City of Gladstone
Public Works Design Standards

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SECTION TWO – STORM DRAIN REQUIREMENTS

2.0000 STORM DRAINS

2.0010 General Design Requirements

Storm drainage design within a development area must include provisions to adequately control run-off 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 Plan 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 the placement or replacement 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 storm water may be a storm drain or a detention or retention pond approved by the Public Works Director. Existing open channels, creeks or streams are approved points of disposal after the stormwater has been treated for water quality. Acceptance of suggested systems will depend upon the prevailing site conditions, capacity of existing downstream facilities, and feasibility of the alternate design.
- When private property must be crossed in order to reach an approved point of disposal, it shall be the developer's responsibility to acquire a recorded drainage easement (of dimensions in accordance with those included in ***Subsection 2.0024, Easements***). Temporary drainage ditch facilities, when approved, must be engineered to contain the storm water without causing erosion or other adverse effects to the private property.
- The peak discharge from the subject property may not be increased from conditions existing prior to the proposed development, except where it can be satisfactorily demonstrated by the applicant that there is no adverse impact.
- Permanent stormwater quality and flow control facilities will be required for all new development or redevelopment activities that result in the creation or disturbance of 800 square feet or more of impervious surface to maintain surface water discharge rates at or below the existing design storm peak discharge, except where permitted otherwise by the Public Works Director due to the development being located within ¼ mile of the Clackamas and/or Willamette Rivers.
- All storm drain system designs shall make adequate provisions for collecting all storm water run-off. The system shall accommodate all run-off from upstream tributary areas regardless if such areas are within the proposed development. The amount of run-off 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 unless approved by the Public Works Director.
- Public storm lines shall be located within the public right-of-way as directed by the Public Works Director, per ***Subsection 2.0021, Right-of-Way Location***. 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 provide required replacement and/or repair.

- Vegetation shall be established on areas disturbed by/or on areas of construction, as necessary, to minimize erosion in accordance with ***Subsection 2.0060, Erosion Control Standards***.
- Applicant must obtain all necessary permits (Division of State Lands, Army Corps of Engineers, Oregon Department of Fish and Wildlife, etc.) for stream and water course crossings and as necessary prior to disturbing ground within environmental overlay districts.

2.0011 Site Drainage Plans

A. Existing Drainage Plan - Provide a topographical contour map defining existing conditions to include the following minimum information:
   - Two-foot contour intervals; slopes over 10% may use 5 ft. intervals; extend contours a minimum of 100 ft. beyond property.
   - All structures, buildings, parking lots, and utilities on the property.
   - Locations of all existing drainage facilities and water courses, including wetlands and floodplain areas.
   - Locations of all subsurface water outlets (e.g., springs).
   - Arrows to indicate direction of flow for all drainage information.

B. 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 ft. or 5 ft. intervals as required.
   - Percent grade for graded slopes; elevations, dimensions and locations for all graded slopes.
   - Cut/fill areas; structural fill placement areas; erosion/sedimentation control methods; reseeding areas.
   - All proposed drainage facilities - public and private systems; paved areas, curbs, sidewalks; drainage ditches, culverts, detention, water quality and infiltration facilities.

C. Floodplain information – Show the delineated 100-year floodplain limits 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 by the Design Engineer.

D. Drainage Calculations - Furnish such supporting information as required per ***Subsection 1.2040, Supporting Information.***

2.0012 Pipe Materials and Size

A. All public storm drains shall be constructed with concrete, PVC, or HDPE smooth interior, corrugated exterior pipe as specified in **DIVISION SIX–STORM DRAIN TECHNICAL REQUIREMENTS**, of the Gladstone Public Works Standard Construction Specifications. PVC pipe having a smooth interior and exterior wall (ASTM D3034, ASTM C900, etc.) is the preferred pipe for storm drains. Where required for additional strength, ductile iron pipe or concrete pipe meeting the requirements of **DIVISION SIX– STORM DRAIN TECHNICAL REQUIREMENTS**, shall be used.

B. Concrete pipe is the strongly preferred material for culvert applications. Before corrugate aluminum alloy pipe may be used for culvert applications, applicant must demonstrate that concrete pipe is either impractical or unavailable. Additionally, any corrugated aluminum alloy pipe requested must be accompanied by certification of it having a 75-year design life, and must be specifically approved by the Public Works Director.

C. Public storm drain main lines shall be a minimum of 12 in. in diameter. Lateral lines to catch basins and other inlet structures shall be a minimum of 10 in. in diameter. Storm drain lines, which convey water from building rain drains and/or footing drains, may be a minimum of 4 in. in diameter, except where 3 in. are acceptable under sidewalks and curbs. All pipe shall have rubber gasket joints.

D. Private storm drain pipe and structures shall meet the requirements of the Oregon Plumbing Specialty Code and do not have to be sized per public standards.

2.0013 Stormwater Management Project Area Thresholds

The following project area thresholds apply to the infiltration, water quality, and water quantity stormwater facility design.

A. Projects resulting in ≥ 5,000 square feet of New or Modified Impervious Area

All development that results in 5,000 square feet or more of new impervious surface and/or a modification of existing impervious surfaces is subject to these stormwater management standards including: water quantity, water quality, infiltration, and erosion control requirements.

B. Projects resulting in < 1,000 square feet of New or Modified Impervious Area

All development that results in less than 1,000 square feet of new impervious surface and/or a modification of existing impervious surfaces is exempt from these stormwater management standards.

C. Erosion Control Plan and NPDES 1200-C and 1200-CN Permits

Within the City of Gladstone, any grading or soil disturbance associated with a development activity that disturbs 800 square feet or more is required to obtain an Erosion Control permit. For erosion control requirements refer to Subsection 2.0060, ***Erosion Control Standards***. Any development activity requiring grading or soil disturbance between 1 acre and 5 acres will also require a National Pollutant Discharge Elimination System (NPDES) 1200-CN Permit, issued by Clackamas County Service District #1. Clackamas County has an agreement with Oregon DEQ to serve as an Agent for DEQ and issue these permits in the City of Gladstone. Clackamas County provides plan review, permitting, inspection and enforcement of NPDES 1200-CN Permit requirements. Development activity that will disturb more than 5 acres of area will require a 1200-C Permit issued by DEQ.

2.0014 Storm Water Quality Treatment Design Standards

A. All new developments and re-developments resulting in 5,000 square feet or more impervious surface and/or a modification of existing impervious surfaces shall provide on-site water quality treatment facilities, as follows:

1. Water quality treatment facilities shall be designed to capture and treat the first 1-inch of stormwater runoff from a 24-hour storm event. The water quality treatment facility shall use a vegetated treatment system. Proprietary treatment systems may only be used with approval of the Public Works Director and shall be designed to provide equivalent treatment to vegetated systems.
2. The City of Gladstone prioritizes the use of vegetative water quality treatment systems including vegetated swales, vegetated basins, vegetated filter strips, constructed wet ponds and extended dry detention ponds. Vegetated treatment systems shall be designed as described in Appendix H of the Clackamas County Service District No. 1 Storm Water Standards, Stormwater Quality Facility Design Criteria.
3. Acceptable proprietary treatment technologies shall meet the Proprietary Stormwater Treatment Technology Policy listed in Clackamas County Service District #1 Stormwater Standards.
4. Treatment systems serving public facilities and multiple land ownerships shall be public facilities maintained by the City of Gladstone. Treatment systems that serve land under a single ownership, such as a commercial site or a multi-family development, shall be privately owned and maintained. Owners of private systems shall be required to consent to annual inspection and maintenance of the

private stormwater facilities as defined in a Maintenance Agreement to be approved by the Public Works Director. Owners of privately maintained systems shall be required to submit proof of maintenance to the City of Gladstone annually.

5. In lieu of constructing a new facility, the Public Works Director may permit a development to upgrade an existing public facility in the same drainage basin.
6. Regional treatment facilities are encouraged. Where topographically feasible, treatment facilities may be sized and constructed to provide treatment for more than one development. Shared maintenance agreements must be provided for the facility if the facilities are privately owned and easements must be provided for each owner.
7. In-lieu-of fees for treatment may be requested by a developer and applied under the following conditions:
   - A regional downstream treatment facility is constructed or an agreement has been approved by the City for construction of a downstream treatment facility to treat the development site.
   - Fees for "in-lieu-of" treatment would be applied as a percentage of facility costs, including engineering and administration. Percentage of costs would be based on percentage of use of facility.
   - Maintenance of facility is provided for and a maintenance agreement for the facility has been recorded.

B. All development that results in between 1,000 square feet and 5,000 square feet of new impervious surface and/or a modification of existing impervious surfaces shall provide on-site water quality facilities, as follows:
   1. Water quality shall be provided through the installation of a water quality facility designed to collect and infiltrate runoff from the site. The water quality facility can be any of the following or combination of the following systems:
      a. Underground infiltration chamber system
      b. Vegetated swale
      c. Vegetated basin
      d. Pervious pavement (pavers, pervious concrete, or porous asphalt).
   2. Water quality facilities shall be sized as follows:
      a. Underground infiltration chamber system:
         i. For 3, 000 square feet or less improvement area: minimum 30 cubic feet of storage
         ii. For > 3,000 square feet improvement area: minimum 60 cubic feet of storage
      b. Vegetated swale: minimum length of 25 feet & minimum width of 3 feet.
      c. Vegetated basin: equal to 1% of the improvement area, with a minimum area of 25 square feet
      d. Pervious pavement: equal to 100% of the new or modified impervious area
   3. The water quality facility shall be located so that runoff from an impervious area at least as large as the improvement area will flow into the facility. The impervious area being treated may be the new development/redevelopment surface area, or any other existing impervious area that doesn't already receive water quality treatment.
   4. Treatment systems that serve a single land ownership shall be privately owned and maintained. Owners of private systems shall be required to consent to annual inspection and maintenance of the private stormwater facilities as defined in a Maintenance Agreement to be approved by the Public Works Director. Owners of privately maintained systems shall be required to submit proof of maintenance to the City of Gladstone annually.

2.0015 Storm Water Infiltration Design Standards

A. All new development and re-development that results in 5,000 square feet or more impervious surface and/or a modification of existing impervious surfaces shall infiltrate all runoff from storm events up to

one-half inch of rainfall in 24 hours. Infiltration shall occur prior to or concurrent with treatment systems in accordance with Subsection 2.0014.A. Infiltration may be incorporated into the detention system design, in order to reduce the required detention volume (see Subsection 2.0016).. Infiltration facilities shall be sized to infiltrate the design runoff volume within a maximum of 96 hours for the one-half inch requirement. Infiltration requirements may be waived, or reduced, if it can be demonstrated by a registered professional engineer that infiltration will destabilize the soil, cause adverse structural or environmental impacts, or due to site constraints such as high groundwater, springs, or impermeable soils.

B. All development that results in between 1,000 square feet and 5,000 square feet of new impervious surface and/or a modification of existing impervious surfaces shall incorporate infiltration into the water quality design in accordance with Section 2.0014.B. Professional onsite infiltration rate testing is not required.

2.0016 Storm Water Quantity / Flow Control Design Standards

A. Conveyance Standards

1. Surface water collection systems draining 10 acres or less land shall be sized for the post-developed 10-year storm, using the Rational Method.

All other surface water conveyance systems shall be sized for post-developed conditions in accordance with the following criteria:

2. Storm sewers and outfall pipes draining more than 10 acres: 25-year, 24-hour design storm.
3. Creek or stream channels draining less than 250 acres: 25-year, 24-hour design storm.
4. Creek or stream channels draining greater than 250 acres: 50-year, 24-hour design storm.
   - Areas draining more than 10 acres of land may use alternate methods such as SBUH, HEC 1, HSPF, or SWMM, or others as approved by the Public Works Director.
   - Exceptions to any of the above must be documented and approved by the Public Works Director.
   - Instream or in-line detention can only be used in locations approved by the Oregon Department of State Lands, US Army Corps of Engineers, and other authorized Federal, State, or Local agencies.
5. Culverts at road crossings shall be designed to pass the peak discharge for the design storm such that the headwater:
   - Does not exceed 1.5 times the culvert diameter; OR
   - Remains at least 1 ft. below the roadway subgrade, whichever is less.
   - Does not go over the top of the road for 100-year, 24-hour design storm.
6. Culverts must allow for fish passage and must meet the requirements of the Division of State Lands, Army Corps of Engineers and Oregon Division of Fish and Wildlife. Bottomless culverts must be installed at locations that are required by the Oregon Department of Fish and Wildlife, and/or the National Marine Fisheries Service.
7. 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.
8. Conveyance piping
   - Time of concentration – Overland flow of run-off to the initial catchment point into the storm drain system shall be a minimum of 5 minutes.
   - Velocity & Slope – All storm drains shall be on a grade which produces a mean velocity, when flowing full, of at least 2.5 feet per second.

- Manning's equation – When calculating minimum pipe slopes and velocities, the Design Engineer shall use the Manning pipe friction formula. The storm drain roughness coefficient to be used in the Manning formula shall not be less than 0.013.

B. Springs & Groundwater

It shall be the responsibility of the owner to provide a drainage system for all water on site and for water entering the property from off-site. Surface water, springs, and groundwater shall be incorporated into the drainage design. Existing drainage problems shall be addressed in plans submitted for review and approval. Groundwater and springs that are encountered during development shall be the responsibility of the developer to address. Plans for drainage of these waters shall be submitted to the City for review and approval prior to construction.

C. On-site Detention Design Criteria

All new developments and re-developments that result in more than 5,000 square feet of impervious surface or a modification of existing impervious surfaces, shall provide onsite storm quantity control facilities designed to capture, detain, and release runoff as follows:

1. Flow Control Design Criteria: 2-year, 24-hour post-developed runoff rate to a ½ of the 2 year, 24-hour pre-developed discharge rate. In addition, the allowable post-developed runoff rates for the 10 and 25 year, 24-hour storm events shall be equal to or less than that of the pre-developed discharge rate.
2. Precipitation-Frequency Estimates. The following design storms shall be used for sizing detention facilities and conveyance system components:
   - 2-year 24-hour equates to a 2.60-inches of rainfall.
   - 10-year 24-hour equates to a 3.50-inches of rainfall.
   - 25-year 24-hour equates to a 4.00-inches of rainfall.
   - 100-year 24-hour equates to a 4.80-inches of rainfall.
3. In areas with identified downstream capacity deficiencies (see Stormwater Master Plan Figures 3-1A & 3-1B) detention shall also be designed to reduce the 25 year, 24-hour, post-developed runoff rate to a 2-year, 24-hour pre-developed discharge rate.
4. Downstream analysis shall demonstrate adequate conveyance capacity to the distance where the project site contributes less than 15% of the upstream drainage area OR 1,500 feet downstream of the project, whichever is greater. If the downstream analysis crosses the jurisdictional boundary of another surface water management agency, that agency must be notified by the Developer or Owner and given the opportunity to review and comment on the analysis.
5. All subdivisions and partitions shall include a plan for drainage for each proposed lot.

E. Onsite Detention Design Method

The procedure for determining the detention quantities is set forth in Chapter 4.4, Retention/Detention Facility Analysis and Design, King County, Washington, Surface Water Design Manual Version 4.21. The Design Manual and associated software are no longer available online. The manual and software procedure can be viewed in it's entirely at the office of Clackamas County Water Environment Services. Upon request, Clackamas County WES can email the relevant sections of the manual and program files. This manual shall be used for procedure only. Local rainfall data and information shall apply. The design criteria shall be as noted herein.

- Engineers desiring to utilize a procedure other than that set forth herein shall obtain the approval of the Public Works Director prior to submitting calculations utilizing the proposed procedure.
- For all development, other than single family and duplex, the sizing of stormwater quantity detention facilities shall be based on the impervious area to be created by the development, including structures and all roads and other impervious areas.

- For single family and duplex residential subdivisions or partitions, stormwater quantity detention facilities shall be sized for the impervious areas to be created by the subdivision or partitions, including all residences on individual lots at a rate of 2,500 square feet of impervious surface area per dwelling unit, plus all roads. If actual impervious area is to be greater than 2,500 square feet per dwelling unit, then the actual impervious area shall be used. Such facilities shall be constructed as a part of the subdivision or partition.
- Existing condition shall be considered as the condition of the site at the time of Land Use Approval.
- Redevelopment shall require detention for the areas impacted by construction only.

F. Regional Detention

Regional detention facilities are encouraged. Where topographically feasible, detention facilities may be sized and constructed to provide detention for more than one development. Shared or coordinated maintenance and access easements must be provided for the facility if the facility is privately owned.

G. In-lieu-of fees for detention may be requested by a developer and applied under the following conditions:

1. A regional downstream facility is constructed or an agreement has been approved by the City for construction of a downstream facility to manage the development site.
2. Fees for "in-lieu-of" stormwater management would be applied as a percentage of facility costs, including engineering and administration. Percentage of costs would be based on percentage of use of facility.
3. Maintenance of facility will be provided by the City or a Maintenance Agreement is already in place.

H. Private Drainage Systems

Private drainage systems may exist upstream of public drainage systems. These systems may be used for the collection and conveyance of roof drains, footing drains, and surface run-off prior to discharge in the , public system or private water quality treatment or detention system prior to the public system. Private storm water systems shall meet the requirements of the Oregon Plumbing Specialty Code. Permits for private drainage systems are issued through Clackamas County Building Department. Easements and maintenance agreements for private drainage systems shall be created and submitted to the City for review when a private drainage system will serve more than one parcel.

2.0020 Alignment and Cover

2.0021 Right-of-Way Location

Storm drain main lines shall generally be located within 10 feet of street centerline. Catch basins laterals will be permitted to run adjacent to a curbline for a distance not to exceed 100 feet. All changes in direction of pipe shall be made at an approved structure.

2.0022 Curvature

Storm drain lines shall not be curved or deflected between structures.

2.0023 Minimum Cover

A. 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.

B. Minimum cover shall be 30 in. above the top of the bell of pipe in paved areas and 36 in. at all other locations. If minimum cover requirements cannot be met, then additional strength measures (such as a

stronger pipe material) shall be required. Minimum cover for catch basin leads shall be 24 inches, 18 inches if C900 or ductile iron pipe is used.

C. In areas of relatively flat terrain, the Design Engineer shall show that sufficient depth is provided at the boundary of the development to properly drain the remainder of the upstream basin tributary area to the site.

2.0024 Easements

A. When it is necessary to locate storm drains in easements, the storm drain shall be centered in the easement. All storm drain easements shall be exclusive and shall not be used for any purpose which would interfere with the unrestricted use of the storm drain line. Exceptions to this requirement will be reviewed on a case by case basis (e.g., a utility corridor in a new subdivision).

B. Easements for storm drain lines 18 in. or less in diameter shall have a minimum width of 15 ft. All pipe lines greater than 18 in. in diameter shall have a minimum width of 20 ft. Larger widths may be required for special circumstances, such as excessively deep pipe or location of building near the easement.

C. 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 ft. from the waterway centerline, or 10 ft. from the top of the recognized bank, whichever is greater. A 15-ft. wide access easement shall be provided on both sides of the channel for channel widths greater than 14 ft. at the top of the recognized bank.

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

E. All easements must be furnished to the Public Works Director for review and approval prior to recording.

F. Minimum width of an access easement from an existing public road to a drainage facility shall be 15 ft.

G. Easements shall state that the City will not in any way be responsible for replacing landscaping including any shrubs or trees, fencing, or other structures that may exist or have been placed in the easement.

2.0025 Relation to Watercourses

Storm drain lines shall enter a creek or drainage channel at 90° or less to the direction of flow. The outlet shall have a head wall and scour pad or rip rap 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 the Gladstone Municipal Code.

2.0030 Structure Location

2.0031 Manholes

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

B. Manhole spacing shall not be greater than 500 ft.

C. Standard manholes are required when rim to crown of pipe elevations exceed 4 ft. at pipe junctions. Flat-top manholes shall be used when rim to crown of pipe elevations are less than 4 ft.

D. At locations where the downstream pipe size is greater than the upstream pipe size, the crown of all upstream pipes shall not be lower than the crown of the downstream pipe.

E. Manholes shall not have open grate lids with the intent to receive surface flows except in special circumstances approved by the Public Works Director. Catch basins shall typically be used.

F. Manholes shall have 16-hole lids. Tamper proof lids will be required on manholes outside vehicle or pedestrian travel ways. Rims shall be 1 ft. above the finished grade if not in a paved area.

G. All manholes, ditch inlets, etc. shall be within 10 ft. of an access road capable of supporting and allowing access to a loaded maintenance vactor truck.

H. A water quality manhole shall be provided prior to any water quality treatment facility. The water quality manhole shall intercept all water from the site prior to its entry to the water quality treatment facility (see Standard Drawing 607A).

2.0032 Gutter Inlets / Catch Basins

A. Gutter inlets shall be located in streets at the curbline to receive storm water run-off and convey it to the main storm drain. Where gutter inlets cannot be installed because of physical limitations, catch basins may be installed with approval from the Public Works Director.

B. Gutter inlets or catch basins shall be located at the following locations, but in no case be spaced further than 300 ft.

- At curb returns on the upstream side of an intersection.
- At the ends of all dead-end streets with a descending grade.
- At intermediate locations, so that storm flows at the curbline do not exceed 3 ft. in width (measured from the curb face) or 3 in. in depth (measured at the curb face), whichever is less.

C. Gutter inlets or catch basins shall be capable of completely intercepting the design storm flow at the curb. The Public Works Director may require multiple or oversized inlets or other special considerations for sags and "downhill" cul-de-sacs. When inlets are installed on a street grade of over 8%, a combination curb inlet, per Standard Drawing 601, may be required by the Public Works Director.

D. Not more than (3) three gutter inlets or catch basins shall be connected in series before a manhole is required. Not more than 100 feet of pipe is permitted to run parallel to and within 5 feet of a curb line. If more than 100 feet of pipe adjacent to a curb line is necessary, then the design should be altered to extend the storm drain main away from the curb line using a manhole to manhole design.

2.0033 Service Lateral

A. Service laterals are private storm drain lines to which a private building storm drain connects.

B. Service laterals shall typically drain to a weephole in the curb where grade permits. Where grade does not permit draining to a weephole, the storm service lateral shall drain directly to the storm drain main line.

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

D. The minimum slope of sewer service lines shall be 2% (1/4 in. per ft.), except for unusual conditions, when a slope of 1% (1/8 in. per ft.) may be approved. The maximum slope shall be 100% (45° or 1 ft. per ft.). Deep connection risers (see the Standard Drawing for service laterals to deep storm drains) or drop connections to manholes must be used where service line slopes would exceed 100%.

E. Tees for service laterals shall be installed at 100% slope, and 1/16 or 1/8 bends installed to provide proper grade for service lateral. Service laterals shall be installed to end beyond the street right-of-way line or easement line where storm drain is installed in easement. A watertight plug shall be installed in end of lateral and a 2 in. x 4 in. wood marker shall be placed at lateral end from pipe invert to at least 36 in. above the finish grade. The 2 in. x 4 in. top shall be painted white and marked with the depth of the lateral measured from ground to invert of pipe.

2.0040 Requirements for Detention Facilities

2.0041 Aesthetics

A. All stormwater facilities must be aesthetically blended into surrounding landscaping to greatest possible extent. When necessary, retaining walls will be allowed inside a stormwater tract, but walls shall be four feet or less in height. Retaining walls taller than four feet shall be constructed in tiers with 1:1 slope and shall be approved by the Public Works Director. Landscaping Plans, including site irrigation, are required to be included with the construction plans for all public and private detention facilities.

2.0042 Emergency Overflow

A. The Design Engineer shall assess the impacts of system failure for on-site detention. Overflow may occur due to rainfall intensity which exceeds the design storm, debris blockage of storm drain system, or some other reason.

B. The storm drain system shall be designed such that overflows do not cause inundation of neighboring properties. Potential overflow routes shall be adequately protected from erosion.

C. If surface detention (e.g., 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.

2.0043 Public Detention Facilities

A. Public detention volume storage methods, in order of preference, are the following:
    1. Surface storage – pond
    2. Underground storage by tank or vault.

B. Ponds
    1. Slopes in detention ponds shall not exceed 3:1 and shall be vegetated with native materials.
    2. Retaining walls for pond construction shall only be approved by the Public Works Director when sloped sides are impracticable. Walls shall meet all of the following requirements:
        i. Shall be limited to a maximum height of 4 feet, with no tiers allowed.
        ii. Shall be limited to a maximum of 33% of the interior or exterior perimeter of the facility
        iii. Shall be approved, upon completion, in writing by a Geotechnical or Structural Engineer
        iv. Shall be owned and maintained by an entity other than the City.

C. Underground storage by tank or vault will be approved by the Public Works Director only when a pond is impracticable due to site constraints. Underground storage facilities will generally not be approved for residential applications.

D. Detention facilities shall have an access road that provides for maintenance and inspection of all inflow and outflow structures. The following criteria are the minimum City requirements unless otherwise approved by the Public Works Director:

- 12 in. of 1-1/2”-0 compacted crushed gravel over firm subgrade and geotextile mat. Crushed aggregate and subgrade shall be compacted to 95% of maximum dry density, as determined by AASHTO T-180.

- The plan shall include design of strengthened sidewalk sections where maintenance vehicles will cross. At a minimum, sidewalks shall be constructed per Standard Drawing 504A or 504B.
- Maximum grade is 15% with a 3% cross slope.
- Minimum width is 15 ft.
- Inside turning radius shall not be less than 28 feet.
- Access shall extend to within 10 ft. of all control structures, including both inflow and outflow structures, except as permitted otherwise by the Public Works Director.
- Access gates to pond shall be 15 ft. wide, lockable and per Standard Drawing 616.

E. All public detention facilities shall be subject to testing prior to final acceptance per ***Standard Construction Specifications, Subsection 604.01, Detention/Retention Facility Testing Requirements***, unless the Public Works Director determines, in writing, that testing is not required.

F. Landscaping in surface detention facilities is required and shall be covered by maintenance bond for a period of 2 years from the date of acceptance of the improvements.

G. Concrete pipe is the strongly preferred material for detention tank applications. Before corrugated aluminum alloy pipe will be approved by the Public Works Director, the Design Engineer must demonstrate that concrete pipe is either impractical or unavailable for the project. Additionally, any corrugated aluminum alloy pipe requested must be accompanied by certification of it having a 75-year design life from the manufacturer.

2.0044 Private Detention Facilities

A. Ponds

1. Slopes in private detention ponds shall not exceed 3:1 and shall be vegetated with native materials.
2. Retaining walls for pond construction shall only be approved by the Public Works Director when sloped sides are impracticable. Walls shall meet all of the following requirements:
   i. Shall be limited to a maximum height of 8 feet in tiers not exceeding 4 feet.
   ii. Shall be limited to a maximum of 50% of the interior or exterior perimeter of the facility
   iii. Shall be approved, upon completion, in writing by a Geotechnical or Structural Engineer

B. Private detention facilities shall have an access road that provides for maintenance and inspection of all inflow and outflow structures by City personnel. The following criteria are the minimum City requirements unless otherwise approved by the Public Works Director:

- 12 in. of 1-1/2”-0 compacted crushed gravel over firm subgrade and geotextile mat. Crushed aggregate and subgrade shall be compacted to 95% of maximum dry density, as determined by AASHTO T-180.
- The plan shall include design of strengthened sidewalk sections where maintenance vehicles will cross. At a minimum, sidewalks shall be constructed per Standard Drawing 504A or 504B.
- Maximum grade is 15% with a 3% cross slope.
- Minimum width is 15 ft.
- Inside turning radius shall not be less than 28 feet.
- Access shall extend to within 10 ft. of all control structures, including both inflow and outflow structures, except as permitted otherwise by the Public Works Director.
- Access gates to pond shall be 15 ft. wide, lockable and per Standard Drawing 616.

C. Private detention facilities shall be owned and maintained by the property owner. The City will not permit private facilities to be maintained by a Home Owner’s Association and therefore, private detention

facilities will not be approved for residential subdivisions or partitions. Residential subdivisions and partitions will be required to construct public detention facilities.

D. All private detention facilities shall be subject to testing prior to final acceptance per ***Standard Construction Specifications, Subsection 604.01, Detention/Retention Facility Testing Requirements***, unless the Public Works Director determines, in writing, testing is not required.

E. Underground detention tanks shall have a certification of having a 75-year design life. This certification shall be submitted to the Public Works Director prior to plan approval.

2.0050 Requirements for Infiltration and Water Quality Treatment Facilities

2.0051 Submittal Requirements

A. Facilities treating more than 5,000 square feet of impervious surface area:

1. Construction plans and calculations prepared by a professional engineer
2. Certification from the Design Engineer that proposed water quality treatment facilities have been designed in accordance with the criteria required in ***Subsection 2.0014 Storm Water Quality Treatment Design Standards***.
3. Recommendations from a Geotechnical Engineer may be required at the discretion of the Public Works Director.

B. Facilities treating between 1,000 square feet and 5,000 square feet impervious surface area:

1. A Site Plan, drawn to scale, showing the size and location of the new or redeveloped impervious area(s) on the site, the type of water quality treatment facilities being proposed, and location(s) of the proposed water quality treatment facilities on the site.

2.0052 Aesthetics

Storm water quality treatment facilities must be aesthetically blended into surrounding landscaping to the greatest possible extent.

2.0053 Landscaping

A Landscape Plan shall be prepared for proposed treatment facilities for projects over 5,000 square feet of new or modified impervious area. Vegetated water quality treatment facilities shall be covered by a maintenance bond for a period of 2 years following acceptance of the development.

2.0054 Access Roads

Water quality treatment facilities serving more than 5,000 square feet of impervious area shall have an access road that provides for maintenance and inspection of all inflow and outflow structures. The following criteria are the minimum City requirements unless otherwise approved by the Public Works Director:

- 12 in. of 1-1/2”-0 compacted crushed gravel over firm subgrade and geotextile mat. Crushed aggregate and subgrade shall be compacted to 95% of maximum dry density, as determined by AASHTO T-180.
- The plan shall include design of strengthened sidewalk sections where maintenance vehicles will cross. At a minimum, sidewalks shall be built per Standard Drawing 504A or 504B.
- Maximum grade is 15% with a 3% cross slope.
- Minimum width is 15 ft.
- Inside turning radius shall not be less than 28 feet.

- Access shall extend to within 10 ft. of all control structures, including both inflow and outflow structures.
- Access gates to pond shall be 15 ft. wide, lockable and per Standard Drawing 616.

2.0060 Erosion Control Standards

2.0061 Introduction

The policies of this section shall apply during construction and until permanent measures are in place following construction as described herein, unless otherwise noted.

A. Erosion Control Measures

It is the policy of the City of Gladstone to require temporary and permanent erosion control measures for all construction projects to lessen the adverse effects of site alteration on the environment. The owner or his/her agent, contractor, or employee, shall properly install, operate and maintain both temporary and permanent measures as provided in this section or in an approved plan, to protect the environment during the useful life of the project. These erosion control rules apply to all parcels within the City. Nothing in this section shall relieve any person from the obligation to comply with the regulations or permits of any Federal, State, or Local authority.

2.0062 Erosion Control

A. Sediment and Pollutants

It is the District's policy to prevent erosion and to minimize the amount of sediment and other pollutants reaching the public storm and/or surface water system resulting from development, construction, grading, filling, excavating, clearing, and any other activity which accelerates erosion as required by water quality standards set forth in OAR 340-41-445 through 340-41-470.

B. Erosion Prohibited

No visible or measurable erosion shall leave the property during construction or during activity described in Section A. The owner of the property, together with any person who causes such action from which the visible or measurable erosion occurs, shall be responsible for cleanup, fines, and damages. Clean up responsibilities involve public facilities and sensitive areas including, but not limited to: creeks, drainageways, wetlands, catch basins and storm drains, and sensitive areas, impacted by a project.

C. General Requirements

Site Plans for storm drainage, grading and erosion control will be required for all development, construction, grading, filling, excavating, cleaning, and any other activity which accelerates erosion as required by water quality standards set forth in OAR 340-41-445 through 340-41-470. Such activities impacting areas of 800 square feet or greater must obtain an erosion control permit. Activities impacting areas less than 800 square feet which result in erosion from a site do not need to obtain an erosion control permit but still must comply with the requirements of Section B. All sites shall submit an erosion control plan for review, regardless of size. The plans shall use the techniques and methods prescribed in the current Clackamas County *Erosion Prevention and Sediment Control Planning and Design Manual*. If the applicant desires to use erosion prevention and sediment control measures different than those contained in the manual, supporting calculations and/or information must be submitted to WES for approval prior to construction.

At a minimum, the Erosion Control Plan shall include:

1. The methods and/or facilities to be used to prevent erosion and pollution created from the activity both during and after construction. Site specific considerations shall be incorporated.

2. Limits of clearing by flagging boundaries in the field before starting site grading or construction. Staging areas shall be included.
3. An analysis of source controls such as detention and storage during construction as an alternative method to control erosion from storm water runoff.
4. A drainage plan during construction.
5. Show existing contours as well as all sensitive areas, creeks, streams, wetlands, and open areas.
6. A description of historic localized flooding problems resulting from surface water runoff, FEMA or flooding problems known to the community or the City.
7. Erosion control plan shall include a schedule for implementation of erosion control measures. The schedule shall include:

   • Measures to cover exposed soil if unworked for 14 days or more.

   • Implementation of wet weather measures between October 1st and May 31st, unless otherwise approved by the WES.

   On sites where vegetation and ground cover have been removed, WES approved ground cover shall be re-established by seeding and mulching on or before September 1 with the ground cover established by October 15. As an alternative to seeding and mulching, or if ground cover is not established by October 15, the open areas shall be protected through the wet season with straw mulch, erosion blankets, or other approved method, where appropriate, in accordance with the approved plan.
8. Water containing sediment shall not be discharged into the surface water management system, wetlands, or streams without first passing through an approved sediment filtering facility or device. Discharge from temporary sedimentation ponds or detention facilities used for sedimentation during construction shall be constructed to WES standards to provide adequate sediment filtration.
9. Re-inspection fees may be charged for those sites that are notified of deficiencies and fail to complete corrective actions in full by the time of the next inspection.

D. Site Plan

A site-specific plan prepared by an engineer shall be required and additional erosion control measures may be required for sites having one or more of the following characteristics:

1. Sites greater than five acres disturbed;
2. Sites with slopes greater than 15 percent on any portion of the site;
3. Sites with highly erodible soils;
4. Sites adjacent to sensitive areas;
5. Sites where grading and clearing activities are likely between October 1 and May 31.

   Refer to current WES erosion prevention manual for additional measures. Additional measures may include, but are not limited to, one or more of the following:

   a. Limited area cleared at any one time;
   b. Additional drainage requirements during construction;
   c. Additional water quality treatment, such as filtering or treatment of runoff;
   d. Cover portions of the site;
   e. Maintain a vegetated buffer strip between site and sensitive area;
   f. Additional facilities to reduce volume and velocity of water runoff;
   g. If there are no workable alternatives, limit clearing and grading in some areas between October 1 and May 31;
   h. No soils shall remain exposed for more than 14 days in the wet weather season unless an advanced sedimentation or filtration process is used. WES must approve such processes prior to implementation.

D. NPDES Permit

All construction activities disturbing an area between one (1) acre and five (5) acres of land shall obtain an NPDES 1200-CN erosion control permit for construction activities issued by Clackamas County Service District #1. Construction activities disturbing more than five (5) acres of land shall obtain a NPDES 1200-C permit through DEQ.

E. Performance

Clackamas County may require the Applicant to submit a bond, cashier's check or irrevocable letter of credit from an acceptable financial institution to secure performance of the requirements of this section. Upon default, WES may perform work or remedy violations and draw upon the bond or fund. If WES does not require a bond and the Developer does not perform the erosion control plan in whole or in part, WES may, but shall not be obligated to, perform or cause to be performed corrective work and charge the Developer. Such amount shall bear interest at 9% per annum and shall be a lien upon the property foreclosable in accordance with ORS Chapter 88.

F. Erosion Control Certification

1. Developers/contractors of building activities requiring erosion control permits who have a certified individual on staff with authority over erosion control and who is responsible for erosion control of the site, are eligible for a discount of their erosion control fees. See WES Surface Water Management Fees and Administrative Rules for implementation of the discount. On large or complex sites, the District may require an individual certified in erosion control to be on site at all times. Developments with certified erosion control staff are subject to all of these Standards. Violation of these Standards resulting in enforcement procedures described in Section 6 of the District Rules and Regulations will result in revocation of the certification and payment of the full erosion control fee. Recertification is required following erosion control violations resulting in enforcement actions. If certification is revoked, then there may be additional inspection fees. See Administrative Rules for details on the certification program.
2. Certification shall involve training in erosion control techniques, issues, and implementation strategies. A minimum of 4 hours of classroom instruction shall be required every 2 years.

G. Maintenance

The applicant shall maintain the facilities and techniques contained in the approved Erosion Control Plan so as to continue to be effective during construction or other permitted activity. If the facilities and techniques approved in an Erosion Control Plan are not effective or sufficient as determined by the WES site inspector, the permittee shall submit a revised plan within three working days of written notification by WES. In cases where erosion is occurring, WES may require the applicant to implement interim control measures prior to submittal of a revised Erosion Control Plan and without limiting WES's right to undertake enforcement measures. Upon approval of the revised plan by WES, the permittee shall immediately implement the revised plan. The developer shall implement fully the revised plan within 3 working days of approval by WES.

H. Initial Inspection

The erosion control measures in accordance with the approved plans and these Standards shall be installed by the owner or their representative and shall be inspected by WES prior to the start of any land disturbance.

I. Deposit of Sediment

No person shall drag, drop, track, or otherwise place or deposit, or permit to be deposited, mud, dirt, rock, or other such debris upon a public street or into any part of the public storm and surface water system, including natural drainage systems, or any part of a private storm and surface water system which drains or connects to the public storm and surface water system, with the exception of sanding for ice and snow and maintenance such as crack or chip sealing. Any such deposit of material shall be immediately removed using hand labor or mechanical means. No material shall be washed or flushed into the

road/street or any part of the storm and surface water system without erosion control measures installed to the satisfaction of WES, and any such action shall be an additional violation.

J. Permit Fee

WES may collect all fees for the review of plans, administration, enforcement, and field inspection(s) to carry out the rules contained herein as established and amended by WES.

K. Permit Duration

1. Development or construction must be initiated as per the approved final development plans within one (1) year of the date of erosion control permit issuance or the permit will be null and void. When the City Council, Planning Commission or Planning Director specify a time period for commencement of a development, that time period shall supersede.
2. Erosion Control permits (excluding 1200-C and 1200-CN permits) shall expire and become null and void 24 months after the date of permit issuance unless extended. If the work authorized by such permit has not received final inspection approval prior to the permit expiration date, and the permit has not been extended by WES, all work shall stop until a new permit is obtained that conforms to the erosion control regulations in effect at the time of re-application. WES may extend the time for action by the permittee for a period not exceeding 12 months on written request by the permittee showing that circumstances beyond the control of the permittee have prevented work from being completed. Failure on the part of WES to notify the permittee by mail prior to the original date of expiration shall result in an automatic 12-month extension. No permit shall be extended more than once.
3. NPDES 1200-C permits shall expire and become null and void if the permit is not renewed annually or as per the general permit schedule set forth by the Oregon Department of Environmental Quality (DEQ).

2.0063 Air Pollution

A. Dust

Dust and other particulate matter containing pollutants may settle on property and be carried to waters of the State though rainfall or other means. Dust shall be minimized to the extent practicable, utilizing all measures necessary, including, but not limited to:

1. Sprinkling haul and access roads and other exposed dust producing areas with water.

2. Establishing temporary vegetative cover.

3. Placing wood chips or other effective mulches on vehicle and pedestrian use areas.

4. Maintaining the proper moisture condition on all fill surfaces.

5. Pre-wetting cut and borrow area surfaces.

6. Use of covered haul equipment.

2.0064 Maintaining Water Quality

A. Waterways

Construction within waterways shall be pursuant to permits issued by State and Federal agencies having jurisdiction and applying their regulations.

B. Discharge of Pollutants

Pollutants such as, but not limited to, fuels, lubricants, asphalt, concrete, bitumens, raw sewage, and other harmful materials shall not be discharged into rivers, wetlands, streams, impoundments, undisturbed buffers, or any storm drainage system, or at such proximity that the pollutants flow to these watercourses.

C. Use of Water from a Stream or Impoundment

The use of water from a stream or impoundment, wetland, or sensitive area, shall not result in altering the temperature or water quality of the water body in violation of Oregon Administrative Rules, and shall be subject to water rights laws.

D. Sediment-Laden Water from Construction

All sediment-laden water from construction operations shall be routed through sedimentation basins, filtered, or otherwise treated to remove the sediment load before release into the surface water system.

2.0065 Fish and Wildlife Habitat

A. Minimize Adverse Effects

Construction shall be done in a manner to minimize adverse effects on wildlife and fishery resources pursuant to the requirements of Local, State, and Federal agencies charged with wildlife and fish protection.

2.0066 Natural Vegetation

A. Vegetation Protected

As far as is practicable, natural native vegetation shall be protected and left in place in undisturbed Buffer areas. Work areas shall be carefully located and marked to reduce potential damage. Trees shall not be used as anchors for stabilizing working equipment.

B. Disturbance Outside the Work Area

During clearing operations, trees shall not be permitted to fall outside the work area. In areas designated for selective cutting or clearing, care in falling and removing trees and brush shall be taken to avoid injuring trees and shrubs to be left in place.

C. Revegetation

Where natural vegetation has been removed, or the original land contours disturbed, the site shall be revegetated per a submitted and approved seeding and maintenance plan from a list approved by WES as soon as practicable after construction has commenced, but not later than September 1. After that date a reseeding and stabilization plan approved by WES must be used.

2.0067 Pesticides, Fertilizers, Chemicals

A. Use of Hazardous Chemicals

The use of hazardous chemicals, pesticides, including insecticides, herbicides, defoliants, soil sterilants, and the use of fertilizers, must strictly adhere to Federal, State, County, and Local restrictions.

B. Hazardous Materials Protected from the Weather

All materials defined in Section A delivered to the job site shall be covered and protected from the weather. None of the materials shall be exposed during storage. Waste materials, rinsing fluids, and other such material shall be disposed of in such a manner that pollution of groundwater, surface water, or the air does not occur. In no case, shall toxic materials be dumped into drainageways.

2.0068 Contaminated Soils

In the event the construction process reveals soils contaminated with hazardous materials or chemicals, all parties shall stop work immediately to ensure no contaminated materials are hauled from the site; remove work forces from the contaminated areas, leaving all machinery and equipment; and secure the areas from access by the public until such time as a mitigation team has evaluated the situation and identified an appropriate course of action. The Owner and the Contractor shall notify OSHA and DEQ of the situation upon discovery. The Owner and the Contractor must comply with OSHA and DEQ statutes and rules.

2.0070 General Requirements

2.0071 Stream Crossings

All stream crossings must be approved by the Oregon State Department of Lands, US Army Corps of Engineers, and any other authorized Federal, State, or Local agency.

2.0072 Site Traversed by a Water Course

In the event a development site or any part thereof is traversed by any water course, channel, stream or creek, gulch or other natural drainage channel, adequate easements for surface water drainage purposes shall be provided to the City. This does not imply a maintenance obligation by the City.

2.0073 Channel Obstructions

Channel obstructions are not allowed except with City approval.

2.0074 Drainage Management Plans

Facilities developed on site shall be constructed in a manner consistent with basin wide or subbasin drainage management plans.

2.0075 Specifications of the City

All surface water facilities, storm conveyance pipes, vaults, detention facilities or water quality treatment facilities shall be designed and constructed to the specifications of the City.

2.0076 Phased Development

Development projects shall not be phased or segmented in such a manner to avoid the requirements of these Standards.

2.0077 Redevelopment

Redevelopment projects shall provide detention, water quality treatment and infiltration facilities as specified in these Standards.

2.0078 Engineering Services

Stormwater management plans and calculations required by these Standards must be stamped and signed by a civil engineer licensed by the State of Oregon. The construction, specifications, and testing must be completed under the direction of the design engineer.

2.0080 Project Construction and Project Close-out

2.0081 Plan Review and Approval

Prior to beginning construction of stormwater management facilities, the Applicant's shall submit plans, reports, studies, other information, and appropriate fees to the City for review as required by City Regulations. The submittals shall be reviewed and approved by the City prior to any construction being performed.

2.0082 Easements

A stormwater management plan shall provide easements and access for construction, operation, and maintenance in accordance with the City Regulations.

2.0083 Licensed Contractor

Stormwater management facilities shall be constructed by a contractor duly licensed by the State of Oregon and any other licensing political subdivision having authority over the work.

2.0084 Inspection

The design engineer shall perform inspection of surface water facilities and shall approve shop drawings. The design engineer shall submit shop drawings to the Public Works Director for review prior to shop drawings being approved for fabrication.

2.0085 As-built Plans

As-built plans of all storm drainage facilities, easements for all facilities, and approved maintenance plans shall be provided to the City upon completion of construction.

2.0086 Construction Certification

Following completion of construction, the design engineer shall submit stamped & signed certification indicating that all surface water systems have been inspected and installed per approved plans and approved changes.

2.0087 Maintenance

Maintenance is required for all surface water facilities. Owners of private stormwater quality treatment or detention facilities shall maintain such facilities in compliance with these Standards and provide documentation of annual maintenance. Owners of private systems shall be required to consent to provide annual inspection and maintenance reports for private stormwater facilities, as defined in a Maintenance Agreement, to be approved by the Public Works Director. Proof of maintenance shall be submitted to the City annually in accordance with a schedule approved by the Public Works Director. If the facility is not maintained per the schedule, the City may perform the maintenance and charge the owner of the facility.