CHAPTER 4

Stormwater Management Facility Selection and Design

CHAPTER 4. STORMWATER MANAGEMENT FACILITY SELECTION AND DESIGN

This section of the Stormwater and Grading Design Standards describes the methods and criteria for selecting and designing stormwater management facilities for projects that exceed the development thresholds described in **Chapter 1**. Additional structural source controls may be required for certain types of development categorized as high risk for pollutants as described in **Chapter 6**.

4.1 Stormwater Management Facility Selection

Impervious area reduction techniques, such as retaining vegetation and open space, clustering buildings, and constructing porous pavement and green roofs, may be used as techniques to help mitigate stormwater runoff and reduce the size of the required stormwater management facilities. Impervious area reduction techniques should be identified during the site planning process (See **Chapter 2)**.

Low-impact development (LID) facilities such as planters, swales, rain gardens, ponds, and other vegetated facilities are best management practices (BMPs) and are the preferred strategy to meet the stormwater management requirements for water quality treatment and flow control. The following types of stormwater management facilities can be used to meet these standards.

Stormwater planters (infiltration and filtration)
Rain gardens (infiltration and filtration)
Vegetated swales (infiltration and filtration)
Detention ponds (infiltration and filtration)

Applicants shall follow the Stormwater Management Strategy in **Section 2.2.4** in selecting the appropriate approach to manage stormwater runoff. **Table 4-1** provides a quick reference to match stormwater management facility types with common design objectives and site constraints.

Table 4-1 Stormwater Facility Selection Guide

Facility can be used for	Porous pavement & Pervious Pavers	Green roof	Stormwater planter	Rain garden	Vegetated swale	Detention pond	Manufactured treatment technologies *
Impervious area reduction	●	●					
Infiltration facility[a]			●	●	●	●	
Flow control	●	●	●	●	●	●	
Water quality treatment	●	●	●	●	●	●	●
Private property	●	●	●	●	●	●	●
Public property or right-of-way		●	●	●	●	●	
Steep slopes		●	**w/liner**	**w/liner**			●

[a] *Facilities that include impermeable liners do not satisfy the requirements for surface infiltration.*
**Applicable only for constrained sites where full implementation of LID facilities may not be possible.*

4.1.1 Alternate Facilities

For privately-owned stormwater facilities, applicants may propose stormwater management facilities that are not listed in **Table 4-1**. Such a proposal must be submitted as a request for a modification to the stormwater standards per **Section 1.6**.

Alternate facilities must be sized using the Engineered Method as described in **Section 4.3.4**. Examples of alternate facilities include filter strips for water quality treatment, underground detention storage, dry wells, or other underground injection control (UIC) facilities on private property.

If a proposed facility meets the Oregon Department of Environmental Quality (ODEQ) criteria for a UIC, the applicant shall prepare appropriate registration information for ODEQ and submit a modification request to the City.

4.2 Design Criteria for Stormwater Management Facilities

Stormwater management facility design is based on meeting the City's design criteria to address LID requirements, water quality treatment standards, and flow control requirements.

A. LID Requirement: The goal is to prioritize the use of LID stormwater facilities to the maximum extent practicable (MEP) to mimic the natural stormwater runoff conditions of the pre-developed site and recharge the groundwater. As described in **Chapter 2**, the following strategies meet LID requirements:

- **Onsite retention of the 10-year design storm** – Retain and fully infiltrate the 10-year design storm (See **Table 5-2 24-hour Rainfall Depths in Oregon City**) onsite using surface infiltration facilities for sites with factored infiltration rates greater than or equal to 2.0 inches per hour. This is equivalent to retaining and infiltrating runoff from new and replaced impervious surfaces for the 3.5-inch storm over 24 hours. The facility must fully infiltrate within 72 hours following the beginning of the storm event. For sites with design infiltration rates between 0.5 and 2.0 inches per hour, the LID facility shall be designed with infiltration as the primary means of flow control. For sites with design infiltration rates less than 0.5 inches per hour, the LID facility will require an underdrain connected to an outlet with a flow control structure. Infiltration of the full 10-year design storm is assumed to satisfy both water quality and flow control requirements listed in paragraphs B and C of this section.
- **Onsite stormwater management using LID** – Utilize vegetated stormwater facilities to address the water quality and flow control requirements of the site. Facilities must be sized according to the design requirements of this chapter, utilizing either the BMP Sizing Tool, explained in **Section 4.3.1**, or the Engineered Method.

B. Water Quality Requirement: Water quality facilities shall be designed to capture and treat 80 percent of the average annual runoff volume to the MEP with the goal of 70 percent total suspended solids removal. The treatment volume equates to a **water quality design storm of 1.0 inch over 24 hours**[1]. The BMP Sizing Tool addresses these water quality requirements to size stormwater management facilities.

Hydrodynamic separators, when used as a sole method of stormwater treatment, do not meet the MEP requirement for water quality treatment with regard to these stormwater standards.

C. Flow Control Requirement: Flow control facilities shall be designed so that the **duration of peak flow rates from post-development conditions shall be less than or equal to the duration of peak flow rates from pre-development conditions for all peak flows between 42 percent of the 2-year peak flow rate up to the 10-year peak flow rate** [2]. A hydrologic/hydraulic analytical model capable of performing a continuous simulation of peak flow rates from local long-term rainfall data must be used to determine the peak flow rates, recurrence intervals, and durations. The BMP Sizing Tool addresses these flow control requirements to size stormwater management facilities.

For sites with conditions that limit the use of infiltration (fill, steep slopes, high groundwater table, wellhead protection areas, and/or contaminated soils), the applicant must submit documentation of limiting conditions. See **Section 2.2.4.1** for additional information regarding limiting conditions. In some cases, utilizing LID facilities may not be feasible and the City may approve the use of alternative stormwater management facilities to meet the water quality and flow control requirements. See **Section 4.1.1** for additional information regarding alternative facilities.

D. General Conveyance: Development shall not cause or increase flooding of adjacent or downstream property. An upstream and downstream analysis of the drainage system shall be conducted according to the guidelines in **Chapter 5**. Open channel and closed conduit systems shall be designed to convey the design storms listed in **Table 5-1**.

4.3 Design Methods

This section explains the two methods accepted by the City for designing stormwater management facilities, the BMP Sizing Tool Method and the Engineered Method. To use a different method for sizing a treatment facility type not covered in these standards, applicants must obtain City approval prior to submitting permit applications for review.

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[1] The water quality design storm rainfall depth as documented in a technical memorandum: *Selection of Representative Rainfall Volume and Rainfall Intensities to result in Capture and Treatment of 80% of the Average Annual Runoff Volume*, Brown and Caldwell, May 11, 2010.

[2] The lower threshold of 42 percent of the 2-year peak flow rate for flow-duration matching is based on a 2008 study by the Oregon Department of Transportation (ODOT) titled, "Water Quantity (Flow Control) Design Storm Performance Standard." ODOT's study found that bed movement in sand-bedded streams occurs at approximately two-thirds of the bank full flow, which is assumed to be roughly equivalent to the 1.2 year discharge. ODOT's flow frequency analysis established that two thirds of the 1.2-year discharge is approximately equivalent to 42 percent of the 2-year discharge.

The Engineered Method must utilize the continuous runoff model or equivalent if approved by the City Engineer as discussed in section 4.3.4.

Submittal requirements are included in **Chapter 9**.

4.3.1 BMP Sizing Tool Method

A BMP Sizing Tool is available from the City's website to assist with the sizing of stormwater management facilities that meet the requirements of these standards. The following facilities can be sized using the tool:

A. Rain garden – infiltration and filtration

B. Stormwater planter – infiltration and filtration

C. Vegetated swale – infiltration and filtration

D. Detention pond – infiltration and filtration

The detention pond option will allow credit for the utilization of upstream LID facilities, including rain gardens, planters, infiltrators, and swales.

The volume for a manufactured underground stormwater management system shall be modeled as a detention pond in the BMP sizing tool.

The report generated by the BMP Sizing Tool should be included with permit application submittals. The BMP Sizing Tool can be used during the initial site planning and during final design. The soil infiltration rates used during final design must meet the criteria outlined in these standards.

4.3.2 Pre-developed Hydrology

For the purposes of hydrologic modeling, the pre-developed conditions of the site will be modeled as the historical vegetation which existed at the site prior to urban settlement. Most areas of the City will be modeled as forest under pre-developed conditions. The applicant may use historic photos, reports, or other available sources to document an alternative condition of the site prior to urban settlement.

In the absence of site-specific resources, the City has developed a map of historic vegetation conditions that can be used in determining the appropriate pre-developed conditions land cover (See **Appendix G**). This map is also available for viewing within the City's GIS Public Portal.

4.3.3 Facility Design Adjustments

The BMP Sizing Tool was developed based on specific design requirements for each facility type. Facilities sized using the tool must follow the design details for ponding depth, overflow height, depth of growing media, depth of drain rock, and sizing of orifice controls (where relevant). Applicants who wish to propose alternate facility specifications may use **Table 4-2** to adjust the size of the stormwater facility calculated from the BMP Sizing Tool.

Applicants considering design adjustments different from those included in **Table 4-2** should utilize the Engineered Method to show how the proposed facility size and design specifications will meet the flow control and water quality requirements of these standards.

Table 4-2. Facility Sizing Adjustments*

Facility types	Design modification	Facility size adjustment
Stormwater planter Rain garden Vegetated swale	Increase growing media depth by 12 inches or more	Reduce required facility surface area by 20 percent

**Additional facility size adjustments may be developed at the discretion of the City Engineer.*

If using a Facility Sizing Adjustment, it must be clearly stated in the report and described and shown on the engineering plans.

4.3.4 Engineered Method

As an alternative to the BMP Sizing Tool, the Engineered Method may be used to calculate the required size of stormwater management facilities for any size or type of development. The Engineered Method provides the developer with flexibility to factor in a wider variety of site data and facility design parameters to determine the size and configuration of stormwater management facilities.

The Engineered Method may be used to do the following:

A. Address unique site conditions
B. Apply a new or emerging design technology
C. Propose alternate facility design specifications

Use of the Engineered Method for flow control requires the use of a continuous simulation hydrologic model that runs a long-term record of historical hourly rainfall data. The model must show that the facility was sized to manage the post-development flows so that outflow from a facility matched the pre-development flow duration curve for the range of flows considered to have the greatest erosive impact on open-channel systems (42 percent of the 2-year peak flow to the 10-year peak flow). The City must pre-approve the hydrologic/hydraulic analytical model prior to submittal or development of any plans and/or calculations. Regardless of how the stormwater calculations are performed, the report submitted to the City must show how the proposed stormwater management facilities meet the design criteria for LID, water quality, and flow control provided in **Section 4.2.**

Creation of a continuous simulation hydrologic model for a specific development site requires specialized expertise and usually takes additional time and expense to develop and review. The applicant will be required to pay additional fees to the City to review stormwater management plans developed using the Engineered Method. These fees will be used to pay for a third-party peer review of the hydrologic model, stormwater management plan, facilities, details, supporting documentation, and submittals.

The Engineered Method can also be used to document the use of the hydrograph method to size water quality and infiltration facilities when flow control is not required. See **Appendix H** for additional hydrograph method guidance.

4.4 Unmitigated Areas

Due to topographic constraints, runoff from portions of a development site may be permitted to be released at post-development rates (without flow control), provided that all of the following are met:

A. Runoff from the unmitigated area rejoins the pre-development downstream drainage course within one quarter mile downstream of the stormwater management facility.

B. The project engineer has demonstrated in the downstream analysis (see **Section 5.2.4**) and in conveyance capacity calculations (see **Chapter 5**) that the downstream drainage course will not be adversely impacted by the runoff from the unmitigated area. Improvements to the downstream conveyance system may be required to provide adequate conveyance capacity for flows from unmitigated areas.

C. Public easements (as required) are obtained by the applicant from all downstream property owners, through whose property the unmitigated runoff flows, prior to rejoining the detained runoff from the site.

D. The cumulative release rate from all areas of the project site, including the unmitigated area, shall not exceed the cumulative pre-developed rates from the site (in accordance with the flow control requirements in **Section 4.2**). This may be achieved by providing additional storage and flow control in the stormwater management facility to compensate for unmitigated areas.

4.5 Infiltration Rate and Testing

To size stormwater management facilities, it is necessary to know the infiltration rate of the soil at the actual facility location. Infiltration testing is not required on development projects which create less than 5,000 square feet of new or replaced impervious surface or when the applicant can justify the lack of a test needed due to historical data assuming no infiltration credit is being requested. When testing is not completed, the facility will be sized using the minimum infiltration rate as shown in the Natural Resources Conservation Service's soil classification. The infiltration rate chosen within the BMP sizing tool, shall match the minimum infiltration rate as shown in the Natural Resources Conservation Service's. The City has approved two methods for performing an infiltration test, Basic Test and Professional Test. Specifications for both test procedures are included in **Appendix D**.

4.6 UIC Registration

Subsurface discharging infiltration facilities that are defined by ODEQ as UICs (e.g., infiltration trenches or dry wells) require an approved modification request (see **Section 1.6**). Any UIC for private property shall be designed with an approved pretreatment device and registered with ODEQ as required. The City will not allow new UIC devices which accept stormwater runoff from a public right-of-way or for public ownership or maintenance.

4.7 Detention Pond Design Requirements

The City encourages the use of detention ponds that serve more than one development. A facility that serves more than one development will be referred to as a sub-regional facility. Sub-regional facilities can be more effective in maximizing the development area, reducing the overall maintenance requirement, and minimizing the overall construction cost.

The City also encourages applicants to design detention ponds to function as multipurpose facilities (i.e. parks, open space, or recreation facilities), provided that any alternative uses are compatible with the primary stormwater functions and maintenance standards.

The following design requirements apply to all detention pond designs:

4.7.1 Geotechnical Report

Detention ponds shall have a geotechnical report that discusses the site's suitability for the type of stormwater pond being proposed and/or the engineer's recommendations as to how the site shall be improved to make the site suitable for the type of stormwater pond being proposed.

4.7.2 Pond Depth

The maximum active storage depth is 4 feet. An exception from this criterion may be approved on a case-by-case basis if additional safety factors can be shown to address this issue.

When using the BMP Sizing Tool, the total depth measurement reported in the tool includes the active storage depth as well as the depth of growing media, separation layer, and drain rock, as shown in **Figure C-11** in **Appendix C**.

4.7.3 Bottom Width

For ponds with an active storage depth of 3 feet or less, the minimum bottom width shall be 10 feet. For ponds with an active storage depth of over 3 feet, the minimum bottom width shall be 15 feet. An exception from this criterion may be approved on a case-by-case basis if required by topographical or physical boundary constraints. For the purposes of this bottom width measurement, the width shall be measured at the interior toe of slope.

4.7.4 Interior Side Slopes

Interior side slopes shall be no steeper than three horizontal to one vertical (3h:1v). An exception from this criterion may be approved on a case-by-case basis if required by topographical or physical boundary constraints.

4.7.5 Exterior Side Slopes

Exterior side slopes that have vegetated surfaces that require mowing shall be no steeper than four horizontal to one vertical (4h:1v). Exterior side slopes that have vegetated surfaces that do not require mowing shall be no steeper than two horizontal to one vertical (2h:1v). Exterior slopes shall be landscaped so that there is no exposed soil.

Berm embankments shall meet requirements of **Section 3.5.6.**

4.7.6 Conveyance Outfalls

Pipe outfalls from the conveyance system into the pond shall be flush with interior side slopes. Conveyance outfalls shall be designed with energy dissipation, in accordance with **Section 5.8**.

4.7.7 Outlet Structures

A. Primary Outlet: Detention ponds shall have a perforated pipe underdrain system to convey water from the pond to the flow control structure. See **Figure C-11** in **Appendix C** for a graphical depiction showing the underdrain system as the primary outlet.

B. Secondary Outlet: Detention ponds shall have a secondary pond outlet structure, such as a catch basin with grated lid located along an interior side slope. This secondary pond outlet will serve as a backup to convey stormwater to the flow control manhole should the primary pond outlet become clogged. The lip elevation of the secondary pond outlet should be set at approximately the ten-year design water surface. See **Figures C-11** and **C-12** in **Appendix C** for a graphical depiction showing a secondary pond outlet.

C. Flow Control Structure. Detention ponds shall have a flow control structure with orifice and weir dimensions sized using the BMP Sizing Tool or the Engineered Method. See **Figure C-12** in **Appendix C** for a graphical depiction showing a typical flow control structure. The flow control structure shall be designed to meet the following criteria:

1. Detention pond control structures may be either weir or orifice structures located in an enclosed manhole and meet City's standards. Locate the outlet control structure(s) outside the open water storage area.
2. The control structure shall be designed with an internal overflow device, such as an open top riser, to pass the 25-year design storm event (or 100-year design storm for a sub-regional facility) without allowing runoff to discharge through the emergency spillway and without causing upstream or downstream flooding. The design of the internal overflow shall assume that flow control orifices are plugged during the peak design storm.
3. Flow control manholes shall have solid locking covers. Open grates shall not be permitted in flow control manholes.
4. Locate the flow control structure to allow maintenance access as described in **Section 4.9.1**. The outlet flow control structure shall require little to no attention for normal operation.
5. The construction drawings shall include a separate design detail for each flow control structure.

4.7.8 Emergency Overflow

All ponds shall have an emergency overflow system that will safely pass runoff from a post-developed 100-year design storm through or around the detention pond and direct flows to the downstream conveyance system. The design intent of the emergency overflow system is to protect the integrity of the pond, as well as associated embankments and downstream properties, during large (rare) storm events and/or failure of the flow control structure. Secondary spillway shall meet the following criteria:

A. Locate the spillway to direct overflows safely toward the downstream conveyance system.

B. Locate the spillway in existing soil wherever possible. Protect the spillway with riprap or an approved material that extends to, and is an appropriate distance beyond, the bottom of the berm embankment. Fill the voids of the riprap with soil and vegetate the spillway with grass or ground cover. The selection of the vegetation on the spillway shall consider the required design capacity.

C. The invert elevation of the spillway shall be a minimum of 6 inches above the primary overflow elevation.

D. The minimum spillway depth shall be nine inches from the top of the berm. The free board during the design storm event shall be a minimum of 6 inches.

E. Alternate methods to accomplish the design intent of the secondary overflow system will be acceptable as long as they accomplish the same level of protection and are approved by the City Engineer.

4.7.9 Swales

All vegetated swales shall use rip rap or other methods to minimize and reduce erosion within the swale.

4.7.10 Inspection and Maintenance Access

All manufactured systems shall include inspection and maintenance access.

4.7.11 Signage

All ponds shall have signs placed so that at least one is clearly visible and legible from all adjacent streets, sidewalks, or paths. Applicants may add an indigenous, native wild bird(s) or wild animal(s) logo or cartoon figure on the sign. Sign spacing shall be approved by the City Engineer. The sign shall read:

> Please Do Not Disturb the Vegetation or Wildlife
> Oregon City Stormwater Management Facility
> For More Information, Call Oregon City Public Works at 503-657-8241

The minimum sign size shall be 12-inches x 18-inches. The maximum sign size shall be 24-inches by 30-inches. The material shall be aluminum with green reflective sheeting and silk screen lettering or equal as approved by the City Engineer. The signs shall be installed on an 8-foot long by 6-inch by 4-inch treated lumber post which is set in concrete and buried 30 inches into the ground. The developer shall install these signs before the City's final acceptance of the pond.

4.7.12 Site Constraints

All publicly-owned detention ponds shall be located in a separate tract dedicated to Oregon City for stormwater facilities. Open ponds shall not be located in dedicated public road right-of-way areas.

4.8 Planting, Irrigation, and Fencing Requirements

Landscaping guidelines for stormwater management facilities are included in the following sections and as described in 9.3.12.

4.8.1 Soil Mixes for Stormwater Management Facilities

Vegetated facilities require a soil/landscape system that simultaneously supports plant growth, soil microbes, water infiltration, nutrient and pollutant adsorption, sediment and pollutant filtration, and pollutant decomposition. Therefore, the soil mix selected for a facility is critical to its success. See the specific facility design criteria in **Appendix C**, and also refer to **Appendix A** for growing media specifications for vegetated facilities.

4.8.2 Planting

Stormwater management facilities with vegetative plantings must meet the following requirements:

A. Establishment procedures, such as control of invasive weeds, animal and vandal damage, mulching, re-staking, watering, and mesh or tube protection replacement, shall be implemented to the extent needed (as determined by the City) to ensure plant survival.

B. Stormwater facilities located in the public street right-of-way are not permitted to use evergreen trees to meet planting requirements.

C. Selected plant materials should be appropriate for soil, hydrologic, and other facility and site conditions (See **Appendix A**).

D. All plants within stormwater management facility areas shall be appropriate native species from the **Appendix A** Plant List (no nuisance, invasive, or prohibited plants).

E. The design for plantings shall minimize the need for herbicides, fertilizers, pesticides, or soil amendments at any time before, during, and after construction and on a long-term basis.

F. Plants shall be selected and planted to minimize the need for mowing, pruning, and irrigation.

G. Certified weed-free native grass or native wildflower seed shall be applied at the rates specified by the suppliers. If plant establishment cannot be achieved with seeding by the time of substantial completion of the stormwater facility portion of the project, the contractor shall plant the area with approved sod, plugs, container plants, or other means to complete the specified plantings and protect against erosion before water is allowed to enter the facility.

H. When any plantings are located within five (5) feet of a perforated pipe, the pipe shall be wrapped in filter fabric. Plantings should be offset from all utilities by a minimum of five (5) feet when possible.

4.8.3 Irrigation

The applicant may choose how to irrigate such as by truck or irrigation system. However, the City recommends onsite irrigation, with appropriate backflow prevention and winterization measures as necessary, to maintain the plant survivability.

When using temporary irrigation onsite using City water, the applicant must obtain a hydrant meter and backflow preventer from Public Works. Once the meter and backflow preventer are returned, the applicant is required to pay the fee for water usage.

Nearby water from a private water line is not allowed for irrigation.

When using temporary irrigation onsite using City water, the applicant shall discuss the irrigation system with the City prior to the completion of the two-year maintenance period. The City may request the irrigation be removed or request the irrigation remain in place for use by the City. In either case, the hydrant meter and backflow preventer will need to be returned and the water fee paid.

Permanent irrigation is desired when the City takes over the maintenance of the stormwater management tracts. Permanent irrigation plans must be submitted to Public Works and approved by Public Works prior to installation.

When using permanent irrigation onsite, the applicant must install a backflow preventer and obtain a meter from Public Works. The applicant is required to pay the fee for water usage during the two-year maintenance period.

All irrigation systems require payment of a water meter installation fee.

Installation of permanent irrigation is considered an additional tap to the water main system and requires a System Development Charge.

4.8.4 Fencing and Handrails

Fences are required for all stormwater facilities with grades steeper than 3 feet horizontal to 1 foot vertical (3h: 1v) or adjacent any walls/bulkheads greater than 24 inches in height. Where fences are required, fence height may range from 4 to 8 feet high depending on the location and security need as determined by the City Engineer. Fencing materials and colors shall be complementary to the site design. Handrails shall be provided on the pedestrian side of stormwater planters or other stormwater management facilities with vertical sides that exceed 24 inches in depth.

Public Facilities: For publicly maintained facilities, the City may require the use of chain link fencing for security and protection. When fencing is required around a pond, a minimum of one locking access gate shall be provided that is 16 feet wide, consisting of two swinging sections each 8 feet in width. At least one pedestrian gate must be provided, with a minimum 4-foot width. Fence material shall be No. 11 gauge galvanized steel fabric with bonded vinyl coating. Vinyl coating shall be a color designed to blend with the surrounding area (likely green, brown, or preferably black). Fence posts shall be galvanized steel, with top caps, and set a minimum of three feet deep in concrete. Crossbars shall connect adjacent fence posts, with diagonal braces at corners and ends. All posts, cross bars and gates shall be painted or coated the same color as the vinyl clad fence. Fence height requirement may range from 4 to 8 feet high depending on the location and security need as determined by the City Engineer.

Private Facilities: Designers are encouraged to **minimize or eliminate the need for fencing** for privately maintained facilities**.** Fencing for privately owned facilities is at the discretion of the owner and shall be implemented if deemed applicable based on local Building Codes. However, private owners are encouraged to follow the above criteria for public facilities when determining fencing requirements. When any fencing is used, it must be consistent with the City's fencing requirements. In some locations City's Zoning Code may prohibit or restrict the type of fencing or require screening. If fencing is prohibited, the designer may have to change the facility design to eliminate fencing requirements.

4.9 Operation and Maintenance (O&M) Requirements

Operations and Maintenance requirements apply to all stormwater management facilities and related facility components. Owners are required to provide all-weather access for the City to inspect the facilities regularly to determine maintenance needs. See **Chapter 8** for O&M requirements.

4.9.1 General Maintenance Access

Publicly-maintained stormwater facilities must be provided an access road designed and constructed for the intended use and purpose for accessing stormwater facilities. City-maintained facilities should be located on or directly adjacent to the public right-of-way. In locations where access roads are approved by the City, following are the minimum criteria required:

A. A site plan and profile of the access road.

B. Maximum grade: 12 percent.

C. Minimum width of surface: 12 feet.

D. Paved surfaces: 2-inch asphalt concrete (AC) thickness over 6" Aggregate Base OR Grass Pavers.

E. Paved surfaces shall extend to within 10 horizontal feet and 3 vertical feet of openings to all water quality and flow control structures unless otherwise approved by the City.

F. Access roads shall have an approved driveway approach from the public street and meet minimum design standards from Oregon City Municipal Code Title 17, except as modified by this section.

G. Maintenance road access for publicly-maintained facilities shall be shown on the recorded plat map and be situated in a separate tract and identified with the specific and intended use for maintenance access.

4.9.2 Detention Pond Interior Maintenance Access

Detention ponds shall have an access road suitable for maintenance equipment (backhoe, etc.) to safely access the interior bottom of the pond for the purpose of sediment removal. Minimum access road requirements include the following:

A. The interior pond access will begin at the edge of the required pavement and end within 3 vertical feet and 10 horizontal feet of the lowest elevation of the pond.

B. The minimum access road requirement is at least 10 feet wide with slopes no steeper than 15 percent. Curved alignments shall be 15 feet wide to accommodate equipment turning radius.

C. Access roads longer than 300 feet from a public right-of-way shall provide for a truck turn-around area.

D. Bollards shall be installed to limit vehicle access. Bollards shall consist of fixed bollards on each side of the access road and two lockable, removable bollards equally located between the fixed bollards.

E. The pond interior access shall be constructed of a landscape block surface by removing all unsuitable material, laying a geotextile fabric over the native soil, placing landscape blocks, filling the honeycombs with topsoil, and planning appropriate zone grass. Other materials may be reviewed and approved on a case-by-case basis, provided they do not create additional impervious surface and will meet vehicle wheel load requirements.

4.9.3 Private Stormwater Facilities

A. Private stormwater facilities require a recorded maintenance covenant on the property that includes the Operations and Maintenance Plan for the private stormwater feature. See **Appendix C** and **Appendix F**.

B. Manufactured Treatment Technologies and Systems as allowed by **Appendix E** shall be designed with appropriate maintenance access points and systems which could include access roads as described in 4.9.1 and/or multiple access hatches to the systems themselves.