of the manhole as coordinated with the City's authorized representative.

2.2.6 Pipe Materials

Materials shall be the following types or approved equal:

I. Polyvinyl Chloride Pipe: 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.

II. Ductile Iron Pipe (D.I.) 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).

NOTE: *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*.

2.2.7 Fittings

Manufactured tee fittings shall be provided in the sewer main for laterals. Fittings shall be of sufficient strength to withstand all handling and load stresses encountered.

Fittings shall be of the same materials as the pipe. Material joining the fittings shall be of the same material as the pipe.

Material joining the fittings to the pipe shall be free from cracks and shall adhere tightly to each joining surface.

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.

2.2.8 Mechanical Couplings

Mechanical couplings shall be wrought steel. Installation procedures must meet the manufacturers' recommendations.

2.2.9 Line Tap Saddle

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.

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.

2.3 Minimum Design Criteria

2.3.1 Velocity

All wastewater lines shall be designed on a grade which produces a mean velocity, when flowing half full or full, of no less than two feet (2') per second and a minimum slope of .004.

2.3.2 Manning Equation

When calculating minimum pipe slopes and velocities, the engineer shall use the Manning pipe friction formula.

2.3.3 Pipe Coefficient

The minimum pipe roughness coefficient for wastewater sewers shall be 0.013.

2.3.4 Inflow and Infiltration

An allowance of 1,000 gallons/acre/day shall be added for all land area in the basin being served for calculation purposes.

2.3.5 Fats, Oils and Grease (FOG)

All Food Service Establishments (FSE) are required to install a grease removal device (GRD) for the kitchen or food/beverage preparation area. GRD's should be cleaned and maintained on a regular basis in order to insure proper functioning and insect free performance.

2.4 Alignment and Cover

2.4.1 Right-of-Way Location

Wastewater lines shall be located north and west from the right-of-way centerline as defined in Standard Drawing No. 103. All changes in direction of pipe shall be made at a manhole.

Sewers shall be located in the street right-of-way. If streets have curved alignments, the center of the manhole shall not be less than six feet (6') from the curb face on the outside of the curve, or the wastewater centerline less than six feet (6') from the curb face on the inside of the curve. Curved alignments in wastewater lines are not permitted.

Utility infrastructure may not be placed within one foot of a survey monument location noted on a subdivision or partition plat per ORS 92.044 (7).

2.4.2 Minimum Cover

In new residential hillside subdivisions, mainline and lateral sewers shall be placed in the street at a depth sufficient to drain building sewers on the low side of the street.

Wastewater sewers in residential areas shall be placed in the street with the following minimum cover, Standard Drawing No. 211 & 212:

Building Service Lateral Six feet (6')
<u>Trunk and Collector Sewer</u>
In the roadway - Eight feet (8')
In easements - Eight feet (8')

Where the topography is relatively flat and existing sewers are shallow alterations to the coverage may be approved by the City Engineer.

2.4.3 Relation to Watercourses

Generally, the top of all wastewater sewers entering, crossing or adjacent to streams shall be at a sufficient depth below the natural bottom of the stream bed to protect the sewer line. One foot (1') of cover is required where the sewer is in rock; three feet (3') of cover is required in other materials. In paved channels, the top of the sewer line shall be placed at least six inches (6") below finish grade of the bottom of the channel, except as provided above.

Sewers located along streams shall be located outside of the stream bed and sufficiently removed there from to provide for future, possible stream channel widening. All manhole covers shall be watertight at or below the 100 year flood elevation.

Sewers crossing streams or drainage channels shall be designed to cross the stream as nearly perpendicular to the stream channel as possible, and shall be free from change of grade. The minimum cover shall be thirty-six inches (36") from the bottom of the stream bed or drainage channel.

Pipe material shall be Class 52 ductile iron or ASTM C-900 PVC with a 20 foot length of pipe centered on the stream or drainage channel centerline. The pipe shall extend to a point where a one to one slope begins at the top of the bank and slopes down from the bank away from the channel centerline and intersects the top of the pipe. (No tees are allowed in DI runs).

Concrete encasement will be required when the above cover requirements cannot be met. Each deviation from the above requirements will be reviewed on a case by case basis, subject to the approval of the City Engineer.

2.5 Manholes

Manholes shall conform to ASTM C 478.

Manholes shall be located at all changes in slope, alignment, pipe size, pipe material, and at all pipe junctions with present or future wastewater sewers. Manhole spacing shall not be greater than 500 feet.

Designs for manholes are shown in Standard Drawing No.204-208. They are suitable for most conditions. New designs or revisions should not be shown on the construction drawings unless the standard designs are not suitable.

New or revised designs may be necessary if:

I. One or more of the sewers to be connected to the manhole is over 36 inches in diameter (smaller diameters may require a special design if the manhole is at an alignment change.)
II. Several sewers will be connected to the manhole.
III. There is less than 90° between the incoming and outgoing sewer.
IV. The manhole will be subject to unusual structural loads.
V. Diversion or other flow control measures are required.

Where one or more of conditions I, II or III is encountered, a drawing of the manhole base should be made to determine if it is feasible to use designs shown in the Standard Drawings. It may be necessary to restrict the options to a specific Standard Drawing specified by a note on the construction drawings. If a special design is required for any reason, it will be necessary to show the Drawing Nos on the construction drawings and to provide structural calculations as needed and be approved by the City Engineer.

2.5.1 Alternate Manhole Features

Some alternate manhole features are shown in the Standard Drawings. Where these features are required, they must be specified by a note on the construction drawings. Some examples are:

I. Short cones must be used in lieu of standard cones where there will be less than five (5) feet between the lowest pipe invert elevation and the top of the manhole lid. Flat top manholes

may not be used on a case by case basis if a standard frame can be used. Pre-approval required.

II. Watertight manhole frames and covers are to be used if flood waters are expected to cover the manhole top or be below 100 year flood elevation. Such conditions should be avoided wherever feasible. For manhole joint seal, apply wrap-around heat-shrink protection sleeves as approved by City Engineer. In remote locations, the finish grade of the manhole casting needs to be 2 feet above existing grade.

III. Tamperproof manhole frames and covers are required in all areas outside the paved public right-of-way.

Standards for elevation differences at manholes have been established to compensate for normal energy losses and to prevent surcharging of a sewer by a larger sewer. For purposes of slope calculation and for establishing elevation differences, the elevations are given at the intersection of the sewer center lines (usually the center of the manhole). The rules for elevation differences at manholes are:

I. The crowns of incoming sewers shall be at least as high as the crown of the outgoing sewer.

II. If the incoming and outgoing sewers are of equal size and are passing straight through the manhole, there shall be 0.20 ft. difference in elevation.

III. If sewers intersect or the alignment changes at the manhole, the invert elevation difference shall be at least 0.20 feet for 0° 45° of horizontal deflection angle, and at least 0.20 feet for over 45° of horizontal deflection angle. Horizontal deflection angles greater than 90° are not allowed.

IV. The slope of a sewer within a manhole shall be no less than the slope of the same sewer outside of the manhole.

V. Drop connections are required when the vertical distance between flow-lines exceeds two (2) feet. The diameter of the drop connection must be specified on the construction drawings. Smooth flow-lines with vertical distances of less than one foot must be provided wherever feasible.

VI. All connections must enter the manhole through a channel in the base. This includes drop connections and connections to existing manholes. Inside drop connections can be constructed per Drawing No. 206.

VII. Channels shall be installed in the base of all manholes to maintain minimum velocity of no less than 2 feet per second. Channels shall also allow for insertion of televised sewer inspection equipment into the pipe from outside of the manhole. All connections shall be made with an approved Rubber Boot. Where conditions make compliance with these rules impractical, exceptions will be permitted. It will be necessary, however, for the designer to provide a complete analysis of the need for such designs and be pre-approved by the City Engineer.

2.6 Cleanouts

Cleanouts will not be approved as substitutes for manholes on public sewer lines. Cleanouts are permitted at the upper end of a sewer that will be extended during a future construction phase. If future extension requires a change in sewer alignment or grade, a manhole will be required at the cleanout location. A manhole or clean out is required between public and private property.

2.7 Service Laterals

Service laterals are those public wastewater lines to which a private building sewer connects. See Drawing No. 211 & 212.

Each individual building site shall be connected by a separate, private, building wastewater service line connected to the public sewer. Multifamily, commercial and industrial service laterals shall connect into the public mainline at a manhole. Combined wastewater service lines will be permitted only when the property cannot legally be further divided. An example of this is a residential lot with a house and an unattached garage or shop with plumbing facilities.

The minimum inside diameter of a wastewater service lateral shall be four inches (4”) and shall be equal to or greater than the building sewer diameter. Service laterals shall be built to the same construction standards and of the same materials as the wastewater mainline. Laterals must be green colored pipes. Service laterals in general shall be placed at 90 degrees to the main wastewater line to avoid excessive exposure to other utilities during excavation for construction or maintenance of the service lines. Angles other than 90 degrees (45 degrees minimum) may be approved for special conditions such as cul-de-sac lots. Service line connections may be made at manholes if such placement would not interfere with other present or future connections to the manhole.

The minimum slope of wastewater service lines shall be 2.00 percent (1/4 inch per foot). Except that for unusual conditions, a slope of 1.00 percent (1/8 inch per foot) may be approved. It will be necessary, however, for the designer to provide a complete analysis of the need for any wastewater service lateral slope less than 2.00 percent. The maximum slope shall be 100.00 percent (45 degrees or one foot per foot).

Tees for service laterals, with a slope greater than 100 percent, shall have 1/16th or 1/8th bend to provide proper grade for service laterals. Service laterals shall be installed to the street right-of-way line or easement line. A water tight plug shall be installed in end of the lateral with a 2" x 4" standard wood marker placed from pipe invert to 12 inches above finish grade. The 2" x 4" top to be painted green and marked with the depth of the lateral measured from ground to invert of pipe. Curb line and concrete gutter surface shall have an "S" branded into both surfaces at lateral crossing.

2.8 Connection to Existing Sewers

Connections to, and extensions of, existing sewers will occur to facilitate new development. Certain requirements will be placed on the design engineer as to the permitted methods and/or locations.

Connections to existing manholes shall be made with the following guidelines:

I. All manhole wall holes and base channels shall be cored; approved Rubber Boots shall be used.
II. Where the invert of the connecting pipe is two feet (2') or less above the invert out elevation, an inside drop (beaver slide) will be constructed utilizing Portland cement concrete. The wastewater entering the manhole will follow a smooth concrete channel transitioning evenly from the invert of the inlet pipe into main channel. Wastewater will not be allowed to fall freely to the manhole base.

III. Where the invert of the connecting pipe is more than two feet above the manhole shelf, the contractor will be required to construct an inside drop per Standard Drawing No. 206 with the inlet pipe invert being located at the manhole shelf. The wastewater entering the manhole will follow a smooth concrete channel transition from the inlet pipe into the main channel. Plastic pipe inserted thru manhole needs to cored with Rubber Boot.

IV. Where the invert is required to enter below the shelf of the manhole, the inlet pipe will not enter below a point where the crown of the new inlet pipe is below the crown of the outlet pipe. The base of the manhole shall be rebuilt if damaged in this process. The wastewater will enter the main flow in a smooth channel transitioning from the inlet pipe to the main channel.

V. No pipe will enter an existing manhole where the angle between the incoming flow and the outgoing flow is greater than 90°.

When sewers are extended from cleanouts, the entire cleanout assembly, including the wye, shall be removed.

New building service laterals will be made at existing tees where possible.

When tees do not exist on the Public Wastewater Conveyance System, the new lateral sewer will enter the collection system through a "cored" opening with an approved connector saddle tap, or 'cut in' tee. This connection shall be done in conformance with City standards.

2.9 Waste Control from Industrial Developments

Where necessary and as determined by the City, any user of the sewer system shall provide, at their own expense, such preliminary treatment as may be necessary to reduce objectionable characteristics or constituents within the City's prohibited discharges, that may cause pass through or interference, or to comply with water quality standards.

Plans, specifications, and any other pertinent information relating to proposed preliminary treatment facilities shall be submitted for the approval of the Public Works Director or designee.

The approval of the plans and inspection of construction shall not relieve the owner from complying with the discharge limitations.

Some industrial facilities shall install a control vault to facilitate the observation, measurement, and sampling of the process wastewater from the facility. Such a control vault, when required, shall be 24 hour accessible and constructed in accordance with plans approved by the City. The control vault shall be installed and maintained by the owner at his/her expense. After installation is complete, the owner shall provide the City with keys necessary to access the vault.

Industries that may be required to install a control vault, but not limited to:

Adhesive Manufacturing	Aluminum Forming	Any Industry Requiring Pretreatment
Asbestos Manufacturing	Battery Manufacturing	Black Carbon Manufacturing
Brewery	Coil Coating	Copper Forming
Dye Manufacturing/Processing	Electrical and Electronic Components Manufacturing	Electroplating
Feedlots	Ferroalloy Manufacturing	Fertilizer Manufacturing
Food Processing	Foundries (Metal Molding/Casting)	Glass Manufacturing
Frain Mills	Hospitals	Ink Formulation
Inorganic Chemical Manufacturing	Iron and Steel Manufacturing	Laboratories
Laundries	Leather tanning and finishing	Mechanical Product Manufacturing
Metal Finishing	Nonferrous Metal Manufacturing	Paint Formulation
Pesticide/Chemical Manufacturing	Petroleum Refining	Pharmaceutical Manufacturing
Porcelain Enameling	Printing and Publishing	Pulp, Paper and Paperboard Manufacturing
Rubber Manufacturing	Soap/Detergent Manufacturing	Steam Electric Power Generation
Sugar Processing	Tars, Asphalt Paving, and Roof Material Manufacturing	Textile Mills
Timber Products Processing	Wineries	

If the development will discharge 25,000 gpd or more they will be considered a Significant Industrial User (SIU) and an additional permit will be required. This permit will be issued by the Director or designee.

2.10 Workmanship

2.10.1 Line and Grade

Survey control hubs for both line and grade shall be provided by the design engineer.

Variance from the established line and grade shall not be greater than 1/4 inch for grade and 1/2 inch for line, provided that such variation does not result in a level or reverse-sloping invert.

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.

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 1/8 inch maximum.

2.10.2 Pipe Handling

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.

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.

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.

The contractor shall lower the pipe into the trench in such a manner as to avoid any physical damage to the pipe.

The contractor shall remove all damaged pipe from the job site.

2.10.3 Tying in

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.

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.

2.10.4 Foreign Material

The contractor shall take all necessary precautions to prevent excavated or other foreign material from entering the pipe during the laying operation.

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.

2.10.5 Pipe Laying

Trench excavation shall be in accordance with Section 6.

Pipe laying shall proceed upgrade, with the spigot ends pointing in the direction of flow.

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.

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.

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.

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.

After the joint is made, the pipe shall be checked for alignment and grade.

The trench bottom shall form a continuous and uniform bearing and support for the pipe at every point between joints.

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.

Do not lay pipe in water or when, in the opinion of the City's authorized representative, trench conditions are unsuitable.

2.10.6 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.

2.10.7 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.

I. Shear ring/ridge transition couplings meeting the ASTM C-564 or equal shall be used.
II. PVC couplers or adapters shall meet the specifications for ASTM D-3034, SDR 35 pipe fittings.
III. 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.

2.10.8 Concrete Closure Collars

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.

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.

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.

2.10.9 Trench Backfill

The contractor shall place trench backfill in accordance with Section 6.

2.10.10 Sanitary Sewer Laterals and Tees

Lateral sewers shall be connected to new sanitary sewer mains with manufactured tee fittings or manholes. Lateral pipe and fittings shall consist of one type of material throughout and no interchanging of pipe and fitting material is allowed. Line taps in new mains are not permitted.

2.10.11 Line Taps

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.

Line tap connections to sanitary lines shall be located a minimum 12" from the sanitary mainline pipe bell.

Line tap connections to existing sanitary lines may be done using saddle tees as per PVC Tee Saddle.

PVC tee saddles shall be installed in accordance with these standards. The area around the line tap installation site shall be cleaned and free of all rough edges before installing fittings.

While installing the connection, no rock, dirt, or debris shall be allowed to enter the main sewer line from the core hole.

The contractor shall install 3/4"-0" crushed aggregate in the pipe zone around the line tap, from 6 inches below the pipe to 12 inches above the pipe.

Laterals shall have tracer wire installed beside the pipe.

2.10.12 Concrete Bases (Poured-in-Place)

Poured-in-place bases shall be used over existing pipelines in accordance with Drawing No. 203 of these standards for 48" diameter manholes. For manholes greater than 48" in diameter, poured-in-place bases shall be provided in accordance with Drawing No. 203 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.

2.10.13 Drop Manholes

The maximum free drop in a manhole shall be 24 inches.

When more than 18 inches of drop exists, a drop manhole shall be provided in accordance with Drawing No. 206.

2.10.14 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 02080.40, "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.

2.10.15 Manhole Inverts

The contractor shall construct manhole inverts in conformance with 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.

2.10.16 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 Drawing 204, 205 & 206 of these standards. The minimum length of stub outs in existing manholes shall be 24 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.

2.10.17 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 02080.40, "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 18 inches 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 24 inches above the pipe crown as shown in Drawing 204 and 205.

2.11 Construction Specifications

2.11.1 General Provisions

The specifications, 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.

2.11.2 Scheduling

The contractor shall plan their construction work in conformance with Section 1.13.

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.

2.11.3 Interferences and Obstruction

Various obstructions may be encountered during the course of the work. The contractor shall follow the guidelines established in Section 1.14, "Interferences, Obstructions, and Abandoned Utilities."

2.11.4 Abandon Sewer Facilities

I. 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.
II. 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 rubberized 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.

2.11.5 Trench Excavation, Preparation, and Backfill

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

2.11.6 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 1.15, "Preservation, Restoration, and Cleanup."

2.12 Testing Procedures

2.12.1 General

I. 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.

II. Testing Order

Prior to the start of sanitary system testing, all manholes shall be 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 revisions to the testing procedure shall be subject to approval of the City's authorized representative.

III. Testing of sanitary systems

Shall be conducted in the following order:

a. Deflection testing of pipelines
b. Air pressure testing of pipelines.
c. Video-inspection of pipelines.
d. Vacuum testing of manholes

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.

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.

The sanitary system must pass deflection testing, air pressure testing, and video inspection before paving of overlying roadways will be permitted.

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 2.11.3.I, "Vacuum Testing" after paving is completed and approved.

2.12.2 Gravity System Testing

I. 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.

II. 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.

III. 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 or manhole-to-cleanout 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.

IV. Air Pressure Testing

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.

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).

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.

After the temperature stabilization period, disconnect the air supply.

Determine and record the time (in seconds) required for the internal air pressure to drop from 3.5 psi to 2.5 psi.

Compare the time recorded in step (g) above with the time required, as determined below.

V. 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. PVC, HDPE, and ductile iron pipe
    i. The minimum duration for the prescribed low-pressure exfiltration pressure drop between two consecutive manholes shall not be less than that shown in Table 4.7. 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.

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 4.7. AIR TESTING OF PVC, HDPE, AND DUCTILE IRON PIPE - 0.5 PSIG PRESSURE

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

Pipe Diameter	**Minimum Time**	**Length for minimum Time**	**Time for Longer Length**	**Specified Minimum for Length (L) Shown (min:sec)**							
(Inches)	(min:sec)	(feet)	(sec)	100ft	150ft	200ft	250ft	300ft	350ft	400ft	450ft
4	3:46	597	0.380L	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	5:42	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.

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

Pipe Diameter	Minimum Time	Length for minimum Time	Time for Longer Length	Specified Minimum for Length (L) Shown (min:sec)							
(Inches)	(min:sec)	(feet)	(sec)	100ft	150ft	200ft	250ft	300ft	350ft	400ft	450ft
4	1:53	597	0.190L	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	2:51	3:12
8	3:47	298	0.760L	3:47	3:47	3:47	3:47	3:48	4:26	5:04	5:42
10	4:43	239	1.187L	4:43	4:43	4:43	4:57	5:56	6:55	7:54	8:54
12	5:40	199	1.709L	5:40	5:40	5:42	7:08	8:33	9:58	11:24	12:50
15	7:05	159	2.671L	7:05	7:05	8:54	11:08	13:21	15:35	17:48	20:02
18	8:30	133	3.846L	8:30	9:37	12:49	16:01	19:14	22:26	25:38	28:51
21	9:55	114	5.235L	9:55	13:05	17:27	21:49	26:11	30:32	34:54	39:16
24	11:20	99	6.837L	11:24	17:57	22:48	28:30	34:11	39:24	45:35	51:17
27	12:45	88	8.653L	14:25	21:38	28:51	36:04	43:16	50:30	57:42	64:54
30	14:10	80	10.683L	17:48	26:43	35:37	44:31	53:25	62:19	71:13	80:07
33	15:35	72	12.926L	21:33	32:19	43:56	53:52	64:38	75:24	86:10	96:57
36	17:00	66	15.384L	25:39	38.28	51:17	64:06	76:55	89:44	102:34	115:23
42	19:54	57	20.942L	34:54	52:21	69:49	87:15	104:42	122:10	139:37	157:04
48	22:47	50	27.352L	45:35	68:23	91:11	113:58	136:46	159:33	182:21	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.

VI. 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 2.11.2.I, "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 2.11.2.I, "Cleaning Before Test" and re-video inspected.

2.12.3 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.

I. 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.

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

II. 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.

2.13 Sanitary Sewer Line Acceptance Policy

The City of Newberg will accept new sanitary installations or systems built to the "Public Works Design and Construction Standards," providing that the following conditions are met.

I. 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.

II. 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 1.16.

III. Maintenance Period

The Contractor or Applicant shall be responsible for providing Maintenance Assurance for Public Improvements as outlined in Section 1.16.1. Public sanitary improvements shall be warranted for a minimum of two years.

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 defects.

Section 3 Water Systems

3.1 Performance Standards

Water distribution systems shall be designed to meet Oregon Administrative Rules Chapter 333 and Oregon Revised Statues 448, AWWA Standards, and guidelines of the current Newberg Water System Master Plan.

Water system design shall provide adequate flow for fire protection and ultimate water system demand. Required water system demands shall be met by maintaining the minimum operating pressures required by the City. For single family residential areas the minimum pressure shall be 40 PSI measured at the meter, and the minimum fire flow shall be 1,000 GPM with a 20 psi residual. For all other developments, the required fire flow shall be as determined by the Fire Marshall.

Water system design shall meet distribution needs for ultimate water system demand within a given service area. New water systems shall allow for future extensions beyond present development that are consistent with the Master Plan.

All waterlines shall be located within the public right-of-way or as directed by the City Engineer. Waterlines are placed within the public right-of-way for ease of maintenance and access, control of the facility, operation of the facility, and to permit required replacement and/or repair. The City Engineer, under special conditions, may allow a public waterline to be located within a public water easement as referenced in Section 3.2.5.

Utility infrastructure may not be placed within one foot of a survey monument location noted on a subdivision or partition plat, per ORS 92.044 (7).

3.2 Pipe Materials and Size

3.2.1 Materials

All public water distribution systems shall be constructed with ductile iron pipe, minimum thickness Class 52. All such pipe shall be cement mortar lined pipe with push-on or mechanical type joints meeting manufacturer and AWWA standards.

3.2.2 Minimum Pipe Size

Water distribution main sizes shall generally conform to the following:

I. 8 inch
Minimum size for permanently dead ended mains supplying fire hydrants with a fire flow less than 1,500 GPM and for primary feeder mains in residential subdivisions.

II. 10-inch and larger
As required for distribution mains and primary feeder lines in larger subdivisions, industrial areas, and commercial areas. Trench dam shall be provided for the 24” diameter water transmission pipeline Standard Drawing No. 319. Placement and number of trench dams shall be determined by the engineer.

3.2.3 Alignment and Cover

I. Grid System

The distribution system mains shall be looped at all possible locations. All developments will be required to extend mains across existing or proposed streets for future extensions of other developments by the City. All terminations shall be planned and located such that new or existing pavement will not have to be cut in the future when the main is extended. The installation of permanent dead end mains greater than 250 feet, upon which fire protection depends and the dependence of relatively large areas on single mains, will not be permitted.

II. Dead End Mains

Dead end mains, which will be extended in the future, shall be provided with end of line gate valve and a properly sized blow-off (see Standard Drawing No. 311) assembly. Permanent dead end mains shall terminate with a standard blow-off assembly see Standard Drawing No. 311.

III. Right-of-Way Location

Water systems shall be located north and west from the right-of-way centerline as defined in Standard Drawing No. 103. All waterlines shall be located in the public right-of-way, unless otherwise approved by the City Engineer. All abrupt changes in vertical or horizontal alignment shall be made with a fitting and secured with Megalugs and/or Field Lok Gaskets. No concrete thrust blocks are allowed unless approved in unique circumstances.

IV. Curved Alignments

Curved alignment for waterlines or mains is permitted and shall follow the street centerline when practical. The minimum allowed radius shall be based on allowable pipe deflection for the pipe diameter and the pipe laying length, but not to exceed 3° joint deflection.

V. Minimum Cover

The standard minimum cover over buried water mains within the street right-of-way shall be thirty six inches (36") from finish grade.

The minimum cover for mains in easements across private property shall be thirty six inches (36") from finish grade.

Finish grade shall normally mean the existing or proposed pavement elevation. Where the main is located in the cut or fill side slope or where mains are located in easements, finish grade shall mean final ground elevation at the water main alignment.

Deviation from the above standards will be considered on a case by case basis. When there is underlying rock strata that prohibits placement of the water main thirty six inches (36") below finish grade, a written request must be submitted to the City Engineer for consideration, together with submission of a soils report, with a plan and profile certifying that bed rock exists less than three feet (3') below the undisturbed ground surface.

3.2.4 Separation with Wastewater and Other Utilities

Water mains shall be installed a minimum clear distance of ten feet (10') horizontally from wastewater sewers and shall be installed to go over the top of such sewers with a minimum of 18 inches of clearance at intersections of these pipes (in accordance with the requirements of OAR Chapter 333,

Public Water Systems). Exceptions shall first be approved by the City Engineer. In all instances the distances shall be measured edge to edge. The minimum spacing between water mains and storm drains, gas lines, and other underground utilities, excepting wastewater sewers, shall be three feet (3') horizontally when the standard utility location cannot be maintained.

Where water mains are being designed for installation parallel with other water mains, utility pipe, or conduit lines, the vertical location shall be twelve inches (12") below (or in such a manner which will permit future side connections of mains, hydrants, or services) and avoid conflicts with parallel utilities without abrupt changes in vertical grade of the above mentioned main, hydrant, or service. Where crossing of utilities are required, the minimum vertical clearance shall be six inches (6"). Check all crossings to avoid conflicts.

3.2.5 Easements

Any water main placed within a water main easement will be permanently marked with steel posts and metal signs at all angle points, and no less than every 100 feet. In addition, such posts and signs shall be placed where the waterline intersects the public right of way at the easement location. A monument cap set in the pavement of parking lots shall be an acceptable alternative to the sign. The City shall provide wording for the sign/monument.

All easements must be furnished to the City for review and approval prior to recording.

3.2.6 Relation to Watercourses

New water mains may cross over or under existing streams, ponds, rivers, or other bodies of water as follows:

I. Above Water Crossings
   The pipe shall be engineered to provide support, anchorage, and protection from freezing and damage, yet shall remain accessible for repair and maintenance. All above water crossings will require review and approval by the City Engineer.

II. Underwater Crossings
   a. Mains crossing stream or drainage channels shall be designed to cross as nearly perpendicular to the channel as possible.
   b. Valves shall be provided at both ends of the water crossing so that the section can be isolated for testing and repair. The valves shall be easily accessible and not subject to flooding. The valve nearest to the supply source shall be in a manhole. Permanent taps shall be made on each side of the valve within the manhole to allow insertion of a small meter for testing, to determine leakage, and for sampling.
   c. The following surface water crossings will be treated on a case-by-case basis:
      i. Stream or drainage channel crossing for pipes twelve inches (12”) inside diameter and grater.
      ii. River or creek crossing requiring special approval from the Division of State Lands.
   d. The minimum cover from the bottom of the stream bed or drainage channel to the top of pipe shall be thirty-six inches (36”) except as noted below in (e).

e. A scour pad centered on the waterline will be required for mains less than twelve inches (12”) inside diameter when the cover from the top of the pipe to the bottom of the stream bed or drainage channel is thirty inches (30”) or less. The scour pad shall be concrete, six inches (6”) thick and ten feet (10’) wide; reinforced with number four bars twelve inches (12”) on center both ways; and shall extend to a point where a one-to-one slope begins at the top of the bank and slopes down from the bank away from channel centerline and intersects the top of the pipe. The upstream edge of the scour pad shall be thickened or protected with rip rap to a depth below the scour depth of bank full velocities.

3.3 Appurtenances

3.3.1 Valves

I. 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.

II. 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.

III. Valves shall have non-rising 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.

IV. 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.

V. The waterway in the seat area shall be smooth, unobstructed, and free of cavities.

VI. 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.

VII. Gate valves shall meet the testing requirements as presented in AWWA C-509.

VIII. Butterfly valves shall be the rubber-seated type, suitable for direct-burial service.

IX. 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.

X. 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.

XI. All joint accessories shall be furnished with valves.

XII. 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.

XIII. 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.

XIV. Butterfly valves shall meet the testing requirements as presented in AWWA C-504.

3.3.2 Extension Stems for Valve Operators

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 Drawing Nos. 311 & 312 of these standards).

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.

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.

3.3.3 Size

In general, valves shall be the same size as the mains in which they are installed. Valve types and materials shall conform to the City of Newberg Specifications.

Distribution system valves shall be located at the tee or cross fitting. There shall be a sufficient number of valves so located that not more than four (4), and preferably three (3) valves, must be operated to affect any one particular shutdown. The spacing of valves shall be such that the length of any one shutdown in commercial or industrial areas shall not exceed 500 feet or 800 feet in other areas.

In general, a tee intersection shall be valved in two branches and a cross intersection shall be valved in three branches. Transmission water mains shall have valves at not more than 800-foot spacing's. Hazardous crossings such as creeks, railroad and freeway crossings, shall be valved on each side per Drawing No. 313.

3.3.4 Valve Boxes

Shall be model 910 cast iron per ASTM A48 CL30 or equal (lug less) and placed at finished grade, centering vertically over operating wheel (2") or nut.

3.3.5 Fire Hydrants

I. Materials
   a. Hydrants shall have a nominal 5H-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 1/2-inch national standard pentagon nut.

c. Hydrants shall be equipped with two 2 ½ inch hose nozzles and one 4 1/2 inch pumper.
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, or approved equal and painted Yellow per Drawing No. 312.

II. Design Requirements

a. The public fire hydrant system shall be designed to provide up to a maximum of 3,500 GPM. The distribution system shall be designed in commercial/industrial areas to accommodate fire flows up to 4,500 GPM. Minimum fire flow in single-family residential areas shall be 1,000 GPM with a 20 psi residual pressure.
b. The distribution of hydrants shall be based upon the required average fire flow for the area served. Design coverage shall result in hydrant spacing of approximately 500 feet in residential areas, approximately 250 feet in commercial or industrial subdivisions, or as approved by the Fire Chief and City Engineer. In addition, sufficient hydrants shall be available within 1,000 feet of a building in commercial/industrial areas to provide its required fire flow.
c. Residential hydrants shall be located as nearly as possible to the corner of street intersections and not more than 600 feet from any cul-de-sac radius point.
d. No fire hydrant shall be installed on a main of less than eight inches (8") inside diameter unless it is in a looped system of six inch (6") mains. The hydrant lead shall be a minimum six inch (6") inside diameter.
e. All fire hydrants will be located behind the existing or proposed sidewalk or in the planter strip. If any public hydrant encroaches on private property, an easement will be provided as directed by the City Engineer.
f. No hydrant shall be installed within five feet (5') of any existing aboveground utility nor shall any utility install facilities closer than five feet (5') from an existing hydrant.
g. Hydrant installation shall conform to Standard Drawing No. 312. Full depth hydrants will be required in all installations. Installation of hydrant extensions will not be allowed in new construction, unless approved by the City Engineer.
h. Each fire hydrant shall have an auxiliary valve and valve box which will permit repair of the hydrant without shutting down the main supplying to the hydrant. The auxiliary valve shall have mechanical flange joint ends as referenced in the Standard Drawing No. 313. The valve shall be connected directly to the water main using a flange joint tee, restrained spool full length using mega lugs and/or field loc gaskets.
i. Hydrants shall not be located within twenty feet (20') of any building, nor will they be blocked by parking. The large hydrant port shall face the road or fire lane.
j. Guard posts, a minimum of three feet (3') high, shall be required for protection from vehicles when necessary. Such protection shall consist of four inch (4") diameter steel pipes, six feet (6') long, filled with concrete, and buried a minimum of three (3’) feet deep in concrete, and located at the corners of a six (6’) foot square with the hydrant

located in the center. Use of posts other than at the four corners may be approved by the City Engineer.

3.3.6 Air Release Valves and Combination Air/Vacuum Release Valves

When designated by the City Engineer, air release valves shall be installed. Such valves will be required on main lines at all high points in grade.

3.3.7 Restrained Joints

Provide joint restraint (locked joints) to prevent movement of the pipe or fitting at all bends tees, crosses, plugs, and hydrants. All MJ fittings shall also be restrained.

I. Mechanical Joint Restraint

Mechanical joint restraint where incorporated into the design of the follower gland shall consist of individually actuated wedges that increase their resistance to pull-out as pressure or external forces increase. The device shall be capable of full mechanical joint deflection during assembly and flexibility of the joint shall be maintained after burial. The joint restraint ring and its wedging components shall be made of grade 60-42-10 to ductile iron conforming to ASTM A-536-84. The wedges shall be ductile iron heat-treated to a minimum hardness of 370 BHN. Dimensions shall be appropriate to match pipe materials being utilized. Torque limiting twist-off nuts shall be used to insure proper actuation of the restraining wedges.

The system shall be rated for working pressures of at least 350 psi for pipes 16 inches and smaller diameter and 250 psi for larger sizes. The devices shall be UL listed up through 24 inch diameters and FM approved through 12 inch diameters. The restraint systems and devices shall be Series 1100 Megalug restraint, as produced by EBAA Iron Sales, Inc., or approved equal. Contractor shall perform visual inspection of the restraint devices for flaws before installation. Faulty restraint devices shall not be used at all. Contractor shall bear all cost of repairing and subsequent retesting to correct the defect.

II. Gasket Joint Restraint

All pipes shall be Tyton joint gasket. Contractor shall use Tyton joint gasket Field-LOK, or approved equal, for pipe-to-pipe gasket joint restraint. Contractor shall perform visual inspection of the restraint devices for flaws before installation. Faulty restraint devices shall not be used at all. Contractor shall bear all cost of repairing and subsequent retesting to correct the defect. See Standard Drawing No. 306.

3.3.8 Railroad or Highway Crossings

All such crossings defined above, or as determined by the City to be of a hazardous nature, shall be valved on both sides of the crossing. Casing of railroad or highway crossings, if required, shall be as noted in the permit from the respective agency.

3.3.9 Water Service Line

The sizes of water service lines that may be used are 3/4", 1", 2", 4", 6", 8", 10", and 12". Water service lines will be reviewed for effects on the distribution system and shall not be greater in size than the distribution main. Meter box lids shall accommodate installation of touch read pad.

For two inch (2") and greater services, a design drawing must be submitted showing the vault and fitting requirements with the expected flow (normal and maximum day flow) requirements and proposed usage.

Domestic service lines 3/4" through 2" shall normally extend from the main to behind the curb, with a meter curb stop and meter box located at the termination of the service connection Standard Drawing No. 307, 308 & 309. Meter must be purchased from and installed by City. Meter boxes are to be provided by the developer. In general, individual service connections shall terminate in front of the property to be served and shall be located 18 inches each side of a common side property line.

When a corrosive potential condition is encountered and the copper service passes over or under an active cathodic protection system, the service will be installed in a Schedule 40 PVC conduit for a distance of 10 feet on each side of the active system. All conduit placements must be provided with as-built records.

3.3.10 Fire Service

The water fire service line shall normally extend from the main to the property line and end with a vault and an approved backflow prevention device.

A vault will be required when a development provides fire sprinklers. The vault drawing will be included on construction drawings submitted to the City. The vault shall contain all valves, fittings, meters, and appurtenances required for fire service to the development and be located on private property adjacent to the to the public right-of-way.

3.3.11 Backflow Prevention

Backflow prevention devices shall be required on all irrigation services, fire sprinkler system services and water services 1 1/2" and larger. All backflow prevention shall conform to OAR 333-061-0070 and 333-061-0071.

3.3.12 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.

3.4 Construction Specifications

3.4.1 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.

3.4.2 Scheduling

I. The contractor shall plan their construction work in conformance with Section 1.13.
II. 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.

3.4.3 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.

3.4.5 Trench Excavation, Preparation, and Backfill

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

3.4.6 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 1.15.

3.4.7 Suitable Conditions for Laying Pipe

I. 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.
II. Do not lay pipe in water or when, in the opinion of the City's authorized representative, trench conditions are unsuitable.

3.5 Handling

I. 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.
II. 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.

III. Cleaning Pipe and Fittings

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. Wipe clean all dirt, grease, and foreign matter from the ends of mechanical joint and rubber gasket joint pipe and fittings.

IV. Placing Pipe in Trench

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. Unless otherwise directed, lay pipe with the bell end facing in the direction of the laying. For lines on slopes greater than 20%, face bells upgrade, unless otherwise directed by the City's authorized representative. 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. 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. 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. 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.

a. Clean the ends of the fittings of all dirt, mud, and foreign matter by washing with water and scrubbing with a wire brush.
b. 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.
c. Guide the fitting onto the spigot of the laid pipe.

V. 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.

3.5.1 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.

Mechanical Joint			Push-On Joint	
Diameter (Inches)	**Max. Defl. Angle**	**Deflection**	**Max. Defl. Angle**	**Deflection**
(Inches)	*(Degrees-Minutes)*	*(Inches)*	*(Degrees)*	*(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.*

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.

3.5.2 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. Gaskets shall be installed in accordance with Drawing No. 306.

3.5.3 Construction of Blow-offs

Blow-offs shall be constructed as shown in Drawing No. 311 of these standards and sized per Table 5.3.

3.5.4 Locating Wire Specifications

I. Install tracer wire beside the pipe and plastic caution tape 1-foot above the pipe crown.
II. 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.
III. Surface tracer wire at fire hydrants, blow-offs, and water services only. Tracer wire shall not be accessed through water valves.
IV. 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.

3.5.5 Valves

Valves shall be installed in accordance with Drawing No. 303, 313 & 304 of these standards. Valves shall be flanged by mechanical joint; valves shall be flanged to all tees and crosses.

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.

Valves shall be installed so that the stems are vertical, unless otherwise directed.

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.

3.5.6 Valve Boxes

Valve boxes shall be installed in conformance with Drawing No. 303 & 304 of these standards.

Center the valve boxes and set plumb over the operating nut 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 Drawing No. 303 of these standards or to another level as may be required.

Where the depth of the operating nut is more than 3 feet, operating extensions shall be provided in accordance with Drawing No. 303.

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.

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.

In non-paved areas, the valve box shall be set in a concrete collar as shown in Drawing No. 303 of these standards.

3.5.7 Installation of Fire Hydrants

Fire hydrants shall be located in compliance with Newberg Fire requirements. Improperly located hydrants shall be disconnected and relocated at the contractor's expense.

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.

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.

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.

Install an approved blue bi-directional, reflectorized button in the center of the near travel lane using an approved fast-setting bonding agent.

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.

Fire hydrants installed on existing mains shall be installed with a standard wet tapping sleeve and gate valve per Drawing No. 312 of these standards. Tapping sleeve shall be flange x MJ gate valve and shall match hydrant line size.

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.

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.

3.5.8 Excavation

Do not carry excavation below the sub-base grade. Refill over excavated areas with Class "B" Backfill material in accordance with Section 6 compact to create a firm foundation.

3.5.9 Base Rock

Place Class "B" Backfill material in accordance with Section 6 on a firm, level sub-base or subgrade to assure uniform support.

3.5.13 Gravel for Drainage

Gravel for drainage shall be washed 2" 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.

3.5.14 Thrust Blocking and Restraint

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.

Push-on joints shall utilize restraining gaskets in accordance with Section 3.3.7

3.6 Testing

3.6.1 Hydrostatic Testing

I. Contractor shall make pressure and leakage tests on all newly laid pipe; follow the procedures specified in AWWA C-600, Section 5.2. The new mains being tested shall remain isolated from the existing water system.
II. Contractor shall furnish all necessary equipment and material, make all taps in the pipes as required, and conduct the tests.

III. 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.

IV. 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

V. 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.

VI. 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 1 ½ 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 1 hour, unless otherwise directed by the City's authorized representative.

a. 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.

b. 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:

$$\frac{L=SD(P)1/2}{133,200}$$

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).

c. 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.
d. 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.

3.7 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.

I. 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 blow-off/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

Normal Pipe Size	**Flow Required to Produce 2.5 FPS Velocity**	**Minimum Inlet & Outlet Pipe Size Required**
(inches)	(GPM)	(inches)
4	110	2
6	240	2
8	430	4
12	950	4
18	2140	6
24	3800	6

II. Sterilizing Mixture

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.

a. 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.
b. 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)	1lb.	7.5 gal
Sodium hypochlorite[2] (5.2% Cl)	1 gal	4.25 gal

[1] *Comparable to commercial products known as HTH®, Perchloron®, and Pittchlor®.*
[2] *Liquid laundry bleach, such as Clorox® or Purex®.*

III. 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.*

IV. 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.

V. Disposal of Flushing and Sterilizing Water

I. 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 Newberg Utility Division 2 business days before disposing of sterilizing water into the City sanitary system.

II. 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.

III. Bacteriological Testing

City Utility staff, with the assistance of the contractor's representative, will obtain water samples for the bacteriological samples after the contractor flushes the water line.

a. The water samples must pass the bacteriological tests before the water facilities will be accepted.

b. 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.

3.8 Water Line Acceptance Policy

3.8.1 Water Line Activation

The City of Newberg will provide water to the project when the following are complete:

I. Compliance with these standards

II. Installation of the materials and workmanship as described herein.

III. A successful hydrostatic pressure tests, as witnessed and approved by the City's authorized representative.

IV. Adequate flushing and chlorination of mains, as witnessed and approved by the City's authorized representative.

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

3.8.2 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. Contractor 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 a 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.

Section 4 Storm Drainage

4.0 General Design Requirements

The City's Public Works Design and Construction Standards define the requirements for development to treat and detain stormwater runoff. Stormwater is the runoff from impervious surfaces such as streets, roofs and parking lots that flows to storm drains, ditches and culverts, and then to the nearest river, stream or wetland. When it rains, stormwater runoff may pick up oil, sediment, bacteria, grease and chemicals that can pollute local waterways.

4.1 Performance Standards

All storm drain system designs shall make adequate provisions for collecting, treating, detaining and conveying all storm water runoff. The system shall accommodate all runoff from upstream tributary areas whether or not such areas are within the proposed development. The amount of runoff to be accommodated shall be based upon ultimate development of all upstream tributary areas.

New or modified existing storm drain systems shall not adversely impact any inadequate downstream system.

Utility infrastructure may not be placed within one foot of a survey monument location noted on a subdivision or partition plat, per ORS 92.044 (7).

Storm drainage design shall comply with the required ESC Measures (see City of Newberg Erosion and Sediment Control Manual). The development area must include provisions to adequately control runoff from all public and private streets and the roof, footing, and area drains of residential, multi-family, commercial, or industrial buildings. The design must ensure future extension of the drainage system to the entire drainage basin in conformance with the adopted Storm Drainage Master Plans and these Public Works Design and Construction Standards. These provisions include:

I. Surface and/or subsurface drainage, caused or affected by the alteration of the natural grade, removal of natural ground cover/vegetation, or placement of impervious surfaces, shall not be allowed to flow over adjacent public or private property in a volume, velocity or location materially different from that which existed before development occurred. Surface and/or subsurface drainage shall be managed, treated, and infiltrated or collected, and conveyed in an approved manner, to an approved point of discharge.
II. Surface water entering the subject property shall be received at the naturally occurring locations and surface water exiting the subject property shall be discharged at the natural locations with adequate flow control and energy dissipation, to prevent adverse impacts from flooding, erosion, or sedimentation.
III. Approved points of discharge for storm water may include but not be limited to a storm drain, existing open channel, creek, low impact development approach facility, detention pond, or retention pond, as approved by the City Engineer. Acceptance of suggested facilities will depend upon the prevailing site conditions, capacity of existing downstream facilities, and feasibility of alternate designs. Curb weep hole drainage systems shall only be utilized for single home developments.

IV. A drainage report with the required analysis of downstream system conditions is required with all plan submittals. Planning applications shall include a draft\ preliminary report.

V. When private property must be crossed in order to reach an approved point of disposal, it shall be the developer's responsibility to acquire a recorded public drainage easement on city form prior to commencement of construction. The drainage facility installed must be a closed conduit system. Temporary drainage ditch facilities, when approved, must be engineered to contain the storm water without causing erosion or other adverse effects to the public and/ or private property.

VI. Drainage from roofs, footings, and downspouts may drain directly to a street through the curb under the following circumstances:

   a. The building pad ground elevation is at least 12 inches above the existing street curb.
   b. The existing street is adequately crowned to avoid sheet flow across the street.
   c. Storm water quantity and quality facility provisions have been satisfactorily addressed.
   d. Springs/ sump pumps shall connect to a piping system, unless approved by the City Engineer.

4.2 Private Storm Drains

Properties that slope and drain away from the public storm drain systems may need to provide a private drainage system in private easements. This system shall be for collection of roof drains, footing drains, and surface runoff. This system shall be designed to meet the Uniform Plumbing Code requirements. For multifamily, commercial and industrial laterals, a manhole is required at the connection between private and public storm systems.

Mainlines crossing multiple lots may be required to be public, such as rear lot drain lines as approved by the City Engineer on a case by case basis. A clean-out shall be installed at the lateral connection between private and public storm system. When required by the City Engineer, a backflow preventer shall be installed on the private side at the lateral connection between private and public storm systems.

Site designers shall consider potential drainage from sump pumps and/ or flow from perennial flowing wall/ building footing drains. Such drainage systems shall not connect to curb weep holes and will be connected to a storm drain piping system.

4.3 Alignment, Location and Cover

4.3.1 Alignment

All pipes shall run in straight lines, with a constant slope, material and diameter from manhole to manhole.

4.3.2 Right-of-Way Location

Public storm lines shall be located within the public right-of-way as directed by the City Engineer. These lines are placed in the public right-of-way for ease of maintenance and access, control and operation of the facility, and to facilitate replacement and/or repair. Please reference Standard Drawing No. 103.

4.3.3 Cover

For stormwater cover requirements reference Standard Drawing No. 110.

4.4 Structures

4.4.1 Manholes

The City preference is for the use of inlet manholes Standard Drawings No. 407, 409, & 410, behind the curb piping systems. Manholes and inlet manholes shall be located at all changes in slope, alignment, pipe size, and at all pipe junctions with existing or future storm drain connections.

Manhole spacing shall not exceed 500 feet and spacing for manholes used as inlets, shall not exceed 400 feet.

When standard manholes are required at pipe junctions, short cone manholes shall be used when rim to lowest pipe invert elevation is less than five feet (5’). Flat tops with a standard frame may be approved on a case by case basis.

When the downstream pipe size increases, the crown of all upstream pipes shall not be lower than the crown of the larger downstream pipe.

All manholes shall be designed with a minimum drop of 0.2 feet from the inlet and outlet invert elevations.

4.4.2 Inlet Manholes and Catch Basins

All structures shall be located in streets at the curb line to receive storm water runoff and provide conveyance to the main storm drain.

Structures shall be located at the following locations, but in no case be spaced further than 400 feet:

I. At curb returns on the upstream side of an intersection.
II. At the end of all dead end streets with a descending grade.
III. At intermediate locations so that storm flows at the curb line do not exceed three feet (3') in width (measured from the curb face) or three inches (3") in depth (measured at the curb face), whichever is less, refer to Table 4-1 for design storm.
IV. An oversized inlet manhole at low point (sag) of all vertical curves. Street and or vertical curves with flat slopes may require installation of additional inlets.
V. All structures shall be capable of intercepting completely the design storm flow at the curb.

4.4.3 Culverts

Culverts at road crossings in natural, perennial channels shall be designed to pass the peak discharge for the specified design storm such that the headwater:

I. Does not exceed 0.8 times the culvert diameter; or
II. Remains at least 1 foot below the roadway subgrade, whichever is less.
III. Bottomless or fish friendly culverts shall be installed in wetland and/or water quality sensitive areas. Final designs shall be permitted by applicable regulatory agencies. Approved permits shall be submitted to the City.

IV. Culvert material shall have a minimum design life of 75 years.

4.4.4 Bridges

New and replacement bridges over natural, perennial channels shall be designed to pass the 100 year peak discharge from the tributary area assuming full development. Vertical clearance between the design water surface and the bottom of any part of the bridge shall be a minimum of two feet.

4.4.5 Walls

When sizing walls, the designer will consider the surcharge caused by vehicles, soil and/ or future building construction on facility walls. All walls in public facilities shall be cast in place reinforced concrete, with a decorative surface finish, designed by a registered professional engineer.

4.5 Drainage Report

A final drainage report containing the information listed below shall be submitted at the time of initial construction plan review by the City. An abbreviated preliminary drainage report shall be prepared and submitted during the land use approval process that is an outline/draft form of the final report requirements listed below. The City may waive some or all of these report requirements for single-family residential partition projects and projects where post-development impervious surfaces constitute less than 25% of the parcel. In order to apply for a waiver, the applicant must submit a written request to the City and the applicant or applicant's Engineer must participate in a pre-design meeting to discuss the proposed project and its stormwater impacts prior to the land use approval process submittal.

I. Narrative, with tables where appropriate, describing
    a. Areas and flows used for design calculations per this design manual.
    b. Results of downstream analysis.
    c. How water quality and quantity requirements of these rules are met by the project.
II. Maps showing the following information
    a. Upstream basin flowing through the site with contours.
    b. Downstream basin to the point where analysis is required in the downstream analysis, with contours.
    c. Site plan showing development layout with contours.
    d. Existing stormwater facilities on and adjacent to the site.
    e. Stormwater facilities proposed to be constructed by the project.
    f. Delineated basins contributing to the stormwater facility including labels and area calculations.
III. Calculations for
    a. Hydrological calculations for both existing and post development conditions.
    b. Conveyance system sizing, including calculations showing portions of existing conveyance system that are not proposed to be altered have adequate capacity according to the criteria in these rules.
    c. Sizing of water quality and quantity facilities.
IV. Downstream Analysis

a. A stamped certificate of investigation stating that the design engineer has taken downstream impacts into consideration is required for each development constructing, collecting or discharging more than 2877 square feet of new impervious area.
b. Projects that receive approval for a fee in lieu of construction and/or install partial or no storm water quantity facilities, the analysis shall extend downstream to a point in the drainage system where the additional flow from the proposed development site constitutes 10 percent or less of the total tributary drainage flow.
c. When the downstream analysis does not continue for at least one-quarter (1/4) mile, the design engineer shall provide a stamped certification of investigation that states the design Engineer has visually investigated the downstream system for at least one-quarter (1/4) mile downstream and is aware of no observable downstream impacts to the conveyance system.

V. For privately maintained water quantity or quality facilities or conveyance systems, a maintenance plan that clearly identifies maintenance activities and frequency in a form that can be easily provided to and understood by the people responsible for maintenance.

The maintenance plan is to be included with the City standard private facility maintenance agreement form and submitted to the City for review. Upon approval of the maintenance agreement by the City, the applicant shall record the agreement with Yamhill County and return one fully executed original to the City Recorders office.

4.5.1 Flow Determination

Design Event/Storm Frequency

All public storm drain systems shall be designed for the storm recurrence interval and 24 hour rainfall depths as in the following Table 4.1 & 4.2:

Table 4.1: Drainage System Design Requirements

Drainage System Design Requirements	
Drainage System Elements	**Design Storm Recurrence Interval (years)**
Facilities: Water Quantity & Quality Control	See Sections 4.8.5 & 4.7.1
Minor: Minor Collector Streets, Local Streets, Curbs, Gutters, Inlets Manholes and Mainlines up to 250 Tributary Acres	25
Major: Major Collector, Arterial Streets, the Drainage System in or under Arterial Streets, and anything greater than 250 Tributary Acres	50
Watercourses: Without FEMA Designated Floodplain	50
Watercourses: FEMA Designated Floodplain	100
Bridges:	100

Table 4.2 Rainfall Depths

24 Hour Rainfall Depths Newberg, Oregon	
Recurrence Interval (years)	**Total Precipitation Depth (inches)**
2	2.5
5	3.0
10	3.5
25	4.0
50	4.2
100	4.5

4.5.2 Computational Methods for Runoff Calculations

Design of conveyance systems shall be based on full build-out of the upstream basin based upon the most recent approved City comprehensive Land Use Plan and realistic estimates of development densities in areas included in recent additions to the Urban Growth Boundary.

Unless an alternative method is approved by the City in writing, calculation of storm runoff used for conveyance design shall be based on one of the following methods with the limitations on use of each listed. A maximum overland distance for sheet flow used in calculations shall be 100 feet.

4.5.3 Rational Method

The rational method is allowed with the following limitations:

I. Drainage sub-basin area cannot exceed 1 acre for a single calculation without approval from the City.
II. The time of concentration shall be a minimum of five minutes.
III. The calculation methodology shall conform to the procedures outlined in Chapter 7 and Appendix A & F of the 2011 Oregon Department of Transportation (ODOT) Hydraulics Manual. The City of Newberg Intensity, Duration, and Frequency (IDF) recurrence interval curves to be used in the calculations shall be ODOT Zone 7.

4.5.4 Santa Barbara Urban Hydrograph (SBUH)

SBUH methods shall be based on the following information:

I. The rainfall distribution to be used within the City is the design storm of 24-hour duration based on the standard NRCS Type 1A rainfall distribution using the chart included herein.
II. Curve numbers shall be derived from the National Resources Conservation Service's (NRCS) runoff curve numbers contained in Technical Release 55 (TR-55)-Urban Hydrology for Small Watersheds.
III. Soil types shall be derived from the NRCS Soil Survey for Yamhill County.

4.5.5 TR-55

The TR-55 method developed by NRCS when used for runoff calculations shall be based on the following information:

I. A standard NRCS Type 1A storm shall be assumed.
II. Curve numbers shall be derived from the National Resources Conservation Service's (NRCS) runoff curve numbers contained in Technical Release 55 (TR-55)-Urban Hydrology for Small Watersheds.
III. Soil types shall be derived from the NRCS Soil Survey for Yamhill County.

4.5.6 Stormwater Management Model (SWMM)

The SWMM method developed by EPA may be used on medium to large projects for computing runoff volumes for conveyance.

Table 4.3: 24 – Hour NRCS Type 1a Rainfall Distribution

Time From Start of Storm, Minutes	% Rainfall	Cumulative % Rainfall	Time From Start of Storm, Minutes	% Rainfall	Cumulative % Rainfall	Time From Start of Storm, Minutes	% Rainfall	Cumulative % Rainfall	Time From Start of Storm, Minutes	% Rainfall	Cumulative % Rainfall
0 - 10	0.40	0.40	360 - 370	0.95	22.57	720 - 730	0.72	67.40	1080 - 1090	0.40	86.00
10 - 20	0.40	0.80	370 - 380	0.95	23.52	730 - 740	0.72	68.12	1090 - 1100	0.40	86.40
20 - 30	0.40	1.20	380 - 390	0.95	24.47	740 - 750	0.72	68.84	1100 - 1110	0.40	86.80
30 - 40	0.40	1.60	390 - 400	0.95	25.42	750 - 760	0.72	69.56	1110 - 1120	0.40	87.20
40 - 50	0.40	2.00	400 - 410	1.34	26.76	760 - 770	0.57	70.13	1120 - 1130	0.40	87.60
50 - 60	0.40	2.40	410 - 420	1.34	28.10	770 - 780	0.57	70.70	1130 - 1140	0.40	88.00
60 - 70	0.40	2.80	420 - 430	1.34	29.44	780 - 790	0.57	71.27	1140 - 1150	0.40	88.40
70 - 80	0.40	3.20	430 - 440	1.80	31.24	790 - 800	0.57	71.84	1150 - 1160	0.40	88.80
80 - 90	0.40	3.60	440 - 450	1.80	33.04	800 - 810	0.57	72.41	1160 - 1170	0.40	89.20
90 - 100	0.40	4.00	450 - 460	3.40	36.44	810 - 820	0.57	72.98	1170 - 1180	0.40	89.60
100 - 110	0.50	4.50	460 - 470	5.40	41.84	820 - 830	0.57	73.55	1180 - 1190	0.40	90.00
110 - 120	0.50	5.00	470 - 480	2.70	44.54	830 - 840	0.57	74.12	1190 - 1200	0.40	90.40
120 - 130	0.50	5.50	480 - 490	1.80	46.34	840 - 850	0.57	74.69	1200 - 1210	0.40	90.80
130 - 140	0.50	6.00	490 - 500	1.34	47.68	850 - 860	0.57	75.26	1210 - 1220	0.40	91.20
140 - 150	0.50	6.50	500 - 510	1.34	49.02	860 - 870	0.57	75.83	1220 - 1230	0.40	91.60
150 - 160	0.50	7.00	510 - 520	1.34	50.36	870 - 880	0.57	76.40	1230 - 1240	0.40	92.00
160 - 170	0.60	7.60	520 - 530	0.88	51.24	880 - 890	0.50	76.90	1240 - 1250	0.40	92.40
170 - 180	0.60	8.20	530 - 540	0.88	52.12	890 - 900	0.50	77.40	1250 - 1260	0.40	92.80
180 - 190	0.60	8.80	540 - 550	0.88	53.00	900 - 910	0.50	77.90	1260 - 1270	0.40	93.20
190 - 200	0.60	9.40	550 - 560	0.88	53.88	910 - 920	0.50	78.40	1270 - 1280	0.40	93.60
200 - 210	0.60	10.00	560 - 570	0.88	54.76	920 - 930	0.50	78.90	1280 - 1290	0.40	94.00
210 - 220	0.60	10.60	570 - 580	0.88	55.64	930 - 940	0.50	79.40	1290 - 1300	0.40	94.40
220 - 230	0.70	11.30	580 - 590	0.88	56.52	940 - 950	0.50	79.90	1300 - 1310	0.40	94.80
230 - 240	0.70	12.00	590 - 600	0.88	57.40	950 - 960	0.50	80.40	1310 - 1320	0.40	95.20
240 - 250	0.70	12.70	600 - 610	0.88	58.28	960 - 970	0.50	80.90	1320 - 1330	0.40	95.60
250 - 260	0.70	13.40	610 - 620	0.88	59.16	970 - 980	0.50	81.40	1330 - 1340	0.40	96.00
260 - 270	0.70	14.10	620 - 630	0.88	60.04	980 - 990	0.50	81.90	1340 - 1350	0.40	96.40
270 - 280	0.70	14.80	630 - 640	0.88	60.92	990 - 1000	0.50	82.40	1350 - 1360	0.40	96.80
280 - 290	0.82	15.62	640 - 650	0.72	61.64	1000 - 1010	0.40	82.80	1360 - 1370	0.40	97.20
290 - 300	0.82	16.44	650 - 660	0.72	62.36	1010 - 1020	0.40	83.20	1370 - 1380	0.40	97.60
300 - 310	0.82	17.26	660 - 670	0.72	63.08	1020 - 1030	0.40	83.60	1380 - 1390	0.40	98.00
310 - 320	0.82	18.08	670 - 680	0.72	63.80	1030 - 1040	0.40	84.00	1390 - 1400	0.40	98.40
320 - 330	0.82	18.90	680 - 690	0.72	64.52	1040 - 1050	0.40	84.40	1400 - 1410	0.40	98.80
330 - 340	0.82	19.72	690 - 700	0.72	65.24	1050 - 1060	0.40	84.80	1410 - 1420	0.40	99.20
340 - 350	0.95	20.67	700 - 710	0.72	65.96	1060 - 1070	0.40	85.20	1420 - 1430	0.40	99.60
350 - 360	0.95	21.62	710 - 720	0.72	66.68	1070 - 1080	0.40	85.60	1430 - 1440	0.40	100.00

4.5.7 Conveyance Design

I. Design for Full Build Out

Storm drainage and conveyance facilities shall be designed and constructed to accommodate all future full build-out flows generated from the upstream drainage basin. Conveyance system adequacy shall be demonstrated by performing a backwater analysis. The calculated hydraulic grade line shall in all cases be lower than a 2 foot minimum from finished grade at all structure locations. The hydraulic grade line for shallow conveyance systems shall be determined by the City Engineer on a case by case basis.

II. Velocity and Slope

All storm drains shall be on a grade that produces a mean velocity, when flowing full, of at least three feet (3') per second.

III. Pipe Roughness Coefficient

The manning's roughness coefficient to be used in conveyance calculations shall be a minimum of 0.013.

IV. Open Channels

Open channel systems shall be designed for minimum 1 foot freeboard from bank full provided no structures are impacted by the design water surface elevation.

V. Natural Channels

Control of discharge from developed areas to natural channels shall be such that the average velocity resulting from all design storms less than or equal to the 10 year event remains below the erosive velocity of the channel.

VI. Manmade Channels (Ditches)

Ditches are only allowed as temporary facilities; rock lining is required when flows are in excess of 3 ft/s. Manmade channels shall be designed for a 10 year storm with a maximum depth of 2 feet and 3:1 side slopes. Water Quality Facilities are not considered ditches.

VII. Overflow Analysis

Overland/Overflow analysis shall be performed for all conveyance, water quality & water quantity systems that demonstrate that the 100-year event will not impact or inundate any buildings. Designer shall submit documentation indicating the overland/ overflow path during the permitting process to the City.

4.5.8 Upstream Impacts

Modifications to the existing on-site storm drainage facilities shall not restrict flows thereby creating backwater onto off-site property to levels greater than the existing situation, unless approved by the impacted off-site Property Owners and the City. When approved, the off-site Property Owner(s) shall agree to and sign a permanent easement legally describing the location of the backwater storage and authorizing the use of their property for stormwater drainage and detention purposes. The easement shall be in a form approved by the City.

4.5.9 Downstream Impacts

Downstream restrictions that create backwater during the 25-year design storm in the current or post-development condition may be required to be removed by the developer, at the discretion of the City. The engineer of record shall evaluate downstream impacts per Section 4.5.

Removal of downstream obstructions shall not be allowed if the removal will cause, contribute, or exacerbate flooding and/or erosion damages to existing buildings, dwellings or properties in the 100-year design storm.

When downstream restrictions are not removed, an on-site detention facility shall be required.

4.5.10 Cross-Lot Drainage

Developments shall accommodate existing off-site drainage entering the site so as to not impact upstream property owners or negatively impact the new development.

4.5.11 Outlet Protection/Dissipation of Runoff

Runoff exiting a development site shall be discharged with adequate energy dissipation to prevent downstream damage. Storm drain lines shall enter a creek or drainage channel at 90° or less to the direction of flow. The outlet shall have a head wall and appropriate scour protection to prevent erosion of the existing bank or channel bottom. The size of pipe or channel being entered will govern which protective measures are required. All protective measures must conform to the erosion control requirements of these Public Works Design and Construction Standards and the City's Erosion and Sediment Control Manual.

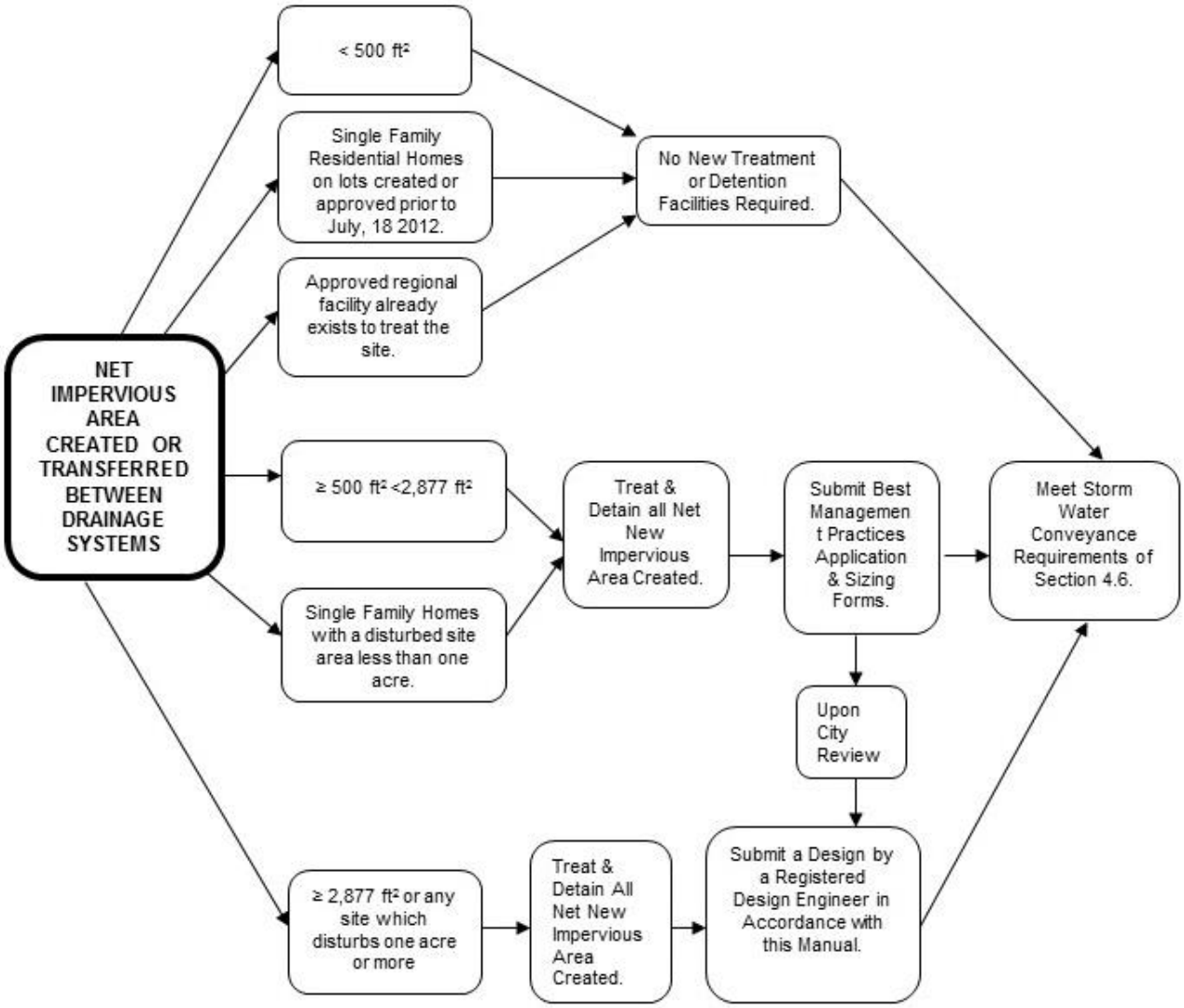
4.5.12 Subsurface Drains

Subsurface drains (under drains) shall be provided at the following locations:

I. For all existing springs and field tile intercepted during construction activity for other facilities; i.e., wastewater, water, mains, street excavations, foundations, etc.
II. Where high ground water exists or when it is necessary to reduce the piezometric surface to an acceptable level to prevent land slippage or under floor flooding of buildings.
III. Subsurface drainage shall not discharge into a street or a street gutter.

4.6 Water Quantity and Quality Facilities

Figure 4.4 Storm water Quality & Quantity Design Flow Chart



4.6.1 Impervious Surface Area

I. For all sites, the threshold and approach for the design of water quality and quantity facilities shall be based on Figure 4-4 (above).

II. For single family and duplex residential subdivisions, stormwater quality and quality facilities shall be sized for all net impervious area created by the subdivision. For design purposed, the impervious area on an individual single family lot may be estimated at the rate of 2877-square feet of impervious surface area per dwelling unit. If design approach for the subdivision included private LIDA facilities on individual lots, actual impervious area shall be used at the time of the building permit. Concept facility design shall be shown on the subdivision plan.

III. Except as noted in Section (I) above, for all developments other than single family and duplex, including row houses and condominiums, the sizing of stormwater quality facilities shall be based on the net impervious area created by the development, including structures, roads, and other impervious areas. Impervious areas shall be determined based upon building

permits, construction plans, or other appropriate methods of measurement deemed reliable by the City.

4.6.2 Erosion Protection

I. Inlets to water quality and quantity facilities shall be protected from erosive flows through the use of an energy dissipater or rip rap stilling basin of appropriate size based on flow velocities. Flow shall be evenly distributed across the treatment area.
II. All exposed areas of water quality and quantity facilities shall be protected using coconut or jute matting. Coconut matting or high density jute matting (Geojute Plus or approved equal) shall be used in the treatment area of swales and below the water quality volume levels of ponds. Low density jute matting (Econojute or approved equal) may be used on all other zones.

4.6.3 Planting/Vegetation

Planting/vegetation shall be in accordance with Appendix A: Planting Requirements. No invasive species shall be planted or permitted to remain within a facility which may affect its function, including, but not limited to the following:

I. Himalayan blackberry (Rubus discolor)
II. Reed canarygrass (Phalaris arundinacea)
III. Teasel (Dipsacus fullonum)
IV. English Ivy (Hedra helix)
V. Nightshade (Solanum sp.)
VI. Clematis (Clematis ligusticifolia and C. vitabla)
VII. Cattail (Typhus latifolia)
VIII. Thistle (Cirsium arvense and C. vulgare)
IX. Scotch Broom (Cytisus scoparius)

4.6.4 Fencing

Any facility with the potential of storing (18) inches or more at any time shall require delineation fencing around facilities and/or tracts containing facilities. The fence shall be 4-foot high, black or brown vinyl-clad chain link fence in conformance with the City Standard Drawing No.419.

I. When a facility is fenced, the fence shall include a 12-foot wide lockable gate for maintenance access conforming to the City Standard Drawing No. 419.
II. If a facility is located adjacent to a riparian corridor, wildlife friendly fencing shall be utilized, as approved by the City Engineer and Planning Division.

4.6.5 Access

Access roads shall be provided for maintenance of all water quality and quantity facilities. The following criteria are considered to be the minimum required for facilities maintained by the City. If the design Engineer anticipates that any of the requirements will not be met due to the configuration of the proposed development, the design Engineer is advised to meet with the City Engineer to gain approval for the deviation prior to submittal.

4.6.6 Standard Road Design

I. The road section shall be designed according to Standard Drawing No. 513; the subgrade shall be compacted to 91-percent AASHTO T-180; or, the design Engineer may submit an alternate design certified as capable of supporting a 30-ton maintenance vehicle in all weather conditions.
II. Strengthened sidewalk and driveway sections according to Standard Drawing No. 510.
III. Maximum grade shall be 10-percent with a maximum 3-percent cross-slope.
IV. Minimum width shall be 12 feet on straight runs and 15 feet on curves. Minimum gravel shoulder width shall be 1-foot, matching the cross slope of the access road.
V. Curves shall have a minimum 40-foot interior radius.
VI. Access shall extend to within 10-feet of the center of all structures unless otherwise approved by the City.
VII. The City may require a curb or other delineator at the edge of the road for drainage, a curb stop, or to demarcate the road where the road edge is not apparent.
VIII. The side slope for road embankments shall be 2H:1V or flatter, as approved by the Geotechnical Engineer for the project.
IX. A vehicle turnaround shall be provided when the access road exceeds 150' in length, reference Standard Drawing No. 529.
X. The road shall provide access to within 10' of all structures.

4.6.7 Maintenance Responsibilities

Public Facilities

I. Unless otherwise approved by the City Engineer, newly constructed water quality or quantity facilities serving public roads shall be publicly maintained to City Standards.
II. The developer, or other legally bound party, shall be responsible for Public facility bonding and maintenance, two years from the date of the acceptance of the public facility improvements. The maintenance period may extend beyond the two year period if facility plant die off is greater than 20-percent at the end of the two year period.
III. Publicly maintained water quality or quantity facilities shall be contained within a tract with an approved access road provided and encumbered by a surface/ stormwater management easement dedicated to the City. The City will retain ownership of the tract.
IV. Irrigation shall be provided to all public facilities. The system development fees and associated costs are the responsibility of the developer.

Private Facilities

Private facilities shall be maintained by the owner. The owner or responsible party shall complete the City standard private maintenance agreement forms and submit to the City for review/approval. The maintenance agreement shall be approved by the City and recorded with Yamhill County before the issuance of building occupancy permits.

A maintenance plan is required for all privately maintained stormwater facilities, it shall:

I. Be composed of an agreement to be signed by the owner of the stormwater facilities and the City and an explanation of the operation, maintenance, and preservation of the stormwater

facility including a schedule of required maintenance activities. The maintenance plan will be appended to the property deed. Operations and maintenance manuals will be provided by the developer to all present and subsequent owners of the facility that describes the stormwater facility, maintenance procedures including methods of waste disposal, maintenance schedule, and the location of the installation and maintenance records of previous years.

II. Components
    a. Inspection schedule including storm- related inspections
    b. Description of facility components, the observable trigger for maintenance, and the method of maintenance including appropriate waste disposal method
    c. Type of maintenance for plants and other landscaping material required for proper functioning of the stormwater facility and to maintain a 75% vegetative cover

III. Contain the location for stormwater installation records. The installation records will be kept until the facility is dismantled and no longer discharges to the City's stormwater system. They include at a minimum, the design calculations and assumptions and the construction drawings that show the individual components and the entire system.

IV. Provide requirements for maintenance records. Annual reports will be submitted to the City by the owners of the stormwater facility attesting to the proper maintenance, safety, and functioning of the stormwater facility. The maintenance records will be kept with the facility installation records and be available for inspection by the City for at least five (5) years. Installation records will be kept until the stormwater facility is dismantled and no longer discharges to the City's stormwater system.

4.6.8 Facility Selection Hierarchy

The hierarchy of preference for public and or private water quantity and/or water quality facilities is listed below in the order of preference by the City Engineer and Public Works Maintenance Department. The highest technically feasible option must be used (1=highest, 4=lowest). Applicants must provide the appropriate technical analysis and evaluation and demonstrate the need to move from a higher option to a lower option as reviewed & approved by the City during the land use application or permit review application process.

Detention Facilities	**Water Quality Facilities**
LIDA Facilities/Regional Facility	LIDA Facilities/Regional Facility
Surface Pond	Swale
Underground Tanks/Pipes	Proprietary Treatment Systems
Fee in lieu of construction payment	Fee in lieu of construction payment

4.6.9 Private and Public Proprietary Treatment Systems

Proprietary treatment systems shall meet the removal efficiency requirements of the City's Willamette TMDL implementation plan. Proprietary treatment systems shall be allowed in situations meeting one of the following criteria:

Private

I. Treatment of runoff from a single parcel.
II. Treatment of runoff from an adjoining commercial, industrial, or multi-family, or condominium parcels which share a common parking lot.
III. Treatment of runoff from high-density zoning classifications where the development is primarily single family residential and the average lot size is 3000 or less square feet.
IV. Proprietary treatment systems shall be maintained by private parties, except for systems that are approved by the City Engineer on a case by case basis, to treat runoff from a public street.
V. Proprietary systems require a long-term maintenance plan identifying maintenance techniques, schedule, and responsible parties. This maintenance plan shall be submitted and approved with the drainage report for the project.
VI. All proprietary treatment systems shall be subject to maintenance responsibilities as stated under 4.7.2.

Public

Treatment of runoff from new and expanded collector and arterial roadways where no other opportunities exist for treatment without necessitation of the removal of homes or businesses.

All public and private water quality proprietary treatment systems shall be in conformance with Contech Stormwater Management Storm Filter system or approved equivalent.

4.6.10 Small Developments

Two and three parcel single family home partitions that can demonstrate (storm report required) adequate downstream conveyance capacity are eligible for a fee in lieu of construction of stormwater quality/quantity facility payment. Large parcel single family home partitions with the potential for additional dwelling units and/or future subdividing/partitioning are not considered small developments.

4.6.11 Fee in Lieu of Construction Payment

Refer to the Engineering Services Department fee schedule for the fee in lieu of construction payment schedule. The payment shall be made to the City before recording of the final partition or subdivision plat for single family home construction, or the issuance of building permits for all other projects.

Fee in lieu of construction payments for water quantity and quality facilities will be collected by the City and used to fund the enhancement/upsizing of existing facilities and development of regional facilities when feasible.

4.7 Water Quantity Facility Design & Control Standards

4.7.1 General Requirements

I. Each new development shall incorporate techniques for mitigating its impacts on the public stormwater system in accordance with Chapter 13 of the Municipal Code by the construction of permanent on-site stormwater quantity detention facilities designed in accordance with this chapter.
II. All water quantity facilities shall be designed in accordance with City guidance documents and be consistent with this Chapter.

III. When required, stormwater quantity on-site detention facilities shall be designed to capture runoff so the post-development runoff rates from the site do not exceed the pre-development runoff rates from the site, based on 24-hour storm events ranging from the ½ of the 2-year return storm to the 25-year return storm. Specifically, the ½ of the 2, 2, 10, and 25-year post-development runoff rates will not exceed their respective ½ of the 2, 2, 10, and 25-year pre-development runoff rates; unless other criteria are identified in an adopted watershed management plan or storm drainage basin master plan.

IV. Applicable low impact development approaches, designed in accordance with this Chapter, can be utilized to meet all or part of any detention requirements on a site.

V. For all sites, the threshold and approach for the design of water quantity facilities shall be based on Figure 4-4.

4.7.2 Hydraulic Design Criteria

I. Detention design shall be assessed by dynamic flow routing through all the conveyance components within the basin. Documentation of the proposed design shall be included in the drainage report. Acceptable analysis programs include those listed below, as well as others using the SBUH or TR-55 methodology.

   a. HEC-1
   b. HEC-HMS
   c. SWMM
   d. HYDRA
   e. Others as approved by the City Engineer

II. A pond overflow system shall provide for discharge of the design storm event without overtopping the pond embankment or exceeding the capacity of the emergency spillway.

III. Provide an emergency spillway sized to pass the 100-year storm event or an approved hydraulic equivalent. Emergency spillway shall be located in existing soils when feasible and armored with riprap or other approved erosion protection extending to the toe of the embankment. The emergency spillway shall direct flows away from proposed or existing structures.

4.7.3 Facility Design Criteria

I. The facility can be a combined water quality and quantity facility provided it meets all relevant criteria.

II. Provide an approved outlet structure for all flows and an approved secondary flow route/path if the primary outlet and or conveyance system fails.

III. Certain situations require use of multiple orifice plates to achieve desired outflow rates.

IV. All water quality/ quantity facilities shall have a maximum depth of 5 feet unless approved by the City Engineer.

4.7.4 Walls in Water Quantity Facilities

I. Retaining walls may serve as pond walls if the design is prepared and stamped by a registered professional engineer and a fence is provided along the top of the wall. At least 25% of the pond perimeter shall be vegetated with a side slope of 3H:1V or flatter allowing for maintenance access. All retaining walls in publicly maintained facilities, shall be cast in place concrete with a decorative surface finish, unless otherwise approved by the City Engineer.

II. Walls that are 4 feet or higher that are surcharged and/ or are periodically inundated shall meet all of the following criteria:
    a. Permitted through the City Building Division.
    b. The party responsible for maintenance of the walls within the water quantity tract or easement area shall be clearly documented on the final plat, or in alternate form, both with review and approval by the City Attorney and City Engineer.

4.8 Water Quality Facility Design and Treatment Standards

4.8.1 Water Quality Treatment Requirements

Owners of new development and other activities which create new impervious surfaces or increase the amount of stormwater runoff or pollution leaving the site are required to construct permanent water quality facilities per Chapter 13 of the Municipal Code to reduce contaminants entering the storm and surface water system.

4.8.2 Required Treatment Design Efficiency

The following approaches are available for meeting the treatment design efficiency standards of the pre-development vs. post development reduction of wind/ rain deposited organic & inorganic sediments, automotive wastes, bacteria, mercury, and temperature control, as follows:

I. Pretreatment as specified in the following sections in combination with a facility listed below:
    a. Low impact development approaches and regional water quality/ detention facilities that can be demonstrated, to the satisfaction of the City, to meet treatment efficiency standards.
    b. Proprietary treatment systems meeting the requirements of Section 4.6.9.

4.8.3 Design Considerations

I. If an onsite water quality facility cannot be constructed to treat the runoff from the development's impervious surface, then with City Engineer approval, an off-site water quality facility may be designed to treat runoff from an equivalent area of adjacent untreated impervious surfaces.
II. Facilities shall be designed such that flow from the development is treated off-line from the storm conveyance system and reconnected to upstream flows following treatment.
III. Discharges to riparian and/or wetland sensitive areas shall maintain the flows of pre-development site conditions to the extent necessary to protect the characteristic functions of the sensitive area. Conversely, discharge of flows that may be damaging to downstream water quality sensitive areas into other catchments will not be permitted.
IV. The maximum drawdown time shall be 48 hours.

4.8.4 Water Quality Volumes and Flows

Water quality volumes and flow rates are calculated using section 4.7.2 computational methods for runoff calculations.

4.8.5 Water Quality Storm

The storm defines both the volume and rate of runoff. The stormwater quality only facilities shall be designed for a dry weather storm event totaling 1.0 inches of precipitation falling in 24 hours with an average storm return period of 96 hours using Figure 4-3, rainfall distribution.

4.8.6 Water Quality Pretreatment

Incoming flows to a regional water quality facility shall be pretreated using a water quality manhole or other pre-treatment methods such as forebays, or other methods, as approved by the City.

4.8.7 Water Quality Manholes

I. Hydraulic Criteria:
   a. Minimum Design Flow: Water Quality Flow
   b. Upstream flow splitter may be used to bypass conveyance flows in excess of the Water Quality flow.

II. Design Criteria:
   a. Shall conform to City Standard Drawings
   b. Minimum Manhole Diameter: 60-inch
   c. Maximum size of incoming pipe: 18-inch (high flow splitter may be required.)
   d. Sump Depth: No deeper than 5 feet from invert out to bottom of sump
   e. Volume of sump: 20 cubic feet/ 1.0 cfs of flow into the water quality manhole, up to the 25-year flow. Flow calculations shall include the effect of an upstream flow splitter.
   f. Maintain a 3-foot clear access zone between the inside structure.
   g. Orient access to structure in a clear zone.

4.9 Low Impact Development Approaches (LIDA)

LIDAs offer options to comply with stormwater management requirements. The five objectives of LIDA are to:

I. Conserve Existing Resources
II. Minimize Disturbance
III. Minimize Soil Compaction
IV. Minimize Imperviousness
V. Direct Runoff from Impervious Areas onto Pervious Areas

4.9.1 LIDA Design Considerations

I. LIDA may be used in combination with standard water quantity and quality facilities to meet the requirements of this Chapter. The engineer shall maximize LIDA to the extent practicable.
II. The applicant shall provide an analysis in the drainage report of the ability of any proposed LIDA to meet the water quantity and quality requirements for a project.
III. For developers creating less than 2877 square feet of impervious surface Drawing No. 451, LIDA Sizing Form may be used. Projects creating more than 2877 square feet of impervious area shall be designed by registered design professional in accordance with the Standards.

IV. The applicant shall provide a report from a registered design professional providing infiltration rates of existing soils for LIDA facilities that are proposed to fully discharge into existing soils.

V. Maintenance access shall be provided for all LIDA facilities adjacent to collector or arterial roadways as approved by the City Engineer.

VI. Approval of use of a LIDA by the City does not eliminate the need for the applicant to secure approval from other appropriate agencies for use of LIDA on their project. A potential example maybe DEQ's underground injection control (UIC) permit.

VII. LIDA facility planting shall follow the guidelines in Appendix A of this Design Manual.

4.9.2 LIDA Approvable by the City:

I. Figure 4-5 identifies acceptable LIDA facilities to meet the requirements of this chapter. Designers are also encouraged to consult the City of Portland's stormwater management manual, Clean Water Services LIDA Handbook, and/or Oregon State University Extension Service LID facility design drawings for additional specific designs and other considerations.

II. LIDA facilities not included in Figure 4-5 may be approved by the City Engineer if the applicant can demonstrate that the LIDA can meet the requirements of this Chapter.

III. LIDA facilities require a long-term recorded maintenance plan identifying maintenance techniques, schedule, and responsible parties. This requirement shall be noted in a maintenance plan and the City private maintenance agreement template shall be completed and approved with the drainage report for a project, before building permit and or site development permit is finalized for a project.

IV. All private LIDA Facilities shall be designed and constructed in locations that are approved by the building department.

Figure 4.5 Approvable Low Impact Development Approaches

Application	Green Roof	Porous Pavement/Pavers	Flow-through Planter	Infiltration Planter[1] / Rain Garden	Vegetated Filter Strip	Swale
Quantity Control	✓	✓	✓	✓		
Quality Control	✓	✓	✓	✓	✓	✓
Impervious Area Reduction	✓	✓				
Infiltrate		✓		✓	✓	✓
Private Property	✓	✓	✓	✓	✓	✓
Public Street/ROW			✓		✓	✓
Steep Slope	✓		✓			
Soils with Low Infiltration Rate[2]	✓	✓	✓		✓	✓
High GW Table	✓		✓		✓	✓
Contaminated Soils	✓		✓			

[1] Water proofing maybe required for the building, foundation or a crawlspace.
[2] Infiltration testing is required to determine rate.

4.10 Materials

4.10.1 Aggregate and Cement

Aggregate shall meet the standards set forth in ODOT SSC Section 02001, "PCC Aggregates"; Portland cement shall meet the standards set forth in ODOT SSC Section 02010, "Portland Cement."

4.10.2 Concrete

PCC for poured in place manholes and structures shall conform to ODOT Class 3000 - 12, Commercial Grade Concrete. Slump shall be between 2 and 4 inches.

4.10.3 Manhole Frames and Covers

I. 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. Castings 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.

II. Rings shall be grouted in place and made watertight with a high-strength, non-shrink grout meeting ODOT SSC Section 2080.40, "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.

III. 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. Manholes covers shall clearly designate it as a storm line, using the approved manhole cover with message as per Drawing 411.

IV. Manholes installed outside of paved street or sidewalk areas shall be installed with a tamperproof frame and cover as shown in Drawing No. 411 of these standards. In remote areas, manhole casting finish grade shall be 18" above existing grade.

4.10.4 Manhole Types

Manholes shall conform to the following.

I. Precast 48-Inch-Diameter Manholes
Materials shall conform to the requirements of ASTM C-478. Minimum wall thickness shall be 5 inches.

II. Precast Large-Diameter (60-inch or larger) Manholes
Materials shall conform to the requirements of ASTM C-478. 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.

III. Precast Manhole Tops
Standard eccentric cone, short eccentric cone, and flat slab tops shall be provided in accordance with Drawing 412. 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.

IV. 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.

V. 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.

VI. Poured-in-place Bases
Poured-in-place manhole bases may only be used when placing a manhole over an existing pipe.

4.10 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 Drawing No. 412 & 413. Field fabricated water stops 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 these

standards. 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.

4.10.6 Pipe Stub-outs for Future Sewer Connections

I. 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. Rubber-gasketed, watertight plugs shall be furnished with each stub-out and shall be adequately braced against air test pressures.

II. Gaskets
Manhole sections shall be installed with reformed rubber gaskets manholes. Rubber gaskets shall conform to AASHTO M 315 and ASTM C-443. See Drawing 412.

III. Steps shall be required and shall be constructed as specified and shown in Drawing No. 412 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 Drawing No. 412 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.

4.10.7 Catch Basins and Inlets

I. Frames, Grates, and Covers: All materials shall be flat bar steel (standard grade), cast iron or ductile iron complying with the requirements of ASTM A-36, A-663, or A-709.

II. Forms: All exterior surfaces shall be formed with steel or plywood. Other surfaces shall be formed with matched boards, plywood, or other approved material. Trench walls, rock, or earth will not be acceptable as form material on interior sides.

III. Metal Reinforcement: All metal reinforcement shall conform to the requirements of ASTM A-615, Grade 60, deformed bars.

IV. Precast Concrete Units: All precast units shall conform to the same requirements as manholes (ASTM C-478).

4.10.8 Storm Pipe

Storm sewer pipe installed by open trenching shall have a minimum pipe stiffness at 5% deflection of at least 45 psi. Materials shall be the following types or approved equal:

I. 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 pipe 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 non-shrink 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 /-inch screen. Mortar mixed for longer than 30 minutes shall not be used.

II. Ductile Iron Pipe (D.I.P.)

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-11o/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.

III. Polyvinyl Chloride Pipe (PVC)

a. 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-900and AWWA C-905.

b. A2000 (PVC): All A2000 PVC pipe and fittings shall conform to ASTM F- 949 specifications.

IV. 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.

1. Fittings shall be of the same materials as the mainline pipe. Material joining the fittings shall be of the same material as the mainline pipe.
2. Material joining the fittings to the pipe shall be free from cracks and shall adhere tightly to each joining surface.
3. 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.

ii. Mechanical Couplings: Mechanical couplings shall be wrought steel. Installation procedures must meet the manufacturers' recommendations.

V. Line Tap Saddle

a. All saddles approved for sanitary sewer tap installation (see Section 2) shall be allowed on storm taps.

4.11 Workmanship

4.11.1 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 6.

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

4.11.3 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.

4.11.4 Manhole Connections

The contractor shall connect sewer pipe to manholes as specified in Section 2.8.

4.11.5 Concrete Bases (Poured-in-Place)

Poured-in-place bases shall be used over existing pipelines in accordance with Drawing No. 203 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 storm lines, comply with Section 2.8

4.11.6 Drop Manholes

The maximum free drop in a manhole shall be 24 inches. When more than 24 inches feet of drop exists, a drop manhole shall be provided.

4.11.7 Placing Manhole Section

The contractor shall clean the end of each sections of foreign material. Manholes shall be installed with either watertight rubber O- rings, preformed flexible joint sealant or preformed plastic gaskets. 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.

4.11.8 Manhole Inverts

The contractor shall construct manhole inverts in conformance with 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.

4.11.9 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 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 add compacted base rock, as specified in these standards, over undisturbed earth under all stub-outs.

4.11.10 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 18"above 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 24 inches. In designated floodplain areas, all manholes shall be at an elevation of at least 2 feet greater than the 100-year storm event.

4.11.11 Types of Connections

I. Connections to New Manholes

   The contractor shall connect storm sewers to new manholes at the locations shown on the plans. All pipes entering or exiting the manhole shall be water tight. Connection shall be done using a rubberized, core-seal boot. The connection shall be grouted smooth on both the interior and exterior of the manhole.

II. Connection to Existing Manholes

   The contractor shall connect storm 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.

III. Manholes Over Existing Sewers

   a. The contractor shall construct manholes over existing operating storm sewer lines at the locations shown on the plans.
   b. Manholes constructed over existing storm 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 the new lines are balled, cleaned, and deflection tested and all portions of the storm line 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.

IV. 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 stormwater entering the manhole shall follow a smooth concrete channel transitioning evenly from the invert of the inlet pipe into the main channel. Stormwater shall not be allowed to fall freely to the manhole base.

4.11.12 Catch Basins

I. Excavation and backfill shall conform to the requirements of Section 6.
II. Bedding: The contractor shall remove all water and debris from the excavation area, and shall install an 8-inch-minimum layer of compacted 3/4 ”-0” crushed aggregate for a base.
III. Cast-in-Place: Cast-in-place catch basins shall have a minimum of 18 inches of concrete between the compacted crushed aggregate and the lowest invert. The forms used for cast-in-place catch basins shall be tight and well-braced. The storm pipe material shall extend into the poured concrete of the catch basin. All corners shall be chamfered. Immediately after placement, the concrete shall be consolidated with an approved vibrator. The top surface shall be screed, and exposed surfaces shall be troweled to a smooth finish, free from marks or irregularities. After forms are removed, the contractor shall patch any defects in the concrete with approved material.
IV. Precast: After the base is prepared, the contractor shall set the precast catch basin to the proper line and grade. The storm pipe material being used shall connect to the precast catch basin.
V. Inverts, Stub-outs, and Sections: Contractor shall clean the ends of all pipes and sections that contact the catch basin. All inverts, stub-outs, and sections shall be installed according to these standards, using a high-strength, non-shrink grout meeting ODOT SSC Section 0208.40, “Non-Shrink Grout,” such as Alcrete Twenty Minute Fast Setting Grout®, or approved equal, making sure all sharp edges or rough sections are removed, to prevent obstruction of the flow. Unused grout shall be discarded after 20 minutes and shall not be used.
VI. Catch Basin Steps: All catch basins deeper than 5 feet, measured from the top of the frame to the flow-line, shall be oversized and have steps.

4.11.13 Line and Grade

I. Survey control hubs for both line and grade shall be provided by the design engineer.
II. Variance from the established line and grade shall not be greater than 1/4 inch for grade and 1/2 inch for line, provided that such variation does not result in a level or reverse-sloping invert.
III. 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.
IV. 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.

4.11.14 Pipe Handling

I. The contractor shall unload pipe only by approved means. Pipe shall not be unloaded by dropping it to the ground and pipe shall not be dropped or dumped into trenches.
II. Pipe shall not be unloaded or stored within the public right-of-way unless approved by the City's authorized representative.
III. 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.
IV. 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.
V. The contractor shall lower the pipe into the trench in such a manner as to avoid any physical damage to the pipe.
VI. The contractor shall remove all damaged pipe from the job site.

4.11.15 Foreign Material

I. The contractor shall take all necessary precautions to prevent excavated or other foreign material from entering the pipe during the laying operation.
II. 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.

4.11.16 Pipe Laying

I. Trench excavation shall be in accordance with Section 6.
II. Pipe laying shall proceed upgrade, with the spigot ends pointing in the direction of flow.
III. 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.
IV. 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.
V. The joint shall be assembled according to the recommendations of the manufacturer. The contractor shall provide all special tools and appliances required for the joint assembly. The contractor shall take care to properly align the pipe before forced entirely home.
VI. 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.

VII. 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 per direction from the City.

VIII. After the joint is made, the pipe shall be checked for alignment and grade.

IX. The trench bottom shall form a continuous and uniform bearing and support for the pipe at every point between joints.

X. 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.

XI. Do not lay pipe in water or when, in the opinion of the City's authorized representative, trench conditions are unsuitable.

4.11.17 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 springline of the pipe without re-compacting the pipe zone.

4.11.18 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.

4.11.19 Concrete Closure Collars

I. The contractor shall pour closure collars against undisturbed earth, remove all water from the excavation, and construct suitable forms to obtain shapes that will provide full bearing surfaces against undisturbed earth.

II. Closure collars shall be used only when approved by the City's authorized representative, and then only to make connections between dissimilar pipe or where standard rubber-gasketed joints are impractical.

III. 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.

4.11.20 Trench Backfill

The contractor shall place trench backfill in accordance with Section 6.

4.11.21 Storm Sewer Laterals and Tees

I. Lateral storm sewers shall be connected to new storm sewer mains with manufactured tee fittings.

   a. Install storm sewer laterals and tee fittings in accordance with Drawing No. 423 of these standards.

b. Lateral pipe and fittings shall consist of one type of material throughout and no interchanging of pipe and fitting material is allowed.

II. Line Taps

a. Line taps are allowed on existing storm sewer lines only and shall be core- drilled unless otherwise approved by the City's authorized representative. Core-drilled holes shall be made using a cylinder-style hole saw for plastic pipe material only, or a diamond core bit for concrete and ductile iron pipes.
b. Line tap connections to storm lines shall be located a minimum 12" from the storm mainline pipe bell.
c. PVC tee saddles shall be installed in accordance with these standards.
d. Line taps shall be centered on the spring line of the pipe being tapped.
e. The area around the line tap installation site shall be cleaned and free of all rough edges before installing the 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 3/4"-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 the pipe crown.

4.12 Construction Specifications

4.12.1 General Provisions

The specifications outlined 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 gravity-flow portions of public storm systems.

4.12.2 Scheduling

I. The contractor shall plan their construction work in conformance with Section 1.13.
II. Newly installed storm sewer lines shall not be placed in service until necessary testing is complete and system has been approved by the City's authorized representative.

4.12.3 Interferences and Obstructions

Various obstructions may be encountered during the course of the work. The contractor shall follow the guidelines established in Section 1.14.

4.12.4 Abandon Storm Facilities

I. Storm Sewer Pipe
Storm sewer pipe facilities to be abandoned shall be cut off and completely removed at 48-inches minimum below finish grade, unless specifically stated otherwise. Storm sewer pipe to be abandoned shall be removed or completely filled with a flow-able, Controlled Low-Strength Material (CLSM) as directed by the City's authorized representative.

II. 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 rubberized 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.

4.12.5 Preservation, Restoration, and Cleanup

I. 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 1.15.

II. Preservation of Drainage Ditches

After backfilling the trenches, the contractor shall restore all public and private storm drain ditches that were destroyed, damaged, or otherwise modified during construction to the condition of the ditch before construction. Ditches shall be built in their original locations unless otherwise redesigned as part of the project.

4.13 Testing

4.13.1 General

I. The contractor shall furnish all necessary testing equipment and perform the tests in a manner satisfactory to the City's authorized representative.

II. All gravity storm systems shall be inspected and tested after backfill has passed the required compaction test(s) based on AASHTO T-180 and roadway base rock has been placed, compacted, and approved. All details of testing procedures shall be subject to approval of the City's authorized representative.

III. If repair work is required on a section of the system, that portion of the system shall be retested.

IV. Deflection testing shall be done in the presence of the City's authorized representative.

V. All testing shall be completed and accepted by the City's authorized representative before paving of overlying roadways will be permitted.

VI. Prior to the start of storm 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.

4.13.2 Line Cleaning

I. 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 storm sewer system.

II. 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. No material shall be flushed into the downstream city storm sewer system.

4.13.3 Deflection Test for Flexible Pipe

Storm systems 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 and after the line is completely balled and flushed with water, and after compaction tests of backfill are completed and accepted. Testing shall be conducted in the presence of the City's authorized representative. The contractor shall 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. Any mechanical device meant or intended to come into contact with the pipe material in an attempt to re-round the pipe is strictly prohibited.

4.13.4 Video Inspection of Gravity Systems

I. All storm 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 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.

II. 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 and re-video inspected.

4.13.5 Locate Wire Testing

Prior to paving, the contractor shall notify the City's authorized representative that the storm sewer locate wire is ready for testing. Contractor personnel shall connect to the locate wire and attempt to locate storm sewer system piping, including services. All points of the storm sewer system piping 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.

4.14 Acceptance

The City of Newberg will accept new stormwater and surface water installations or systems built to the "Public Works Standards and Section 1.16.

Section 5 Streets

5.1 Performance Standards

All street designs shall provide for the safe and efficient travel to the motoring public. Streets shall be designed to carry the recommended traffic volumes identified for each street classification. Street classifications are set forth in the City of Newberg Transportation System Plan (2005) and the Newberg Development Code.

Streets shall be designed to meet or exceed the minimum guidelines set forth in the "AASHTO Policy on Geometric Design of Highways and Streets" (latest edition). Traffic Control Devices shall conform to the "Manual on Uniform Traffic Control Devices for Streets and Highways," Federal Highway Administration, with Oregon Supplements, Oregon Department of Transportation (latest edition).

All vertical and horizontal curves shall meet the guidelines of the AASHTO Policy and the design speed for each street classification.

5.2 Right-of-way and Pavement Width

Please refer to City of Newberg Development Code.

5.3 Access

Please refer to City of Newberg Development Code.

5.4 Traffic Analysis

The City Engineer will require a traffic analysis report as determined by the type of development and its potential impact to existing street systems. A traffic analysis will generally be required for a development:

I. When it will generate in excess of 40 trips per p.m. peak hour, or
II. When a development's location, proposed site plan, and traffic characteristics could affect traffic safety, access management, street capacity, or known traffic problems or deficiencies in a development's study area.

The report shall be prepared by a licensed traffic engineer in the State of Oregon. At a minimum, the report shall contain the following:

I. Purpose of Report and Study Objectives

A discussion of key traffic issues to be addressed and the transportation system and development objectives related to a specific development.

General transportation system objectives are:

I. To provide safe and effective transfer of vehicle traffic between the site and the street system;
II. To maintain easy and safe traffic flow on surrounding street system;
III. To provide convenient, safe and efficient on site and off site movement of vehicles, pedestrians, transit, service and delivery vehicles, and bicycles;

IV. To effectively mitigate adverse site generated traffic impacts on affected streets and intersections. Site specific objectives may be established by the City for each study.

5.4.1 Executive Summary

A concise summary of the study purpose/objectives, site location and study area, development description, key assumptions, findings, conclusions and recommendations.

5.4.2 Description of Site and Study Area Roadways

Anticipated nearby development and committed roadway improvements, which would affect future traffic in the study area.

5.4.3 The study area will be defined by

All roads, ramps, and intersections through which peak hour site traffic composes at least 5% of the existing capacity of an intersection approach, or roadway sections on which accident character or residential traffic character is expected to be significantly impacted.

5.4.4 On site Traffic Evaluation

An evaluation of the proposed (and alternative) site access locations, the adequacy of access drive depth, driveway lanes, and queuing storage, the safety and efficiency of proposed vehicular circulation, parking layout, pedestrian and service vehicle routes/facilities, together with recommendations for onsite traffic markings and controls.

5.4.5 Technical Appendix

A technical appendix including worksheets, charts, and drawings to support findings described in the body of the report.

5.4.6 Recommendations for Public Improvements

Recommendations should be made for external roadway improvements, such as additional through lanes and turn lanes, and traffic control devices necessitated as a result of the development. Recommended improvements to transit facilities, and pedestrian and bike circulation should also be reported.

The recommendations should specify the time period within which improvements should be made, particularly if improvements are associated with a phased development, the estimated cost of improvements, and any monitoring of operating conditions and improvements that may be needed. If needed street improvements unrelated to the development are identified during the analysis, such improvements should be reported.

5.4.7 Access Management

On sites with arterial and major collector street frontages, the report shall evaluate and recommend the use of access management plans or techniques:

I. To separate basic conflict areas (reduce number of driveways or increase spacing between driveways and intersections).

II. To remove turning vehicles or queues from the through lanes (reduce both the frequency and severity of conflicts by providing separate paths and storage area for turning vehicles and queues).

These techniques may include turn restrictions, striping, medians, frontage roads, channelization of lanes or driveways, shared driveways and access between similar uses, access consolidation, lanes for left or right turns, and other transportation system management (TSM) actions.

5.4.8 Offsite Traffic Evaluation

Offsite traffic should include:

I. Existing daily and P.M. peak hour counts by traffic movements at intersections effected by generated traffic from the development (use traffic flow diagrams).
II. Projected daily and P.M. peak hour volumes for these same intersections and proposed access points when the development is in full service. (Use traffic flow diagrams)
III. A determination of the existing levels of service and projected levels of service at each intersection and access points studied.
IV. A discussion of the need for traffic signals. This should include a traffic warrant computation based on the latest edition of National Manual on Uniform Traffic Control Devices.
V. The recommendations made in the report should be specific, and should be based on a minimum level of service "D" with maximum volume to capacity (v/c) ratio of 0.90 when the development is in full service. As an example, if a traffic signal is recommended, the recommendation should include the type of traffic signal control and what movements should be signalized. If a storage lane for right turns or left turns is needed, the recommendation should include the amount of storage needed. If several intersections are involved for signalization and an interconnect system is considered, specific analysis should be made concerning progression of traffic between intersections.
VI. The report should include a discussion of bike and pedestrian usage, safe route to schools, and the availability of mass transit to serve the development.

5.5 Intersections

Connecting street intersections shall be located to provide for traffic flow, safety, and turning movements, as conditions warrant. Where signalized, design shall provide for optimal signal phasing. Consideration for arterial street progression, protected/permitted and permitted left turn phasing shall occur. New signal proposals in remote locations shall first include an evaluation of alternate applications such as roundabouts.

5.5.1 Arterial Intersections

Exclusive left and right turn lanes will be provided; bus turnouts will be provided if traffic flow and safety conditions warrant; designated crosswalks will be provided at controlled locations; street alignments across intersections shall be continuous.

5.5.2 Minor Collector and Local Street Intersections

Street and intersection alignments should facilitate local circulation but avoid alignments that encourage non local, through traffic.

Streets shall be aligned so as to intersect at right angles (90°). Angles of less than 75° will not be permitted. Intersection of more than two streets at one point will not be permitted.

New streets shall intersect with existing street intersections so that center lines are not offset, except as provided below. Where existing streets adjacent to a proposed development do not align properly, conditions may be required of the development to provide for proper alignment.

For intersections which are not directly aligned with street center lines, the centerline spacing must meet the following minimum separation distance:

Street Class	Intersection Spacing (FT.)*
3 Lane Major/Minor Arterial	300
Major Collector	200
Minor Collector	150
Local/Cul-de-sac	100

*The City Engineer may permit a lesser spacing when comprehensive findings are made to establish that:

I. Without the change, there could be no public street access from the parcel(s) to the existing street, and
II. All other provisions of the street design requirements can be met.

5.6 Half Street Construction

Half street construction is generally not acceptable. Where such a street is justified, the City Engineer will approve the right-of-way and pavement width. In no case shall the pavement width required be less than that required to provide two lanes of traffic to pass at a safe distance. For a 34 foot local street, the half street pavement width will be 22 feet. Half streets will only be approved when the abutting or opposite frontage property is undeveloped and the full improvement will be provided with development of the abutting or opposite (upon right-of-way dedication) frontage property. Half street shall be signed “No Parking” until the full width of the street is improved. A clear 20 feet for travel shall be maintained at all times.

A development on an unimproved street shall be responsible for constructing a continuous, City standard street to a connection with the nearest standard (publicly maintained) street.

5.7 Street Classification

All streets within the City shall be classified as listed in Newberg Transportation System Plan. The classification for any street not listed shall be that determined by the City Engineer.

5.8 Design Speed

Design speeds for classified streets shall be as follows*:

3 Lane Major/Minor Arterial	35 – 45 mph
Major Collector	25 – 35 mph
Minor Collector	25 – 35 mph
Local/Cul-de-sac	25 mph

*Where existing traffic conditions identify speeds in excess of design speeds listed, then the higher speed will be used for design purposes.

5.9 Horizontal/Vertical Curves and Grades

5.9.1 Horizontal Curves

Horizontal curve radius (on centerline) for each street classification shall be designed according to the roadway design speed. The radius shall not be less than the following:

Design Speed (MPH)	Radius (Feet)
25	180’
30	300’
35	450’
40	670’

All horizontal curves shall be designed to the current version of the American Association of State Highway and Transportation Officials (AASHTO) Manual.

5.9.2 Vertical Curves

Vertical curve length shall be based on the design criteria which include:

I. Design speed
II. Crest vertical curve
III. Sag vertical curve - stopping sight distance for crest and sag vertical curves shall be based on sight distance and headlight sight distance, respectively.

All vertical curves shall be parabolic and the length shall be computed for each location and shall be designed to the current version of the American Association of State Highway and Transportation Officials (AASHTO) Manual.

5.9.3 Grades

Maximum grades for each street classification shall be as follows:

Arterial	0.060 ft/ft	(6%)
Major Collector	0.080 ft/ft	(8%)
Minor Collector	0.100 ft/ft	(10%)
Local/Cul-de-sac	0.120 ft/ft	(12%)

Local and cul-de-sac streets may exceed 12%, but in no case permitted to exceed 15%. The City Engineer may approve a grade greater than 12% when all of the following conditions exist:

I. Topographic constraints do not allow the development to be served by a street with a maximum grade of 12% without causing destabilization of soils by excessive cuts and fills.

II. There is no access to the property being developed through adjacent properties at a maximum 12% grade.
III. The section of local street will not exceed a combination of length, horizontal alignment, and/or grades exceeding 12% which will create hazardous traffic conditions.
IV. In no case shall the maximum street grade exceed 15%.

Minimum grade for all streets shall be 0.0050 feet per foot (0.50%) however, in all cases street grades shall allow for proper and adequate drainage. Cul-de-sac "bulbs" shall have a minimum slope of 0.0060 feet per foot (0.60%).

Street cross slopes shall be as shown in street typical section Standard Drawing No. 513.

5.10 Pavement Design

In general, all streets shall be constructed with asphaltic concrete; however, Portland Cement Concrete (PCC) streets are permitted as approved by the City Engineer.

Typical flexible pavement thicknesses will be as shown in Standard Drawing No. 513. This will apply only to local streets and lower classifications.

The Design Engineer will provide a street structural design section for all roadways classified as “Minor Collector” and higher, and for local streets in industrial zones. Minimum standards for roads classified as “Minor Collector” and higher shall be as shown in Standard Drawing No. 527.

5.11 Concrete Curb

All development projects will be required to construct street improvements with concrete curbs. Monolithic curb and gutter, as shown in the Standard Drawings, shall be used on all streets. Curb exposure for monolithic curb and gutter shall be six inches (6") and eight inches (8") at catch basins. Joint spacing in curbs shall be 15 foot maximum for contraction joints and 45 foot maximum for expansion joints. In addition, expansion joints shall be located at all curb return points and at driveway curb-drop transition points.

A minimum of two drainage block outs to accommodate 3" drain pipe shall be provided for each lot. Typically these block outs are located five feet (5') from each side of property line.

5.12 Curb Return Radius

Please refer to City of Newberg Development Code.

5.13 Parking

Street Class	Parking Lanes	Parking Required
3 Lane Major/Minor Arterial	None	Not Allowed
Major Collector	None	Variable (1) (2)
Minor Collector	2	Yes
Local/Cul-de-sac	2	Yes (3) (4)

1. Where bike lanes exist, parking may be prohibited.
2. No parking within 45' of curb return.
3. No parking within 30' of curb return.

4. Local Streets and Cul-de-sacs in areas of steeper topography, which are approved for reduced 32 feet pavement width, will be required to have one parking lane; to assure that on street parking is adequate for adjacent uses, a reduced street design will consider clustered parking bays adjacent to the street, if needed. Parking will not be allowed in reduced radius cul-de-sacs.

For streets designated as "Major Collector" and below, the City Engineer may consider design modifications to conserve major trees in the public right-of-way. Subject to approval by the City Engineer, parking lanes may be removed on one or on both sides of a street.

5.14 Sidewalks

In general, new sidewalks are required for all development requiring a development permit. Where planter strips are required, sidewalks shall be one (1) foot off the right-of-way line (except cul-de-sacs). Where no planter strips are required, sidewalks shall abut curbs. Minimum sidewalk width is five feet.

For streets designated as "Major Collector" and below, the City Engineer may modify design of sidewalk to conserve major trees in the public right-of-way. Include handrails or fences to protect pedestrians when there is a vertical drop of 30-inches or greater adjacent to sidewalk.

5.14.1 Sidewalk Ramps

All new street intersections shall provide sidewalk ramps (for access) that meet the requirement of the Americans with Disabilities Act (ADA). In residential areas the ramp will be located at the midpoint of the curb return. On streets classified above local or cul-de-sac, ramps may be required at different locations within the curb return. It may also be required to construct two (2) ramps at a curb return when a different location is required. Retrofit of existing ramps within the project limit may be required.

Locations of sidewalk ramps shall be designed with regard to storm water flows, street grades, and pole locations. Other factors may also dictate sidewalk ramp location.

See Standard Drawing No. 505 for standard locations.

5.15 Bikeways

The City has adopted the "Newberg Bicycle/Pedestrian Plan." This plan summarizes the City's policy and implementation strategies for bikeways within the City. Follow AASHTO and ODOT standards and criteria as the minimum guidelines for bikeway design, construction, and control.

Use the following guidelines for bikeway improvements:

I. ODOT, "Oregon Bicycle & Pedestrian Plan" (latest edition.)
II. AASHTO, "Guide to Development of Bicycle Facilities" (latest edition.)
III. Manual on Uniform Traffic Control Devices with Oregon supplements by Oregon Transportation Commission (latest edition.)

Bikeway Location, Width

Bikeway Location	Width	Comments
Public Street (Designated bike lane)	6'	Each direction of travel at shoulder/curb

5.15.1 Design Criteria

In general, bikeway design shall meet the adopted standards referred to in Section 5.11.

All bikeways shall have a minimum cross slope of two percent (2%) and a maximum cross slope of five percent (5%). On curved alignments, the cross slope shall be to the inside of the curve.

Bikeway curvature will be based on a minimum design speed of 20 MPH.

Bikeway grades shall be limited to a maximum of five percent (5%). Where topography dictates, grades over five percent (5%) are acceptable when a higher design speed is used and additional width is provided.

5.16 Driveways

Access to private property shall be permitted with the use of driveway curb cuts. The access points with the street shall be the minimum necessary to provide access while not inhibiting the safe circulation and carrying capacity of the street.

On Major Collector streets and above, one driveway per site frontage will be the normal maximum number. Double frontage lots and corner lots on these streets may be limited to access from a single street, usually the lower classification street. If additional driveways on a frontage are approved by the City Engineer, a finding shall be made that no eminent traffic hazard would result and impacts on through traffic would be minimal; restrictions may be imposed on additional driveways, such as limited turn movements, shared access between uses, closure of existing driveways, or other access management actions. Please refer to City of Newberg Development Code.

Driveway approach types shall generally be limited to those shown in the Standard Drawings for residential driveways, and commercial/industrial driveways. Residential driveways shall conform to Standard Drawing No. 508 & 509; commercial/industrial driveways shall conform to Standard Drawing No. 510 & 511. Curb return driveway approaches must be approved by the City Engineer.

Table 5.1 Driveway Widths (Minimum/Maximum in Feet)

Street Classification	Residential Zone	Commercial Zone	Industrial Zone
3 Lane Major/Minor Arterial	NA (1)	NA (1)	NA (1)
Major Collector	12/24 (2)	12/36 (5)	12/40 (5)
Minor Collector	12/24 (2)	12/36 (3)	12/40(3)
Local/Cul-de-sac	12/24 (2)	12/36	(4)

NOTES:

1. Special conditions may warrant access.
2. 28' maximum with 3-car garage (measured at low curb cut)
3. Frontage greater than 130/ft. permitted one additional curb cut.
4. Build to Minor Collector standard.
5. Certain businesses may warrant one additional curb cut for service driveway.

For classification of Major Collector and above, driveways adjacent to street intersections shall be located beyond the required queue length for traffic movements at the intersection. If this requirement prohibits access to the site, a driveway with restricted turn movements may be allowed.

Within commercial, industrial, and multi-family areas, shared driveways and internal access between similar uses are encouraged to reduce the access points to the higher classified roadways; to improve internal site circulation; and to reduce local trips or movements on the street system. Shared driveways or internal access between uses will be established by means of common access easements at the time of development.

Driveway grades shall not exceed twelve percent (12%) from the curb line to the front edge of setback (Type "A") sidewalk.

5.17 Street Lighting, Trees, Names and Signage

5.17.1 Street Lighting

Utility infrastructure may not be placed within one foot of a survey monument location noted on a subdivision or partition plat, per ORS 92.044 (7).

I. General Design

a. All street lighting shall be designed using the American National Standards Institute (ANSI), Illuminating Engineering Society of North America (IESNA), National Electrical Code, Oregon Amended (NEC) and Portland General Electric (PGE) unless otherwise amended by these Standards or City Engineer.
b. All electrical components shall be lab approved from labs accepted by the State of Oregon or Underwriter's Laboratories, Inc. (UL).
c. All street light plans shall include model number for intended material used which includes but not limited to; conduit, wire, junction box, precast foundation, transformer/unmetered distribution panel/controller, pole, LED Luminaire, photoelectric control, and shall also include plan layout with all electrical components included. Plans may require P.E. Certification. All materials shall be on the latest PGE Approved Materials List, be approved by the City Engineer.
d. The Contractor shall be responsible to provide all required traffic control during system installation and follow workmanship conforming to the National Electrical Safety Code (NESC), and Standards for the American Society for Testing and Materials (ASTM).
e. The Contractor shall be responsible for making arrangements with PGE for installation and connecting the street lighting system to the local distribution system, and following all installation requirements specified by PGE.
f. For installation of new street lighting on an existing street lighting system, contact the City Engineer.
g. All street light poles should be located near property lines and at least 25 feet from any street trees, unless otherwise approved in writing by the City Engineer.
h. The Design Engineer shall submit a copy of the approved lighting plan to the City before commencement of any onsite or offsite work.
i. The Contractor shall submit a copy of the final electrical inspection to the City prior to City acceptance of the street light system. This shall include City inspections and a specified burn in test.
j. The City and the appropriate natural resource agencies shall determine whether or not

lighting shall be provided for shared-use paths in designated natural resource and wildlife areas.

k. All street lights shall be Option "C" as defined below unless otherwise approved in writing by the City Engineer. The Public Works Director will have to approve any alternative street illumination options (A or B) with PGE prior to approving site work construction plans.

Lighting Levels Illumination On The Horizontal

	Minimum Average Maintained Foot Candles		
Roadway Classification	Low Pedestrian Usage (Residential)	Medium Pedestrian Usage (Mixed-use)	High Pedestrian Usage (Commercial)
Local	0.5	0.7	1.0
Collector	0.7	0.9	1.2
Arterials	1.0	1.4	2.0

*Intersections shall be double the levels shown above.

II. Conduit

a. Schedule 40 PVC or better shall be used on all raceways.
b. All conduit shall be mandrel tested prior to conductor placement.
c. All conduit shall be a minimum 2 inches.
d. Plug or cap all conduit ends until wiring is installed. After wiring is installed install duct seal compound or precut closed cell polyethylene foam that will prevent debris from entering the conduit system.
e. Conduit shall be between 4 and 6 inches below the bottom of the junction box. All conduit shall enter through the bottom of the junction box and enter the box from the direction of the raceway.

III. Wire

Streetlight Wire: Underground or In Pole	
Streetlight Wire	**Description**
#10 CU 3-Conductor (00036) **(Contact PGE for Suppliers)**	#10 AWG, 600 Volt. 3-Conductor, Class B Stranding, Type TC. With Sunlight-Resistant 45-mil PVC Jacket. Suitable for direct burial installations. Insulation to be black, red, and green per NEMA WC-7 for NEC applications (TFN, THWN, THHN), with fillers or binding tape added to produce round outer jacket rated 90 C dry and 75 C wet 1,000 ft NR reels. Jacket to display sequential footage markings, 2 reel labels, one attached to the outside flange surface, one attached to the drum wrapping: each to detail total footage, inside or starting footage.

a. Pull all wire by hand and on a straight line with the conduit opening to prevent damage to insulation. If pulls are made with poles or cabinet in place, use a pulley device to achieve a straight pull or conduit end bells.
b. Clearly label all conductors with associated circuits in the junction boxes, panels, and all splice points. Color coding of each conductor shall remain consistent throughout the entire system per NEC. All splices shall be moisture and water proof by using either a heat shrink tubing with pre-applied sealant or electrical insulating rubber

tape overwrapped with electrical vinyl tape. Each splice shall be sealed separately.

c. All poles, metal junction boxes, and cabinets shall be grounded. Grounding rods shall be driven into native dirt material at least 6 inches. Placement of grounding rods into granular aggregate instead of native dirt is not acceptable.

IV. Junction Box

a. All junction boxes shall be reinforced precast concrete with tamper resistant fasteners, and shall be stamped "Street Lighting."
b. All boxes shall be flush with finished grade and no more than 3 feet from the pole it serves. Boxes may serve more than one pole.
c. All junction boxes shall have a base of 3/8-inch – 0-inch pea gravel in the bottom of the junction box for water drainage 6 inches deep minimum; ¾-inch – 0-inch crushed rock is acceptable for a sub-base under the pea gravel. Any contaminated pea gravel shall be removed prior to City final approval.
d. Feet of slack shall be coiled up neatly inside junction boxes.

V. Foundation

a. A precast lamp pole footing shall be provided that meets or exceeds that of the Oldcastle Precast "20R-LB-5" specifications.
b. Cast in place footings shall be pre-approved by City Engineer and be stamped by a PE in that trade. A City inspection shall be required of every concrete pour.

VI. Transformer / Unmetered Distribution Panel / Controller / Distribution

a. A single phase, 3 - #10 AWG, 240 volt, dedicated unmetered service shall be provided by the developer for street lighting.
b. In systems with lights on both sides of the street, the circuitry shall be designed such that the lights on one side of the street can be "de-energized" without affecting the operation of the lights on the opposite side of the street.
c. Drawing No's of the street lighting controller cabinet and system shall be submitted to the City Engineer for approval prior to fabrication.

VII. Pole

a. All poles shall pre-approved by City Engineer and have a hand hole 4 feet above finished grade and be at 90 degrees from the mast arm.
b. All poles shall be "Valmont" model number "1MA0632S-220840705T4" or approved equal with similar manufacture's specifications.

VIII. LED Luminaire

a. LED Luminaire shall be approved by City Engineer.
b. Luminaire shall be a "cobrahead" style.
c. LED Luminaire shall have no less than a 7000 Lumens and no less than 30 LEDs.
d. City Preference is "Leotek" GC1 series.

IX. Photoelectric Control

a. All street light circuits shall be controlled by a single photocell installed on the street light fixture closest to the controller cabinet.
b. Photocontrol shall be pre-approved by the City Engineer and be brand "Dark to Light" or approved equal.

5.17.2 Street Trees

Please refer to City of Newberg Development Code.

5.17.3 Street Names and Traffic Control Signage

Signs will conform to current City Sign Standards.

The City's Planning Division, prior to recording of any maps or plats will approve street names for all new development. The city planner shall refer proposed street names to the Newberg Fire Department for their consideration.

Street names and building numbers shall conform to the established grid system(s) in the City and metropolitan area. No new street name shall be used which will duplicate or be confused with the name of existing streets within the Newberg Fire District.

5.18 Permanent Dead-end Streets

A standard cul-de-sac turnaround shall be provided at the end of a permanent dead end street that does not provide looped circulation. Permanent dead end streets shall be limited to serving no more than twenty five dwellings and shall not exceed four hundred feet in length from the point of the nearest centerline/centerline intersection.

A permanent dead end street is measured from the right-of-way line at the nearest intersecting street which has at least two points of access, to the right of way line at the furthest end of the dead end street. Exceptions to the dead end street standard must comply with the Newberg Development Code.

An existing dead end street system which is more than 600 feet long or which serves more than 25 dwelling units may be terminated in a cul-de-sac if no Future Street Plan has been adopted and the following criteria are met:

I. Alternative emergency vehicle access or fire protection is provided satisfactory to the Manager; and,
II. Neighborhood traffic circulation needs are not adversely impacted by the proposed cul-de-sac termination of the street.

5.19 Alleyways and Private Residential Streets/Access ways

5.19.1 Alleyways

Alleyways may be provided in commercial and industrial developments with approval by the City Engineer. When approved, alleyways shall be dedicated to the City. The right-of-way width shall be 20 feet with a 20 foot pavement width.

Design for alleyways shall meet the same criteria as other public streets. The exception to those criteria may be centerline radius and design speed. Generally, alleyways shall be designed for one way operation.

5.19.2 Private Streets

Private streets are not allowed, refer to Newberg Municipal Code.

5.19.3 Limited Residential Streets

Design for limited residential streets shall meet the same criteria as other public streets including structural section and materials.

The conditions for usage as set forth in the Newberg Development Code specify factors that will be reviewed by the governing body in determining feasibility.

5.20 Local Street Design for Adverse Topography

Local streets shall have a minimum cross section slope of 2.5% ("crown") in accordance with Standard Drawing No. 513, except in situations of adverse topography. The Design Engineer may utilize an "offset" or unequal crown section when the existing ground slope exceeds 8.00% across the roadway section.

The offset crown design shall meet the following conditions:

I. Minimum distance from "crown" to (one) face of curb is 10 feet.
II. Maximum cross slope of pavement is 5.00%.
III. Maximum differential in top of curb elevation from one side to the other is 1 foot.

The existing ground "side slope" criteria are based on the relationship of the slope of the ground to the transverse slope of the roadway profile. This relationship shall be met for the entire length of the roadway alignment utilizing an offset.

5.21 Five Year Moratorium Street Cut Replacement Guidelines

The City of Newberg has enacted a five-year moratorium on all new pavement surfaces. This will include overlays, inlays, reconstruction, and new construction of at least a half street or greater.

Anyone applying to open cut a moratorium street for utility connections, upgrading/repair of subsurface facilities or new street connection shall apply for the appropriate permit through the City of Newberg Engineering Services Department.

If the permit is approved, the applicant shall adhere to strict reconstruction guidelines to achieve the following goals per Section 5.22:

I. Minimize pavement degradation
II. Maintain structural integrity of street
III. Maintain a smooth riding surface
IV. Limit visual impact and perceptions

5.22 Trench Restoration Requirement

The actual trench cut shall be repaired as per standard drawing number 517. Asphaltic concrete shall be replaced in a minimum of 2 lifts and be at least 91% of rice theoretical maximum density as determined in conformance with AASHTO T-209.

5.22.1 Moratorium Repair

After performing trench cut restoration, a 2" grind/inlay for a distance of 1' per posted mile per hour (mph) each direction from the cut is required. The extent of surface grind/inlay width will be as follows:

I. A single lane that is impacted will have full restoration for the width of the lane
II. If multiple lanes, the full width of those lanes shall be restored
III. If impact extends past the centerline, all lanes curb to curb shall be restored
IV. All inlayed asphaltic concrete shall be placed with a self-propelled slip form paver. Drag boxes shall not be used
V. All tie-in joints to existing asphaltic concrete surfaces shall be sealed with rubberized asphalt emulsion (hot or cold)
VI. All striping removed by grinding shall be replaced with thermoplastic. All symbols, emblems, arrows, letters and bars shall be pre-formed thermoplastic

5.22.1 Striping Restoration

All striping removed by grinding shall be replaced with thermoplastic. All symbols, emblems, arrows, letters and bars shall be performed thermoplastic

5.23 Intersection Sight Distance

It is the policy of the City to have the applicant's Project Engineer evaluate safe intersection sight distance using the principles and methods recommended by the current edition of AASHTO. This policy shall apply to the design of new streets and driveways, and to the placement of any object in the public right-of-way, including landscaping features. Unless superseded by the current version of AASHTO, the following minimum standards shall apply:

I. Intersection (and Driveway) Sight Distance: The following table is for intersection and driveway sight distances:

Intersection Sight Distance Design Speed (MPH)	Minimum Intersection Sight Distance (Feet)
15	145
20	195
25	240
30	290
35	335
40	385
45	430

Source: American Association of State Highway and Transportation Officials, A Policy of Geometric Design of Highways and Streets 2001, Fourth Edition, (based on AASHTO Case B2 and B3).

Sight distance shall be determined for each street approach to an intersection. A driver on the approach street should be able to see each vehicle on the intersecting street from the time that the vehicle is the sight distance from the intersection until the time that the vehicle reaches the intersection. Poles, trees, and similar obstructions will be allowed within the sight distance area only if it can be shown that such obstructions do not prevent the continuous view of the vehicle approaching on the intersecting street.

For purposes of this calculation, the driver's eye is assumed to be 15 feet from the near edge of the nearest lane of the intersecting street, and at a height range of 3.5 feet to 7.6 feet above the approach street pavement. The sight distance criteria should be met throughout the range of driver's eye heights. The top of the vehicle on the intersecting street is assumed to be 3.5 feet above the cross-street pavement.

The traffic speed used in the calculation shall be the highest of the following:

1. The design speed of the intersecting street;
2. The posted speed of the intersecting street; or
3. The measured 85th percentile speed of the intersecting street. Where the intersecting street is controlled by a stop sign or yield sign, a design speed of zero may be assumed.

Where traffic signal control exists at an intersection or where a traffic signal is likely to be installed in the future, adequate sight distance shall be provided for potential right turns on red. In some locations, maintenance of the required sight distance may require restrictions to potential development outside the public right-of-way. The Project Engineer shall demonstrate that adequate restrictions are in place (and enforceable by the City such as sight distance easements) to assure that the required sight distance can be maintained in the future.

At the time of construction plan submittal, the project engineer shall submit a stamped intersectional sight distance report for each new or modified intersection by a development which generally includes a sketch, calculations, narrative, and photographs, for review by the City.

No modifications or exceptions to these standards shall be allowed unless approved by the City Engineer.

5.24 Material Specifications

5.24.1 Granular Fill

I. 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.

II. The leveling course shall consist of 3/4"-0" grade crushed aggregate material, and be a minimum thickness of 2 inches when compacted.

III. 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.

IV. Gradation requirements of the crushed aggregate shall be in conformance with Table 5.3. Sieve analysis shall be determined according to AASHTO T-27.

5.24.2 Asphalt Concrete

I. Courses of asphalt concrete pavement shall consist of the following unless otherwise specified by the design engineer and approved by the City Engineer.

II. The wearing surface of AC pavement shall consist of 1 1/2" Hot Mixed Asphalt Concrete (HMAC), conforming to ODOT SSC Section 00745; "Asphalt Concrete Pavement (ACP)".

III. The base courses for AC pavement shall consist of 1 1/2" Hot Mixed Asphalt Concrete (HMAC) conforming to ODOT SSC Section 00745, "Asphalt Concrete Pavement (ACP)".

IV. The AC pavement shall be either Level 2 or Level 3 ACP, as determined by Section 5.10.

V. Asphalt cement shall be 85-100 penetration paving asphalt conforming to ASTM D- 946.

VI. 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.

VII. Warm Mix Asphalt Concrete (WMAC) shall incorporate the additives or processes listed in Table 5.4.

Table 5.3 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 5.4 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
Redie-Set WMX	Chemical Additive	Akzo Nobel Surfactants, Inc.
Sasobit	Organic Additive	Sasol Wax Americas, Inc.
Plant Foaming Equipment	Foaming Process	Various Suppliers

5.24.3 Portland Cement Concrete

Concrete shall have a minimum compressive strength of 3300 psi, 28 days after placement. An air-entraining admixture shall be used. Entrained air (percent of volume) range shall be 4% to 7% (ASTM C138, C173 or C231). The maximum water/cement ratio shall be 0.52 and the slump range shall be

between 3 and 5 inches (ASTM C143). Temperature of the concrete at time of placement shall range from 50°F to 90°F (ASTM C1064). Concrete aggregates shall conform to ASTM C33 requirements.

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.

Reinforcement steel shall conform to ASTM A-615, Grade 40, deformed bars.

5.25 Construction Specifications

5.28.1 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.

5.25.2 Scheduling

The contractor shall plan their construction work in conformance with Section 1.13.

5.25.3 Interferences and Obstructions

Various obstructions may be encountered during the course of the work. The contractor shall follow the guidelines established in Section 1.14.

5.25.4 Trench Excavation, Preparation, and Backfill

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

5.25.5 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.

5.25.6 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 1.15.

5.26 Workmanship

5.26.1 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.

5.26.2 Clearing and Grubbing

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.

Erosion-prevention and sediment-control measures shall be installed before the start of clearing and grubbing. 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.

5.26.3 Subgrade

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

I. The subgrade shall be firm and free of roots and deleterious materials.
II. 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 5.29.4.

5.26.4 Base and Leveling Course

Base and leveling course shall consist of crushed aggregate as specified in Section 6.2.3.

I. 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.
II. Material shall be compacted to 91% of the maximum dry density, as determined by AASHTO T-180 and acceptable testing reports provided to the City.
III. 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.

5.26.5 Construction Procedure

I. 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 6.2.3. Base rock shall be approved by the City's authorized representative prior to placement of asphalt concrete, Portland cement concrete or Segmental Concrete Pavers.

II. 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.
III. PCC for concrete pavement shall conform to Section 5.24.3.
IV. Portland cement concrete whose batch time exceeds 90 minutes and has not yet been placed may be refused by the City's authorized representative.

5.26.6 Curb and Gutter

I. Curb and gutter shall be installed as per Drawing No. 501 of these standards with asphalt pavement.
II. When medians are specified, curb and gutter shall be installed as per Drawing No. 502 of these standards.
III. 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 has been attained; this includes installation of adjacent asphalt pavement.
IV. Curb and gutter jointing shall match adjacent PCC street pavement jointing. Joint locations shall be installed per Drawing No. 501.

5.26.7 Asphalt Pavement

I. Prime Coat
After the leveling course is compacted, an asphalt prime coat 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.
II. 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. 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.
III. Thickness
Minimum total thickness of AC shall be 3 inches placed in two 1 1/2-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.
IV. Placement
Asphalt concrete shall be placed according to the following minimum requirements.
    a. Prior to placing asphalt concrete, all cold edges of existing asphalt concrete shall be saw cut to provide a clean joint to pave against.
    b. 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.
    c. The longitudinal joints in any layer of pavement shall be offset from those joints in layers below by not less than 1-foot.
    d. 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.

V. Compaction

Compact asphalt concrete in accordance with the following minimum requirements.

a. Roll asphalt concrete with power rollers capable of providing compression of 350 pounds per linear inch.
b. 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.
c. AC pavement shall be compacted to a minimum of 91% relative density, based on the theoretical maximum density determined in accordance with ASTM D-2041, "Rice Gravity."

VI. 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.

5.26.8 Driveways

I. Construct residential driveways in accordance to Drawing No. 508 & 509 of these standards.
II. Construct commercial driveways in accordance to and Drawing No. 510 or 511 of these standards.
III. 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 has been attained; this includes installation of adjacent asphalt pavement.

5.26.9 Sidewalks

I. Construct new sidewalks in conformance with Drawing No. 503 & 504 of these standards.
II. Sidewalk repairs, replacement or reconstruction shall be in conformance with Drawing No. 503 & 504 of these standards.
III. ADA ramp repairs, replacement or reconstruction shall be in conformance with Drawing No. 505, 506 & 507 of these standards.
IV. 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.
V. Barriers shall be installed in conformance with Drawing 108.

5.26.10 Testing

I. 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 91% relative density, based on the theoretical maximum density determined in accordance with ASTM D-2041, "Rice Gravity."

II. 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.

III. Testing Frequency
City reserves the right to direct testing agency on frequency of testing.

5.26.11 Weather Conditions

I. 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 40F and rising.

II. 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.

III. 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 and ensure all pick holes are clean after paving.

5.26.12 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 2-year period.

5.26.13 Rock Surfacing

Where gravel shoulders have been disturbed, place 3/4"-0" crushed aggregate backfill 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.

5.26.14 Surface Restoration

I. 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.

II. Asphalt Concrete Replacement
Base, sub-base, or subgrade material that has been removed shall be replaced with 1 1/2"- 0" base and ¾"-0" leveling crushed aggregate backfill 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 95% of the maximum dry density. Place the leveling course for the full width of the trench where pavement was disturbed, including bituminous surface shoulders.

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 over all trench or excavation areas. No open cuts shall be left overnight. Cold- patch asphalt mix may be used as a temporary patch.

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 Drawing No. 517 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.

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 5 inches or match existing pavement depth, whichever is greater. AC pavement shall be compacted to a minimum of 91% relative density, based on the theoretical maximum density determined in accordance with ASTM D-2041, "Rice Gravity."

a. 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.
b. Within 5 working days after completion of all paving or utility work, the contractor shall repair all cored areas with hot-patch asphalt mix.

All joints and saw-cuts shall be sand sealed within 24 hours of trench and excavation areas repaired with asphalt concrete. Seal material shall consist of hot-applied emulsified rubber slurry seal, supplied and installed in accordance with ODOT SSC Section 00706, "Emulsified Asphalt Rubber Seal Surfacing."

III. 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.
b. Coring
    i. When the pavement surface has been cored, the area shall be repaired as follows:
        1. Base, sub-base, or subgrade material that has been removed shall be replaced with 3/4"-0" crushed aggregate backfill or CLSM. 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 1/8 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.

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.

IV. Sidewalk Replacement

a. Construct sidewalks in accordance with Drawing No. 503 & 504 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 Drawing No. 506 & 507 of these standards.

5.27 Street Names and Traffic Control Signage and Striping

5.27.1 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. Signs are to conform to Drawing No. 523, 524A, 524B, 525A, and 525B.

5.27.2 Traffic Control Signage and Striping

Traffic control signing and striping shall be in conformance with the MUTCD. A "Signage and Striping Plan" shall be included with plan submittals for new street construction and street improvements.

5.28 Street Acceptance Policy

The City of Newberg will accept new public street installations or systems built to the "Public Works Design and Construction Standards," providing that the following conditions are met.

5.28.1 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.

5.28.2 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 1.16.

5.28.3 Maintenance Period

I. The Contractor or Applicant shall be responsible for providing Maintenance Assurance for Public Improvements as outlined in Section 1.16.1.

II. 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.

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 6 Trench Excavation and Backfill

6.1 Definitions

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.

I. "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.
II. "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 or power-operated rock breaking equipment. Boulders or concrete pieces larger than 1 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.

Trench Foundation: The bottom of the trench where the pipe bedding will lie. The trench foundation supports the pipe bedding.

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.

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.

Spring Line: Halfway up the sides of the pipe (horizontal centerline) when the pipe is laid on the pipe bedding.

Haunch: That portion of the pipe below the spring line.

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.

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.

6.2 Materials

6.2.1 Trench Foundation

Trench foundation (as defined in Section 6.1) 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 Drawing No. 201A and 201B.

6.2.2 Aggregates

Aggregate shall be crushed gravel or crushed rock conforming to the following:

I. Grading Requirements: The determination of sizes and grading of aggregate shall conform to AASHTO T27.

Sieve Size Passing	Base 1 ½"	Leveling ¾"
2"	100	
1 ½"	95-100	
1"		100
¾"	55-75	90-100
3/8"		55-75
¼"	35-50	40-60
Fraction Pass ¼"		
#10	40-60	40-60

II. Liquid Limit and Plasticity Index

Test	Test Method	Requirements
Liquid Limit	AASHTO T89	NP or 33 max
Plasticity Index	AASHTO T90	NP or 6 max

% Passing #40 Sieve	Liquid Limit	Plasticity Index
0.0 to 5.0	33	6
5.1 to 10.0	30	5
10.1 to 15.0	27	4
15.1 to 20.0	24	3
20.1 to 25.0	21	2
Over 25.0	21	0 or NP

III. Fracture of Rounded Rock: Fracture of rounded rock will be determined according to ODOT TM 213. Provide at least one mechanically fractured face based on the following percentage of particles retained on the ¼" sieve for the designated size:

Designated Size	Minimum % Retained on the ¼" Sieve
1 ½" – 0 and larger	50
Smaller than 1 ½" - 0	70

IV. Durability: Base aggregate shall meet the following durability requirements:

Test	Test Method	Requirements
Abrasion	AASHTO T96	30% max
Degradation Passing 850um sieve	ODOT TM 208	30% max
Degradation Sediment Height	ODOT TM 208	3" max

6.2.3 Pipe Area

Pipe Bedding: Pipe bedding material shall be Class B backfill in accordance with Section 6.2.4, or as approved by the City's authorized representative.

6.2.4 Pipe Zone

The pipe zone material shall consist of Class B backfill in accordance with Section 6.2.4.

6.2.5 Trench Backfill

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

I. 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.

II. Class B Backfill

Class B backfill shall be 3/4"-0" granular grade crushed aggregate material, unless otherwise approved by the City's authorized representative. The aggregate shall conform to the following.

a. 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.
b. The aggregate shall meet the requirements for fractured faces and durability as specified in ODOT SSC Section 00640.
c. 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.
d. Class B backfill material shall be approved by the City's authorized representative prior to placement.

III. Class D Backfill

Class D 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.

6.3 Construction

6.3.1 Excavation

Clearing and Grubbing: When clearing the right-of-way is necessary, clearing shall be completed before the start of trenching. 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.

6.3.3 Interferences and Obstructions

Various obstructions may be encountered during the course of the work. The contractor shall follow the guidelines established Section 1.14.

6.3.5 Open Trench Limit

I. 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.
II. 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.
III. 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.
IV. Trenches with unstable trench walls shall be backfilled immediately upon verification by the City's authorized representative.
V. 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.

6.3.6 Trench Width

I. 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.
II. 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 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.

III. 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.
IV. 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.

6.4 Grading

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.

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.

6.5 Rock Excavation

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.

Excavations below subgrade in rock shall be backfilled to subgrade with Class B backfill material, in accordance with Section 6.2.4 and compacted to not less than 95% of its maximum dry density as determined by AASHTO T-180.

6.6 Explosives

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

6.7 Installation

6.7.1 Shoring

I. 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.

II. 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.

III. 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.

IV. The use of horizontal strutting below the barrel of pipe, or the use of pipe as support for trench bracing, will not be permitted.

6.7.2 Dewatering

I. 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.

II. 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.
III. Dewatering systems shall be discharged to a storm water detention/retention facility unless otherwise approved by the City's authorized representative and never through the pipe being installed.
IV. 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/flocculants where its use has been approved.
V. Filtering devices need to be inspected frequently to make sure they are functioning properly.
VI. Filtering devices shall be filled in or otherwise removed when they are no longer necessary.

6.7.3 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.

6.7.4 Trench Foundation

I. 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.
II. The contractor shall backfill the trench to the subgrade of the pipe bedding with Class B backfill in accordance with Section 6.2.4, over the full width of the trench, and shall compact in layers not exceeding 6 inches deep.
III. Fill material shall be compacted to not less than 95% of its maximum dry density, as determined by AASHTO T-180.

6.7.5 Pipe Bedding

I. Class B backfill in accordance with Section 6.2.4, shall be placed under all pipes.
II. 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.
III. 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.

IV. 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.

V. 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.

6.7.6 Backfill in Pipe Zone

After the pipe is in place and ready for backfilling, place Class B backfill, in accordance with Section 6.2.4, 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.

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

6.7.7 Trench Backfill

I. 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.

II. If the required compaction density cannot be obtained, the contractor shall remove the backfill from the trench and re-compact. 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.

III. Within the public right-of-way, trench backfill shall consist of Class B backfill.

IV. The City‘s authorized representative may approve the use of Class D backfill, CLSM, material for trench backfill above the pipe zone.

6.7.8 Native or Select (Class A) Backfill

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.

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 compacted so that no settlement will occur.

6.7.9 Granular (Class B) Backfill

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.

Compact the trench backfill material within 2 feet of road base rock grade to not less than 91% 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.

6.7.10 Controlled Low-Strength Material (Class D) Backfill

I. Controlled Low-Strength Material (CLSM) shall meet the requirements Section 6.2.4.
II. Backfill the trench above the pipe zone with CLSM to the bottom of the proposed surfacing. No compaction of the CLSM is allowed.
III. 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 be preapproved and installed with proper signage per the MUTCD.

Appendix A

PLANTING REQUIREMENTS

A1.0 INTRODUCTION

A1.1 General

The City recognizes the need to improve water quality and preserve aquatic species. To meet the intent of both the federal Clean Water and the Endangered Species Acts, the City developed requirements for planting Stormwater Facilities.

Successful vegetation of Stormwater Facilities is key for the benefit of water quality and quantity management, and aquatic species preservation. This Appendix aids professionals, the development community, and field crews in planning, designing and implementing successful vegetation projects. This document guides design decisions to promote successful planting efforts, while allowing flexibility to address opportunities and constraints at each site.

A1.2 Jurisdiction

Most Sensitive Areas are regulated by the Department of State Lands (DSL) and/or the U.S. Army Corps of Engineers (Corps). Where the Corps and/or DSL permit mitigation, planting plans for these areas shall follow DSL and Corps guidelines and approved plans. Stormwater Facilities are regulated by the City and the plans and management strategies for these areas shall follow the steps outlined in this document. Alternative plans and management strategies may be approved by the City

A1.3 Professional Assistance

Vegetation in Stormwater Facilities should facilitate succession toward low-maintenance plant communities. Consultation with a professional landscape architect, ecologist, or horticulturist knowledgeable in native plants is highly recommended when preparing plans. Satisfying the landscaping requirements may require the services of a registered landscape architect. See ORS 671.310 through 671.459.

Non-native, invasive plant management and wildlife damage management strategies may need to be developed. Especially challenging management situations may require assistance from a landscape maintenance contractor or a wildlife biologist.

A2.0 PLANTING PLAN METHODS

Planting plans shall be required for development projects with Stormwater Facilities. When a planting plan is required, four major components shall be addressed: hydrology, soils, plant materials, and maintenance. When developing planting plans, the following steps should be used:

A2.1 Step 1: Assess Hydrologic and Hydraulic Conditions

I. Determine the frequency and duration of water inundation, including appropriate elevations of the vegetation area. In some cases, current site conditions (i.e. wetland presence) will suffice. For Stormwater Facilities, the models used to design and size the facility shall be used to determine frequency, duration and surface water elevations within the facility.

II. Assign appropriate hydrologic zones to the vegetation area and apply them to the plan. Most project sites include one or more of the following planting zones with respect to hydrology during the growing season:
    a. Wet - standing or flowing water/nearly constant saturation; anaerobic soils
    b. Moist - periodically saturated; anaerobic and/or aerobic soils
    c. Dry - infrequent inundation/saturation, if any; aerobic soils

A2.2 Step 2: Assess Soil Conditions and Assign Appropriate Preparation

Specifications to Plans:

I. Determine the organic content and non-native, invasive seed bank likely in the soil. For most Stormwater Facilities, the soil is often high in clay, gravel, or minerals devoid of topsoil and organic material, and/or high in non-native, invasive weed content. The conditions in Sensitive Areas and adjacent areas can vary greatly.

II. For upland sites with at least one foot of native topsoil, but containing a non-native, invasive seed bank or plants, add notes to the plan to remove the undesirable plants, roots, and seeds prior to planting.

III. For upland sites with either disturbed and compacted soils or less than one foot of topsoil and invasive, non-native seed bank or plants that have become established, the following notes shall be added to the plan:
    a. Remove the undesirable plants, roots, and seeds prior to adding topsoil.
    b. Till the sub-grade in these areas to a depth of at least four inches and add at least 12 inches of clean compost-amended topsoil. The compost-amended topsoil shall have the following characteristics to ensure a good growing medium:
        i. Texture – material passes through one-inch screen
        ii. Fertility – 35% organic matter
        iii. In lieu amending onsite soils, the contractor can import a certified amended soil in the treatment area which is composed of equal parts of organic compost, gravelly sand and topsoil. Compost is weed-free, decomposed, non-woody plant material; animal waste is not allowed. Check with the City of Newberg or Clean Water Services for Seal of Testing Approval Program (STA) Compost provider.
    c. In the event of floodplain grading, over-excavate the sub grade to ensure 12 inches of topsoil can be applied without impacting surface water elevations.

IV. For wet areas in Sensitive Areas and Stormwater Facilities, the soil conditions shall be hydric or graded to hold sufficient water to promote hydric soil formation. The addition of organic muck soil will improve plant establishment for some bulbs and tubers.

V. Where appropriate and necessary for erosion control or to enhance organic matter, leaf compost may be placed uniformly on topsoil. (Refer to the Erosion and Sediment Control Manual). Other amendments, conditioners, and bio-amendments may be added as needed to support the specified plants or adjust the soil pH. Traditional fertilization techniques (applying N-P-K) are not necessary for native plants.

A2.3 Step 3: Identify Plants to be Preserved

Select Re-vegetation Plant Materials, Quantities, Placement, and Assign Planting Zones and Specifications to Plans

I. Preservation: Every effort shall be made to protect a site's existing native vegetation. Native vegetation along Sensitive Areas and adjacent areas shall be retained to the maximum extent practicable.

II. Selection: Plant selection shall be from a native species palette and shall consider site soil types, hydrologic conditions, and shade requirements. Containerized or bare root plants may be used. A list of common native plant community types appropriate for planting Sensitive Areas, and Stormwater Facilities are provided in Planting Tables. Unless approved by the City Engineer, planting restrictions are limited to the following:

   a. Deep rooting trees and shrubs (e.g. willow) shall not be planted on top of concrete pipes, or within 10 feet of retaining walls, inlet/outlet structures or other culverts; and
   b. Large trees or shrubs shall not be planted on berms over four feet tall that impound water. Small trees or shrubs with fibrous root systems may be installed on berms that impound water and are less than four feet tall.

III. Quantities:

   a. Sensitive Areas
      i. Trees and shrubs shall be planted using the following equations to achieve the specified densities:
         1. Total number of trees: 1 tree per every 200 square feet of area.
         2. Total number of shrubs: 1 shrub per every 100 square feet of area.
         3. Groundcover: plants and seeds to achieve 100% areal coverage
   b. Stormwater Facilities
      i. Stormwater Facilities in tracts or easements less than 30 feet wide shall be planted using the following equations to achieve the specified densities on a per acre basis:
         1. Total number of shrubs: 1 shrub per every 100 square feet of area.
         2. Groundcover: plant and seed to achieve 100% areal coverage
      ii. Stormwater Facilities in tracts or easements 30 feet wide or more shall be planted using the following equations to achieve the specified densities on a per acre basis:
         1. Total number of trees: 1 tree per every 200 square feet of area.
         2. Total number of shrubs: 1 shrub per every 100 square feet of area.
         3. Groundcover: plant and seed to achieve 100% areal coverage
      iii. Size: Potted plants shall follow size requirements outlined in (Planting Tables). Bare root plants shall be 12 to 16 inches long.
      iv. Placement: Plant placement shall be consistent with naturally occurring plant communities. Trees and shrubs shall be placed in singles or clusters of the same species to provide a natural planting scheme. This arrangement may follow curved rows to facilitate maintenance. Distribution and relative abundance shall be dependent on the plant species and on the size of the re-vegetation

area. Plant placement and seeding shall promote maximum vegetative cover to minimize weed establishment.

A2.4 Step 4: Determine Plant Installation Requirements and Assign Specifications to Plans

I. Timing

Containerized stock shall be installed only from February 1 through May 1 and October 1 through November 15. Bare root stock shall be installed only from December 15 through April 15. Plantings outside these times may require additional measures to ensure survival which shall be specified on the plans.

II. Erosion Control

Grading, soil preparation, and seeding shall be performed during optimal weather conditions and at low flow levels to minimize sediment impacts. Site disturbance shall be minimized and desirable vegetation retained, where possible. Slopes shall be graded to support the establishment of vegetation. Where seeding is used for erosion control, an appropriate native grass, Regreen (or its equivalent), or sterile wheat shall be used to stabilize slopes until permanent vegetation is established. Biodegradable fabrics (coir, coconut or approved jute matting (minimum 1/4" square holes) may be used to stabilize slopes and channels. Fabrics such as burlap may be used to secure plant plugs in place and to discourage floating upon inundation. No plastic mesh that can entangle wildlife is permitted. Refer to the Erosion and Sediment Control Manual for additional information.

III. Mulching

Trees, shrubs, and groundcovers planted in upland areas shall be mulched a minimum of three inches in depth and 18 inches in diameter, to retain moisture and discourage weed growth around newly installed plant material. Appropriate mulches are made from composted bark or leaves that have not been chemically treated. The use of mulch in frequently inundated areas shall be limited, to avoid any possible water quality impacts including the leaching of tannins and nutrients, and the migration of mulch into waterways.

IV. Plant Protection from Wildlife

Depending on site conditions, appropriate measures shall be taken to limit wildlife-related damage.

V. Irrigation

Appropriate plant selection, along with adequate site preparation and maintenance, reduces the need for irrigation. However, unless site hydrology is currently adequate, a City approved irrigation system or equivalent (i.e., polymer, plus watering) shall be used during the two-year plant establishment period. Watering shall be at a minimum rate of at least one inch per week from June 15 through October 15. Other irrigation techniques, such as deep watering, may be allowed with prior approval by the City Engineer.

VI. Access

Maintenance access for plant maintenance shall be provided for Stormwater Facilities. Stormwater Facility access requirements are provided in the Chapter 4.

A2.5 Step 5: Determine Plant Monitoring and Maintenance Requirements

I. Monitoring

Site visits are necessary throughout the growing season to assess the status of the plantings, irrigation, mulching, etc. and ensure successful re-vegetation.

II. Weed Control

The removal of non-native, invasive weeds shall be necessary throughout the maintenance period, or until a healthy stand of desirable vegetation is established.

III. Plant Replacement and Preservation

Installed plants that fail to meet site review inspections by the City Engineer shall be replaced during the maintenance period. Prior to replacement, the cause of loss (wildlife damage, poor plant stock, etc.) shall be documented by a landscape, arboriculture, and/or wildlife specialist with a description of the corrective actions taken.

A2.6 Step 6: Prepare Construction Documents and Specifications

I. The construction documents and specifications shall include:

a. Sensitive Area boundaries that include limits of approved, temporary construction encroachment.

b. Site Preparation plan and specifications, including limits of clearing, existing plants and trees to be preserved, and methods for removal and control of invasive, non-native species, and location and depth of topsoil and or compost to be added to re-vegetation area.

c. Planting plan and specifications, including all of the following:

   i. Planting table that documents the common name, scientific name, distribution (zone and spacing), condition and size of plantings

   ii. Installation methods for plant materials

   iii. Mulching

   iv. Plant tagging for identification

   v. Plant protection

   vi. Seeding mix, methods, rates, and areas

d. Irrigation plan and specifications, including identification of water source, watering timing and frequency, and maintenance of the system.

e. Maintenance schedule; including responsible party and contact information, dates of inspection (minimum three per growing season and one prior to onset of growing season) and estimated maintenance schedule (as necessary) over the two-year monitoring period.

f. Good rated corridor notes i.e. invasive species removal resulting in cleared areas exceeding 25 square feet shall be replanted with native vegetation.

g. Access points for installation and maintenance including vehicle access if available.

h. Standard drawing (north arrow, scale bar, property boundaries, project name, drawing date, name of designer and Property Owner).

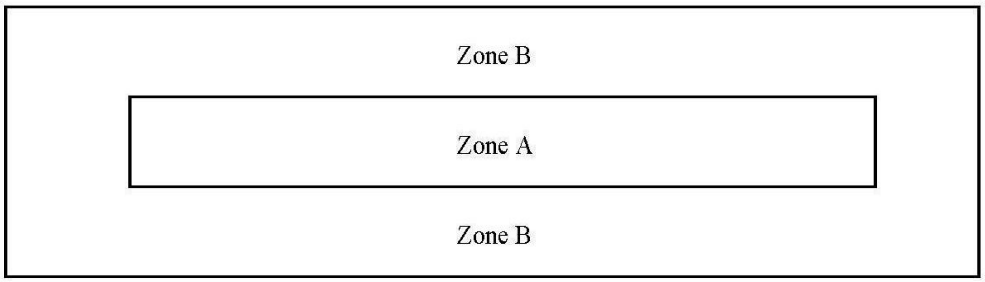
Facility Planting Shedule					
Facility Type	**Number of Plants**	**Vegetation Type**	**Per Square Feet**	**Size**	**Spacing Density (on center)**
Planters, Zone A, Option 1:	115	Herbaceous Plants	100	1 gallon	1 ft
Planters, Zone A, Option 2:	100	Herbaceous Plants	100	1 gallon	1 ft
	4	Small Shrubs	100	1 gallon	2 ft
Vegetated Filter Strip:	100 Percent cover by native grasses, native wildflower blends, native ground covers, or any combination thereof.				
Private Swales, Zone A-Option 1:	115	Herbaceous Plants	100	1 gallon	1 ft
Private Swales, Zone A-Option 2:	100	Herbaceous Plants	100	1 gallon	1 ft
	4	Small Shrubs	100	1 gallon	3 ft
Private Swales, Zone B, Option 1:	1	Evergreen Tree or (Deciduous Tree)	200	6 ft Min., (1 1/2" at 6" above base)	na
	3	Large Shrubs	100	3 gallons or equivalent	4 ft
	4	Medium to Small Shrubs	100	1 gallon or equivalent	2 ft
	70	Groundcover	100	1 gallon or equivalent	1 ft
Public Swales, Zone A, Option 1:	115	Herbaceous Plants	100	1 gallon	1 ft
Public Swales, Zone A, Option 2:	100	Herbaceous Plants	100	1 gallon	1 ft
	4	Small Shrubs	100	1 gallon	2 ft
Public Swales, Zone B, Option 1:	12	Small Shrubs	100	1 gallon or equivalent	2 ft
	70	Groundcover	100	1 gallon or equivalent	1 ft

PLANTING TEMPLATES AND PLANT LISTS

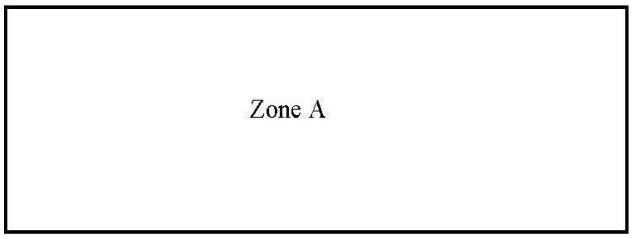
Zone A: Area of the facility defined as the bottom of the facility to the designed high water mark. This area has moist to wet soils and plants located here shall be tolerant of mild inundation.

Zone B: Area of the facility defined as the side slopes from the designed high water line up to the edge of the facility. This area typically has dryer to moist soils, with the moist soils being located further down the side slopes. Plants here should be drought tolerant and help stabilize the slopes.

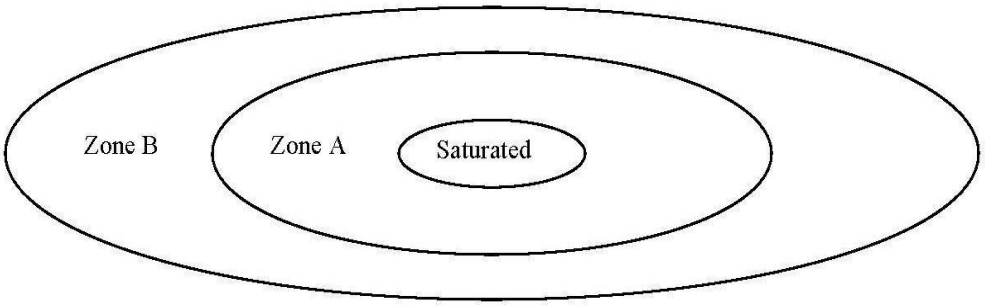
Swale Planting Zones



Planter Planting Zones



Basin Planting Zones



Public Streets Planting List

Plant Name		Facility Type			Characteristics				
		Public							
Botanic name, Common Name	Zone	Swale	Curb Extension	Planter	NW Native	Evergreen	Potential Hgt.	O.C. Spacing	Under Powerlines
Herbaceous Plants									
Carex densa, Dense Sedge	A	X	X	X	Y	Y	24"	12"	
Carex morrowii, Ice Dance	A	X	X	X	N	Y	24"	12"	
Carex obnupta, Slough Sedge	A	X	X	X	Y	Y	48"	12"	
Deschampsia cespitosa, Tufted Hair Grass	A/B	X	X	X	Y	N	48"	12"	
Helictotrichon sempervirens, Blue Oat Grass	B	X	X		N	Y	24"	12"	
Juncus patens, Spreading Rush	A	X	X	X	N	Y	36"	12"	
Shrubs									
Cornus sericea 'Kelseyii', Kelsey Dogwood	A/B	X	X	X	N	N	24"	24"	
Euonymous japonicus 'Microphyllus' Boxleaf Evergreen	B	X	X		N	Y	24"	24"	
Mahonia nervosa, Dull Oregon Grape	B	X	X		Y	Y	24"	24"	
Spiraea betulifolia, Birchleaf Spiraea	A/B	X	X	X	Y	N	24"	24"	
Spiraea densiflora, Sub-alpine Spiraea	A/B	X	X	X	Y	N	24"	24"	
Spiraea japonica, Japanese spirea cultivars: Dart's Red, Goldflame, Goldmound, Little Princess, Magic Carpet	A/B	X	X	X	N	N	24"-36"	24"	
Groundcovers									
Arctostapylos uva-ursi, Kinnickinnick	B	X	X		Y	Y	6"	12"	
Fragaria chiloensis, Coastal Strawberry	B	X	X		Y	Y	6"	12"	

Public Streets Planting

Plant Name		Facility Type			Characteristics				
		Public							
Botanic name, Common Name	Zone	Swale	Curb Extension	Planter	NW Native	Evergreen	Potential Hgt.	O.C. Spacing	Under Powerlines
Mahonia repens, Creeping Oregon Grape	B	X	X		Y	Y	12"	12"	
Rubus calcynoides & pentalobus, Creeping Bramble	A	X	X		N	Y	6"	12"	

Public Streets Planting

Plant Name		Facility Type			Characteristics				
		Public							
Botanic name, Common Name	Zone	Swale	Curb Extension	Planter	NW Native	Evergreen	Potential Hgt.	O.C. Spacing	Under Powerlines
Accent Plants									
Camassia leichtlinii, Great Camas	A/B	X	X	X	Y	N	24"	12"	
Camassia quamash, Common Camas	A/B	X	X	X	Y	N	24"	12"	
Iris douglasiana, Douglas Iris	B	X	X		Y	N	18"	12"	
Iris tenax, Oregon Iris	B	X	X		Y	N	18"	12"	
Street Trees									
Acer campestre 'Evelyn', Queen Elizabeth Hedge Maple	A/B	X	X	X	N	N	30'		N
Betula jacquemontii, Jacquemontii Birch	A/B	X	X	X	N	N	60'		N
Celtis occidentalis, Hackberry	A/B	X	X	X	N	N	50'		N
Koelreuteria paniculata, Goldenrain Tree	A/B	X	X	X	N	N	30'		Y
Nyssa sylvatica, Black Tupelo	A	X	X	X	N	N	50'		N
Prunus virginiana 'Canada Red', Canada Red Chokecherry	A/B	X	X	X	N	N	25'		Y
Quercus shumardii, Shumard Oak	A/B	X	X	X	N	N	70'		N
Rhamnus purshiana, Cascara	A/B	X	X	X	Y	N	30'		Y

Facility Plant List

Plant Name		Proposed Facility Type						Characteristics			
		Private					Public				
Botanic name, Common Name	Zone	Swale	Planter	Basin			Basin	NW Native	Evergreen	Potential Hgt.	O.C. Spacing
Herbaceous Plants											
Aster suspicatus, Douglas' Aster	B	X		X				Y	N	36"	12"
Athyrium felix-femina, Lady Fern	B	X		X			X	Y	N	36"	24"
Blechnum spicant, Deer Fern	B	X		X			X	Y	N	24"	24"
Bromus carinatus, Califonia Brome Grass	A			X			X	Y	Y	18"	12"
Bromus sitchensis, Alaska Brome	A			X			X	Y	Y	18"	12"
Bromus vulgaris, Columbia Brome	A			X			X	Y	Y	18"	12"
Camassia leichtlinii, Camas Lily	A	X	X	X				Y	N	24"	12"
Camassia quamash, Common Camas	A/B	X	X	X			X	Y	N	24"	12"
Carex deweyanna, Dewey Sedge	A	X	X	X			X	Y	Y	36"	12"
Carex densa, Dense Sedge	A	X	X	X			X	Y	Y	24"	12"
Carex obnupta, Slough Sedge	A	X	X	X			X	Y	Y	4'	12"
Carex rupestris, Curly Sedge	A	X	X	X				N	Y	14"	12"
Carex stipata, Sawbeak Sedge	A	X	X	X				N	N	20"	12"
Carex testacea, New Zealand Orange Sedge	A	X	X	X			X	N	Y	24"	12"
Carex vesicaria, Inflated Sedge	A	X	X	X			X	Y	N	36"	12"
Deschampsia cespitosa, Tufted Hair Grass	A/B	X	X	X			X	Y	N	36"	12"
Eleocharis acicularis, Needle Spike Rush	A	X	X	X			X	Y	Y	30"	12"
Eleocharis ovata, Ovate Spike Rush	A	X	X	X			X	Y	Y	30"	12"
Eleocharis palustris, Creeping Spike Rush	A			X			X	Y	Y	30"	12"
Elymus glaucus, Blue Wild Rye	B	X		X			X	Y	Y	24"	12"

Facility Plant List

Plant Name		Proposed Facility Type						Characteristics			
		Private					Public				
Botanic name, Common Name	Zone	Swale	Planter	Basin			Basin	NW Native	Evergreen	Potential Hgt.	O.C. Spacing
Herbaceous Plants (continued)											
Festuca occidentalis, Western Fescue Grass	A	X		X			X	Y	N	24"	12"
Festuca rubra, Red Fescue	B	X		X			X	Y	Y	24"	12"
Glycera occidentalis, Western Manna Grass	A			X			X	Y	Y	18"	12"
Hebe 'Autumn Glory', Hebe	B	X		X				N	Y	14"	12"
Iris douglasiana, Douglas Iris	B	X		X			X	Y	N	18"	12"
Iris sibirica, Siberian Iris	A	X	X	X				N	N	36"	12"
Iris tenax, Oregon Iris	B	X		X			X	Y	N	18"	12"
Juncus balticus, Baltic Rush	A	X	X	X				N	N	20"	12"
Juncus effusus var. pacificus, Soft rush	A	X	X	X			X	Y	Y	36"	12"
Juncus ensifolius, Dagger-leaf Rush	A	X	X	X			X	N	N	10"	12"
Juncus patens, Spreading Rush	A	X	X	X			X	N	Y	36"	12"
Juncus tenuis, Slender Rush	A	X	X	X			X	Y	Y	36"	12"
Lupinus micranthus, Small Flowered Lupine	B	X		X			X	Y	N	18"	12"
Lupinus polyphyllus, Large-leaved Lupine	A/B	X		X				Y	N	36"	12"
Polypodium glycrrhiza, Licorice Fern	A	X	X	X				Y	Y	12"	12"
Polystichum munitum, Sword Fern	A/B	X		X			X	Y	Y	24"	24"
Pteridium aquilinum, Bracken Fern	B	X		X				Y	Y	5'	12"
Scriptus acutus, Hardstem Bulrush	A	X	X	X				N	N	10"	12"
Scriptus americanus, American Bulrush	A	X	X	X			X	Y	Y	30"	12"
Scriptus mlcrocarpus, Small Fruited Bulrush	A			X			X	Y	Y	24"	12"
Scriptus validus, Softstem Bulrush	A	X	X	X				N	N	5'	12"

Facility Plant List

Plant Name		Proposed Facility Type						Characteristics			
		Private					Public				
Botanic name, Common Name	Zone	Swale	Planter	Basin			Basin	NW Native	Evergreen	Potential Hgt.	O.C. Spacing
Herbaceous Plants (continued)											
Sedum oreganum, Oregon Stonecrop	B	X						Y	Y	4"	12"
Sisyrinchium californicum, Yellow-eyed Grass	A/B	X	X	X				N	Y	6"	12"
Veronica liwanensis, Speedwell	A	X		X				N	N	2"	12"
Large Shrubs and Small Trees											
Acer circinatum, Vine Maple	A/B	X	X	X			X	Y	N	15'	10'
Amelanchier alnifolia, Western Serviceberry	B	X		X			X	Y	N	20'	10'
Ceanothus sanguineus, Oregon Redstem Ceanothus	B	X		X			X	Y	Y	7'	4'
Holodiscus discolor, Oceanspray	B	X		X			X	Y	N	6'	4'
Lonicera involucrata, Black Twinberry	B	X		X			X	Y	N	5'	4'
Oemleria cerasiformis, Indian Plum	B	X		X			X	Y	N	6'	4'
Philadelphu lewisii, Wild Mock Orange	B	X		X			X	Y	N	6'	4'
Ribes sanguineum, Red-Flowering Current	B	X		X			X	Y	N	8'	4'
Rubus parviflorus, Thimbleberry	B	X		X			X	Y	N	8'	4'
Rubus spectabilis, Salmonberry	A	X	X	X			X	Y	N	10'	4'
Salix fluviatalis, Columbia Willow	A/B	X	X	X			X	N	N	13'	6'
Salix lucida var. 'Lasiandra', Pacific Willow	A	X	X	X			X	Y	N	13'	6'
Salix purpurea nana, Blue Arctic Willow	B	X		X				N	N	8'	6'
Salix stichensis, Sitka Willow	A	X	X	X			X	Y	N	20'	6'

Facility Plant List

Plant Name		Proposed Facility Type						Characteristics			
		Private					Public				
Botanic name, Common Name	Zone	Swale	Planter	Basin			Basin	NW Native	Evergreen	Potential Hgt.	O.C. Spacing
Large Shrubs and Small Trees (continued)											
Sambucus cerulea, Blue Elderberry	B	X		X			X	Y	N	10'	10'
Sambucus racemosa, Red Elderberry	B	X		X			X	Y	N	10'	10'
Spriaea douglasii, Douglas Spiraea	A/B	X	X	X			X	Y	N	7'	4'
Viburnum edule, Highbush Cranberry	A/B	X	X	X			X	Y	N	6'	4'
Shrubs											
Ceanothus velutinus, Snowbrush	B	X		X			X	Y	Y	4'	3'
Cornus sericea, Red-twig Dogwood	A	X	X	X			X	Y	N	6'	4'
Cornus sericea 'Kelseyii', Kelsey Dogwood	B	X		X			X	N	N	24"	24"
Gaultheria shallon, Salal	B	X		X			X	Y	Y	24"	24"
Mahonia aquifolium, Oregon Grape	B	X		X			X	Y	Y	5'	3'
Mahonia nervosa, Dull Oregon Grape	B	X		X			X	Y	Y	24"	24"
Physocarpus capitatus, Pacific Ninebark	A/B	X	X	X				Y	N	10'	3'
Rosa gymnocarpa, Baldhip Rose	B	X		X			X	Y	N	3'	3'
Rosa nutkana, Nootka Rose	B	X		X			X	Y	N	8'	3'
Rosa pisocarpa, Swamp Rose	A/B	X	X	X			X	Y	N	8'	3'
Symphoricarpos alba, Common Snowberry	B	X		X			X	Y	N	6'	3'
Groundcovers											
Arctostaphylos uva-ursi, Kinnickinnick	B	X		X				Y	Y	6"	12"
Fragaria chiloensis, Coastal Strawberry	B	X		X				Y	Y	6"	12"

Facility Plant List

Plant Name		Proposed Facility Type						Characteristics			
		Private					Public				
Botanic name, Common Name	Zone	Swale	Planter	Basin			Basin	NW Native	Evergreen	Potential Hgt.	O.C. Spacing
Trees (continued)											
Rhamnus purshiana, Cascara	A/B	X	X	X			X	Y	N	30'	
Salix hookeriana, Hooker's Willow	A/B	X	X	X			X	Y	N	15'	
Salix scouleriana, Scouler's Willow	A/B	X	X	X			X	Y	N	15'	
Thuja plicata, Western Red Cedar	A			X			X	Y	Y	150'	
Tsuga hetrophylla, Western Hemlock	A	X		X			X	Y	Y	125'	
Tsuga mertensiana, Mountain Hemlock	B	X		X			X	Y	Y	125'	

Facility Plant List

Plant Name		Proposed Facility Type						Characteristics			
		Private					Public				
Botanic name, Common Name	Zone	Swale	Planter	Basin			Basin	NW Native	Evergreen	Potential Hgt.	O.C. Spacing
Groundcovers (continued)											
Fragaria vesca, Woodland Strawberry	B	X		X				N	Y	10"	12"
Fragaria virginiana, Wild Strawberry	B	X		X				N	Y	10"	12"
Helictotrichon sempervirens, Blue Oat Grass	B	X		X				N	Y	24"	12"
Mahonia repens Creeping Oregon Grape	B	X		X				Y	Y	12"	12"
Trees											
Abies grandis, Grand Fir	B			X			X	Y	Y	150'	
Acer griseum, Paperbark Maple	B	X		X				N	N	30'	
Acer macrophyllum, Big Leaf Maple	B	X		X			X	Y	Y	60'	
Alnus rubra, Red Alder	A	X		X			X	Y	N	80'	
Arbutus menziesii, Madrone	B			X			X	Y	N	35'	
Crataegus douglasii, Black Hawthorn	A	X		X			X	Y	N	40'	10'
Fraxinus latifolia, Oregon Ash	A/B	X		X			X	Y	N	30'	
Malus fusca, Pacific Crabapple	A	X	X	X			X	Y	N	30'	10'
Metasequoia glyptostroboides, Dawn Redwood	B			X			X	N	N	80'	
Populus tremuloides, Quaking Aspen	A			X			X	Y	N	40'	
Prunus emarginata var. mollis, Bitter Cherry	A/B	X	X	X			X	Y	N	50'	
Pseudotsuga menziesii, Douglas Fir	B	X		X			X	Y	Y	200'	
Quercus garryana, Oregon White Oak	B	X		X			X	Y	N	100'	

Pond Plant List

Plant Name	Planting Zone			Characteristics			
Botanic name, Common Name	Wet to Saturated	Moist to Dry	Dry/Upland	NW Native	Evergreen	Potential Hgt.	O.C. Spacing
Herbaceous Plants							
Alisma plantago-aquatica, Water Plantain	X			Y	N	24"	12"
Alopecurus geniculatus, Water Foxtail		X		Y	Y	18"	12"
Aster suspicatus, Douglas' Aster	X	X		Y	N	36"	12"
Bidens cernua, Nodding Beggerticks		X		Y	N	24"	12"
Blechnum spicant, Deer Fern	X	X		Y	N	24"	24"
Bromus sitchensis, Alaska Brome		X	X	Y	Y	18"	12"
Camassia quamash, Common Camas		X		Y	N	24"	12"
Carex deweyanna, Dewey Sedge	X	X		Y	Y	36"	12"
Carex obnupta, Slough Sedge	X			Y	Y	4'	12"
Deschampsia cespitosa, Tufted Hair Grass		X		Y	N	36"	12"
Eleocharis ovata, Ovate Spike Rush	X			Y	Y	30"	12"
Eleocharis palustris, Creeping Spike Rush	X			Y	Y	30"	12"
Elymus glaucus, Blue Wild Rye		X		Y	Y	24"	12"
Glycera occidentalis, Western Manna Grass	X	X		Y	Y	18"	12"
Lemna minor, Common Lesser Duckweed	X						
Juncus effusus var. pacificus, Soft rush	X	X		Y	Y	36"	12"
Juncus ensifolius, Dagger-leaf Rush	X	X		Y	Y	24"	12"

Pond Plant List

Plant Name	Planting Zone			Characteristics			
Botanic name, Common Name	Wet to Saturated	Moist to Dry	Dry/Upland	NW Native	Evergreen	Potential Hgt.	O.C. Spacing
Herbaceous Plants (continued)							
Juncus oxymeris, Pointed Rush	X	X		Y	Y	24"	12"
Juncus patens, Spreading Rush	X	X		N	Y	36"	12"
Juncus tenuis, Slender Rush	X	X		Y	Y	36"	12"
Lupinus polyphyllus, Large-leaved Lupine		X		Y	N	36"	12"
Myosotis laxa, Small-flowered Forget-Me-Not	X			Y	N	18"	12"
Polystichum munitum, Sword Fern	X	X		Y	Y	24"	24"
Sagittaria latifolia, Wapato	X			Y	N	24"	12"
Potamogeton natans, Floating-leafed Pondweed	X			Y	Y	18"	12"
Scriptus acutus, Hardstem Bulrush	X			N	N	10"	12"
Scriptus mlcrocarpus, Small Fruited Bulrush		X		Y	Y	24"	12"
Sisyrinchium idahoense Blue-eyed Grass		X		N	Y	6"	12"
Sparganium emersum, Narrowleaf Bur-reed	X			Y	N	24"	12"
Veronica liwanensis, Speedwell	X	X		N	N	2"	12"
Viola palustris, Marsh Violet	X	X		Y	N	6"	6"
Large Shrubs and Small Trees							
Acer circinatum, Vine Maple	X	X		Y	N	15'	10'
Amelanchier alnifolia, Western Serviceberry			X	Y	N	20'	10'
Holodiscus discolor, Oceanspray			X	Y	N	6'	4'
Lonicera involucrata, Black Twinberry			X	Y	N	5'	4'

Pond Plant List

Plant Name	Planting Zone			Characteristics			
Botanic name, Common Name	Wet to Saturated	Moist to Dry	Dry/Upland	NW Native	Evergreen	Potential Hgt.	O.C. Spacing
Large Shrubs and Small Trees (continued)							
Oemleria cerasiformis, Indian Plum		X	X	Y	N	6'	4'
Philadelphu lewisii, Wild Mock Orange			X	Y	N	6'	4'
Ribes sanguineum, Red-Flowering Current			X	Y	N	8'	4'
Rubus parviflorus, Thimbleberry		X		Y	N	8'	4'
Rubus spectabilis, Salmonberry	X	X		Y	N	10'	4'
Salix fluviatalis, Columbia Willow	X	X		N	N	13'	6'
Salix lucida var. 'Lasiandra', Pacific Willow	X	X		Y	N	13'	6'
Salix stichensis, Sitka Willow	X	X		Y	N	20'	6'
Sambucus racemosa, Red Elderberry		X		Y	N	10'	10'
Spriaea douglasii, Douglas Spiraea		X		Y	N	7'	4'
Viburnum edule, Highbush Cranberry		X		Y	N	6'	4'
Shrubs							
Cornus sericea, Red-twig Dogwood	X	X		Y	N	6'	4'
Fragaria vesca, Woodland Strawberry		X	X	N	Y	10"	12"
Fragaria virginiana, Wild Strawberry		X	X	N	Y	10"	12"
Mahonia aquifolium, Oregon Grape		X	X	Y	Y	5'	3'
Mahonia nervosa, Dull Oregon Grape		X		Y	Y	24"	24"

Pond Plant List

Plant Name	Planting Zone			Characteristics			
Botanic name, Common Name	Wet to Saturated	Moist to Dry	Dry/Upland	NW Native	Evergreen	Potential Hgt.	O.C. Spacing
Shrubs (continued)							
Physocarpus capitatus, Pacific Ninebark	X			Y	N	6'	3'
Rosa gymnocarpa, Baldhip Rose	X			Y	N	3'	3'
Rosa nutkana, Nootka Rose		X		Y	N	8'	3'
Rosa pisocarpa, Swamp Rose	X			Y	N	8'	3'
Spiraea betulifolia, Birchleaf Spiraea		X		Y	N	24"	24"
Symphoricarpus alba, Snowberry		X		Y	N	3'	3'
Trees							
Abies grandis, Grand Fir		X		Y	Y	150'	
Acer macrophyllum, Big Leaf Maple		X		Y	Y	60'	
Alnus rubra, Red Alder	X	X		Y	N	80'	
Arbutus menziesii, Madrone			X	Y	N	35'	
Cornus nuttalii, Western flowering Dogwood		X	X	Y	N	20'	
Crataegus douglasii, Black Hawthorn	X			Y	N	40'	
Fraxinus latifolia, Oregon Ash	X	X		Y	N	30'	
Malus fusca, Pacific Crabapple	X	X		Y	N	30'	
Pinus ponderosa, Ponderosa Pine			X	Y	Y	70'	
Pinus monticola, Western White Pine		X	X	Y	Y	90'	
Prunus emarginata var. mollis, Bitter Cherry	X			Y	N	50'	
Pseudotsuga menziesii, Douglas Fir		X		Y	Y	200'	

Pond Plant List

Plant Name	Planting Zone			Characteristics			
Botanic name, Common Name	Wet to Saturated	Moist to Dry	Dry/Upland	NW Native	Evergreen	Potential Hgt.	O.C. Spacing
Trees (continued)							
Quercus garryana, Oregon White Oak		X		Y	N	100'	
Rhamnus purshiana, Cascara	X			Y	N	30'	
Salix hookeriana, Hooker's Willow	X	X		Y	N	15'	
Salix scouleriana, Scouler's Willow	X	X		Y	N	15'	
Thuja plicata, Western Red Cedar	X	X		Y	Y	150'	

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