CITY OF GRESHAM
PUBLIC WORKS DESIGN STANDARDS

INDEX

SECTION ONE – GENERAL

SECTION TWO – GENERAL TECHNICAL

SECTION THREE – WASTEWATER SYSTEMS

SECTION FOUR – STORM DRAINAGE

SECTION FIVE – WATER SYSTEMS

SECTION SIX – TRANSPORTATION

SECTION SEVEN – PARKS

SECTION ONE – GENERAL

1.01 AUTHORITY AND PURPOSE

In 1999 the City of Gresham adopted a revised Gresham Community Development Plan that regulates land use and development issues within the City. This comprehensive planning document consists of three volumes. Volume III, titled Gresham Community Development Code, consists of thirteen articles defining separate development standards. Appendix 5.0000 – Public Facilities discusses generalized public facility design requirements and requires compliance with the Gresham Public Works Construction Standard Specifications, or the shortened version known as the Construction Specifications. The information contained in this document shall be known as the Gresham Public Works Design Standards or, in the shortened version, as the Design Standards.

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

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

Alternate materials and methods will be considered for approval by the Engineer as the need arises and conditions warrant modification. This consideration will be on a case-by-case basis and require sufficient justification prior to approval.

1.02 DEFINITIONS

Alley – A public access easement or right-of-way not more than 20-feet and not less than 12-feet in width that intersects with a public street.

Approved Backflow Prevention Assembly – A testable assembly that has been investigated and approved by the Oregon State Health Division.

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 and dated by the Engineer of Record indicating that the plans have been reviewed and revised, if necessary, to accurately show all as-built construction. Also referred to as record drawings.

Average Daily Demand – The total volume of water delivered to the system in 1-year divided by 365-days.

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 testable assembly or means to prevent backflow into the potable water system.

Back-siphonage – Backflow that results from negative 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 that is completely separated from the vehicular travel lanes and is within independent rights-of-way.

Bike Route – A designated travel-way for a bicyclist 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 is used).

Building Fire Flow Requirements – Fire flow requirements based on type of occupancy and building material construction.

Building Service Lateral – A public wastewater sewer between the property line or public easement line and the wastewater sewer main.

Building Sewer – A private wastewater sewer between the property line or public easement line connecting to the building service lateral and a point 5-feet outside the building.

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.

CAD – Computer aided design.

City – The City of Gresham, Oregon.

Collection Systems – Facilities maintained by the City connected thereto for the collecting, pumping, conveying, and controlling of wastewater.

Collector Sewer – The portion of the public wastewater system that 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.

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

Cross Connection – Any physical connection between foreign material, including other water sources, and the potable water that the system supplies.

Cul-de-sac – A dead-end street having a circular turnaround area at the end.

Curb – The line indicating the edge of the vehicular roadway within the overall right-of-way.

Cut Sheets – Sheets of tabulated data indicating stationings, structures, fittings, angle points, beginning of curve, points on curve, end of curves, street grade, pipe slope, staking offset, various elevations, and offset cuts for streets, waterlines, wastewater sewers, and storm drains.

Datum, Horizontal – The horizontal control network of the City was adjusted to the North American Datum 83(91) expressed in Oregon North Zone State Plane Coordinates in international feet.

Datum, Vertical – The vertical elevation control for the City is "The National Geodetic Vertical Datum of 1929" that corresponds to the USC&GS 1947 Datum.

Dead-end Street – A street or series of streets that 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. Permanent dead-end streets must provide adequate turn-around capability.

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 Engineer. Similarly, the words "approved", "acceptable", or "satisfactory", shall mean approved by, acceptable to, or satisfactory to the Engineer.

Demand – The total quantity of water supplied for a given period of time to meet the various required uses. The various uses include residential, irrigation, commercial, and industrial uses as well as fire fighting, system losses, other unaccounted for, and miscellaneous uses.

Design Intensity – The uniform rainfall intensity, inches per hour, associated with a duration equal to the time of concentration of the basin and a specified return frequency (e.g., 2-year, 10-year, etc.) that is used to calculate the peak discharge rate to be used for stormwater conveyance system design.

Design Storm – A rainfall event of a specified duration (e.g., 6-hour, 12-hour, 24-hour) and return frequency (e.g., 2-years, 10-years, etc.) that is used to calculate the runoff volume and/or discharge rate to be used for stormwater system design.

Designated Arterial or Collector Street – A street designated as an arterial or collector in the Comprehensive Plan.

Detention – The storage and subsequent release of excess stormwater runoff to control peak discharge rates prior to discharge to the storm drain or natural drainageway.

Detention Volume – The storage volume required to control the peak discharge rates at the point of discharge from a development.

Development – Any man-made change to improved or unimproved real estate, including but not limited to construction, installation, or alteration of buildings or other structures, condominium conversion, land division, establishment or termination of a right of access, storage on real property, tree cutting, and clearing, mining, dredging, filling, grading, paving, excavation or drilling operations.

Direct Discharge – Any stormwater discharge from a developed site that has not passed through approved water quality treatment prior to its ultimate outfall to a natural drainageway, wetland, or other natural resource area.

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 wastewater system or by means of private wastewater disposal system.

Double Check Detector 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 provide backflow protection for the distribution system and, at the same time, provide a metering of the fire system showing any system leakage or unauthorized use of water.

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.

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 stormwater run-off.

Drywell – See Stormwater Sump.

Easement – Areas located outside of dedicated rights-of-way that are granted to the City for special uses and public facilities.

Engineer – The applicable City Department of Environmental Services division manager or designee who is licensed as a registered professional engineer in the State of Oregon.

Engineer of Record – A registered professional engineer licensed to practice in the State of Oregon who is responsible for the design of a public improvement project and has stamped the plans.

Expansion Joint – A joint to control cracking in the concrete surface structure and is filled with preformed expansion joint filler.

Fire Protection Service – A metered connection to the public water main intended only for the extinguishment of fires and the flushing necessary for its proper maintenance.

French Drain or Leach Line – A covered underground excavated trench filled with washed gravel that surrounds a perforated delivery pipe used to receive storm water, wherein the sides and bottom of the trench are porous, permitting the storm water to seep into the ground.

Grade – The degree of inclination of a road or slope.

Hydrant Lead – The waterline connecting the fire hydrant to the auxiliary valve on the City distribution main.

Impervious Areas – Those hard surface areas located upon real property that either prevent or retard saturation of water into the land surface, as existed under natural conditions pre-existent to development, and cause water to run off the land surface in greater quantities or at an increased rate of flow from that present under natural conditions pre-existent to development.

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

Interceptor Sewer – A primary public wastewater pipe that conveys wastewater directly into the Wastewater Treatment Plant.

Irrigation Service – A metered connection intended for seasonal use and delivering water that is not discharged to the wastewater system.

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

Longitudinal Joint – A joint, which follows a course approximately parallel to the centerline of the roadway.

Major Trees – Trees that are 30-inches or larger in diameter and are either within the right-of-way or public easement or are within 10-feet of the right-of-way or public easement. Major trees are protected by the City's "Trees First" policy and design modifications of public facilities may be required to accommodate tree preservation.

Manager – The City Manager of the City of Gresham acting either directly or through authorized representatives.

Maximum Daily Demand – The maximum volume of water delivered to the system in any single day of the year, divided by one day.

Minor Partition – See Partition.

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

On-Site Detention – The detention of stormwater from a private storm drain in a privately owned and maintained storm drain system to provide a controlled release, at or below a maximum allowable rate, to the public storm drain system.

Outfall – The point at which collected, concentrated stormwater is discharged, generally from a pipe(s), from a development to an open drainage element such as a ditch, channel, swale, stream, river, pond, lake or wetland.

Owner – The owner of record of real property as shown on the latest tax rolls or deed records of the County, and includes a person who furnishes evidence that he is purchasing a parcel of property under a written recorded land sale contract.

Partition – To divide an area or tract of land into 2 or 3 parcels within a calendar year when such area or tract of land exists as a unit or contiguous units of land under single ownership at the beginning of such year.

Peak Hour Demand – The maximum volume of water delivered to the system in any single hour of the year multiplied by 1-hour.

Peak Run-off – The maximum stormwater runoff rate (CFS) determined for the design storm or design rainfall intensity.

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

Plans – The Standard Details or reproductions thereof and project specific plans, profiles, cross sections, elevations, details, and other working or supplementary drawings signed by the Engineer of Record that show the location, character, dimensions, and details of the work to be performed. Plans for privately financed public improvement projects must be approved by the Project Manager. Plans for publicly financed public improvement projects may either be bound in the same book as the balance of the Contract Documents or bound in separate sets and are a part of the Contract Documents regardless of the method of binding.

Potable Water – Water that is satisfactory for drinking, culinary, and domestic purposes and meets the requirements of the health authority having jurisdiction.

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

Private Storm Drain – A storm drain located on private property.

Project Manager – The City's representative charged with the management of the project. For publicly financed public improvement projects the Project Manager is typically the Engineer or the Engineer's representative. For privately financed public improvement projects the Project Manager is typically a development specialist of the City.

Projected Maximum Daily Demand – The maximum volume of water anticipated to be delivered to the system in a future single-day of a year divided by 1-day.

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

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

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.

Residential Street – See Local Street.

Retention – The process of collecting and holding surface and stormwater runoff with no surface outflow from a developed property.

Right-of-Way – A general term denoting public land, property, or interest therein acquired for or devoted to a public street or accessway.

Roadway – That portion of a street and its appurtenances, typically between curbs or ditches, primarily used for vehicular traffic.

Sedimentation – Deposition of erosional debris soil sediment transported by water.

Sewage – A combination of the water-carried wastes from residences, business buildings, institutions, and industrial establishments, except industrial wastes.

Sewer Lateral – A building's wastewater service pipe.

Sidewalk – A path along the side of a road for pedestrians. A right-of-way deeded, dedicated, and designated for the use of non-motorized vehicles and pedestrians.

Silt – Fine textured soil particles, including clay and sand, as differentiated from coarse particles of sand and gravel.

Standard Details or Standard Detail Drawings – Detailed representations of structures, devices, or instructions set forth in the Public Works Standards.

Stormwater Sump – A drainage facility (or system) designed to utilize the infiltration capability of the ground, commonly referred to as percolation, to dispose of surface and stormwater runoff.

Streets – Any street, avenue, boulevard, alley, lane, bridge, bicycle path, road, public thoroughfare or public way, and any land over which a right-of-way has been obtained or granted for any purpose of public travel.

Structures – Those structures designated on the standard plans such as catch basins, manholes, etc.

Subdivision – To divide an area or tract of land into 4 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.

Swale – A broad-bottomed, shallow, vegetation-lined channel that allows for reduced flow velocity and filtration of stormwater, generally with flow depths less than 1-foot.

Total Fire Flow – A combination of building fire-flow requirements, any internal system fire-flow requirements (e.g., sprinklers), and domestic maximum daily demand (highest 24-hour consumption within the last 3-years).

Transverse Joint – A joint that follows a course approximately perpendicular to the centerline of the roadway.

Treatment Volume – The storage volume necessary to provide the required level of water quality treatment of stormwater prior to discharge to a storm drain element, facility, or natural drainage element.

Trunk Sewer – A wastewater pipe that is primarily intended to receive wastewater from collector pipes, other trunk sewers, existing major discharges of raw or inadequately treated wastewater, or water pollution control facilities.

Turnaround Area – A paved area of sufficient size and configuration that a motor vehicle may maneuver so as to travel in the opposite direction.

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 and called the "Oregon State Plumbing Specialty Code".

Wastewater – The total fluid flow in the wastewater system that includes industrial waste, sewage, or any other waste (including that which may be combined with any ground water, surface water, or storm water) that may be discharged into the wastewater system.

Water Distribution System – Water distribution pipelines, pumping stations, reservoirs, valves, and ancillary equipment used to transmit 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 metering device, hydrant, or fire line backflow prevention assembly.

Wet Weather Season – Defined for the purposes of construction and development in the City as the period between October 1st and the following May 31st.

Wetlands – Those lands adjacent to watercourses or isolated therefrom that may normally or periodically be inundated by the waters from the watercourse or the drainage waters from the drainage basin in which it is located. These include swamps, bogs, sinks, marshes, and lakes, all of which are considered to be part of the watercourse and drainage system of the City and shall include the headwater areas where the watercourse first surfaces. They may be, but are not necessarily, characterized by special soils such as peat, muck, and mud.

1.03 ENGINEERING POLICY

It shall be the policy of the City 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 stamped with the engineer's seal to indicate the engineer's responsibility for them. It shall be this Engineer of Record's responsibility to review any proposed public facility extension, modification, or other change with the City prior to engineering or other proposed design work to determine any special requirements or whether the proposal is permissible. A "Preliminary Review" and/or a "Plans Approved for Construction" stamp of the City on the plans, etc., 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.

1.04 APPLICABILITY

These Design Standards shall govern all construction and upgrading of all public and privately financed public facilities in the City and applicable work within its service areas.

1.05 STANDARD SPECIFICATIONS

Except as otherwise provided by these Design Standards, all construction design detail, workmanship, and materials shall be in accordance with the current edition of the City Construction Standard Specifications and Standard Details.

1.06 APPROVAL OF ALTERNATE MATERIALS OR METHODS

Any substitution material or alternate method not explicitly approved herein will be considered for approval as set forth in ***Section 1.01***. Persons seeking such approvals shall make application in writing. Approval of any major deviation from these Design Standards shall be in written form. Approval of minor matters shall be made in writing if requested.

Any alternate must meet or exceed the minimum requirements set in these Design Standards.

The written application is to include, but is not limited to, the manufacturer's specifications and testing results, design drawings, calculations, and other pertinent information.

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

1.07 SPECIAL DESIGN PROBLEMS

Special applications not covered in these Design Standards require review and approval by the City. Submittal of full design calculations, supplemental drawings, and information will be required prior to any approval.

Such applications that may occur requiring special review and approval include, but are not limited to, the following:

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

1.08 REVISIONS TO DESIGN STANDARDS

It is anticipated that revisions to these Design Standards will be made from time to time. The date appearing on the title page is the date of the latest revision. Users should apply the latest published revision to the work contemplated.

Parenthetical notations at the bottom of the pages indicate the most recent change to these sections. It shall be the user's responsibility to maintain his/her copy of these Design Standards with the latest changes.

2.01 CONSTRUCTION PLAN GENERAL INFORMATION

Prior to any construction work and plan approval, complete construction plans, specifications, and all other necessary submittals and submit to the Project Manager for review.

2.02 CAD DRAFTING STANDARDS

2.02.01 General Guidelines

The City of Gresham Drafting Standards were developed to provide guidance to both the manual and CAD-based drafter although the majority of the documents deal with CAD-related issues. The increased use of CAD in the public and private sectors and the use of differing sets of standards necessitated their development. Particularly, problems arise in the transfer of CAD files from and/or to other organizations. It is hoped that these standards will improve the consistency of preliminary plans, construction plans, and as-built drawings. These standards address many of those routine questions that arise during the design and drafting stages of developments within the corporate limits of the City.

The intent is to present the design in a form that can be understood and constructed. The user of the drawing depends upon it to understand the idea accurately. Another purpose of the drawing, especially related to CAD work, is the possibility of data retrieval and reuse. If CAD-based drawings are built in a standard way, data can be extracted for use in other applications such as databases, estimates, proposals, and other drawings. This is a major consideration when using CAD. Remember, the data entered into a CAD drawing has possibilities far beyond the drawing itself.

2.02.02 CAD Criteria

CAD files submitted to the City shall be either AutoCAD 2002 .dwg files or .dxf files that can be imported directly into AutoCAD 2002 or later. Format is subject to change per annual review. All CAD files submitted to the City must conform to the City's layering. CAD files submitted as .dxf files shall be capable of maintaining the City's layering standards after translation to AutoCAD 2002 or later. All CAD files submitted to the City must be accompanied by the following City of Gresham documentation records:

	Title	**Description**
1.	Plotting list	Listing of all plotted sheets and source drawing files
2.	Reference file list	Parent/child listing of all external referenced drawing files used in the project
3.	Drawing assembly listing	Instructions/order for all referenced or inserted drawings
4.	Non-standard drawing list	Listing of all non-standard drawings used in the project
5.	Non-standard layer list	Listing of all non-standard layers used in the project
6.	Drawing checklist	Checklist of City drawing submittal requirements

2.02.03 Prototype Drawing Files

All CAD files submitted to the City shall be prepared using the City's CAD prototype drawing file – an AutoCAD 2002 drawing file named COGPROTO.dwg. The prototype drawing files and associated documentation are found in the "CAD Standards" folder that is included in the CD version of the Public Works Standards. It can be obtained from the Department of Environmental Services (DES). It may be converted to other CAD formats provided that the CAD files submitted to the City are capable of maintaining the prototype drawing appearance after being imported back into AutoCAD 2002 or later. COGPROTO.dwg contains the following:

1. City title block and attributes (in paper space)
2. City cover sheet example
3. Plan and profile title block
4. Standard text styles
5. Symbols library title block
6. General layers
7. COG.ctb plot file

2.02.04 Electronic Acceptance Standards

Purpose – All as-built construction drawings shall be submitted in accordance with ***Section 2*** of these Design Standards. This section outlines electronic standards, layering conventions, and sheet layouts. Electronic file format shall be compatible with the AutoCAD version accepted by the City. Files submitted shall adhere to the following minimum standard:

1.	All electronic files submitted must be generated with e-transmit command of AutoCAD.	
2.	Layering protocols (layering system)	
3.	List of layers	
4.	All electronic files submitted for submission files should be zipped or be accompanied by a separate support folder that contains the following:	
	a.	Company's **.ctb that controls the plotted pens weights; default**; .ctb's (acad.ctb, grayscale.ctb, etc.) are unacceptable if they have been modified; if the **.ctb has been altered in any way, it will need to be renamed intuitively.
	b.	All Xref's file paths should be detached.
	c.	Bind all Xref's in the **.dwg.
	d.	All fonts should be standard in the **.dwg.

Accuracy – All as-built drawings shall accurately represent as-built construction and shall be graphically and mathematically correct, i.e., drawing shall represent changes in dimensioning during construction. Drawing shall also adhere to requirements in ***Sections 1 and 2*** of these Design Standards.

Consistency Between Electronic Copy and Hard Copy – (1) Submit all information required to reproduce a hard copy from the electronic file. The electronic copy and the hard copy shall be identical with the exception of the original signature of the signature on the engineer's stamp. (2) Use only standard AutoCAD line types, fonts, and shapes. If the City encounters significant problems during reproduction, the drawing shall not be accepted.

Electronic As-built Drawing Set – Submit a complete electronic as-built drawing set. This drawing set shall include, but not be limited to, a design drawing model and all contract drawing sheets. The electronic as-built drawing set shall conform to the minimum standards specified in this section.

1.	**Plan and Profile:**	
	a.	All infrastructure components shall be placed on the appropriate layers as described in the layering conventions. See the Layer Naming Convention chart and the Layer List in the CAD Standards folder for reference.
	b.	In the plan section of the drawing, submit all infrastructure components in models space. Drawing objects not directly tied to the model and/or sheet-specific information may be placed in model or paper space.
	c.	In the profile, detail, and cross section, all infrastructure components not directly tied to the model may be placed in model space or paper space and shall be placed on the appropriate layers as described in the layering conventions. See the Layer Naming Convention chart and the Layer List in the CAD Standards folder for reference.
	d.	All specific construction notes shall be placed in model space. General construction notes may be located in either model space or paper space.

	e.	Non-referenced images, standard drawings, specifications, and/or blocks shall be embedded in the drawing and not attached as an external reference.
	f.	If registered orthophotography is used as a backdrop, the image and registration file, along with directory information, shall be provided.
2.	**Plot Layout/Plot Settings:**	
	a.	Submit all information required to reproduce a hard copy from the submitted electronic file in the standard City title block.
	b.	Standard AutoCAD font and line types shall be used. If unsure, place drawing objects in model space on a unique layer.

Reference Information – (1) If Xref's are used with a drawing, bind all Xref's before submission. The City will not accept drawings with Xref's. (2) Purge all invisible drawing objects before submission.

Layering Conventions – All drawing components shall be placed on the correct layer as described in the layering protocols and conventions. See the Layer Naming Convention chart and the Layer List in the CAD Standards folder for reference. The layering protocols are to assist users with correctly developing layer names that will consistently meet the City's layering convention standards. All drawing components shall comply with these conventions.

Media – Files submitted shall be on a CD ROM or other storage media approved by the Engineer. Clearly label all media with City project number, project name, file name and extension(s), AutoCAD version, and date.

City Inventory Information – This information is needed to update City inventories and databases. When applicable, drawing content shall include this information and each item shall be placed on the appropriate layer as defined in the layering conventions. See the Layer Naming Convention chart and the Layer List in the CAD Standards folder for reference.

2.02.05 Plan Sheet Sizes, Layouts, and Format

Construction plans and specifications shall be stamped by a professional engineer licensed in the State of Oregon.

Drawings shall be, except as noted below, ANSI "D" size (22-inch by 34-inch) sheets. Title blocks are supplied by the City of Gresham.

Draw the plan so the north arrow is prominent and towards the top (long side) or left of the sheet whenever possible.

Scales: Different standards, other than the 2 listed below, may be used as approved by the Manager:

Plan/Scale	Horizontal	Vertical
Street	1" = 20'	1" = 2'
Sewer	1" = 40'	1" = 4'
	1" = 50'	1" = 5'
Storm	1" = 40'	1" = 4'
Water	1" = 20'	1" – 2'
	1" = 40'	1" = 4'
Parks	1" = 20'	1" = 2'

Complex utility locations may require a larger scale plan to show the necessary detail. If a scale is indicated on a plan sheet, a bar scale shall be used.

Provide match lines with matched sheet number where the plan is drawn on more than one sheet. If the plan is shown on three or more sheets, include a site plan key map at a common scale of 1" = 100' or 1" = 200' or representative fraction of 1:1200 or 1:2400.

Section and detail call-outs are shown on both the plan and the section/detail. They should include assigned section/detail letters/numbers and drawing sheet location number.

Final plans shall be submitted using the standard City of Gresham title block. The electronic digital drawing file shall accompany the submission. The City of Gresham title block (AutoCAD 2002 or later drawing file format) can be found in the CAD Standards folder on the Public Works Standards CD and can be obtained from the City's Department of Environmental Services.

Plans must be of such quality that when reduced to 50% of original scale the prints will be clearly legible.

Plan Sequence – Use the following sequence for the applicable sheets for design and as-built plans:

1. Cover Sheet – Site Plan Key Map
2. Symbols and Abbreviations
3. Plat Sheet
4. Composite Utility Drawing
5. Grading and Erosion Prevention & Sediment Control (EPSC)
6. Grading and EPSC Details and Notes
7. Street and Storm Plan and Profile
8. Offsite Street and Storm Plan and Profile
9. Street and Storm Details and Notes
10. Sanitary Sewer and Water Plan and Profile
11. Offsite Sanitary Sewer and Water Plan and Profile
12. Sanitary Sewer and Water Details and Notes
13. Streetlight Plan (may be included on composite utility drawing)
14. Traffic Control Plan
15. Standard Details and Notes

An index is to be included on the cover sheet of all plan sets using the titles as they appear on the plan sheet(s).

The vicinity map needs to show the locations and limits of the project and specify scale.

Plan and profile shall be placed on the same sheets. The horizontal scale of the profiles shall be the same as that on the plan.

Required Information – The following items shall be contained within the City of Gresham title block aligned vertically along the right side of each sheet:

a. Project title

b. Sheet title

c. Designer's company/agency information – name, address, voice/fax telephone numbers, e-mail address, logo, etc.

d. Engineer's stamp and signature

e. Review stamp (if applicable) – When plans are submitted to the City for review and comment, the plans shall be clearly marked "PRELIMINARY – NOT FOR CONSTRUCTION" over the engineering stamp and signature.

f. Date of drawing

g. Revision block – including area for revision number, description, date, and name

h. Project name, date, time, and file name and project number – orientated vertically near the bottom left hand corner of the sheet

i. "City Approval" (blank area for City approval stamp and signature by the Engineer)

Submittals shall contain the following sheets: title sheet (unless not required by the Engineer), plan and profile sheet(s), Standards Checkoff Sheet (see CAD Standards folder), and detail sheet(s).

Drafting Requirements:

1. Plan sheets may be plotted from CAD files using industry standard output devices.

2. Minimum lettering size is 0.10-inch (metric size needed) to ensure legibility after reduction to one-half size. Lettering and dimensioning shall be placed so they may be read from left to right as viewed from the bottom of the sheet and from bottom to top when viewed from the right side of the sheet. Text should be clear of any lines.

3. No stick-on's are to be used on final plan sheets.

4. Existing features and topography shall be shown with sufficient density to adequately reproduce at a 50% reduction of scale.

5. All existing and proposed improvements shall be referenced to the City of Gresham Photogrametric Control Network and conform to Multnomah County Surveying Standards.

   a. For survey reference, improvement project coordinate values are based on the Lambert State Plane Coordinate System, Oregon North Zone. Basis of bearing for all measures shall be taken from the City Photogrametric Control Network.

   b. All vertical survey measurements and elevations shall be made with reference to the vertical datum as defined in ***Subsection 1.02***.

   c. Horizontal and vertical control stations used as a basis of project control shall be prominently provided on the cover sheet.

6. Existing and proposed topography contours shall cover the entire site and, whenever practicable, a minimum of 50-feet beyond the site boundary. Existing topography should be screened. Topography contour intervals shall be shown at:

   2-foot for slopes less then 10%
   2-foot for slopes between 10% and 40%
   5-foot for slopes greater than 40%.

7. All division or phase lines shall be indicated showing proposed limits of construction.

8. Label all streets with City of Gresham names.

9. All final design sheets shall include the professional engineer's seal, signature, address, and phone number placed in the title block area as shown on City of Gresham sample Title Block Sheet in the CAD Standards folder.

2.02.06 City of Gresham Prototype Drawing Files

All CAD files submitted to the City shall be prepared using the City's CAD prototype drawing file, an AutoCAD 2002 drawing file named COGPROTO.dwg and located in the CAD Standards folder on the Public Works Standards CD. The prototype-drawing file can be obtained from the City's Department of Environmental Services. It may be converted to other CAD formats provided the CAD files submitted to the City are capable of maintaining the prototype drawing appearance after being imported back into AutoCAD 2002 or later.

COGPROTO.dwg contains the following:

1. City title block and attributes (in paper space)
2. Standard text styles
3. Gridline block for plan and profile drawings north arrow block
4. General layers
5. Symbols library drawing

2.02.07 Text Styles

All .dwg CAD files submitted to the City shall use the following native AutoCad 2002 text fonts. CAD files submitted as .dxf files must emulate these styles. No custom or proprietary fonts shall be submitted without prior approval. Use ROMANS as the primary font. Minimum plotted height is 0.10-inch on "D" size drawing. The maximum oblique angle allowed is 8º. Use only 0 or 8º.

Application – The City requires the "STANDARD" text style be used in the following instances:

- Text notes used for information regarding
  - Benchmark locations
  - Notification contacts
  - General and erosion control construction notes

- Construction notes on plan/profile drawings
  - Text used in details
  - Attention to utility conflicts
  - Connection to existing facilities
  - Identification of topographical features
  - A notation referencing details, sections, sheets in bubbles, etc.
  - Existing and proposed utility identification
  - Utility feature
  - Size of diameter
  - Material
  - Slope
  - Privately maintained conveyance
  - Dimension text styles
  - Custom created detail notes, dimensions, text, etc.

These are some of the instances you would use the "STANDARD" text style, but certainly not all. Minimum plotted text height of all text must be .10-inch when plotted for submittal on the 22-inches x 34-inches City title block.

2.03 REQUIRED SHEET INFORMATION

Construction plan submittals shall contain the following minimum sheets: Title Sheet (unless not required by the City), Composite Utility Plan, Erosion Prevention & Sediment Control, and Tree Removal Plan.

2.03.01 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:

a. 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.

b. Vicinity map at a 1" = 1000' scale or greater.

c. Index of sheets.

d. Complete legend of symbols used.

e. General and construction notes pertinent to project.

f. Datum, as defined in ***Section 1.02*** and temporary and/or permanent benchmarks used along with their descriptions, and elevations of benchmark.

g. Engineer's name, address, phone number, and seal.

h. Developer's/owner's name, address, and phone number for privately financed public improvements.

i. Statement referencing City of Gresham Standard Specifications.

j. Provide contact phone number for all affected utility companies and pertinent City personnel.

k. Show tax lot numbers or lot and block designations.

2.03.02 Erosion Prevention & Sediment Control and Tree Removal Plan

The erosion control plan shall address the measures as required by the City's Erosion Prevention & Sediment Control Manual (EPSC). Construction projects anticipating construction activity between October 1st and May 31st will be required to submit a plan addressing "wet weather" measures as outlined in the EPSC Manual. Construction activity is assumed as "active" until permanent vegetation and/or erosion protection is established.

The plan shall include existing contours at 2-foot intervals or as approved by the City, including location of erosion control facilities (e.g., silt fence, straw mulch, sediment ponds, etc.); inlet and outlet structures (e.g., catch basins, culverts, creeks, etc.); and existing public and private utilities.

All trees with 8-inch and larger diameters shall be shown on the plan. The plan shall identify the location, caliper, and species of the tree and shall indicate if the tree is proposed to remain or to be removed.

2.03.03 Plan Sheet

All plans shall use elevations based on the datum as defined in ***Section 1.02***.

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

a. 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 sanitary sewer, points of disposal for building storm drains, and how new curbs will join to existing curbs.

b. 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.

c. Location of all water courses, railroad crossings, culverts, bridges, large water transmission pipes and wastewater systems, and/or storm drains within 200-feet of proposed wastewater system and storm drain extensions if they affect the design of the project. All watercourses shall show the 100-year flood plain as indicated on the U.S. Army Corps of Engineers and Federal Emergency Management Agency (FEMA) maps.

d. On wastewater 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. Each line shall be stationed continuously on the plan sheet. Each separate line shall be separately designated (e.g., wastewater line "A", storm line "A", etc.).

e. On plat sheet, 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.

f. Where streets are being widened, edge of pavement elevations shall be shown to determine pavement cross-slope to new curb or pavement edge.

g. 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 details for valves and fittings are required when scale of plans is smaller than 1" = 20' (i.e., 1" = 40').

h. Where elevation contours are shown, they shall use elevations based on the datum as defined in ***Section 1.02***.

2.03.04 Profile Sheet

All profiles shall use elevations based on the datum as defined in ***Section 1.02***.

Profiles for construction plans shall be the same horizontal scale as the plan sheet. Where profiles are drawn on the same sheet as the plan view, the profile shall be immediately below the plan view. Stationing shall be continuously upgrade from left to right with lower stations to the left. The following minimum information shall be shown:

a. For waterlines, show all locations of fittings, valves, and fire hydrants with each having size and stationing call-outs.

b. For wastewater systems and storm drains, show locations of manholes, catch basins, and cleanouts, with each numbered and stationed as indicated in ***Subsection 2.03.03d***.

c. Existing profile at centerline of proposed utility or street, plus, whenever practicable, 100-feet each direction from end of proposed street.

d. Proposed profile grade, as appropriate, for all wastewater systems, storm drains, and waterlines, giving pipe size, length between structures or fittings, slope, backfill and pipe material, sewer inverts, rim elevations, etc.

e. Existing and proposed underground utility that crosses the alignment of the proposed facility.

f. Beginning of all vertical curves, points of vertical intersection, end of vertical curve, low point of sag curve, high points, and length of vertical curve. Whenever practicable, profiles of existing centerline grade shall extend a minimum of 250-feet beyond the end of the improvement.

g. Clearly show all potential conflicts with existing public and private utilities (i.e., pipes, conduits, vaults, cathodic protection systems, etc.) that impact proposed design.

SPECIAL NOTE: City as-builts are only to be used as an aid to the Engineer of Record. When a potential conflict may occur, the Engineer of Record 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.

2.03.05 Detail Sheets

Standard Details shall be included on a separate sheet(s) with all construction plans. If a Standard Detail, such as sewer manholes, must be modified to fit existing or unique conditions, the modified drawing shall be marked accordingly on the detail. When appropriate due to required detail complexity or if a standard detail does not exist, a separate detail sheet shall be drawn.

2.04 SUPPORTING INFORMATION

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

a. Design calculations

b. For storm drains, hydrology and hydraulic calculations with basin maps

c. Alternate materials specifications including manufacturer's design application recommendation

d. Grading plan support information to include as appropriate:
   (1) Soils engineering report
   (2) Hydrology report
   (3) Engineering geology report

e. A narrative of the stormwater facility, including its intended functionality, and an explanation of how the outlet(s) function to meet peak discharge control and water quality treatment control requirements

f. Downstream analysis:
   (1) An analysis shall be performed to determine the potential impacts from the project on the downstream system. At a minimum, the downstream analysis will include the area from the project site to a point, to be determined by the city, downstream of the project site. The analysis must proceed far enough along the drainage course to determine that nothing downstream of the end point will be adversely affected by the project's runoff. Refer to ***Section 4.04***, Downstream Analysis Report, for a detailed description of how to perform a downstream analysis.
   (2) For waterline systems, water model calculations

2.04.01 Facility Plan

When designing wastewater or stormwater sewer facilities, a facility plan shall be submitted with the construction plans when required by the Engineer. This plan shall be used to identify and analyze the proposed extension of facilities. Whenever practicable the topographic plan shall show all upstream and tributary areas within at least 200-feet of the proposed development.

The plan shall include existing contours at 2-foot intervals, or as approved by the City, including location of existing structures and public and private utilities.

2.04.02 Maintenance Plan

A maintenance plan shall be submitted for City review and approval for all privately financed private detention, retention, and water quality facilities. The plan shall include types and frequencies of maintenance activity required.

2.05 PLAN SUBMITTAL

Construction plans for all privately financed public improvements shall be submitted to the Project Manager. The Project Manager will coordinate the plan review and approval of all construction plans that will include review for compliance with all conditions of approval, Gresham Public Works Standards, the Gresham Community Development Plan, City Code, Ordinances, and any relative master plan.

All plan submittals shall include information required in ***Section 2*** of these Design Standards along with all other information requested by the Engineer. This information is to include, but not be limited to, construction cost estimates, 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 of Record 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.

2.06 AS-BUILT PLAN REQUIREMENTS

For all public works improvements the Engineer of Record shall submit certified as-built drawings for all plans that were approved for construction within 3-months of the completion of construction. As-built drawings shall meet the requirements of ***Sections 2.02***, ***2.03***, and this subsection and shall be of archival quality. At a minimum, the drawings shall be 4-mil mylar with permanent, UV resistant marking medium. Original inked mylars may also be submitted in lieu of photographic mylars.

The Engineer of Record shall be responsible for as-built surveying of the project to incorporate information including, but not limited to, ends of sewer laterals, manhole locations, and depths of pipes at manholes for inclusion in as-built drawings, and shall submit, along with the as-built drawings, a statement certifying that all work for which plans were approved has been completed in accordance with the Gresham Public Works Standards specifications.

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

All sheets that were part of the original, approved design plan set shall be submitted as part of the as-built drawings, including title and detail sheets.

As-builts must include all private and public easement information.

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.

2.06.01 Street

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

a. Change in horizontal alignment, curve data, and stationing of primary control points (e.g., PC, PI, PT, PRC)

b. Vertical curve or grade changes; change in location of low point in sag vertical curve

c. Change to approved thickness for street structural section components. Show station limits where changes in structural section have occurred

d. Change to driveway locations or widths

e. Other change altering the approved plans

2.06.02 Storm Drains

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

a. Station of 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

b. 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

c. Other change altering the approved plans

2.06.03 Wastewater

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

a. 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

b. Depth at the end of service lateral measured from existing ground to invert of pipe; when required by the Engineer, invert elevations shall be noted

c. Length of service lateral measured from centerline of sewer main to end of pipe

d. 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

e. Other change altering the approved plans

f. Provide complete test results to the Project Manager

g. Type of pipe, backfill material, and location

2.06.04 Water Main

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

a. Station and/or property line/corner to valves (not at standard location), all fittings, blow-offs, and dead-ended lines

b. All changes from standard 36-inch depth cover; limits shall be shown on plan with annotated reason for change; actual pipe elevation (top of pipe) will be taken at every fitting that is not at standard cover

c. 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 fitting

d. Provide manufacturer of all valves; identify types of fittings (e.g., MJ x MJ, FLG x MJ, etc.); provide information in the form of an inventory list on construction drawings

e. Other change altering the approved plans

f. Provide design calculations and complete test results to the Project Manager

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

2.06.05 Parks

The following minimum information shall be noted on parks, trails, and natural area as-built drawings:

a. Dimension horizontal distances from at least two permanent visible structures to each angle point or other change in direction of irrigation piping as well as sleeves, valves, and other buried appurtenances

b. Note depth of bury of irrigation piping, especially at changes of such depth

c. Note all changes in designed system flow, in GPM, and valve schedule, head placement, etc.

d. Indicate contractor's company name, phone number, and contact person

e. Other change-altering approved plans

SECTION THREE – WASTEWATER SYSTEMS

3.01 GENERAL DESIGN REQUIREMENTS

Performance Standards – Wastewater system design shall meet the policies and guidelines of the latest Sewerage System Master Plan and its updates.

Wastewater systems shall be designed to provide gravity service to all areas of development.

Wastewater system capacity shall be designed for ultimate development density of the contributing area. The system shall allow for future system extension and for future development based on current and on proposed land use designations.

Wastewater systems shall be designed to remove the domestic wastewater and industrial wastes from basements of houses where practical, commercial or industrial buildings, and all public and private establishments where possible.

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 system.

In general, wastewater systems shall be designed to allow for future loads and for ultimate development of the specific drainage area or basin based on current and on proposed land use designations.

As a condition of wastewater service, all developments will be required to provide public wastewater systems to adjacent upstream parcels in order to provide for an orderly development of the drainage area. This shall include the extension of wastewater mains in easements across the property to adjoining properties, and across and 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 lines that are sized to provide capacity for upstream development.

All public wastewater systems shall be located within the public right-of-way whenever possible. Under special topographical conditions, the placing of public wastewater systems outside of public right-of-way may be approved by the Engineer. When system access facilities such as manholes and cleanouts are constructed beyond access from the roadway, a heavy vehicle accessway shall be provided as shown in Standard Detail 605.

Design shall comply with Oregon Department of Environmental Quality sewer design guidelines, **OAR 340, Division 52**.

For any project requiring construction within or adjacent to watercourses and/or wetlands, in addition to approval by the City, permits from the appropriate responsible agencies (Oregon Department of Fish and Wildlife, Oregon Division of State Lands, U.S. Army Corps of Engineers, U.S. Fish and Wildlife Service, U.S. National Marine Fisheries Service, etc.) shall be obtained. Copies thereof, or written evidence that no permit is required. shall be given to the City prior to any clearing or construction.

3.01.01 Wastewater Plans

In addition to the requirements of ***Section 2*** of these Design Standards, the following requirements shall apply to plans for public wastewater system improvements: Whenever practicable the plan and profile sheets shall show the topographic information required by ***Subsection 2.04.01*** for a minimum of 200-feet upstream of the proposed end of any extendable mainline sewer.

3.01.02 Pipe Materials and Size

All public wastewater systems shall be constructed with ASTM D-3034, SDR35 PVC pipe as specified in ***Section 301*** of the Construction Standard Specifications. Where required for added strength, AWWA C-900, or AWWA C-905, PVC Pipe, or ASTM C-76 reinforced concrete pipe shall be used. Class 50 ductile iron pipe will be used when added strength is needed and pipe wall thickness is limited.

Solid wall HDPE pipe may be used in boring, jacking, pipe bursting, and other similar applications when approved by the Engineer. Private sanitary sewers shall meet the appropriate sections of the Uniform Plumbing Code.

All public wastewater main lines shall be a minimum diameter of 8-inches.

3.01.03 Minimum Design Criteria

Design Values – If there are no specific project values for the amount of sewage to be generated (Uniform Plumbing Code flows), the following design values shall be used:

Land Use Designation	**Net Density (Dwelling Units/Acre)**	**Net Population (People per Acre)**	**Daily Wastewater Flow (Gallons/Day/Acre)**
LDR	8.71	19.2	1,533
TLDR	20.00	44.0	3,520
MDR-12	12.10	26.6	2,130
MDR-24	24.20	53.2	4,259
OFR	12.10	26.6	2,130
Gresham Butte Overlay	1.00	2.2	176
BP	1.00	2.2	176
LI	2.18	4.8	384
HI	2.18	4.8	384
NC	4.36	9.6	767
GC	4.36	9.6	767
RTC	40.00	88.0	7,040
SC	60.00	132.0	10,560
SC-RJ	60.00	132.0	10,560
CMF	24.00	52.8	4,224
CMU	24.00	52.8	4,224
CC	40.00	88.0	7,040
MC	40.00	88.0	7,040
CUC	60.00	132.0	10,560
DT	60.00	132.0	10,560
DR-12	12.00	26.4	2,112
DR-30	30.00	66.0	5,280
DC-1	30.00	66.0	5,280
DC-2	30.00	66.0	5,280
TDM-C	60.00	132.0	10,560
TDH-C	60.00	132.0	10,560
HDR-C	60.00	132.0	10,560
MDR-C	30.00	66.0	5,280

In addition to the wastewater flows in this table, an allowance of 1,000-gallons/day/acre shall be added for all the land area in the basin being served to account for inflow and infiltration (I & I).

A peaking factor shall be applied to the daily wastewater flow. The peaking factor shall be 3.0.

The wastewater design flow in gpd is then calculated as: Acres * (1,000 + DWF * 3.0) where DWF = Daily Wastewater Flow in gpd/acre from table above.

Velocity – All wastewater pipes shall be designed at a grade that produces a mean velocity of the wastewater design flow of no less than 2-feet per second and not more than 15-feet per second. If topography requires a grade that would result in a velocity greater than 15-feet per second in one pipe section, additional drop manholes shall be installed as required by the City.

The velocity shall be calculated using the wastewater design flow for the basin to be served now and at ultimate design flow in the future.

Size – The pipe size shall be based on the minimum size needed for the design flow and not the size needed to result in a desired slope. The pipe size shall be determined by using one-half of the maximum gravity flow capacity of the pipe for pipes 15-inches in diameter and less, and shall be two-thirds for pipes larger than 15-inhes in diameter.

The Engineer of Record shall submit his calculations for each wastewater line to be installed, exclusive of sewer laterals. Such calculations shall include the requirements of ***Subsection 3.0010*** herein before.

Manning's Equation – When calculating volumes, slopes, and velocities, the Engineer of Record shall use the Manning pipe friction formula.

$$V = (1{,}486/n) * (R^{(2/3)}) * (S^{(0.S)})$$

Where: V = Q/A = 2 ft./Minimum 1 sec
n = 0.013 Minimum
R = Hydraulic Radius, ft
S = Slope, ft/ft

Minimum Slope – For verification purposes the following table of minimum pipe slopes shall be used. The slopes shown are for informational purposes only. The actual slopes shall be determined by the actual wastewater design flow.

Pipe Size (Inches)	Slope (Feet/Feet)
6	0.00490
8	0.00334
10	0.00248
12	0.00195
15	0.00145
18	0.00114
21	0.00093
24	0.00078
27	0.00066
30	0.00058
36	0.00045
42	0.00037
48	0.00031
54	0.00027
60	0.00023
66	0.00020
72	0.00018

Pipes with slopes of 20% or more, while having to conform to the maximum velocity requirements specified above, are required to have anchor walls as detailed in the Standard Detail 321.

3.02 ALIGNMENT AND COVER

3.02.01 Right-of-way Location

Wastewater lines shall be located 5-feet north or west of the right-of-way centerline.

Wastewater systems shall be located in the street right-of-way. If streets have curved alignments, the center of the manhole shall not be less than 6-feet from the curb face.

Curved alignments in wastewater systems, vertically or horizontally, are not permitted.

3.02.02 Minimum Cover

All wastewater pipes shall be laid at a depth sufficient to drain building sewers to protect against damage by frost or traffic and to drain basement sewers where practical. Sufficient depth shall mean the minimum cover from the top of the pipe to finish grade at the wastewater alignment. In new residential hillside subdivisions, mainline and sewer laterals shall be placed in the street at a depth sufficient to drain building sewers on the low side of the street.

Wastewater pipes in residential areas shall be placed with the following minimum cover:

Building Service Branch	–	6-feet at right-of-way for level or upward sloping lots
Trunk and Collector Sewer	–	9-feet in roadways and easements

C-900, C-905, or ductile iron pipe shall be used in accordance with ***Subsection 3.01.02*** when cover is less than 3-feet from subgrade.

Where the topography is relatively flat and existing sewers are shallow (5-feet or less), the minimum cover shall be 3-feet.

Deviation from the above standards will be considered on a case-by-case basis when one of the following circumstances exist:

a. Underlying rock strata – required submittal: A request in writing to the Engineer, together with submittal of a soils report, with a plan and profile certifying that bedrock exists 3-feet below the undisturbed ground surface at all investigated alignments.

b. A ditch or stream must be crossed – required submittal: A plan and profile; horizontal scale 1-inch = 20-feet, vertical scale 1-inch = 2-feet.

3.02.03 Separation with Waterlines

Water mains shall be installed a minimum clear distance of 5’ horizontally from wastewater pipes and shall be installed to go over the top of such pipes with a minimum of 18” of vertical clearance at the crossing of these pipes (in accordance with the requirements of OAR Chapter 333, Public Water Systems). Exceptions shall first be approved by the Engineer. In all instances the distances shall be measured surface to surface.

Where individual properties are served by private pumps and force mains discharging to a public wastewater system at the property line and a domestic water well is also on that same property, either Uniform Plumbing Code (for water systems servicing 3 or less dwelling units) or State Health Department (for community water systems servicing 4 or more dwelling units) specified separation of wastewater and waterlines shall apply.

3.02.04 Easements

When, in the Engineer’s opinion, it is impractical to locate City utilities in rights-of-way, the utilities shall be placed in an easement. All public utility easements granted to the City shall be perpetual easements.

All easements shall be exclusive to a single City utility unless otherwise approved by the Engineer.

The conditions of the easement shall be such that the easement shall not be used for any purpose that would interfere with the unrestricted operation and maintenance of the utility. Under no circumstances shall a building or any other structure be placed over a utility or utility easement. This shall include overhanging structures with footings located outside the easement.

Easement locations for public utility facilities serving a PUD, apartment complex, or commercial or industrial development shall be in parking lots, private drives, or similar open areas that will permit an unobstructed vehicle access for maintenance.

Except with approval of the Engineer, easements shall be placed on a single property, not centered on property lines, and the utility shall be centered in the easement. If an easement centered along a property line is approved by the City, the utility shall be offset 18-inches from the property line.

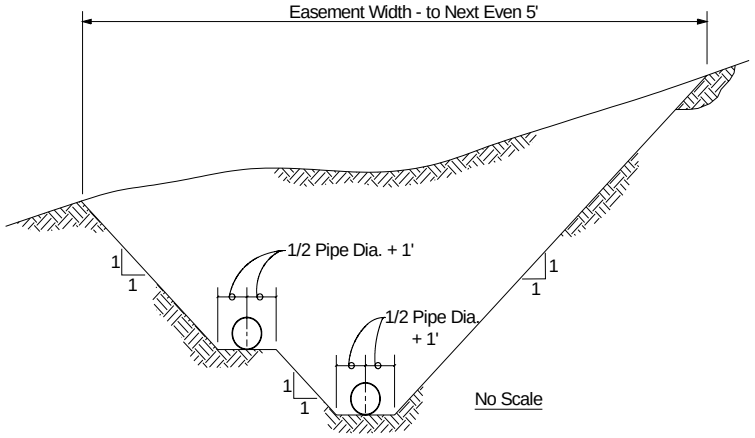
All easements must be furnished to the Engineer for review and approval prior to recording and the start of construction.

Easement location, purpose, width, and description shall be shown on the plans.

Minimum width of a public utility access easement shall be 15-feet.

Minimum width of a public utility easement shall be 20-feet. Easement width shall be determined by multiplying the vertical distance from the pipe invert to the ground surface by 2, then adding the nominal pipe diameter plus 2-feet. Easement width shall be rounded upward to even 5-foot increments, but in no case shall be less than 20-feet. In areas of steel (15% slope or greater) or unusual topography, a wider easement may be required as determined by the Engineer.

For multiple utilities to be located within the same easement, the same above rules apply except that the separation of the sewers, both horizontally and vertically, must be considered. Utilities must have at least a 1-foot horizontal separation of the outside surfaces, including bells. For multiple utilities at differing elevations, the horizontal separation and easement width is determined as shown below:



3.02.05 Relation to Watercourses

Generally, the top of all wastewater pipes entering, crossing, or adjacent to streams shall be at a sufficient depth below the natural bottom of the streambed to protect the line. One-foot of cover is required where the wastewater line is in rock; 3-feet of cover is required in other materials. In paved channels, the top of the wastewater line shall be placed at least 6-inches below finish grade of the bottom of the channel, except as provided above.

Wastewater lines located along or parallel to streams shall be located outside of the streambed and sufficiently removed therefrom to provide for future, possible stream channel widening. All manhole covers at or below the 100-year flood elevation shall be watertight.

Wastewater lines crossing streams or drainage channels shall be designed to cross the stream as nearly perpendicular to the stream channel as possible. The minimum cover shall be 36-inches from the bottom of the streambed or drainage channel to the top of pipe.

The pipe material shall be C-900, C-905, or ductile iron in accordance with ***Subsection 3.01.02***, or continuous high-density polyethylene with an 18-foot length of pipe centered on the stream or drainage channel centerline. The specified pipe type shall extend to a theoretical 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.

Concrete encasement per Standard Detail 322 will be required when the above cover requirements cannot be met. Each deviation from the above requirements will be reviewed by the Engineer on a case-by-case basis.

3.03 STRUCTURES

3.03.01 Manholes

Manholes shall be located at all changes in pipe slope, alignment, size, type, and at all pipe junctions with present or future wastewater lines excluding 4" or 6" service branches serving 4 or fewer living units.

Manhole spacing shall not be greater than 500-feet.

The Standard Details 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:

a. One or more of the sewers to be connected to the manhole is over 27-inches in diameter (smaller diameters may require a special design if the manhole is at an alignment change)

b. Several sewers will be connected to the manhole

c. There is less than 90º between the incoming and outgoing sewer

d. The manhole will be subject to unusual structural loads

e. Diversion or other flow control measures are required

Where one or more of conditions a, b, or c are encountered, a drawing of the manhole base shall be made to determine if it is feasible to use designs shown in the Standard Details. It may be necessary for the Engineer of Record to restrict the manhole options to a specific Standard Detail specified by a note on the construction drawings. If a special design is required for any reason, it will be necessary to show that design on the construction drawings and to provide the Project Manager with structural calculations.

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

a. Slab tops must be used in lieu of cones where there will be less than 4-feet between the top of pipe and the top of the manhole lid.

b. Watertight manhole frames and covers are to be used if floodwaters are expected to cover the manhole top or if the manhole must be located in the street gutter. Such conditions should be avoided wherever feasible.

c. Tamperproof manhole frames (7-inch depth) 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 the wastewater system. For purposes of slope calculation and for establishing elevation differences, the elevations are given at the theoretical horizontal intersection of the wastewater centerlines (usually the center of the manhole). The rules for elevation differences at manholes are:

a. The crowns of incoming pipes shall be at least as high as the crown of the outgoing pipe.

b. If the incoming and outgoing pipes are of equal size and are passing straight through the manhole, no added elevation change is required.

c. If the pipe alignment changes at the manhole, the invert elevation difference shall be at least 0.10-feet for 0° – 45° of horizontal deflection angle, and 0.20-feet for 45° – 90º of horizontal deflection angle. Horizontal deflection angles of greater than 90º are not allowed.

d. Drop connections are required when the vertical distance between flow-lines exceeds 2-feet.

e. All connections must enter the manhole through a channel in the base. This includes drop connections and connections to existing manholes.

Where conditions make compliance with these rules impractical, exceptions will be permitted. It will be necessary, however, for the Engineer of Record to provide a complete analysis of the need for such designs.

3.03.02 Cleanouts

Cleanouts will not be approved as substitutes for manholes on public wastewater lines. Cleanouts are permitted at the upper end of a wastewater line that is designed to be extended during a future phase of construction. If future extension requires a change in pipe slope, alignment, size, or type, a manhole will be required at the cleanout location.

Cleanouts are permitted at the end of a non-extendable sewer line that does not exceed 250-feet in length nor serve more than 8 lots.

3.04 SEWER LATERALS

Sewer laterals are those public wastewater lines to which a private building sewer connects.

Each individual building lot shall typically be connected by a single, separate, private, building-sewer/sewer lateral line connected to the public wastewater system. Individual sewer laterals shall be located no closer than 10-feet to the property line. Combined (Siamese) wastewater service branches for 2 lots will be permitted only when each property cannot legally be further divided and it is in the best interest of the City to do so. See Standard Detail 318.

The minimum nominal diameter of a sewer lateral shall be 4-inches. In all cases the sewer lateral shall be equal to or greater than the building sewer diameter. Sewer laterals shall be built to the same construction standards and of the same materials as the wastewater main line. Sewer laterals in general shall be placed at 90º to the wastewater main line to avoid excessive exposure to other utilities during excavation for construction or maintenance of the sewer laterals. Angles other than 90º (45º minimum) may be approved by the Project Manager for cul-de-sac lots. Sewer lateral 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 sewer laterals shall be 2%. Except that for unusual conditions, a slope of 1% may be approved. It will be necessary, however, for the Engineer of Record to provide a complete analysis of the need for any sewer lateral slope less than 2%. The maximum slope shall be 100% (45º). Connections to deep wastewater main

lines shall be made with risers (see the Standard Detail 316). Alternately, drop connections into manholes must be used where sewer lateral slopes would exceed 100%.

3.05 CONNECTION TO EXISTING SEWERS

Connections to and extensions of existing wastewater systems will occur to facilitate new development. Certain requirements will be placed on the Engineer of Record as to permitted methods and/or locations.

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

a. Where the invert of the connecting pipe is 2-feet or less above invert of the outgoing pipe, the sewage entering the manhole will follow a smooth concrete channel transitioning evenly from the invert of the inlet pipe into main channel. Sewage will not be allowed to fall freely to the manhole base.

b. Where the invert of the connecting pipe is more than 2-feet above the invert of the outgoing pipe, the Contractor will be required to construct an inside drop per Standard Detail 304 for pipes 15-inches and smaller. Drops for larger pipes will not be allowed. Wastewater entering the manhole will follow a smooth concrete channel transition from the bottom of the drop into the main channel.

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

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

3.06 PRIVATE SEWER LINES

Private sewer lines shall be installed on private property in accordance with the requirements of the Uniform Plumbing Code.

Easements for private sewer lines are the responsibility of the owners; but copies of the recorded easements must be given to the Project Manager prior to any construction.

Private sewer lines shall not be permitted within the public right-of-way.

3.07 SUBSURFACE DISPOSAL

Subsurface wastewater disposal is permitted only when connection to a public wastewater system is not practical as determined by the City. Contact the City of Portland, as the responsible regulatory body for questions and permits for subsurface disposal within the Multnomah County area.

3.08 WASTEWATER PUMP STATION DESIGN STANDARDS

3.08.01 General

The pump station shall be a submersible pump-type facility and shall generally conform to the plans and specifications for the City of Gresham Standard Submersible Pump Station. A copy of these documents may be obtained from the City's Wastewater Division. In addition, the design shall meet or exceed the minimum requirements of the Oregon Department of Environmental Quality (DEQ) as established in the Oregon Administrative Rules, Chapter 340, Division 52, and as presented in the DEQ publication "Oregon Standards for Design and Construction of Wastewater Pump Stations". Where conflicts exist between the Gresham Public Works Standards and

the aforementioned documents, or any other technical specifications identified therein, the most stringent requirements shall take precedence.

3.08.01A Facility

The station shall include: Submersible pumps, wet well, valve vault, associated piping and valves, electrical controls, instrumentation, telemetry**,** access road, fencing, landscaping, and potable water supply.

3.08.01B Capacity

Pump station shall be designed to pump the peak wastewater flow from the service area. When the service area is not built-out, staging of pump station capacity may be allowed.

3.08.01C Standby Power

At a minimum a connection for an external power source must be provided. Where the flow is substantial or where environmental damage may occur due to power failure, the Engineer may require permanent standby power.

3.08.02 Design

3.08.02A Calculations Required

Service area, peak flow, and pump station calculations shall be submitted to the Project Manager.

3.08.02B Storage Volume

Wet well shall be designed to provide 4-hours of wastewater inflow storage above high water alarm elevation.

3.08.03 Materials

3.08.03A Pumps

A minimum of 2 pumps shall be supplied. Each pump shall be capable of pumping the peak wastewater flow. Where more than 2 pumps are used, the station shall be able to pump peak wastewater flow when the largest pump is out of service.

Pumps shall be submersible pumps manufactured by FLYGT (or equal), explosion-proof, suitable for hazardous location, capable of passing solids and shall be UL or FM listed.

3.08.03B Piping and Valves

Piping and valves shall be in accordance with DEQ publication “Oregon Standards for Design and Construction of Wastewater Pump Stations”.

3.08.03C Electrical

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

3.08.03D Controls

Pump stations shall utilize a PLC-based control system.

An ultrasonic level transducer shall control pump operation and alarms.

A redundant float activated circuit shall provide a fail-safe, high-water alarm system. The Engineer shall provide the brand and model of the programmable logic controller, as well as other devices, in order to ensure compatibility with the existing system.

Control system design shall be subject to the approval of the Engineer.

3.08.03E Alarms and Telemetry

Alarms shall be telemetered to the City of Gresham Wastewater Treatment Plant. Telemetry shall conform to specifications and requirements provided by the Engineer to ensure compatibility with existing systems. Required alarms include:

Pump failure
Power failure
High water
Telemetry failure

3.08.03F Landscaping and Fencing

Refer to plans and specifications for the City of Gresham Standard Submersible Pump Station. A copy of these documents may be obtained from the City's Wastewater Division.

3.08.03G Additional Features

Provide 1-inch hose bib at valve vault. Potable water shall be provided by reduced pressure backflow preventer.

Provide positive ventilation in valve vault.

Provide odor control systems as required by the City.

3.08.03H Force Main

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

3.08.04 Construction

3.08.04A Code Authority

Pump station and related facilities will be constructed in conformance with City of Gresham Electrical and Building Codes.

3.08.04B Fabricated Steel Surface Finish

Steel fabrications shall be 304 stainless steel or hot dipped galvanized. Corrosion resistant painting shall be required on valves, piping, and pipe fittings or other items not galvanizable.

3.08.04C Operating and Maintenance Data

Prepare an operation and maintenance (O&M) manual including all product data and related information necessary for the City's operation and maintenance of all products and systems provided with the pump station.

The O&M manual shall conform to the guidelines as set forth in the Oregon DEQ publication “Guidelines for Writing Pump Station O&M Manuals”.

3.08.04D Spare Parts

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

SECTION FOUR – STORM DRAINAGE

4.01 GENERAL DESIGN REQUIREMENTS

Performance Standards – Storm drainage design within a 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 Design Standards. These provisions include:

Surface or subsurface drainage, caused or affected by the changing of the natural grade of the existing ground or removal of natural ground cover or placement of impervious surfaces, shall not be allowed to flow over adjacent public or private property in a volume or location materially different from that which existed before development occurred, but shall be collected and conveyed in an approved manner to an approved point of disposal.

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 energy dissipaters within the subject property to minimize downstream damage and with no diversion at any of these points.

The approved point of disposal for all stormwater may be a storm drain, existing open channel, creek, and detention or retention pond approved by the Engineer. Acceptance of proposed systems will depend upon the prevailing site conditions, capacity of existing downstream facilities, and feasibility of the design.

When adjacent 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 drainage easement (of dimensions in accordance with those included in ***Subsection 4.11.03***). The drainage facility installed must be a piped system. Temporary drainage ditch facilities, when approved, must be engineered to contain the stormwater without causing erosion or other adverse effects to the adjacent private property.

The peak discharge from the subject property, for all applicable design storms, may not be increased from conditions existing prior to the proposed development.

Retention and/or detention facilities will be required, where necessary, to maintain surface runoff rates from the subject property at or below the existing runoff rates for all applicable design storms.

Drainage from roofs, footings, downspouts, and side yard swales may only drain directly to a street through the curb under the following circumstances:

1. Onsite disposal is not practical, or

2. The building pad ground elevation is at least 2-feet above the existing street curb, and

3. The existing street is adequately crowned to avoid sheet flow across the street. This requirement may be waived if on narrow streets or on a case-by-case basis.

Vegetation shall be established on areas disturbed or on areas of construction, as necessary, to minimize erosion in accordance with the City's Erosion Prevention & Sediment Control manual.

Stormwater quality facilities will be required to control the discharge of pollutants from development to the municipal storm drainage system or natural watercourse.

All storm drain system designs shall make adequate provisions for collecting all stormwater 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.

Proposed storm drain systems shall not discharge flows into inadequate downstream systems.

Public storm lines shall be located within the public right-of-way per ***Subsection 4.11.01***, except as noted in ***Subsection 3.02.04***. When system access facilities such as manholes, cleanouts, inlets, and outfalls are constructed beyond access from the roadway, a heavy vehicle accessway shall be provided as shown in Standard Detail 605.

4.01.01 Site Drainage Plans

Existing Drainage Plan – Provide a topographical contour map defining existing conditions to include the following minimum information:

- 2-feet contour intervals; slopes over 10% may use 5-foot intervals; extend contours a minimum of 100-feet beyond property
- All structures, buildings, parking lots, and utilities on the property
- Location of all existing drainage facilities and water courses, including wetlands and floodplain areas
- Locations of all subsurface water outlets (e.g., springs)
- Show arrows to indicate direction of flow for all surface drainage information

Proposed Drainage Plan – Show proposed site grading and drainage facilities on a topographical contour map. Unless the detail for proposed improvements will obscure the conditions shown on the existing drainage plan, proposed site grading and drainage may be shown on the existing drainage plan. The following minimum information shall also be shown:

- Finished contours of the property after development at 2-foot or 5-foot intervals as required
- Percent grade for graded slopes and elevations, dimensions, and locations for all graded slopes
- Cut/fill areas; structural fill placement areas; erosion prevention and sedimentation control methods; reseeding areas
- All proposed drainage facilities – public and private systems; paved areas, curbs, and sidewalks; drainage ditches and culverts

Drainage Calculations – Furnish such supporting information as required per ***Section 2.04*** of these Design Standards. This information shall include basin (sub-catchment) boundary maps, a site Drainage Submittal Summary sheet (as provided by the City), discharge rates, velocities at the system outfall, and hydraulic grade line calculations where required by the City.

Detention Requirements – All proposed development would be required to use adequate drainage management practices. Developments located within a master planned drainage basin will follow the recommendations adopted in that plan. Developments not located within master planned drainage basins will minimize the rate and amount of runoff to receiving systems and streams as required by the City. Onsite storm detention will be required as necessary to ensure that new development does not increase flooding or erosion downstream.

4.02 MINIMUM DESIGN CRITERIA

Storm Frequency – All public storm drain systems shall be designed for the design storm recurrence interval in the following table:

DRAINAGE SYSTEM DESIGN CAPACITY		
Drainage System Element		**Design Storm Recurrence Interval (Years)**
Minor:	Streets, curbs, gutters, inlets, catch basin and connector drains	10
Major:	Laterals (collectors) <250 tributary acres	10
	Trunk >250 tributary acres	50*
	Arterial Streets and the Drainage System in or under Arterial Streets	50*
Watercourses:	Without designated floodplain	50
	With designated floodplain	100
Bridges:		100
Detention Facilities:	Storage volume (onsite)	25
	Storage volume	100
	Discharge rate	Function of downstream capacity
Retention Facilities:	Drywell infiltration capacity	25**

*Surcharged conditions for pipe systems and culverts and bank-full conditions for open ditches and channels are acceptable only for demonstrating the adequacy of the conveyance system to convey the peak runoff for the 25 or 50-year design storms (as required) provided that:

a. runoff is contained within defined conveyance system elements; AND
b. the hydraulic grade line does not exceed the elevation of the roadway subgrade; AND
c. no portions of a building will be flooded.

**Maximum allowable design capacity = 1200 GPM = 2.67 CFS per drywell.

Conveyance system adequacy shall be demonstrated by performing a backwater analysis.

Time of Concentration – Overland flow of runoff to the initial catchment point into the storm drain system shall be a minimum of 10 minutes.

Velocity and Slope – All storm drains shall be on a grade that produces a mean velocity, when flowing full, of at least 3-feet per second.

Velocity in 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.

Manning's Equations – When calculating minimum pipe slopes and velocities, the design engineer shall use the Manning pipe friction formula.

Pipe Coefficient – The storm drainpipe roughness coefficient to be used in the Manning formula shall be not less than 0.013.

Stormwater Flows – Several methods are available to engineers for estimating peak runoff rates. Three of these are the "Rational Method", the SCS "Curve Number" method, and the Santa Barbara Urban Hydrograph

(SBUH) method. These methods will be acceptable for estimating the peak runoff rates to be used in sizing storm drainage conveyance improvements in those areas for which there are no specific master plan recommendations.

Detention Volumes – Several methods are available for the calculation of runoff rate volumes for the purpose of calculating detention/retention storage volume requirements. Detention volume estimates shall be based on hydrographs developed for the storm duration specified by the City for the applicable return frequencies. A method shall be used that routes the design hydrograph through the proposed detention system. Unless specified otherwise, the standard design storm duration shall be 24-hours. For development of the appropriate hyetograph(s), the SCS Type 1A 24-hour rainfall distribution is currently being accepted for all development submittals. If necessary, that distribution may be obtained from the City. A table of 24-hour rainfall depths for storms with 2, 5, 25, and 100-year recurrence intervals is also available from the City. For methods based on the SCS "curve number" approach, the City provides a table of the SCS soil types found within the City along with their respective hydrologic soil groups. A second table is available that associates runoff curve numbers (CN) with the hydrologic soil groups and a variety of land uses. This table is intended as guidance only. The Rational Method, or other "intensity based" methods shall not be used to establish storage volume calculations or allowable release rates for detention facilities.

4.03 FLOODPLAIN INFORMATION

Floodplain information, delineating the floodway and 100-year floodplain limits, shall be shown where it occurs within the development. Floodplain limits shall be based on maps prepared by the U.S. Army Corps of Engineers and the Federal Emergency Management Agency (FEMA). Where better information is available, it shall be used.

4.04 DOWNSTREAM ANALYSIS REPORT

The downstream analysis will show what impacts, if any, a project will have on the hydraulic conveyance system(s) downstream of the project site. The analysis is to be divided sequentially into 3 parts. The 3 parts include: (1) review of resources, (2) inspection of the affected area, and (3) analysis of downstream effects.

(1) During the review of resources, the Engineer of Record must review any existing data concerning drainage of the project area. This data will commonly include area maps, floodplain maps, wetland inventories, stream surveys, habitat surveys, engineering reports concerning the entire drainage basin, inventories of known drainage problems, and previously completed downstream analyses. The City may be able to provide most of this information. Other sources of information include, Oregon Department of Environmental Quality, Oregon Division of State Lands, Department of Fish and Wildlife, and other local agencies.

(2) During the inspection of the affected area, the Engineer of Record must physically inspect the drainage system at the project site and downstream of the site. During the inspection, the Engineer of Record should investigate any problems or areas of concern that were noted during the review of resources. The Engineer of Record should also identify any existing or potential capacity problems in the drainage system, any existing or potential areas where flooding may occur, any existing or potential areas of channel destruction (including erosion and sedimentation), and existing or potential areas of significant destruction of aquatic habitat.

(3) During the analysis of downstream effects, the information that has been gathered must be analyzed to determine if construction of the project will create any drainage problems downstream or will make any existing problems worse. Often, if the other minimum requirements are met, the project will not negatively impact the downstream drainage system. There are however some situations that, although minimum requirements have been met, will still have negative impacts. Whenever a situation is encountered where it has been determined that there will be negative impacts resulting from the project, mitigation measures must be included in the project to correct for the impacts.

4.05 CULVERTS

Culverts at road crossings in natural perennial channels shall be designed to pass the peak discharge for the 25 -year design storm such that the headwater water surface elevation:

a. does not exceed 1.5 times the culvert diameter; OR

b. remains at least 1 foot below the roadway subgrade, whichever is less

Water crossing structures on all creeks and tributaries shall be constructed and maintained so as to not impede or eliminate a native fish species' access to habitat or ability to migrate. Proposed culvert crossings, regardless of tributary size, intermittent or perennial, shall conform to Oregon Department of Fish & Wildlife and National Marine Fisheries Service's regulations and stream crossing guidelines.

4.06 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 2-feet or 25% of the mean channel width between ordinary high water marks at the crossing, whichever is greater.

4.07 EROSION PREVENTION AND SEDIMENT CONTROL

4.07.01 General

Developments shall provide erosion prevention and sediment control methods in accordance with the City of Gresham **"**Erosion Prevention and Sediment Control Manual**"** to limit the transportation of soil materials by storm runoff and construction activities during all phases of the construction project.

Obtaining permits from outside agencies are the responsibility of the applicant. These agencies include, but are not limited to, the Department of Environmental Quality, the National Marine Fisheries Service, the Division of State Lands, the Army Corps of Engineers, and the Oregon Department of Fish and Wildlife.

4.07.02 Erosion Prevention Sediment Control Plan

Perform erosion study including review of maps and aerial photos, distinctive minerals, alluvial fans, precipitation patterns, watershed size, topography, soil types, groundcover, and land use.

Select site-specific erosion prevention and sediment control materials based on effectiveness, environmental impacts, regulatory acceptability, long-term cost (maintenance), and public acceptability.

Gather information and requirements from outside agencies as listed above.

Gather field information including topography, existing drainage upstream and downstream, sensitive areas, soil samples, and critical habitat including wetlands vegetation profile.

Use the revised Universal Soil Loss Equation (RUSLE) "A" to determine base-line site erosion:

$$A = R \times K \times LS \times C \times P$$

Where:
- A = Average annual rate of erosion in tons/acre/year
- R = Rainfall factor
- K = Soil erodibility factor (from Natural Resource Conservation Service Ratings)
- L = Slope length
- S = Slope gradient
- C = Cover
- P = Conservation practice

Develop the construction plan by establishing primary access point(s) for construction traffic, laying out limits of clearing and construction activities, restricting all activities in sensitive areas (mark accordingly), establishing base measures including sediment control at toe of disturbed areas and stabilized construction entrances, and establishing maintenance procedures for EPSC measures. Establish permanent ground cover or landscaping prior to removing base measures as approved by permitting City. The plan shall also include construction notes, BMP's

standard symbols, names of existing roads, waterways and drainage features, boundaries of environmentally sensitive areas such as wetlands, rights-of-way and easements, existing and proposed contour lines, and, if applicable, wind erosion control during/following construction. Additional base measures will be necessary during the wet weather season (October 1st through May 31st).

Recommended erosion control grass seed mixes are as follows. Similar mixes designed to achieve erosion control may be substituted if approved by local jurisdiction. Native plantings should be used whenever possible.

1. Dwarf Grass Mix (low height, low maintenance); Dwarf Perennial Ryegrass, 80% by weight; Creeping Red Fescue, 20% by weight; Application rate = 100-pounds minimum per acre

2. Standard Height Grass Mix; Annual Ryegrass, 40% by weight; Turf-type Fescue, 60% by weight; Application rate = 100-pounds minimum per acre

Hydro-mulch shall be applied with grass seed at a rate of 2,000 pounds/acre. On slopes steeper than 10%, hydro-seed and mulch shall be applied with a bonding agent (tackifier) and application rate and methodology to be in accordance with seed supplier recommendations.

Permanent or temporary irrigation shall be supplied especially in abnormally hot or dry weather or on adverse sites. Water application rates shall be controlled to provide adequate moisture without causing runoff.

Establish requirements for permanent ground cover or landscaping to be installed prior to removal of base measures.

4.08 STORMWATER DETENTION/RETENTION

There are 4 drainage basins within the City, each with unique flood control problems; these are Johnson Creek, Fairview Creek, Kelly Creek and West Gresham. Detention/retention requirements and methods are evaluated on a case-by-case basis and may vary between and within basins.

4.08.04 Development not Requiring Detention

In general, developments meeting the following criteria will not be required to provide detention:

a. Partitions
b. Multi-family developments of less than 4 units
c. Commercial and industrial development where the construction of a new facility or expansion of an existing facility will not increase the impervious area by 5,000 square feet or more

4.08.02 Detention Volume

When detention is required or downstream facilities are inadequate, the volume to be detained will be the volume necessary to limit the developed site peak discharge to pre-developed rates for all storm events with a recurrence interval less than or equal to 25-years.

4.08.03 Emergency Overflow

The Engineer of Record shall assess the impacts of system failure for onsite detention. Overflow may occur due to rainfall intensity that exceeds the design storm, debris blockage of storm drain system, or some other reason.

If a system overflows it shall not cause inundation of neighboring properties. Potential overflow routes shall be protected from erosion and/or structural failure by adequate means.

If surface detention (e.g., detention/retention pond) is used, an overflow system shall be included

to provide controlled discharge of the 100-year, 24-hour design storm event for developed conditions, without overtopping any part of the pond embankment or exceeding the capacity of the emergency spillway. The overflow design shall assume failure of the normal outlet control structure. An emergency spillway shall be able to safely pass all flows over the pond embankment without overtopping the embankment. Sufficient armoring will be required to the toe on each face of the embankment to prevent failure of the embankment from erosion.

4.08.04 Detention Facility Design

There are generally 2 types of detention facilities – surface storage (e.g., ponds) and piped systems (or a combination thereof). While the City prefers surface storage systems, either type may be used.

Detention facilities shall not be considered sedimentation facilities unless the following minimum requirements are met:

a. The sediment control portion of the facility must be either a separate pond or structure, or a separate "cell" or element that is isolated from the high flows generated by larger storms that could flush accumulated material back into the stormwater system or channel.

b. Separate calculations shall be submitted demonstrating the designed performance of the sedimentation element. Information must include an explanation of the function of the facility, the required live and dead storage volumes, detention time, and projected frequency of maintenance.

4.08.05 Infiltration Facility Design

When infiltration groundwater recharge disposal of stormwater is proposed, the following shall be submitted for review:

a. Soil Logs – A minimum of one soil log per acre. Each soil log shall extend to a depth of at least 5-feet below the bottom elevation of the proposed infiltration facility or to the seasonal water table elevation.

b. Infiltration Tests – The results of infiltration tests which have been performed in accordance with City requirements and procedures in the subsection.

c. Engineer's Opinion – The written opinion of a qualified soils engineer that the site is capable of supporting a functional infiltration system that will meet the design requirements for the development being proposed. Any requirements related to steep slope, landslide hazard, or other sensitive area impacts shall also be addressed in the report.

Infiltration facilities shall not be allowed outside of the City's designated sump area within the City. Maps of this area are available upon request.

In addition to all other applicable requirements, the approval of infiltration groundwater recharge stormwater disposal systems requires the performance of one or more percolation tests. The number and location of these tests will be dependent upon the size and location of the subject property, and shall be submitted to the City for review prior to testing. All test measurements shall be made during the period when groundwater level is expected to be at its maximum. All tests made for the purpose of approval of infiltration systems shall be performed under conditions in which the surrounding soil is saturated, or nearly so. The infiltration rate test procedure shown below simulates this condition. All tests shall be conducted in accordance with this procedure.

Maximum Infiltration Rate Test

This test is used to determine the maximum subsurface infiltration rate for the purpose of designing infiltration systems such as drywells and infiltration trenches, ponds, or vaults. The purpose of the procedure is to ensure the simulation of actual conditions that occur during storms, including the saturation of the surrounding soil.

1. An excavation shall be made to the bottom elevation of the proposed infiltration system. The maximum infiltration rate shall be determined using either the EPA falling head percolation test procedure (Design Manual – Onsite Wastewater Treatment and Disposal Systems, EPA, 1980) or the double ring infiltrometer test (ASTM D3385).

2. The test hole or apparatus is filled with water and maintained at depths above the test elevation for a period of not less than 4-hours. This represents the saturation period.

3. Following the saturation period, the infiltration rate shall be determined in accordance with one of the test procedures specified above with a head of 6-inches of water.

4. The Engineer shall perform at least 2 tests per acre to determine a representative infiltration rate for the site. The measured rate shall have the following factors of safety applied:

EPA Method	Factor of Safety = 2.0
ASTM D-3385	Factor of Safety = 1.75

All newly constructed stormwater drywells (sumps) shall be tested prior to paving in order to determine their in-place capacity. Testing of both new and existing drywells shall follow the procedure outlined below:

a. Fill sump with water at an initial rate equivalent to the minimum required flow rate for the sump, or 300 GPM, whichever is less, and record the water surface elevation below the sump rim after 5-minutes. Maintain the initial flow rate recording the water surface elevation every 5-minutes until it stabilizes.

b. After the water surface elevation stabilizes, increase the flow rate by 300 GPM and record the water elevation as in Step 1.

c. Repeat Step 2 until:

(1) the sump has reached the design capacity; or

(2) the sump has reached the maximum allowable capacity for a single drywell; or

(3) the sump has reached its actual in-place capacity; or

(4) the maximum flow rate from the water source has been reached.

(Note: The minimum peak inflow for a test to be considered valid shall be 600 GPM unless this exceeds the design capacity of the sump.)

d. Cease discharge of water to the sump and record the water surface elevation every minute until the sump is empty or the water surface has remained constant for a period of 5-minutes.

e. Provide the City with all recorded test data within 24-hours following the test.

f. If, following analysis of the test data, the tested capacity of the drywell is less than the design capacity, contact the City immediately.

The City must be notified at least 24-hours prior to conducting the test. Only clean water shall be delivered to the sump or sedimentation manhole for testing. The introduction of silts, sediments, gravels, or any other foreign material shall not be permitted.

4.09 STORMWATER QUALITY TREATMENT

General Requirements and Applicability

The purpose of the water quality treatment facilities is to reduce the pollutants associated with stormwater runoff from new development and redevelopment. By establishing these criteria, the City is satisfying federal regulatory requirements to control the discharge of pollutants into stormwater as specified in the Clean Water Act Amendments of 1987 and its National Pollutant Discharge Elimination System (NPDES) permit for discharges from a municipally owned and operated separate storm sewer system issued by the Oregon Department of Environmental Quality (DEQ) under authority of the United States Environmental Protection Agency (EPA).

The requirements are minimum standards. If the City determines that additional controls are necessary in basins that drain to sensitive receiving waters or groundwater sources (such as defined by the DEQ's 303d, and proposed Total Maximum Daily Load (TMDL) requirements for water-quality limited streams, the DEQ's Underground Injection Control Regulations, or Federally designated threatened and endangered fish listings), additional facilities, treatments, or other best management practices (BMP's) may be required. These requirements could include larger facility designs as well as additional types of water quality controls.

It is the responsibility of the City and property owners to meet stormwater treatment requirements. The "Water Quality Manual" offers some methods of achieving water quality control requirements. While there has been significant advances in the field of stormwater treatment technologies, the water quality program still requires a best effort attempt at installing facilities that will address the commonly predictable stormwater problems of a development. Therefore, it is essential that the site planner and the design engineer consider the future use of a site and provide solutions for any predictable water quality problems.

All new development and redevelopment applying for a permit application on or after January 1, 1999, are to meet the stormwater treatment requirements as adopted by the Council Order No. 489. The "Water Quality Manual" provides guidance for selection and basic design considerations of stormwater quality facilities in the City of Gresham.

4.10 PRIVATE STORM DRAIN SYSTEMS

4.10.01 Subdivisions

When subdivision lots drain to the rear, it may be necessary to provide a private storm drain 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.

4.10.02 Subsurface Drainage

The drainage line installed shall begin at a cleanout and terminate at an approved point of disposal. Open-jointed storm drain lines will not be considered as an acceptable solution.

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

a. For all existing springs and field tile intercepted during construction activity for other facilities; i.e., sewer/water mains, street excavations, foundations, etc., except subsurface drains are not needed if the entire tile system is removed.
b. Where high groundwater 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.

4.11 ALIGNMENT AND COVER

4.11.01 Right-of-way Location

Storm drain lines shall generally be located five 5-feet south or east from right-of-way centerline. All changes in direction of pipe shall be made at an approved structure.

Storm drain systems shall be located in the street right-of-way. If streets have curved alignments, the center of manhole shall not be less than 6-feet from the curb face.

Curved alignments in stormwater systems, vertically or horizontally, are not permitted.

4.11.02 Minimum Cover

All storm drains shall be laid at a depth sufficient to protect against damage by traffic and to drain building footings where practical. Sufficient depth shall mean the minimum cover from the top of the pipe to finish grade at the storm drain alignment.

Minimum cover shall be 30-inches above the top of the pipe in paved areas and 36-inches at all other locations.

In areas of relatively flat terrain, the design engineer must show that sufficient depth is provided at the boundary of the development to properly drain the remainder of the upstream basin area contributing to the site.

4.11.03 Easements

Easements shall meet the requirements of ***Subsection 3.02.04*** except as noted below.

Open channels shall have easements sufficient in width to cover the 100-year floodplain line when a 100-year design storm is required, or 15-feet from the waterway centerline, or 10-feet from the top of the recognized bank, or such a distance that is required by the Water Quality Resource Area Overlay District – Article V of the GCDP, whichever is greater. In addition, a 15-foot wide access easement shall be provided on both sides of the channel for channel widths greater than 14-feet at the top of the recognized bank.

4.11.04 Relation to Watercourses

Storm drain lines shall enter a creek or drainage channel at 60˚ or less to the direction of flow. The outlet shall have a head wall and scour pad or riprap 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 requirements of ***Subsection 4.12.04***.

4.11.05 Outfalls on Slopes

Outfalls proposed on slopes greater than 15% or greater than 20-feet in height must meet one of the following criteria:

1. The discharge must be less than 0.5 cfs; or

2. A tight-line conveyance system must be constructed to convey the runoff to the bottom of the slope with adequate energy dissipation at the bottom to protect the toe of the slope and/or the receiving watercourse from erosion.

4.12 STRUCTURES

4.12.01 Manholes

Manholes shall be located at all changes in pipe slope, alignment, size, type, and at all pipe junctions with present or future storm drains.

Manhole spacing shall not be greater than 500-feet.

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

4.12.02 Catch Basins

Catch basins shall be located in streets at the curb line to receive storm water runoff and convey it to the main storm drain.

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

a. At curb returns on the upstream side of an intersection

b. At the ends of all dead-end streets with a descending grade

c. At intermediate locations so that storm flows at the curb line do not exceed 3-feet in width (measured from the curb face) or 3-inches in depth (measured at the curb face), whichever is less

d. At the downstream end of the street improvements that abut unimproved roads or undeveloped property

e. At the upstream end of the street improvements that abut unimproved roads or undeveloped property

f. A single unit double catch basin is required at low point (sag) of all vertical curves. Refer to Standard Detail 402

Catch basins shall be capable of intercepting completely the design storm flow at the curb.

4.12.03 Inlet Manholes

Where stormwater systems connect to the existing or proposed public stormwater system at a catch basin location, inlet manholes shall be required where any of the following apply: (a) the pipe connection is larger than 6-inches in diameter, (b) 2 or more pipes discharge to the location, or (c) the design peak flow from the onsite system exceeds 0.5 cfs. Refer to Standard Detail 406-A, 406-B, or 406-C.

4.12.04 Outfall Protection

The outfalls of all stormwater systems shall be adequately protected to prevent erosion of slopes and channels. All outfalls shall include, at a minimum, the erosion protection as shown in the table below. Alternative approaches to protection may be accepted as approved by the Engineer.

ROCK PROTECTION AT OUTFALLS						
DISCHARGE VELOCITY AT DESIGN FLOW (fps)		REQUIRED PROTECTION				
		Minimum Dimensions				
Greater than	Less than or equal to	Type	Thickness	Width	Length	Height
0	5	Riprap*	1-foot	Diameter + 6-feet		Crown + 1-foot
5	10	Riprap**	1-foot	Diameter + 6-feet or 3 times diameter, whichever is greater		Crown + 1-foot
10	20	Gabion Outfall	1-foot	(As required)	(As required)	Crown + 1-foot
20	----	Engineered energy dissipater required				

Riprap to be reasonably well graded with the following gradation:

*	Maximum stone size	=	8-inches	**	Maximum stone size	=	24-inches
	Median stone size	=	6-inches		Median stone size	=	16-inches
	Minimum stone size	=	2-inches		Minimum stone size	=	4-inches

4.13 PIPE MATERIALS AND SIZE

All public storm drains shall be constructed with either concrete or HDPE smooth interior, corrugated exterior pipe as specified in the Construction Standard Specifications. Where required, for added strength, Class 50 or greater ductile iron pipe will be used. Concrete pipe strength shall meet the applicable sections of ASTM C-76.

Aluminized steel Type II spiral rib pipe may be used for private detention pipe applications only. Structural end-cap bracing specifications from the manufacturer are required. Refer to: Standard Detail 408.

Private storm drainpipe shall meet the appropriate sections of the Uniform Plumbing Code.

All public storm drain main lines and lateral lines to catch basins and other inlet structures shall be a minimum of 12-inches in diameter, except that storm drain lines that convey water directly from private property may be a minimum of 6-inches in diameter if they do not extend into the roadway. All lines must discharge into a drainage structure of the public system and at a location and elevation approved by the City.

SECTION FIVE – WATER SYSTEMS

5.01 GENERAL DESIGN REQUIREMENTS

Performance Standards – Water distribution systems shall be designed to meet Oregon Administrative Rules Chapter 333 (including ORS448), AWWA Standards, and guidelines of the current Water System Master Plan and its updates.

Water system design shall provide adequate flow for fire protection during projected maximum water usage and consumption. Required water system demands shall be met while maintaining the minimum operating pressures of 20psi required by the State of Oregon. For single-family residential areas (including attached single-family) the minimum static pressure shall be 35psi and the minimum fire flow shall be 1,000 GPM. For all other developments, including areas with single-family homes larger than 3,600 square feet or mixed-use areas, the required fire flow shall be as determined by Fire & Emergency Services Department up to a maximum of 3,500 GPM. For requirements above 3,500 GPM, the development shall provide supplemental fire flow as approved by Fire & Emergency Services Department.

Water system design shall meet distribution needs for projected maximum daily demand within a given service area. New water systems shall allow for future extensions beyond present development that are consistent with the master plan. New water systems shall be sized according to the current zoning area fire flow needs, velocity, standards, and water modeling determinations.

All waterlines shall be located within the public right-of-way or as directed and approved by the Engineer. These lines are placed in 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 Engineer, under special conditions, may allow a public waterline to be located within a public water easement as referenced in ***Subsection 5.02.05***.

5.01.01 Pipe, Valve, and Fitting Materials and Size

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. When a corrosive potential condition is encountered, all ductile iron pipe and fittings will be polyethylene encased with an 8-mil tubing meeting manufacturer and AWWA Standards. Where an active cathodic protection system is encountered as a result of other utilities, a deviation from the normal pipe design/material/installation practice may be required by the Engineer. PVC pipe may be considered as an alternate to ductile iron pipe where an active cathodic protection system is encountered.

Polyvinyl Chloride (PVC) Pipe and Tracer Wire Installation – PVC pipe 4-inches to 12-inches shall conform to AWWA C-900 and UNI-BELL Standards. All PVC pipe shall have a dimension ratio no greater than 18, with an outside diameter identical to cast iron. Tracer wire shall be a minimum 12-gauge, blue-coated copper wire and shall be installed with all PVC water pipe.

All gate valves shall be pressure rated for 200psi and all butterfly valves shall be pressure rated for 150psi. All ductile iron mechanical joint fittings shall be pressure rated at 350psi. All flanged fittings and cast iron mechanical joint fittings shall be pressure rated at 250psi. All fittings shall be factory cement mortar lined and coated. Pipe constructed per ***Subsection 5.02.06*** will require the use of restrained pipe joints or ball and socket river pipe.

Water distribution main sizes shall generally conform to the following:

4-inch – May only be used with approval of the Engineer in residential zones on dead-end streets less than a centerline distance of 250-feet measured from the center of the intersection street to the radius point of the cul-de-sac and that serves 12 or fewer single-family residences. All 4-inch mains shall be connected to a looped minimum 6-inch main. Fire hydrants are not permitted on 4-inch lines. All 4-inch lines shall terminate with a standard blow-off (Standard Detail 507A).

6-inch – Minimum size residential subdivision distribution water main for the grid (looped) system. A 6-inch line shall not exceed an unsupported length of 600-feet and shall not be permanently dead-ended. Looping of the distribution grid shall be at least every 600-feet.

8-inch – Minimum size for permanently dead-ended mains supplying fire hydrants with a fire flow of 1,000 GPM and for primary feeder mains in residential subdivisions. Not to exceed an unsupported length of 600-feet unless otherwise approved by the Engineer.

10-inch and larger – As required for primary transmission lines in subdivisions, industrial areas, and commercial areas.

Where system static pressures allow and field flow measurement or system modeling shows adequacy, velocities in distribution mains may be designed but shall not exceed 8-feet per second for combined fire, domestic, and irrigation flows. Velocity in service lines (as defined in ***Section 5.05***) shall be designed not to exceed 10-feet per second.

For portions of the water system with mid-range to low-static pressures, required flows may not be achievable while still maintaining a minimum system residual of 20psi. Oversizing of waterlines may be required to achieve the required flows.

5.01.02 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. 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.

5.01.03 Dead-end Mains

Dead-end mains that are permanent or that will be extended in the future shall be provided with a properly sized blow-off. See Standard Details 507A and 507B.

The installation of permanent or long-term, dead-end mains greater than 250-feet, upon which fire protection depends, and single mains serving relatively large areas will not be permitted unless otherwise approved by the Engineer.

No more than 20 single-family residences shall be temporarily served from an un-looped waterline during a phased construction, unless approved by the Engineer.

5.02 ALIGNMENT AND COVER

5.02.01 Right-of-way Location

Where waterlines are located within narrow rights-of-way (less than 50-feet), location of waterline shall be reviewed and approved by the Engineer on a case-by-case basis.

In general, water systems shall be located 12-feet south or east from the right-of-way centerline or as approved by the Engineer. Except as provided in ***Subsection 5.02.05***, all waterlines shall be in the public right-of-way. All abrupt changes in vertical or horizontal alignment shall be made with a fitting and adequate thrust restraint. Refer to Standard Details 508, 509, and 510.

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 deflections.

5.02.02 Minimum Cover

The standard minimum cover over buried water mains within the street right-of-way shall be 36-inches from finish grade. Standard trench section Standard Detail 502 will be utilized for all water pipe installed.

The minimum cover for mains in unpaved areas shall be 48-inches 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 the following exists:

a. When there is underlying rock strata that prohibits placement of the water main 36-inches below finish grade, a written request must be submitted to the Engineer, together with submission of a soils report with a plan and profile certifying that bedrock exists less than 3-feet below the undisturbed ground surface.

b. Substantial utilities exist at an elevation conflicting with the waterline at 36-inches below finished grade; and installation of the waterline below such utility would cause the new waterline to be at an unreasonably deep elevation below finished grade.

c. Where the water main or service is installed at a depth of 24-inches or less below finished grade, controlled density fill (CDF) shall be used in place of standard backfill material.

5.02.03 Separation with Sewer Lines

Water mains and services shall be installed a minimum clear distance of 5-feet horizontally from gravity sanitary sewer mains and laterals, 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. Separation from sanitary sewer force mains shall be reviewed on a case-by-case basis. Exceptions shall first be approved by the Engineer. In all instances, the distances shall be measured edge to edge.

5.02.04 Separation with Utilities

The minimum spacing between water mains and storm drains, gas lines, and other underground utilities, excepting sanitary sewers, shall be 3-feet horizontally when the standard utility location cannot be maintained. This separation also applies to water service and utility service lines.

Where water mains are being designed for installation parallel with other water mains, utility pipe, or conduit lines, the vertical separation shall be 12-inches below or in such a manner that will permit future side connections of mains, hydrants, or services, and avoid conflicts with parallel utilities without abrupt changes in vertical grade of the above mentioned main, hydrant, or service. Where crossing of utilities are required, the minimum vertical clearance shall be 6-inches.

5.02.05 Easements

Easements shall meet the requirements of ***Subsection 3.02.04*** except as noted below.

Any water main placed within a water main easement will be permanently marked with blue plastic markers at all angle points, and no less than every 200-feet, or at a change in direction. In addition, markers 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, driveways, etc. shall be an acceptable alternative to the sign.

5.02.06 Relation to Watercourses

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

Mains crossing stream or drainage channels shall be designed to cross as nearly perpendicular to the channel as possible.

Valves shall be provided at both ends of the water crossing so that the section can be isolated for testing or repair. The valves shall be easily accessible and not subject to flooding.

a. **Above Water Crossings** – The pipe shall be designed by the Engineer of Record 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 Engineer.

b. **Underwater Crossings**

(1) The following surface water crossings will be treated on a case-by-case basis:

(a) Stream or drainage channel crossing for pipes 12-inches inside diameter and greater

(b) River or creek crossings requiring special approval from the Division of State Lands

(2) The minimum cover from the bottom of the streambed or drainage channel to the top of pipe shall be 36-inches, except as noted below.

(3) A scour pad centered on the waterline will be required for mains less than 12-inches inside diameter when the cover from the top of the pipe to the bottom of the streambed or drainage channel is 36-inches or less. The scour pad shall be concrete, 6-inches thick and 6-feet wide; reinforced with #4 bars 12-inches 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. There shall be a minimum 6-inches clearance between bottom of pad and top of waterline.

5.03 APPURTENANCES

5.03.01 Valves

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

Distribution system valves shall be located at and flanged to the tee or cross fitting. There shall be a sufficient number of valves located so that not more than 4, and preferably 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 2 branches and a cross-intersection shall be valved in 3 branches. Transmission water mains shall have valves at not more than 1,000-foot spacing. Hazardous crossings such as creeks, railroad, and freeway crossings shall be valved on each side. Valves shall be accessible at all times.

When a hydrant tee or a tee branching to a cul-de-sac blow-off is installed in a sloped waterline, install a main line valve on the up hill run of the tee to allow for release of air from hydrant or blow-off. An additional main line valve may be needed on the down hill run of the tee for other operational purposes.

Distribution tees and crosses with valves for future branch lines on transmission mains may be required at the direction of the Engineer.

5.03.02 Fire Hydrants

The public water system supplying public fire hydrants shall be designed to provide up to a maximum of 3,500 GPM. Minimum fire flow in single-family residential areas shall be 1,000 GPM, except in areas where homes exceed 3,600 square feet or areas of mixed use, in which case fire flows will be as determined by Fire & Emergency Services Department.

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 400-feet in residential areas and approximately 300-feet in commercial or industrial subdivisions. Additional hydrants shall be placed as required by Fire & Emergency Services Department and the Engineer.

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.

No fire hydrant shall be installed on a main of less than 8-inches inside diameter unless it is in a looped system of 6-inch mains. The hydrant lead shall be a minimum of 6-inches nominal diameter.

All fire hydrants will be located at the back of the existing or proposed sidewalk, in the planter strip, or behind the sidewalk if adequate right-of-way exists. If any public hydrant encroaches on private property, an easement must be provided to the City. In general, fire hydrants will be located at or near the point of curvature of the curb return or at a common property line. Pumper port of fire hydrant shall be perpendicular to the curb line or shoulder as applicable.

No hydrant shall be installed within 5-feet of any existing above-ground utility, nor shall any utility install facilities closer than 5-feet to an existing hydrant.

Hydrant installation shall conform to Standard Detail 501. Maximum 6-foot bury hydrants will be required in all installations. Installation of hydrant extensions will not be allowed, unless approved by the Engineer.

Unless off of a fire line/fire sprinkler service, fire hydrants shall be placed on the same side of the right-of-way as the waterline serving the fire hydrant. Other proposed locations must be approved by the Engineer.

Each fire hydrant shall have an auxiliary valve and valve box that will permit repair of the hydrant without shutting down the main supplying the hydrant. Such auxiliary valves shall be resilient-wedge gate valves. The auxiliary valve shall have mechanical joint-by-flange joint ends as referenced in the Standard Detail 501. The valve shall be connected directly to the water main using a flange joint tee and “Megalug” retainer glands, or approved equal.

Hydrants shall not be located within 20-feet of any building, nor shall they be blocked by parking.

Guard posts, a minimum of 3-feet high, shall be required for protection from vehicles when necessary. Such protection shall consist of 4-inch diameter steel pipes 6-feet long, filled with concrete, buried a minimum of 3-feet deep in concrete and located at the corners of a 6-foot square with the hydrant located in the center. Use of posts other than at the 4 corners may be approved by the Engineer.

5.03.03 Pressure-reducing and Combination Air Valve Units

The City's water distribution system is divided into several pressure zones. Where water systems cross these zone lines, a pressure-reducing valve station may be required. The specific design and location for such valves will be reviewed and approved by the Engineer.

When shown on the plans or designated by the Engineer, combination air valve units, per Standard Detail 406, shall be installed. Such valves will be required on large diameter transmission lines at all high points in grade and at other points as determined by the Engineer.

5.03.04 Railroad or Freeway 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 freeway crossings, if required, shall be as noted in the permit from the respective agency.

5.04 BACKFLOW PREVENTION

Backflow prevention assemblies shall be required on all 1½-inch and larger water services, irrigation services, and fire sprinkler system services, and as provided for in Chapter Five of the Gresham Revised Code. Backflow assemblies shall be located on the lot it serves at the right-of-way line. For installation requirements on assemblies 3-inches through 10-inches, see Standard Detail 516A-D. All assemblies shall be State of Oregon approved and testable.

5.05 WATER SERVICE LINES

The sizes of water service lines that may be used are 1-inch, 2-inch, 4-inch, 6-inch, 8-inch, 10-inch, and 12-inch. Water service lines will be reviewed for impacts on the distribution system and shall not be greater in size than the distribution main. In no case shall a new service be provided off of an existing galvanized waterline.

Domestic service lines 1-inch and 2-inche 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 Details 503, 504A, and 504B). Meter shall be provided and installed by City. Meter boxes are to be provided by the owner. Whenever possible, individual service connections shall terminate in front of the property to be served along the street frontage where property is addressed, and shall be located 36-inches each side of a common side property line. Water service via an easement across a separate parcel under separate ownership, or capable of being sold off, is not allowed unless otherwise approved by the Engineer.

For services 4-inch and larger (3-inch and larger meters), a design drawing must be submitted to the City showing the vault and fitting requirements with the expected flow (normal and maximum daily flow) requirements and proposed usage, and meter vaults shall be placed at the entrance to the property being served, unless otherwise approved by the Engineer. See Standard Detail 515A-D.

Multiple service connections to a premise shall be laid out to follow a logical sequence of addresses to facilitate matching of service connection to building(s). Onsite waterlines shall be laid out to facilitate a logical matching of service connection to building and address. Each meter must have its own service line and connection to a water main. No manifolding will be allowed unless approved by the Engineer.

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 shall be included in the as-built drawings.

GENERAL DESIGN CRITERIA

WATER SERVICE AND METER SIZING

SERVICE SIZE (INCHES)	METER SIZE (INCHES)	MAXIMUM DESIGN FLOW (GPM)
1	¾	30
1	1	50
2	1½	100
2	2	160
4	3	320
4	4	500
6	6	1,000
8	8	1,600

Notes:	1.	Continuous flow not to exceed 30% of maximum design flow for ¾-inch to 2-inch disk meters
	2.	Continuous flow not to exceed 50% of maximum design flow for all compound meters
	3.	Meters larger than 8-inches will be reviewed on a case-by-case basis

Fire Service – There are 3 categories of private fire services: (1) hydrants, (2) fire sprinkler lines, and (3) combination hydrant and fire sprinkler lines.

The water fire service line shall normally extend from the main to the property line and end with a vault, metering device, and valves. An approved backflow prevention assembly will be required of the property being served.

The City shall install a flow meter and sensor (Data Industrial Series 1400 w/220 MB sensor or approved equal) on all fire lines with onsite fire hydrants. All costs for the installation shall be the responsibility of the property owner being served.

Fire lines serving only fire sprinkler systems shall be metered by a detector meter on the approved backflow assembly.

Whenever possible, the fire service shall be located along the street frontage where the parcel is street addressed.

Fire sprinkler systems for single-family residences or rowhouse-type residences shall be served through a standard metered service. The fire sprinkler system may be served through the domestic service for the same residence. The combined domestic, irrigation, and fire sprinkler flow demands may not exceed the City of Gresham allowable flow for that particular size of service and meter.

Fire Vaults – A vault for a 30-inch and larger double check detector assembly will be required when a development provides fire sprinklers. The vault drawing will be included on construction drawings submitted to the City.

GENERAL DESIGN CRITERIA

FIRELINE/FIRE SPRINKLER SYSTEM SERVICES

SERVICE SIZE (INCHES)	METER SIZE (INCHES)	MAXIMUM DESIGN FLOW (GPM)
1	¾	30
1	1	50
2	1½	100
2	2	160
4	City installed flow meter	500
6	City installed flow meter	1,000
8	City installed flow meter	1,600
10	City installed flow meter	2,500

Notes:	1.	Continuous flow not to exceed 30% of maximum design flow for ¾-inch to 2-inch disk meters
	2.	Continuous flow not to exceed 50% of maximum design flow for all compound meters
	3.	Meters larger than 8-inches will be reviewed on a case-by-case basis

5.06 SYSTEM TESTING

All new water systems (lines, valves, hydrants, and services) shall be individually pressure tested, chlorinated, and tested for bacteria. All testing shall be performed in accordance with the Gresham Public Works Standards and in the presence of a City Inspector.

No connection to the existing system shall be made until the new system has been tested and accepted.

5.07 WATER QUALITY SAMPLING STATIONS

Water sampling stations will be required and installed in all new subdivisions, or as directed by the Engineer. In general, install one station for every 20 lots. See Standard Detail 505.

6.01 GENERAL DESIGN REQUIREMENTS

6.01.01 Performance Standards

All street designs shall provide for the safe and efficient travel of motorist, bicyclists, and pedestrians. Streets shall be designed to carry the recommended traffic volumes identified for each street classification. Street classifications are set forth in the Transportation System Description and Function section of the Gresham Community Development Plan (GCDP).

Streets shall be designed to meet or exceed minimum guidelines. These guidelines are 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. Where practical, the Engineer of Record shall provide the decision sight distance for the design speed based on the methodology in AASHTO Chapter IX, or the stopping sight distance based on the 85% speed as set forth in the AASHTO policy, whichever is greater. Only with the approval of the Engineer shall a lesser sight distance be permitted.

6.01.02 Access

All development shall be provided with public street access. Access streets (public and/or private), driveways, and easements shall be as set forth in other sections of these Design Standards.

6.01.03 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 service no more than 25 dwellings and shall not exceed 200-feet in length

A permanent dead-end street is measured from the right-of-way line at the furthest end of the dead-end street.

6.01.04 Transportation Analysis

The 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 when (1) it will generate 1,000 vehicle trips or more per weekday; or (2) when a development's location, proposed site plan, or traffic characteristics could affect traffic safety, access management, street capacity, or known traffic problems or deficiencies in a development's study area; or (3) when a proposed change in zoning designation could result in higher trip generation than current zoning.

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

1. **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 to:

- maintain easy and safe traffic flow on surrounding street system;

- provide effective and safe transfer of vehicle traffic between the site and the street system;

- provide convenient, safe, and efficient onsite and offsite movement of vehicles, pedestrians, transit, service and delivery vehicles, and bicycles;

- effectively mitigate adverse site-generated traffic impacts on affected streets and intersections – site-specific objectives may be established by the City for each study; and

- analyze accident history in study area and evaluate impacts of site-generated traffic.

2. **Executive Summary**

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

3. **Description of Site and Study Area Streets**

A description of the site and study area, existing traffic conditions and accident history in the study area, and anticipated nearby development and committed street improvements that would affect future traffic in the study area.

The study area will be defined by:

All streets, ramps, and intersections through which peak hour site traffic composes at least 5% of the existing capacity of an intersection approach, or street sections or intersections impacted by site traffic on which existing volume to capacity (V/C) ratio exceeds 0.90 or level of service "D", or accident character or residential traffic character is expected to be significantly impacted.

4. **Onsite Traffic Evaluation**

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

5. **Offsite Traffic Analysis**

The analysis shall include:

a. Existing daily, p.m. peak hour, and site peak hour counts by traffic movements at intersections affected by generated traffic from the development (use traffic flow diagrams).

b. Background daily, p.m. peak hour, and site peak hour volumes for these same intersections and proposed access points. Background traffic includes existing volumes plus traffic projected from in-process development.

c. Total daily, p.m. peak hour, and site peak hour volumes for these same intersections and proposed access points when the development is in full service (use traffic flow diagrams). In the case of zoning changes, the traffic study shall assume land uses that result in greatest trip generation. The study shall also include a 20-year forecast.

d. A determination of the existing levels of service, background levels of service, and total traffic levels of service at each intersection and access points studied. For signalized intersections, levels of service shall be reported using existing timing plans and lane configurations.

e. A discussion of the need for traffic signals. This should include a traffic warrant computation based on the National Manual on Uniform Traffic Control Devices (latest edition).

f. The recommendations made in the report should be specific and should be based on a minimum level of service "D" with maximum V/C ratio of 0.90 when the development is in full service. Individual movement level of service must meet level of service "E" and a V/C ratio of 1.0. 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. For stop-controlled intersections, a minimum level of service "E" shall be required on the minor approach. Level of service shall be based on the current edition of the TRB Highway Capacity Manual and the associated Highway Capacity Software. The Engineer may approve other methods.

g. The report should include a discussion of bike and pedestrian usage and the availability of mass transit to serve the development.

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.

Traffic signals proposed within ¼-mile of nearest signal shall incorporate a Synchro/Simtraffic analysis to verify compatibility of operation. Where time-of-day plans are in operation, proposed signals shall be analyzed with those time-of-day plans and recommendations made accordingly.

7. Access Management

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

- separate basic conflict areas (reduce number of driveways or increase spacing between driveways and intersections); and
- 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 streets, 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.

8. Safe Route to Schools

Traffic studies associated with schools shall include a "Safe Route to School Study". The purpose of the study is to designate routes that are safe for children to walk to and from school. The route should guide students over the safest and best path to and from school. The route should cross the fewest major streets possible and have the most protection available from existing traffic controls. If necessary, school boundaries should be revised to eliminate extremely hazardous conditions, otherwise bus transportation should be considered. At times,

children may be required to take a longer route to avoid hazardous locations, or to use existing safety features or controls.

9. Technical Appendix

A technical appendix including worksheets, charts, and drawings to support findings described in the body of the report. Include computer diskette with all HCS Synchro/Simtraffic input and output files matching those provided in the traffic analysis report. The files shall be clearly identified on the disc for easy reference.

6.02 STREETS

6.02.01 Street Classification

All streets within the City shall be classified as listed in Section A5.500 – Transportation System Description and Function, Vol. III, GCDP except as noted herein. The classification for any street not listed shall be that determined by the Manager.

6.02.02 Right-of-way and Pavement Width

Right-of-way dedication at intersections shall be along the "long cord".

Right-of-way and pavement widths for each street classification shall be as follows:

Standard Streets	Right-of-way (Feet)	Curb to Curb Width (Feet)
Principal Arterial	120	84
Arterial	100	76
Boulevard	115	84
Collector	80	60
Community	70	48
Local Transitional	50[a, b]	32[a, b]
Local Queuing	46	26
Local Lane	27	20
Cul-de-sac Turnaround	45 radius	35 radius
Minor Access Street	25	20
Major Alley[c]	21	20
Minor Alley[c]	15	14
Green Streets	Right-of-way (Feet)	Curb to Curb Width (Feet)
Major Boulevard	111	88
Minor Boulevard	89	66
Major Arterial	100	72
Minor Arterial	78	50
Major Collector	80	59
Minor Collector	72	45
Community	72	46
Parkway Arterial	62	34
Parkway Collector	60	32
Connector	62	36
Local Transitional	56	32
Local Queuing	50	26

Notes:	a.	In the Hillside Constraint District, right-of-way width may be 40-feet and pavement width may be 28-feet with approval of the Manager.
	b.	In Commercial/Industrial, the right-of-way shall be 58-feet and the pavement width shall be 40-feet.
	c.	May also be constructed as green streets by conforming to "Note 5" on Standard Detail #607.

In areas of the City where green streets are required, only the streets classified as green streets, above, will be allowed.

Local Transitional Street: The local transitional street standard of 32-foot wide pavement applies in the following areas. In all other cases the local queuing standards apply.

1. Continuation of existing local streets in established neighborhoods to the next intersection.

2. In mixed-use neighborhoods.

3. On primary emergency response routes.

4. On local streets where volumes are expected to exceed 800 average daily trips (ADT).

For streets designated collector and below, the design engineer must consider design modifications to conserve major trees in the public right-of-way and submit to the Project Manager for review. Pavement width on a collector street may be reduced to no less than 34-feet, consisting of two 11-foot travel lanes and two 6-foot bicycle lanes.

6.02.03 Half-street and Frontage Improvement Construction

Where half-street is justified, the right-of-way and pavement width will be approved by the Engineer. The pavement width shall be at least ½ of the standard street classification width, but in no case shall the pavement width be less than that required to provide 2 lanes of traffic to pass at a safe distance. For a 32-foot local street, the half-street pavement width will be 20-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-streets shall be signed "No Parking" on the improved (curb) side of the street and, if necessary, the unimproved side of the street to provide a clear-traveled way of 20-feet.

A development on an unimproved substandard street shall be responsible for constructing a continuous 20-foot half street to a connection with the nearest standard (publicly-maintained) street.

Frontage improvements will be required in cases where a paved street that is substandard exists along the frontage to be developed. If a pavement design, including an analysis of the existing pavement section, indicates that the existing pavement is adequate to provide a minimum of 20-years design life, then that pavement may remain and only the additional improvements, such as curb and pavement widening, are required. If the analysis indicates that the existing pavement is inadequate, half-street construction as described above will be required.

6.02.04 Pavement Design

In general, all streets shall be constructed with asphaltic concrete (AC); however, other materials such as Portland cement concrete (PCC), concrete paver stones, etc., are permitted as approved by the Engineer. When required by the City, all public street improvements shall include a specific pavement design based on existing soil conditions and the recommended traffic volumes for the street classification.

- **Street Pavements** – The street pavement sections shown in the Standard Detail are typical and are comprised of PCC or AC with crushed rock base on compacted subgrade soil. Treated subgrades in the pavement section are also acceptable as approved by the Engineer.
- **Soil Tests** – Conduct 2 soil tests for projects that have 500-feet or less of new street. An additional soil test may be required for each additional 500-foot section. For asphalt

pavements, conduct soil testing to determine the design subgrade resilient modulus (Mr) within the top 2-feet of the proposed subgrade elevation.

- **Design Life** – 20-years.
- **Design Procedure/Asphalt Pavements** – The design procedures contained in the following references are preferred (see the References section for full citations).
  AASHTO Guide for Design of Pavement Structures, current edition – American Association of State Highway and Transportation Officials.
  Thickness Design – Asphalt Pavements for Highways and Streets, current edition – The Asphalt Institute.
- **Design Procedure/Concrete Pavements** – The design procedures contained in the following references are preferred (see the References section for full citations).
  AASHTO Guide for Design of Pavement Structures, current edition.
  Thickness Design for Concrete Highway and Street Pavements, current edition – Portland Cement Association.
- **Minimum Thickness** – The thickness designs pecified in the Standard Details are minimums. Actual pavement thickness may be based on specific pavement designs as approved by the Engineer.
- **Local Street and Community Street Asphalt Pavement** – Specify ½-inch Level 2 surface course with a minimum thickness of 2-inches. Specify the base course of asphalt concrete as ½-inch Level 2 with a minimum thickness of 2-inches.
- **Arterial, Boulevard, and Collector Asphalt Pavement** – Specify ½-inch Level 2 wearing surface with a minimum thickness of 2-inches. Specify the base course of asphalt concrete as ½-inch or ¾-inch Level 2 with the thickness as identified on the Standard Details.
- **Treated Base Materials** – For asphalt pavement sections that include either a cement treated base (CTB) or an asphalt treated base (ATB), specify a finish surface pavement of not less than 3-inches of asphalt concrete.
- Pavement design shall take into account the topography and include subsurface drains and/or geotextiles as required.

6.02.05 Design Speed

Design speeds for classified streets shall be as follows:

Principal Arterial	45 – 55 mph*
Arterial	35 – 45 mph*
Boulevard	25 – 35 mph*
Collector	25 – 35 mph
Community Street	25 – 35 mph
Local Transitional/Queuing/ Lane	25 mph
Minor Access Street	15 mph

* Use posted speed where posted speed is within range indicated. Where posted speed is outside range given above, use the closest design speed for that classification.

6.02.06 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)
15	100
25	180
30	300
35	450
40	670
45	900

"Loop" roads and other traffic-calmed local roads that are designed to "self enforce", lower speeds may use centerline radius as low as 50-feet with the Manager's approval. Such roads shall be limited to low density, residential developments with a maximum number of 50 dwelling units and 500 ADT. Maximum distance between speed control points shall be 500-feet. Speed control points include horizontal curves of 50-feet to 100-feet, traffic circles, textured pavement sections, or other similar traffic calming devices. Use of speed bumps is discouraged.

6.02.07 Vertical Curves

Vertical curve length shall be based on the design criteria that include: (1) design speed, (2) crest vertical curve, and (3) 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 per AASHTO design criteria.

6.02.08 Grades

Maximum grades for each street classification shall be as follows:

Principal Arterial/Arterial/Boulevard	0.060 ft./ft.	(6%)
Collector	0.080 ft./ft.	(8%)
Community	0.100 ft./ft.	(10%)
Local Transitional	0.120 ft./ft.	(12%)
Local Queuing	0.120 ft./ft.	(12%)
Local Lane	0.120 ft./ft.	(12%)
Minor Access	0.120 ft./ft.	(12%)

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

1. 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.

2. There is no access to the property being developed through adjacent properties at a maximum 12% grade.

3. The section of local street being designed will not exceed a combination of length, horizontal alignment, or grades exceeding 12% that will create hazardous traffic conditions.

For unsignalized intersections, keep the longitudinal grade on stop-controlled approaches below 8% for an approach distance of 50-feet.

Minimum grade for all streets shall be 0.0050 foot per foot (0.50%). 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%).

6.02.09 Concrete Curb

All street improvements will be constructed with monolithic curb and gutter. Standard curb as shown in the Standard Details may only be used when the longitudinal street grade is 0.01 foot per foot (1.0%) or greater; or where cross slope of roadway drains away from curb such as with raised median construction.

6.02.10 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.

Arterial and Collector Intersections: Exclusive left turn lanes will be provided; crosswalks will be provided at all approaches; street alignments across intersections shall be continuous.

Community 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 70° will not be permitted. Intersection of more than 2 streets at one point will not be permitted.

New streets shall intersect with existing street intersections so that centerlines 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 that are not directly aligned with street centerlines, the centerline spacing must meet the following minimum separation distance:

Street Class	Intersection Spacing (Feet)
Principal Arterial	500*
Arterial/Boulevard	400*
Collector	300*
Community Street	150
Local Queuing	100
Local Lane/Minor Access	100

* The Engineer may permit a minimum spacing of not less than 300-feet (Principal Arterial), 200-feet (Arterial/Boulevard), 200-feet (Collector) when findings are made to establish that:

1. Without the change there could be no public street access from the parcel(s) to the existing street, or
2. The change is necessary to support local pedestrian/bicycle circulation and access; and the change is necessary due to topographic constraints; and all other provisions of the street design requirements can be met.

6.02.11 Curb Return Radius

Curb return radius at street intersections shall be designed to accommodate all expected traffic. Curb extensions and/or special crosswalk/sidewalk features designed to enhance pedestrian safety may be required to encourage pedestrian usage.

The minimum allowed curb return radii between intersecting streets are shown below. The minimum radii are based on the lowest classification of the 2 intersecting streets. For example, if a minor arterial intersects a neighborhood collector, the minimum turning radius for the 4 intersection corners should be 25-feet as displayed on the neighborhood collector row. If the intersection corner has on-street parking or bicycle lanes, the minimum radii can be reduced by 5-feet.

Minimum Curb Return Radii (Feet) Edge of Pavement/Curb	
Lowest Street Classification of 2 Intersection Streets	Minimum Curb Return Radius
Principal Arterial	30
Arterial	30
Boulevard	30
Collector	25
Community Street	25
Local Transitional	20
Local Queuing	20
Local Lane	15
Minor Access Street	15

If bicycle lane or on-street parking exists, above turning radii may be reduced by 5-feet, and in Special Plan Districts such as Downtown, Gresham Civic Neighborhood, and Rockwood.

Streets with heavy truck movements may be required to install larger curb radii than shown in the table. The Engineer will provide direction in deciding if an area needs larger than minimum turning radii at specific intersections. When designing turning radii higher than the minimums, the Engineer will identify the design vehicle to be applied. Streets with daily transit routes shall not have curb return radii less than 25-feet to accommodate safe bus turning movements.

6.02.12 Parking

Street Class	**Parking Lanes**	**Parking Required**
Principal Arterial	None	Not allowed
Boulevard	None	May be allowed or required in town centers, regional centers, or adjacent to mixed use districts
Collector	2	Variable (1)
Community	2	Yes
Local Transitional	2	Yes (2) (3) (4)
Local Queuing	2	Yes (2)
Local Lane	None	Not Allowed (5)
Minor Access Street	None	Not Allowed (5)
(1) Collector – no parking within 45-feet of curb return		
(2) Local – no parking within 30'feet of curb return		

(3)	Local Streets in the Hillside Constraint District that are approved for reduced 40-feet right-of-way and 28-feet pavement 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.
(4)	Cul-de-sac – no parking allowed within the 35-foot radius cul-de-sac turnaround
(5)	One additional off-street parking space is required for each residential unit that accesses a local lane or minor access street.

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

6.02.13 Local Street Design for Adverse Topography

Local streets shall have a cross-section slope of 2.0% ("crown") in accordance with Standard Detail 500, except in situations of adverse topography. When approved by the Engineer, the Engineer of Record 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:

1. Minimum distance from "crown" to (one) face of curb is 10.00-feet.

2. Maximum cross-slope of pavement is 5.00%, except for horizontal curves. On horizontal curves, maximum reverse superelevation is 2%.

3. Maximum differential in top of curb elevation from one side to the other is 1.00-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 crown. Other non-standard cross-sections such as "shed roof", "saw tooth", etc., may also be approved by the Engineer.

6.02.14 Streetlighting

A complete streetlighting system shall be the responsibility of the developer. All streets fronting the property and pedestrian accessways shall be provided adequate lighting as determined by the City. For lighting requirements, all developments will be required to submit a lighting plan to the Project Manager. The lighting plan shall conform to IESNA RP-8 (Illuminating Engineering Society of North America) American National Standard Practice for Roadway Lighting.

Streetlights shall conform to Standard Details 636 through 640. Decorative lights, per Standard Detail 637, are required in the Gresham downtown districts. Infill development utilizing existing utility poles may be designed in accordance with Standard Detail 640.

6.02.15 Street Trees

Street trees in the public right-of-way, or within the setback and/or buffer area immediately adjacent to the right-of-way, will be required of all developments. The particular species will be reviewed and approved as part of overall project submittals. A deposit for street trees to assure installation of the trees prior to occupancy may be required at the time of building permit issuance.

Minimum caliper of street trees shall be 1¾-inch. Street trees shall not be located within the portion of the clear vision area approaching an intersection. Street trees located in the portion of the clear vision area leaving the intersection shall be a minimum of 2-inch caliper and a minimum of 8-feet head height at time of planting. Newly-planted trees shall be securely staked for the first 2-years after planting and shall be replaced if they die or are destroyed.

Tree Spacing	
Principal Arterial	30-feet
Boulevard	30-feet
Collector:	
Residential	30-feet (2 min. – 3 min. if corner lot)
Commercial	20-feet (2 min. – 3 min. if corner lot)
Industrial	20-feet
Community:	
Residential	30-feet (2 min. – 3 min. if corner lot
Commercial	20-feet (2 min. – 3 min. if corner lot)
Industrial	20-feet
Local Transitional:	
Residential	30-feet (2 min. – 3 min. if corner lot)
Commercial	20-feet (2 min. – 3 min. if corner lot)
Industrial	20-feet
Local Queuing /Local Lane/Minor Access	30-feet (2 min. – 3 min., if corner lot)
Notes: (1) Spacing required may vary depending on site and/or topography constraints.	
(2) Distances include linear section of cul-de-sac.	
(3) Street trees shall be located at least 15 feet from streetlights and stormwater catch basins and at least 5 feet from driveway cuts and underground utilities.	

Recommended Street Trees

Trees for a 2-foot to 4-foot planting strip:
Paperbark Maple*
Allegheny Serviceberry*
Crimson Cloud Hawthorn*
Adirondack Crabapple*
Red Jewel™ Crabapple*
Japanese Tree Lilac*
Ivory Silk Tree Lilac*

Trees for a 3-foot to 6-foot planting strip:
Hedge Maple*
Rocky Mountain Glow® Maple*
Columnar Norway Maple
Crimson Sentry Norway Maple*
Olmstead Maple
Apollo® Maple*
Lavalle Hawthorn*
Flowering Ash
Golden Desert® Ash*
Professor Sprenger Crabapple*
Tschonoskii Crabapple
American Hophornbeam
Newport Plum*
Columnar Sargent Cherry*
Pink Flair™ Cherry*
Royal Burgundy Cherry

Trees for 4-foot planting strip or wider:
Queen Elizabeth™ Maple
Easy Street™ Maple
Superform Maple
Bowhall Maple
New World Maple
Scarlet Sentinel® Maple
Norwegian Sunset® Maple
Pacific Sunset® Maple*
European Hornbeam
Pyramidal European Hornbeam
Frans Fontain Hornbeam
Skyline® Ash
Tricolor Beech
Autumn Gold Ginkgo
Princeton Sentry® Ginko
Saratoga Ginkgo
Skyline® Honeylocust
Kwanzan Cherry* (on a 6-foot minimum graft)
Cleveland Select Pear
Chanticleer® Pear
Forest Green® Oak
Pyramidal English Oak
Skyrocket® Oak
Chancellor® Linden
Mushshino Zelkova
Wireless™ Zelkova*

Trees for 6-foot planting strip or wider:
State Street™ Maple
Veriegated Norway Maple
Cleveland Norway Maple
Parkway® Norway Maple
Emerald Queen™ Norway Maple
Globe Norway Maple*
Wineleaf Sycamore Maple
Sycamore Maple
Armstrong Maple
Brandywine Maple
Embers Red Maple
Red Sunset® Maple
Morgan Maple
Northwood Maple
October Glory® Maple
Scanlon Red Maple
Schlesinger Maple
Sun Valley Maple
Green Mountain® Maple
Hackberry
Katsura Tree
Yellowwood
Empire Ash
Autumn Purple® Ash
Summit Ash
Urbanite Ash
Marshall's Seedless Ash

Patmore Ash
Shademaster® Honeylocust
Skyline® Honeylocust
Halka™ Honeylocust
Moriane Sweetgum
Black Tupelo*
Yoshino Cherry*
Rancho Pear
Trinity Pear
Scarlet Oak
Skymaster® Oak
Redmond Bigleaf Linden
Rancho Linden
Glenleven Linden
Greenspire® Linden
Frontier Elm
Accolade™ Elm
Triumph™ Elm
Green Vase® Zelkova
Halka Zelkova
Village Green Zelkova

Trees for 8-foot planting strip or wider:
Schwedler Norway Maple
Canoe or Paper Birch
Purple Rivers Beech
Kentucky Coffee Tree
Tulip Tree
Dawn Redwood
Red Oak

*Trees that may be planted under power lines

6.02.16 Street Names and Traffic Control Signage and Striping

Street names for all new development will be approved by the City prior to recording of any maps or plats. 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 that will duplicate or be confused with the name of existing streets in the metropolitan area.

The development shall pay for all street name and traffic control signage prior to the signing of the final plat or map by the City. All new signage will be installed by the City. A "signage and striping plan" shall be included with plan submittals for new street construction and approved by the Engineer.

6.03 ALLEYS AND PRIVATE RESIDENTIAL STREETS/ACCESSWAYS

6.03.01 Alleys

Alleys may be provided in commercial, industrial, and residential developments with approval of the Engineer. Design for alleys shall meet the same criteria as other public streets. Centerline radius and design speed shall be the same as a minor access street. Alleys shall be designed for one-way operation.

Alleys must begin and end at connections with streets classified between and including collectors and queuing streets. All lots must have frontage to a public street, other than an alley, unless otherwise allowed by GCDC. The length of any alley shall not exceed 400 feet. If there are parking restrictions on the fronting public street or there is no fronting public street, additional parking spaces must be provided off of the alley.

Alleys may be designed and constructed to be minor alleys unless one or more of the following conditions are met whereupon the alley shall be designed and constructed as a major alley:

1. The alley is in a commercial or industrial zone
2. The alley is longer than 200'
3. There are public utilities in the alley
4. The alley is designed with a horizontal curve

Alleys shall be dedicated to the City unless specified otherwise by the Engineer.

6.03.02 Private Residential Streets

In general, private residential streets and accessways shall be provided for multi-family developments such as condominiums and apartments. "PRIVATE STREET" signage and driveway approach shall be placed at the intersection with the public street to clearly identify the private accessway.

6.04 DRIVEWAYS

Access to private property shall be permitted with the use of driveway curb cuts where curbs exist and with AC connections where no curbs exist. 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. Driveways shall meet all applicable guidelines of the Americans with Disabilities Act (ADA).

On arterial and 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. Commercial developments with frontage greater than 250-feet may request an additional driveway if needed. If additional driveways are approved by the Engineer, a finding shall be made that no eminent traffic hazard would result, impacts on through traffic would be minimal, projected travel demands indicate it is in the interest of good traffic operations, and adequate street frontage exists to meet the driveway spacing standards of this section. 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.

A new driveway will not be allowed (measured to the driveway centerline):

1. Within 30-feet of any commercial property line except when it is a shared-use driveway serving 2 or more abutting properties;
2. Within 100-feet of the right-of-way of an intersecting arterial street;
3. Within 50-feet of the right of way of a non-arterial street;
4. When adequate sight distance cannot be provided.

Residential curb cuts shall be a minimum distance from adjacent property lines such that driveway curb wings and ramped sidewalk do not encroach on adjacent properties. Exceptions are allowed for shared driveways or when the lot is platted as a zero lot line or as an attached single-family lot.

DRIVEWAY LOCATIONS

Street Classification	Residential	Commercial	Industrial
Principal Arterial	100 feet[1,3]	100 feet[1]	100 feet[1]
Arterial	100 feet[1,3]	100 feet[1]	100 feet[1]
Boulevard	100 feet[1,3]	100 feet[1]	100- feet[1]
Collector	45 feet[3]	100 feet[1]	100 feet[1]
Community	45 feet[2,3]	100 feet[1]	100 feet[1]
Local Transitional	45 feet[2]	45 feet	45 feet
Local Queuing	45 feet[2]		
Minor Access	45 feet[2]		

Notes: 1.	Minimum distance from curb return unless this prohibits access to the site.
2.	Corner lot driveways on a frontage that is less than 75-feet shall be located no more than 8-feet from the interior property line and shall be no more than 24-feet wide.
3.	Direct access to this street may not be allowed if an alternative exists or is planned.

DRIVEWAY WIDTHS (Minimum/Maximum) IN FEET

Street Classification	Residential	Commercial	Industrial
Principal Arterial	N/A[1]	12/36	12/36
Arterial	12/24[2]	12/36	12/36
Boulevard	12/24[2]	12/36	12/36
Collector	12/24[2]	12/36	12/36
Community	12/24[2]	12/36	12/36
Local Transitional	12/24[2,4]	12/36[3]	12/36[3]
Local Queuing	12/24[2,4]	N/A	N/A
Minor Access	12/24[2,4]	N/A	N/A

Notes: 1.	Special conditions may warrant access.
2.	28-foot maximum with 3-car garage (3 bays wide).
3.	Build to community street standard.
4.	In the LDR District, the maximum width is 16-feet on interior lots with less than 45-feet of street frontage. Corner lots accessing the street with less than 36-feet of street frontage as measured from the curb return to property line are limited to a 12-feet driveway width.

For classification of 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 required.

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.

6.05 SIDEWALKS

In general, new sidewalks with curbs are required for all development requiring a development permit. Sidewalks shall be buffered from the roadway to provide for the safety and comfort of pedestrians.

6.05.01 SIDEWALK WIDTH

Street Class/Location	Sidewalk Width	Approximate Planter Strip Width
Principal Arterial	8-feet	6-feet
Arterial	6-feet	4-feet
Boulevard	11-feet	4-feet
Collector	6-feet	4-feet
Community	6-feet	4-feet
Local Transitional	5-feet	3.5-feet
Local Queuing	5-fet	4-feet
Local Lane	5-feet	N/A

Sidewalks shall be installed such that back of walk is 6-inches inside the right-of-way, except in cases where buildings abut the right-of-way in which cases the sidewalk will abut the building.

Sidewalks may meander within the dedicated right-of-way or outside of the right-of-way within an easement with the approval of the Engineer.

Sidewalks shall have a maximum cross slope no greater than 1:50. Sidewalks shall be constructed with a continuous passage of 5-feet clear of all obstructions, including poles, mailboxes, signposts, etc. With the Engineer's approval, utilities with facilities in the sidewalk may locate their facilities to be in conformance with a 36-inch minimum horizontal clearance. A 7-foot vertical clearance above the sidewalk shall be maintained.

Include handrails or fences to protect pedestrians when there is a vertical drop of 30-inches or greater adjacent to sidewalk.

6.05.02 Sidewalk Ramps

New street intersections shall incorporate 2 sidewalk ramps per corner, unless approved otherwise by the Project Manager. Retrofits shall incorporate ramps that line up with existing ramps, typically a single diagonal ramp. Where ADA ramps are non-existent opposite new ramps installed as part of new frontage construction, new ramps shall be constructed on the other side of the street in addition to the new ramps constructed as part of the frontage. Sidewalk ramps shall meet all applicable guidelines of the Americans with Disabilities Act (ADA), except as noted herein.

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

In areas of existing steep terrain, the City encourages the Engineer of Record to:

- Utilize existing code provisions to eliminate sidewalk on one side of the street when permissible. This is permitted by development standards and will reduce the overall number of ADA ramps. However, designer will need to provide continuity in the pedestrian network.
- Utilize existing standards that allow the flexible use of either one or two ADA ramps per corner.

The City will review cross slopes on construction plans as follows:

- For street grades of less than 8%, cross slopes shall not exceed 2%.
- For street grades equal to or greater than 8%, cross slopes of up to 5% will be permitted if considered reasonable in the engineering judgment of the City.
- Cross slopes greater than 5% may be proposed in cases of technical infeasibility and will only be permitted if considered reasonable in the engineering judgment of the City.

The City will not approve cross slope more then 2% in advance of the submittal of construction plans. Written construction plans must be submitted to, reviewed, and approved by the Engineer prior to construction

There may be rare cases in which circumstances justify a cross slope greater than 5%. The City will permit such cross slopes only if, in the exercise of the City's reasonable engineering judgment, the City determines that there are no other practical alternatives. The following considerations will apply to the exercise of reasonable engineering judgment by the City:

- For cross slope of greater than 5%, the Engineer of Record must state that every effort has been made to design a project with 5% cross slopes. Rough plans showing 5% cross slopes must be submitted with additional information to identify why the plan is not a practical alternative.
- City approval shall include a disclaimer that City approval will not act as an agreement or obligation to indemnify anyone if an ADA violation is alleged.

- The Engineer will consider the following factors in determining whether allowing a cross slope greater than 2% is a reasonable exercise of engineering judgment.

    - Street grades and width
    - Anticipated vehicle speeds
    - The nature of intersection controls
    - Alternative accessible routes
    - Permitted land uses in the area
    - Impact on natural resources

The engineering judgment will be documented by the Engineer and approved by the Transportation Manager. If the cross slope exceeds 5%, the DES Director's approval of the engineering judgment must also be obtained. See Standard Details 626 and 627 for additional details.

6.06 BICYCLE FACILITIES

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

The City's adopted guidelines for bikeways consist of the following:

1. AASHTO, "Guide to Development of Bicycle Facilities" – latest edition
2. ODOT, "Oregon Bicycle & Pedestrian Plan" – latest edition
3. Manual on Uniform Traffic Control Devices with Oregon supplements by Oregon Transportation Commission – latest edition

6.06.01 Bikeway Location Width

Bikeway Location	Width	Comments
Public Street (designated bike lane)	6-feet[1]	Each direction of travel at shoulder/curb

Note: 1. The 6-foot section is required unless this width is not practical because of physical or economic constraints as approved by the Manager. In the aforementioned case, a minimum width of 4-feet may be designated as a bicycle lane.

6.06.02 Pedestrian/Bicycle Accessway

Accessways are subject to the following design standards.

All rights-of-way for pedestrian and bicycle accessways shall be dedicated to the City for public use or may be approved as public access easements on private property. Accessways shall be maintained as part of the public right-of-way or by the underlying landowner if constructed as public easements over private land.

Right-of-way or easement width shall be 10-feet except that a 15-foot width is required for accessways that also provide for public utility corridors. Also, if an accessway provides secondary fire access, a minimum 20-foot width is required.

The Engineer may approve accessways exceeding 200-feet in length if there is adequate right-of-way or easement width to provide for safe pedestrian and bicycle travel.

A clear-vision triangle, as specified in GCDP Section 9.0200, shall be provided at the ends of all accessways. Accessways shall be straight enough to allow both ends of the accessway to be seen from the adjacent

public streets and lighting must be provided. On-street parking shall be prohibited within 15-feet of the intersection of an accessway and a public street to preserve safe sight distance.

The construction of stairways shall be avoided whenever possible. Where the path grade would exceed 12% slope, an accessway will be constructed as stairs for pedestrians. Based on local conditions, the Manager may approve alternatives to stairs, including the use of switchbacks and alternative materials. If stairways are needed, they shall be at least 5-feet wide with handrails on both sides.

When required for buffering, accessways shall be fenced and screened along adjacent property lines. The area between the pathway and fences shall be planted with a combination of groundcover or low-growing shrubs that will reach no more than 2-feet high at maturity.

Accessways shall be designed to prohibit motorized traffic.

Off-street pedestrian/bicycle accessways shall be constructed for 2 different situations – where no vehicular use will occur and where heavy maintenance vehicle use will occur. In both cases, subgrade preparation will require removal of existing organic material in accordance with roadway construction.

When drainage such as side ditches is required parallel with the bikeway, the ditch centerline shall be at least 5-feet from the edge of the pavement and additional right-of-way or easement width may be required. Ditch side slope adjacent to the bikeway shall be no steeper than 2:1 when measuring the horizontal distance to the vertical distance.

When accessway crosses culverts, the ends of the pipe shall be no closer than 5-feet from the edge of the accessway.

7.01 GENERAL DESIGN REQUIREMENTS

7.01.01 General

The development standards are not intended to cover every possible situation encountered during the design and construction of park facilities. The standards are intended to provide the flexibility to incorporate products and materials in an easy and consistent manner. Other designs and products may be submitted as variances and equals for approval.

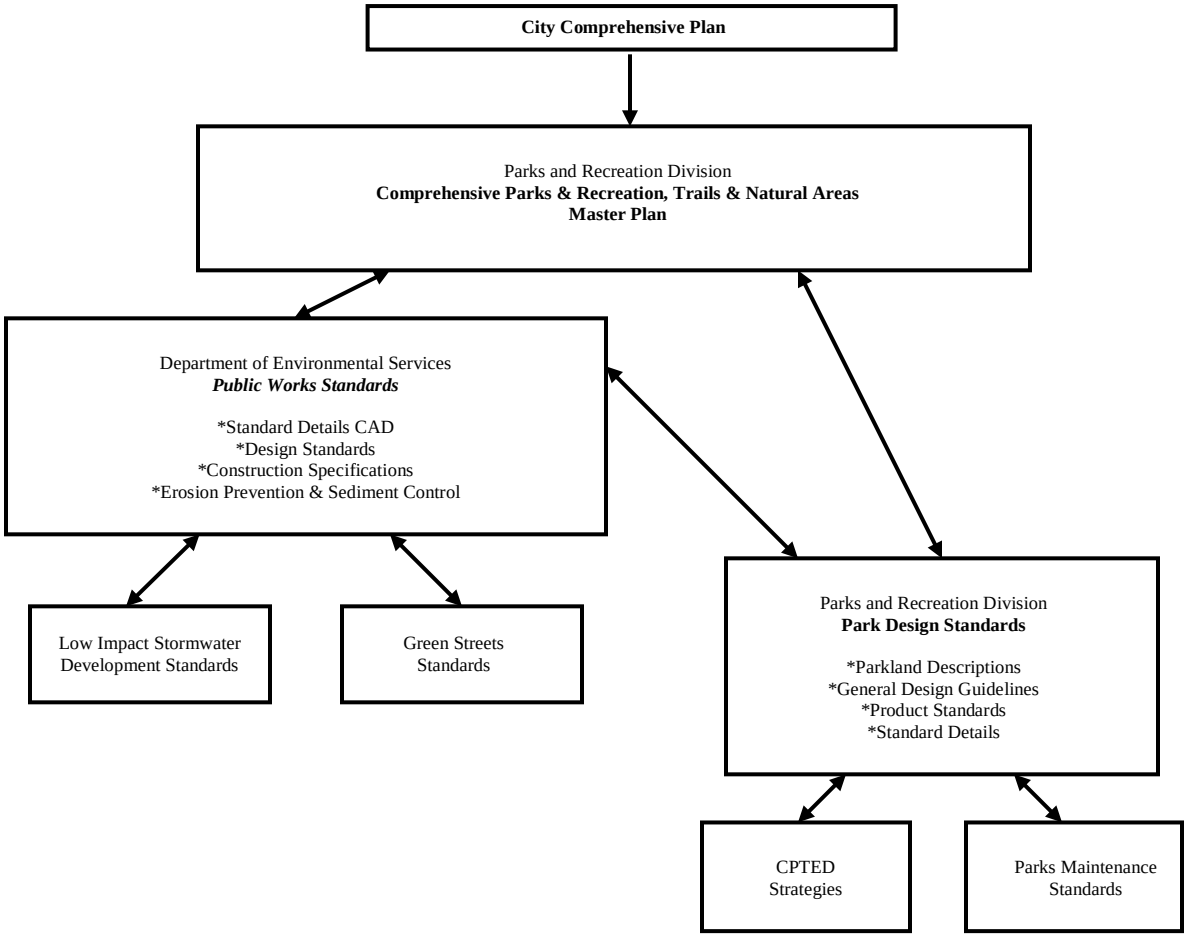
Utilize well-qualified and experienced professional park designers for all planning and design.

Designs shall comply with the latest edition of the *Crime Prevention through Environmental Design* (CPTED) concepts and strategies, which is available from the City of Gresham's Police Department.

It is essential that park development be consistent for the ease of maintenance and quick approval of products for our parks, trails, and other recreational facilities.

7.01.02 Park Planning and Design Documents

GRESHAM PARK PLANNING & DESIGN DOCUMENTS



7.01.03 Park Standard Details and Specifications

Install all site furnishings according to drawings, details, and approved shop drawings. Products should be installed as recommended and/or specified by the manufacturer. Assemble and install all products in accordance with the manufacturer's recommendations, as modified or shown on the drawings, and as approved by the City. Obtain approval of layout/location from the City prior to installing.

7.01.04 Additional Technical Specifications

In addition to the technical specifications in these *Public Works Standards*, the following additional technical specifications are incorporated herein by reference for the development of Gresham's parks, trails, and natural areas. The additional technical specifications are listed below as per the Construction Specifications Institute (CSI) standard titles. If a conflict exists between these *Public Works Standards* and the referenced CSI standards, the *Public Works Standards* will take precedence.

DIVISION 2 SITE WORK

Section 02100 – Site Preparation/Demolition
Section 02710 – Subsurface Drainage System
Section 02780 – Concrete Unit Pavers
Section 02795 – Porous Pavement
Section 02810 – Irrigation
Section 02810 – Temporary Irrigation
Section 02830 – Chain Link Fences
Section 02910 – Tree, Shrub, and Groundcover Transplanting
Section 02930 – Seeded Lawns
Section 02950 – Tree, Shrub, and Groundcover Planting

7.02 PLANNING AND CONSTRUCTION PROCESS

7.02.01 General

Proposed Parks & Recreation facilities are subject to the requirements and review of the Planning Services Department (PSD), Development Services Department (DSD), and the Department of Environmental Services (DES). The planning process is largely governed by City of Gresham Development Code, Section 11.0200, DEVELOPMENT PROCEDURES.

7.02.02 Planning and Approval Process for City Constructed Parks

The City's approval process for Parks is as follows:

Park Identified in P&R Master Plan & SDC Study
Park Budgeted in CIP
Park Master Plan Developed by Staff / Consultant
Park Master Plan Reviewed by Neighborhood Association
Park Master Plan Reviewed by Parks & Recreation Council Advisory Committee
Park Master Plan Reviewed by Planning Commission (not required for neighborhood parks & open space improvements)
Park Master Plan Approved by City Council
Pre-Application Conference
Early Neighborhood Notification
Park Construction Documents Developed by consultant and reviewed by staff
Type II Land-Use Permit Process (not required for community parks & regional trails)
Type III Land-Use Permit Process (not required for neighborhood parks & open space improvements)
Park Construction Documents Approved by Planning Services Department
Park Construction Documents Approved by Planning Commission (not required for neighborhood parks

& open space improvements)

7.02.03 Design Development, Review, and Approval Process for Developer Constructed Neighborhood Parks

Gresham has adopted a process by which the city works with developers to plan the new park that the developers will be constructing. Because the developer constructed parks are being developed in conjunction with the development of the new neighborhood, and because the neighborhood park plans are considered as a part of the development application review process, a more streamlined approach for those parks is described below.

a. Project identified in Parks Master Plan, Pleasant Valley or Springwater Public Facility Plan, and Parks SDC project list.
b. Project funding/SDC credit agreement is secured via infrastructure funding agreement approved by Council.
c. Park Location approved via Neighborhood Master Plan or Development Application approval.
d. Developer meets with staff to review, discuss and agree upon goals for the park and receive City's Park Development Standards.
e. Developer via landscape architecture firm develops concept (schematic site) plan; schedules Pre-Application Conference for review.
f. Concept Park Plan presented to and reviewed by Parks & Recreation Council Advisory Committee and Neighborhood Association. Feedback used to develop Park Site Master Plan.
g. Park Site Master Plan reviewed and approved by Parks and Planning Services Department staff.
h. Construction documents submitted to the Parks & Recreation Division for review, confirm compliance with the Development Standards at 30%, 50%, 90%, and 100% completion, and approval.
i. Construction documents submitted to Planning Services Department for review and approval per the development code.

Comprehensive construction plans, specifications and details will be required for approval. A 3-person internal committee of Parks & Recreation Division employees will review the concept sketch, preliminary and final design and products proposed; and evaluate "Or Approved Equal" substitution requests.

7.02.04 Final Submittals

Photocopy the Irrigation Valve Schedule from As-built Drawing (with any revisions noted). Laminate both sides of the copy with plastic and tape inside the controller. Provide equipment operating instructions, parts lists, service manuals, specification sheets, warranty information, winterization instructions, precipitation rates per hour, and circuit operating time for each zone. Punch and place all materials in a 3 ring binder. Submit to Owners Representative for review. Deliver to owner after Owners Representatives' approval.

The contractor shall conduct a training and orientation session covering the operation, adjustment, and maintenance of the irrigation system. Contractor shall be responsible for one full winterization and one spring activation of the sprinkler system including backflow test and any repairs and shall conduct these operations as part of the owner's training and orientation procedures.

7.03 PARKLAND DESCRIPTIONS

The parkland managed by Gresham Parks and Recreation is generally categorized into six park types.

- Neighborhood Parks and Pocket Parks
- Community Parks
- Urban Plazas and Town Squares
- Natural Areas and Greenways
- Trails and Trailheads
- Regional Parks

Each park type offers a different experience and function. Developed park sites, within the system, offer space for active and intensive recreation, including sports fields, play equipment and ball courts. Natural areas and greenways are lands of natural quality set aside for protection of natural resources, nature-oriented outdoor recreation, and trail and trail-oriented activities.

The following are general guidelines. Each park development will be approved by staff based on what is appropriate for that specific site.

7.03.01 Neighborhood Parks and Pocket Parks

A neighborhood park generally serves nearby residents; enhances neighborhood identity; preserves neighborhood open space; and is within walking and bicycling distance (½ miles or less) of a person's home. They provide access to basic recreational opportunities for residents of all ages; and are designed primarily for non-organized recreation. They are typically 1-13 acres in size and may include restrooms and skate park, but do not include parking lots, unless warranted by unique circumstances.

Neighborhood Parks include Pocket Parks in denser urban areas which are usually less than 1 acre in size.

Neighborhood parks often include amenities such as:

- Graded and seeded lawns
- Play equipment / children's play area for early childhood as well as youth ages 5-12
- Picnic areas, tables / picnic shelter / BBQs
- Benches
- 10 foot wide multi-use paved trail system
- Automatic irrigation system
- Landscaping: trees, shrubs and lawn
- 8 foot x 8 foot backstop panel for children's games
- Hard court play area, such as volleyball, half-court basketball, or other sports facilities
- Security bollards and/or fencing
- Signage
- Restroom building
- Lighting
- On-street parking
- Bike racks
- Community gardens where space is available
- Trash cans and drinking fountain
- Public art
- Horseshoe pits
- Special gardens
- Skate park

Neighborhood parks typically do not include:

- Recreational facilities intended for large groups, i.e. sports fields
- Off-street parking

Examples:

- Yamhill Neighborhood Park
- Bella Vista Neighborhood Park
- Davis Neighborhood Park

7.03.02 Community Parks

Community parks provide a focal point and gathering place for broad groups of users and are used by all segments of the population. A community park generally serves the community within a 5 mile radius service area. They are typically 13-50 acres in size and are intended to serve a larger community need. Community parks provide access to active and passive recreational opportunities and accommodations for larger groups. They provide: a variety of accessible recreation opportunities for all age groups; environmental education; the recreational needs of families; and community social activities. Because of their large service area, community parks require more support facilities, such as larger restrooms, skate parks, and off-street parking.

Community parks often include amenities such as:

- Graded and seeded lawn areas
- Play equipment / children's play area for early childhood as well as youth ages 5-12
- Picnic areas, tables, picnic shelter, BBQs, and group picnic areas
- Benches
- 10 foot wide multi-use paved trail system
- Automatic irrigation system
- Landscaping: trees, shrubs and lawn
- Recreation facilities for organized activities
- Competitive sports fields and facilities such as softball, baseball, or soccer fields
- Hard or soft play court areas, such as basketball, skateboard area, or volleyball
- Security bollards and/or fencing
- Signage
- Off-street parking lots, possibly with pull through bus parking
- Restroom building
- Community gardens
- Natural areas or botanical gardens
- Lighting
- Bike racks
- Trash cans and drinking fountain
- Passive recreation space
- Public art, fountains, interpretive facilities, and larger community facilities such as community centers, amphitheaters, festival space, and swimming pools
- Dog off leash area
- Skate parks

Additional programming and activities can be included within a community park. The city relies on the sports groups to construct, operate and maintain concessions at their expense.

Examples:

- Main City Park
- Pat Pfeifer Community Park
- Red Sunset Community Park
- Zimmerman Heritage Farm Community Park

7.03.03 Urban Plazas and Town Squares

Urban plazas are multi-purpose paved areas within high density urban developments and along transit corridors and include town squares. They are focal points of town center districts. Urban plazas provide for the day to day recreational needs of nearby residents and employees, as well as shoppers, transit-users, and recreationalists. They provide space for community events; help balance high density development; and communicate neighborhood character. They are expected to be relatively small, less than 1.5 acres in size, usually less than 1 acre.

They may include:

- A multi-use paved area
- Community green or garden
- Children's integrated play areas, such as climbable sculpture and boulders
- Public art and fountains
- Landscaping and irrigation
- Seating
- Multi-purpose performance space
- Small scale sports facilities, such as basketball hoops
- Signage
- Restroom building
- Trash cans and drinking fountain

Urban plazas usually do not include:

- Off-street parking
- Lawns

Examples:

- Pioneer Square, Portland
- Westlake Park, Seattle
- Union Square, San Francisco

7.03.04 Natural Areas and Greenways

These are areas of natural quality for protection of natural resources, nature-oriented outdoor recreation, trail and trail-oriented activities. Open spaces include buttes, view points, and undeveloped natural areas. Greenways are linear open spaces along significant waterways, wetlands, seasonal streams, sloughs, river frontage or simply a continuous open area. Many Natural Areas and Greenways are forested or wetlands. They provide opportunities for rest and relaxation; protect valuable natural resources; protect wildlife; and contribute to the environmental health of the community.

Natural Areas and Greenways should have sufficient size to protect resources. They should have sufficient width and suitable topography to accommodate pedestrian or bicycle trails.

They may include:

- Trails
- Trailhead amenities
- Parking
- Restroom building
- Bike racks
- Trash cans and drinking fountain
- Picnic areas
- Benches
- Signage
- Outdoor classroom
- Native plants

Open Spaces and Greenways usually do not include:

- Facilities that do not directly support nature and trail oriented passive recreation
- Ornamental plants
- Lawns

- Parking within the greenway

Examples:

- Nadaka Open Space
- Butler Creek Greenway
- Gresham Butte Open Space
- Hogan Butte Open Space

7.03.05 Trails and Trailheads

Trails and trailheads provide a public access route for commuting and recreational activities, such as walking, running, biking, skating, skateboarding, and horseback riding. Trails include sidewalks, bikeways, multi-use trails and paths. Trailheads are an integral part of this system. They provide opportunities for rest and relaxation; provide opportunities for trail oriented activities; reduce auto-dependency; and connect community facilities.

Trails and trailheads should have the appropriate size to protect the surrounding natural resources. They should have sufficient width and suitable topography to accommodate pedestrian or bicycle trails:

- Multi-use path, 12 foot wide pervious asphalt or crushed rock with 2 foot wide crushed rock shoulders.
- Walking / hiking trail, 6 foot wide soft surface trail formed of native soil, mulch or crushed rock.

Trails and trailheads may include:

- Trails
- Trailhead amenities
- Walk-in trailheads or access points
- Parking
- Restroom building
- Picnic shelter
- Picnic tables
- Lighting outside of important wildlife habitat
- Trash cans
- Drinking fountains
- Bike racks
- Benches
- Signage
- Structures
- Native plantings; and landscaping and automatic irrigation system for trailheads

Trails and trailheads do not include:

- Facilities that do not directly support nature and trail oriented passive recreation
- Ornamental plants
- Lawns

Examples:

- Springwater Trail
- Gresham/Fairview Trail
- Gresham Butte Saddle Trail
- Kelly Creek Greenway Trail
- Linnemann Station Trailhead

- Hogan Road Trailhead

7.03.06 Regional Parks

Regional parks are recreational areas that serve residents from throughout Multnomah and Clackamas Counties and beyond. The regional park system consists primarily of conservation and habitat properties or large scale parks provided and managed by Metro regional government or county government. Regional parks are usually larger than 50 acres in size and provide opportunities for diverse recreational activities. Currently Gresham does not have a regional park.

Facilities may include:

- Sports fields
- Extensive trail systems
- Large picnic areas
- Large natural areas
- Boat Launch Facilities

In addition, regional parks often include passive recreation space and unique features, such as significant natural areas or access to lakes or rivers. Because of their large size and broad service area, regional parks typically require more support facilities, such as parking and restrooms. These parks are usually designed to accommodate large numbers of people.

Examples:

- Delta Park Sports Complex
- Oxbow Regional Park
- Blue Lake Regional Park

7.04 DESIGN REQUIREMENTS

7.04.01 Grading

Design grass slopes no steeper than 3.5:1 to facilitate mowing of lawns. Steeper slopes should be planted in shrubs or possibly ground covers.

Limit the height and extent of mounds and berms to avoid creating hiding places.

7.04.02 Planting

As part of the park construction contract, contractor shall spray kill lawn and install 2 foot clear radius mulch circles around the outside of new and existing trees.

Place new trees 17 feet minimum from fence lines, buildings, other structures; and 12 feet minimum from sidewalks and roads to maximize lawn mowing efficiency; minimize root heave damage; and damage to trees.

Limit installation of new shrubs in areas other than main park entry points.

Avoid using plant material which will prohibit clean, clear sight lines. Avoid using shrubbery within the 3 foot to 6 foot height range. Avoid creating hiding places.

Long, gentle seeping curves for lawn lines are preferred over short, abrupt changes in direction.

7.04.03 Water, Irrigation, and Drinking Fountains

Quick coupling valves should be located less than 100 feet from play areas, play equipment, drinking fountains, restroom buildings, and shelters. A drinking fountain with an interior hose bib may be installed instead.

Irrigation designs should anticipate possible volume lost due to future adjacent development. Designers should contact the local water district to determine minimum available water pressure and flow for that area of the service district. Any private sprinkler (fire, irrigation) system or on-site private hydrant system needs to be designed to function at a pressure at least 10psi lower than the lowest expected pressure of the adjacent public water system.

Valve boxes should be located in shrub beds whenever possible. Pipes, sharing a trench, must be spaced 2 inches minimum apart. Install a locator tracing wire for all mainline pipes. As built drawings must be provided for all irrigation systems in accordance with 2.06.05.

Back flow devises must be installed a minimum of 24 inches, to the top of the device, below finish grade to protect from freezing as per building code requirements. Wherever possible this should also be the maximum depth. In some cases, when approved in advance, the City of Gresham may allow a minimum of 18 inches from finish grade to the top of the device.

Backflow devices are to be positioned/rotated to allow clearance/access for inspections and repairs.

Do not install frost-resistant drinking fountains.

For installation of new water meters, install 2 inch service minimum from city water line and 3/4 inch water meter minimum.

7.04.04 Lighting

Lights should be similar to the style used in Main City Park. Lighting should be mainly cast downward; utilize cut off luminaries if necessary and directed to not cast light on adjacent properties. Utilize high pressure sodium vapor lights were possible. Use smooth concrete or metal poles, no composite.

7.04.05 Designing for Maintenance

Consider replacement costs, maintenance costs, and graffiti removal when selecting materials. Apply anti-graffiti coatings to applicable surfaces.

Do not use exposed aggregate concrete for paving, walls and site furnishings.

Use standard poured in place curbing in parking lots. Wheel stops and 6 inch x 6 inch extruded curbing are not acceptable.

7.04.06 Structures

Restroom fixtures, including sinks, toilets, hardware, and urinals, shall be stainless steel. Do not use spring loaded doors and seats. Restrooms should have a large utility chase room with a door to the outside. Chase door should be on the same side of the building as the restroom doors. Restrooms fixtures should use parts and brands that are locally and currently available. Only the toilet flush ignition button should be located within the restroom; with the activator located within the chase.

Shelter structures should be designed to seat approximately 50-100 people. Typical construction material is steel columns and roofs. Other materials may be used if approved by the Engineer. Shelters shall be simple and open with few opportunities for birds to nest or people to climb. Shelters shall have a strong gutter system with schedule 40 steel downspouts to direct storm water and minimize vandalism and be

designed for low maintenance and up keep. Tongue and grove 2 inch decking is required unless otherwise approved by the Engineer. Metal parts shall be powder coated and the structure coated with an anti-graffiti coating.

Good examples of shelters are the 32 foot x 32 foot shelters at Red Sunset Park or the shelter at Main City Park, each of which provide seating for approximately 100 people.

Avoid providing routes and ways to access roofs of park structures.

7.04.07 Circulation

Do not include stairs unless otherwise explicitly approved by the Engineer.

Trail bridges shall be the same width as the trail, plus 18 inches "shy" distance on each side, and capable of similar use as trail. Steel bridges with concrete or metal decking are required unless otherwise approved by the Engineer. Bridges should not be designed with columns in streams.

7.04.08 Play Structures

A City standard concrete curb shall be installed to contain the engineered wood chips used under and around play structures. Wood members shall not be used in play structures and decking should be of coated metal.

Green and blue have been standard Gresham park colors; however other colors may be approved by the Engineer. Play structure colors should be naturalistic utilizing browns and green tones. Avoid garish bright colors.

7.05 SIGNAGE PROGRAM

Trails Signage Requirements are as follows. Additional signage may be required by the City.

Recommended signage types for park property includes:

1. One or more park site identification signs at main entrances
2. One or more park general regulatory signs at main entrances
3. Interpretive signage as desired and located near the resource of interest
4. Accessibility signage as required
5. Traffic and parking control signage as required
6. Dog enforcement code signs at park entrances
7. Other signage as required

All signage shall be as per Park and City standards. Utilize metal break away posts on single post signs. See City Standard Signpost Detail 640.

Recommended signage for specific park property signage types as listed below:

Park Type	**Signage Type (see above)**
Neighborhood	1, 2, 4, 6
Community	1, 2, 4, 6
Urban Plazas and Town Squares	1, 2, 3, 6
Natural Areas	1, 2, 3, 4, 6
Greenways and Trails	3, 4, 6
Trailheads	1, 2, 4, 6
Regional	1, 2, 3, 4, 6

7.06 PRODUCT STANDARDS

7.06.01 Site Furnishing Product Standards

Other designs and products may be submitted for consideration as an approved equal per 1.06, APPROVAL OF ALTERNATE MATERIALS OR METHODS, of these Design Standards, and 108.07, TRADE NAMES, EQUALS, OR SUBSTITUTIONS, of the Construction Standard Specifications.

Item	Manufacturer	Model Number and Notes
Barbecue:		
For picnic shelters & community parks: Group Barbecue	Pilot Rock	P-1000/S B7 B7 surface mount base, bolt down 1008 sq. inches, 215 lbs. Example: Red Sunset Community Park
For single family & neighborhood parks: Barbecue	Pilot Rock	B-24/SB2 w/ optional shelf B2 standard base, concrete embedded 384 sq inches, 91 lbs. Example: Red Sunset Community Park
Benches:		
Renaissance bench w/ 3 armrests* *This bench will be dropped from the standard if it doesn't withstand Gresham vandalism.	Columbia Cascade	8 foot, surface mount; Solid steel
Parkway bench w/ 3 armrests	Columbia Cascade	2016-8-E-M 8 foot, 3 x 4 and 3 x 8 inch mix rather than all 3 x 4 inch. Wood
Tables:		
Parkway Table	Columbia Cascade	8 foot, continuity with Parkway bench, wood Can be built as an accessible table with an overhang
Picnic Table	Natural Structures	91-137, 7 foot – 10 inch long, 3x10 inch tight knot Doug Fir Embedded, Black power coat Example: Red Sunset Community Park
Bicycle Racks:		
Bicycle Rack	Columbia Cascade	Model 2172 (bollard type) Example: Linnemann Station Trailhead, Springwater Trail
TimberForm Cycloops embedded	Columbia Cascade	#2170-7G or C (approx. 5 foot-3 inch x 3 foot-0 inch)
Bollards:		
Bollard Wood		Not acceptable
Bollard Concrete		Might be approved for urban settling, provide details
Bollard Embedded metal	Columbia Cascade	TimberForm #2190-E, Evergreen color Power-coated Example: Pat Pfeifer Community Park
Bollard Removable metal	Columbia Cascade	TimberForm #2190-RC, Evergreen color Power-coated, provide sleeve cap Examples: Pat Pfeifer Community Park and Gresham-Fairview Trail Phase 1
Drinking Fountains:		
Drinking Fountain	Most Dependable	Model 440SM w/ concrete pad, surface mount, emerald color, w/ recessed hose bib w/ lock door Example: Red Sunset Community Park
Concrete Drinking Fountain		Not acceptable
Trash Receptacle:		
Trash Receptacle	Concrete Shop, Inc., Vancouver,	w/ Rubbermaid dome top Model SF034, smooth finish concrete, open bottom

	WA	spring loaded door & metal ring to hold bag. Install per city detail on concrete pad, See detail. Examples: Linnemann Station Trailhead, Springwater Trail
Basketball Equipment:		
Basketball Posts:	Gared	GN 45 (1266-4 system) 4 ½ inch O.D. schedule 40 galvanized steel pipe, single post, 4' offset arch; available from Wildwood Playgrounds Example: Yamhill Neighborhood Park
Basketball Backboards:	Gared	1266; Regulation 54 inch fan shaped, galvanized 12 gage reinforced steel plate, power coated white; available from Wildwood Playgrounds Example: Yamhill Neighborhood Park
Basketball Goal and Net:	Gared	#266; goal comprised of 5/8 inch steel ring and ½ inch reinforcing ring, with 12 no-tie hooks for net, power coated orange; available from Wildwood Playgrounds Example: Yamhill Neighborhood Park
	Collegiate Pacific	Perma-Net BBNETC, Coated Cable
Baseball, Softball, Soccer, Football, Tennis, Skate Park Equipment:		
Bleachers	Collegiate Pacific	Stationary Bleachers – Preferred Double foot planks on all rows
Backstop	Paterson Williams	
Children's Play Equipment and Safety Surfacing:		
Play Equipment	Landscape Structures & Ross Recreation	Model & color varies Examples: Pat Pfeifer and Main City Community Parks; Bella Vista and Butler Creek Neighborhood Parks
Drainage: Drain rock		6 inch min depth of 1 inch washed round drain rock
Safety Surfacing: Sof'Fall engineered wood fiber	Landscape Structures, Recreation Resource, Inc., & Ross Recreation	Example: Pat Pfeifer Community Park
or		
GT IMPAX engineered wood fiber	Site Lines Park & Playground Products	
Geotextile Fabric		Minimum of 28 mills thick and 26 gallons per square foot per minute permeability Example: Pat Pfeifer Community Park
Signage:		
Park Identification Sign	Multnomah Co. Sign Shop	Fabricated per photo, use graffiti film
Park Regulatory Sign	Multnomah Co. Sign Shop	Fabricated per photo, use graffiti film
Other signs	Gresham Sign Shop	Use graffiti film
Metal posts		2" square 14 gauge break away posts For single post signs see City Standard Signpost Detail 531
Trails and Walks:		
Interior Paved Walks		10' wide min. porous asphalt, porous concrete, pavers, or reinforced concrete
		Only soft surface trails within natural areas may be constructed with screened AC grindings or ¼ inch minus crushed rock, 4 – 6 feet wide and 3-4 inch

		depth minimum
Concrete Unit Pavers:		
Double Soldier Course Edges, under benches, and Paver Bands:		
"Holland-Stone"	Willamette Graystone	(60 mm) thickness, 3.9" x 7.9", Charcoal color
Inner Field Pattern 6 / Muster K:		
"Holland-Stone"	Willamette Graystone	(60 mm) thickness, Walnut Blend color
Permaloc "StructurEdge" metal	Permaloc Corp.	1/8" x 2 ¼", black DuraFlex finish, 8 foot lengths
Snap Edge plastic edge restraint	Willamette Graystone	
Geotextile:		
AMOCO 4545 (non-woven)	A.C.F. West Inc.	
or		
Mirafi 600 X soil stabilization fabric	Willamette Graystone	
Bedding Course Sand:		Clean concrete sand, fine, sharp, non-plastic aggregate complying with ASTM C33; do not use mason sand. No material shall pass the No. 200 sieve
Joint Sand:		ASTM C 144 except use aggregate graded with 100 percent passing the No. 8 sieve and 95%, the No. 16 sieve; no material shall pass the No. 200 sieve.
Paver Sealant: Techni-Seal "iN Sealant"		Invisible, water based and non-film forming; apply as per manufacturer's specifications
Paver Joint Filler: Techni-Seal "HP Polymeric Sand", Granite Grey		Install per manufacturer's specifications Example: Pat Pfeifer Community Park
Lighting:		
Parking Lot Lighting	Ameron Pole Products	VEF-6.1 (513A) Pole w/ Alum Tenon - PGE Brown Nat., Exp. Aggregate Finish w/ Gloss Coat Victorian Series Fluted Pole Similar to Main City Community Park
Path Way Lighting		Same as above
Lawn Seed:		
CPR Perennial Ryegrass Blend	United Horticulture Supply	For parks & sports fields Example: Pat Pfeifer Community Park

7.06.02 Restroom Product Standards

Item	Manufacturer	Model Number and Notes
Complete Restroom*	CXT Precast Products	Cortez – Double flush restroom Examples: Rockwood Central Neighborhood Park and Pat Pfeifer Community Park
Complete Restroom*	Romtec	Sierra II – Double restroom with 8' storage and 2 roof extensions with exterior siding fixture package (cedar board & batten with stone veneer) Example: This restroom has not yet been constructed at a park in Gresham
Complete Restroom*	Romtec	Sierra Stretch Quattro (quad restroom) – Title 24 w/4' center storage/mech. room with exterior siding fixture package (cedar board and batten with stone veneer) Example: This restroom has not yet been constructed at a park in Gresham

* The City will determine which restroom or approved equal will be constructed at each park.

Plumbing Fixtures:		
Urinal	Acorn 1705-ADA-W-1-SW-Q	Penal-ware
Urinal Flush Valve	Sloan Royal 952-FW	
Toilet	Acorn 1675-W-1-SW	Wall mount stainless steel
Toilet Mount		Behind wall carrier
Toilet Flush	Sloan Royal 952-FW	Flush valve
Toilet Seat	Olsonite	Open end solid plastic
Sink	Acorn 1652-ADA-1-LF-3-M-LW1-SW	Wall mount stainless steel
Floor Drains	Josam 30000 A series	6-inch interior floor drains
Drinking Fountains	Most Dependable	Exterior stainless steel wall mount
Exterior Hose Bib	Smith 5509qt	Exterior recessed stainless steel box
Cleanouts	Smith 4020	Flush mounted
Waterhammers	Smith series 5000	Hydrotrols hammer arresters
Pressure Regulator valve	Wilkins 25-75 PSI	
Architectural:		
Toilet Paper Dispenser		Furnished by owner
HC Grab Bars	Cipco	s.s. surface mount vandal resist
Doors/Frames		Metal; 12 gage steel with grouted frame
Locks	Best	
Kick Plate		Stainless Steel 10 inch x 35 inch
Push Plates		Stainless Steel 10 inch x 16 inch
Vents		Galvanized Steel
Electrical Components:		
Hand Dryer		Through wall mount
Chase Lights		Florescent fixture Example: Pat Pfeifer Community Park

7.06.03 Irrigation Product Standards

Item	Manufacturer	Model Number and Notes
PVC Pipe and Fittings:		
PVC Pipe (Polyvinyl Chloride Plastic)		PVC 1120, Type 1, normal impact, I.P.S., N.S.F. approved.; Schedule 40 pipe conforming to ASTM D-1784-69, ASTM D-1785, PS22-70; Class 200 pipe conforming to ASTM D-1784-69, ASTM D-2241, PS22-70; all pipes shall be new, defect free, and continuously and permanently marked with the manufacturer's name or trademark, size, schedule and type of pipe; minimum 200PSI rated and with SDR 21 walls
PVC Pipe Fittings		PVC 1120, Schedule 40 Type 1, normal impact, I.P.S., N.S.F. approved; meeting requirements of ASTM D-2466
PVC Solvent Cement		Weld-On 721 meeting N.S.F. approval for Type I and II PVC through 6 inch and meeting requirements of ASTM D-2564

PVC Cleaner and Primer		Weld-On P-68 or P-70 or meeting requirements of ASTM F-656, purple color; one step glue with built-in primer is not acceptable
PVC Sleeves		Schedule 40; 4 inch min.
Galvanized Steel Pipe and Fittings		Schedule 40, hot dip galvanized, conforming to ASTM A120-76; fittings shall be malleable iron, hot-dip galvanized
Irrigation Heads	Rainbird	Use rubber cap option on rotors in sports fields

Valves and Accessories:

Automatic Control Valves		See valve schedule on drawings; supply and install PVC unions on both sides of valves (see details)
Ball Valves (full port)	Conbraco, Apollo 70 series, Watts, or Nibco	Brass or bronze, 400PSI min. with standard seat and threaded ports; stainless steel ball and stem; non-latching stainless steel lever handle (not latching or chrome plated or tee handle); same size as pipe or as indicated on drawings; Nibco requires contractor to replace zinc coated steel handle with the stainless steel handle; supply and install PVC male adapters or PVC nipples into valve, not galvanized nipples; supply and install PVC unions or flanges on both sides of valves
Gate Valves		200PSI min. cold working pressure; supply and install PVC adapters or PVC nipples into valve, not galvanize nipples; supply and install PVC unions or flanges on both sides of valves (PVC unions manufactured by KBI)
Gate Valves at P.O.C. and mainlines over 2½inches in diameter	Nibco model MJF-619-RW-SON	Ductile iron, resilient wedge, non-rising stem, flanged end, square operating nut; size to match mainline
Gate Valves on mainlines less than 3 inches and at automatic control valves	Nibco model T-113-BHW	Domestic manufactured bronze, threaded ports, solid wedge, non-rising stem, round bronze hand wheel, dezincification resistant; size to match mainline and or valves
Drain Valves		Ball valves as described in second item above
Quick coupling valves		
For potable water lines	Rainbird # 44LRC	Locking Rubber [yellow] Cap
For non-potable	Rainbird #44NP	This has a locking purple cap, which says “DO NOT DRINK!” in English and Spanish
Valve boxes		For control, gate, and ball valves – 11 inch wide x 16 inch long x 12 inch deep with locking top, stainless steel bolts, and 3 inch and/or 6 inch extensions as needed to meet finish grade; install filter fabric under and around all valve boxes
Paver Blocks Under Valve Boxes		8” x 2” x 16 inch, flat, solid, precast concrete paver or plastic lumber
Shrub Areas	Carson #1419-12	With stainless steel bolt and washers with #1419-4B bolt down tee lid, color deep green
Lawn Areas	Carson #1419-12	With stainless steel bolt and washers with #1419-4B bolt down tee lid, color deep green
Valve Box for Quick-coupling Valve		10 inch round twist lock box
Shrub Areas	Carson #910-3B	With optional locking stainless steel bolt
Lawn Areas	Carson #910-3B	With optional locking stainless steel bolt

Other Materials:

Keys		Two valve operating keys (heavy galvanized plate iron) length as needed to operate deepest valve(s) for systems that use manual zone valves
Low Voltage Control Wire		Color coded direct burial cable, solid copper, type UF, UL listed for direct burial in ground; use white

		for common wire, red for control wires, and blue for spares; size of wire shall be in accordance with manufacturer's recommendation, but in no case smaller than single strand number 14 gauge
Electrical Connectors	3M DBY	All wire connections and splices to be placed in a box
Pipe Backfill Material		Imported riverbank sand
Drain Rock		1½ inch round drain rock; no fines
Detector Tape	Allen Systems or Lineguard	2 inch wide blue metallic tape with permanent "Caution – Buried Waterline Below"
Permanent Waterproof Number Tags for control wires		
In valve boxes	Permatag	Aluminum tie-on markers
In Controller		Coated adhesive numbers labels
Swing Joints for Rotary Heads		Same size as head inlets
Irrigation Controller		See drawings for controller model number
Backflow Preventor	Wilkens 950	
Backflow Preventor Valve Box		Size to match backflow with locking top, stainless steel bolts, and 3 inch and/or 6 inch extensions as needed to meet finish grade; install filter fabric under and around all valve boxes

7.07 SUPPLIER CONTACT INFORMATION

A current list of suppliers and their contact information is available from the City's Parks & Recreation Division.