Chapter 3 OPERATIONS AND MAINTENANCE

This chapter presents operations and maintenance (O&M) requirements for the stormwater management facilities in this *Stormwater Management Manual* (SWMM). It includes applicability information, submittal requirements, and guidance for developing an appropriate stormwater management O&M plan.

		Page
3.1	Applicability of O&M Requirements	3-2
3.2	O&M Requirements	3-4
	3.2.1 Simplified Approach for Private Facilities	3-5
	3.2.2 Presumptive and Performance Approach	
	for Private Facilities	3-5
	3.2.3 Presumptive and Performance Approach	
	for Public Facilities	3-6
3.3	O&M Submittal Guidance	3-8
	3.3.1 O&M Specifications for Simplified Approach	3-8
	3.3.2 O&M Plan for Presumptive and Performance	
	Approaches	3-18
3.4	O&M Enforcement	3-42
3.5	O&M Revisions	3-42

3.1 APPLICABILITY OF O&M REQUIREMENTS

The O&M requirements in this chapter apply to all stormwater management facilities and related facility components identified in Chapters 1, 2, and 4 of this *Stormwater Management Manual*.¹

- When the **Simplified Approach** is used for design, the O&M Specifications provided in this chapter can be used.
- When the **Presumptive Approach** or **Performance Approach** is used, a sitespecific O&M Plan must be developed.
- If a stormwater facility that is not included in this manual is used (such as a manufactured stormwater treatment technology), the applicant must still prepare and submit an O&M Plan that includes facility-specific O&M activities in compliance with this chapter and with manufacturer requirements.

It is essential to maintain facilities so they function as intended and limit offsite environmental impacts. Owners are required to check their facilities regularly to determine maintenance needs. Routine inspection and maintenance can help keep overall maintenance costs low by detecting problems early and avoiding large repair or replacement costs.

The key goals of any O&M plans and specifications are to:

- Relay information between the designer/engineer and those actually providing the maintenance.
- Identify all facilities, runoff sources, and discharge points that require maintenance. Show the integration of site stormwater design and related regular operations.
- Provide long-term guidance on items to address in order to prevent system deterioration and failure.
- Provide a schedule for maintenance and regular operation.
- Designate and clarify responsibilities.
- Establish fiscal responsibility.
- Provide logs to be filled out by maintenance personnel.

¹ See Portland City Code, Title 17.38.040 for the relevant code requirements.

Access for Operation and Maintenance

Stormwater facilities must be accessible for monitoring and maintenance. Maintain paths, gates, and covers to ensure access is adequate to safely and efficiently locate and enter facilities. Public facilities must have access routes at least 8 feet wide, less than 10 percent in slope, and located adjacent to public right-of-way wherever feasible. Where structural surfaces are needed to support maintenance vehicles, access routes must be constructed of gravel or other permeable paving surface where possible. Public facility vehicular access routes must be designed for H-20 loading.

3.2 O&M REQUIREMENTS

Every permitted project with at least one stormwater facility is required to submit the **Operations & Maintenance Form** provided in **Appendix D**. The O&M Form must identify:

- Owner's name, address, and phone number.
- Site address.
- Financial method used to cover future operation and maintenance.
- Parties responsible for inspecting and maintaining the facility.
- Size and sources of runoff entering the facility and ultimate stormwater discharge point.

The O&M Form also provides a space to insert a site plan. The site plan must identify:

- Type and size of the facility.
- Location of the facility, using reference to an easily identified permanent point or geo-coordinates.

The O&M Form must be included with every stormwater management facility permit application and must be **recorded with the applicable county** before permit issuance.

Additional submittal requirements differ, based on how the facility was sized (using the Simplified Approach, Presumptive Approach, or Performance Approach described in **Chapter 2**) and whether the facility is public or private:

- Private facilities that use the Simplified Approach can use the O&M Specifications (described in Section 3.2.1 and provided in Section 3.3.1).
- Private facilities that use the Presumptive Approach or Performance Approach must provide a site-specific O&M Plan (described in Section 3.2.2 and outlined in Section 3.3.2).
- Public facilities that use the Presumptive Approach or Performance Approach must provide a O&M Plan to cover the warranty period (described in Section 3.2.3 and outlined in Section 3.3.2).

City Code requires facility owners to keep an inspection and maintenance log. In general, the log should note all inspection dates, the facility components inspected, and any maintenance or repairs made. The O&M Form should serve as a checklist for what to include in the log. **Page 3-4** provides an example of an inspection and maintenance log.

Exemptions from O&M Requirements

Single or dual family unattached residences are not required to provide the O&M Form if a drywell or soakage trench is the only stormwater facility on the permit.

A contract with the Watershed Revegetation Program (WRP) does NOT exempt facilities from O&M requirements. The WRP can accept maintenance of only the vegetation.

3.2.1 Simplified Approach for Private Facilities

When the Simplified Approach is used to design stormwater management facilities on private property, the required O&M submittal to BES is:

- A completed O&M Form (including sketched or attached site plan) that has been recorded with the appropriate county.
- Associated O&M Specifications.

Section 3.3.1 provides facility-specific O&M Specifications for the Simplified Approach. These specifications correspond with the permitted stormwater facility unless a revised specification or an addendum stormwater management plan is submitted for review. The property owner should keep a copy of the recorded site plan and the appropriate O&M Specifications onsite. The date of county record for the O&M Form defines the appropriate version of the *Stormwater Management Manual* and the associated O&M Specifications.

3.2.2 Presumptive and Performance Approach for Private Facilities

When the Presumptive or Performance Approach is used to design stormwater management facilities on private property, the required O&M submittal to BES is:

- A completed O&M Form (including sketched or attached site plan) that has been recorded with the appropriate county.
- A site-specific O&M Plan.

Using the outline provided in Section 3.3.2, an O&M Plan must be prepared for review by BES. The O&M Plan must describe each type of facility servicing the site, the impervious area draining to the facilities, the facilities' discharge points, and the frequency and timing of maintenance. It must address in detail the procedures necessary to maintain each facility type in good working condition. Scheduling or time intervals between maintenance procedures must be part of the plan. An integral element is a description of how the O&M Plan will be implemented.

Section 3.3.2 also includes a sample O&M Plan that can be used for guidance.

3.2.3 Presumptive and Performance Approach for Public Facilities

A stormwater management facility that receives stormwater runoff from a public rightof-way becomes a public (City-maintained) facility unless the right-of-way is not part of the City's road maintenance system. Facilities that will become City-maintained must be constructed under a public works permit and must go through a warranty period prior to transfer.

For public facilities, the required O&M submittal to BES is:

An O&M Plan

A preliminary O&M Plan must be submitted before construction, as part of the applicant's public works permit application package. This plan will be finalized and in effect during the warranty period, when the City holds no responsibility for operations and maintenance. If a contract has been established with the Watershed Revegetation Program, the O&M Plan does not need to address those services provided (see Section 2.3.2 under the Watershed Revegetation Plan heading). The applicant must also demonstrate on the O&M Plan that the City can achieve the specified O&M activities. This may involve the construction of maintenance access roads and the dedication of public access easements.

Warranty Period Responsibilities and Inspections for Public Facilities

The contractor/permit authority that builds stormwater management facilities under a public works permit is responsible for maintaining all site stormwater management features during the maintenance warranty period. This includes maintaining, repairing, and/or replacing the associated vegetative components; any structural or functional repairs; and the general maintenance of the facility. The contractor/permit authority is also responsible for reporting to BES on the condition of the facility on a scheduled basis over the warranty period, as outlined in **Exhibit 3-1**. BES will inspect the facility to verify that the information in the reports is accurate. The warranty period is 2 years. The City reserves the right to perform any work necessary to correct deficiencies in the facility should the contractor/ permit authority fail to perform the work after given notice. The City shall seek reimbursement from the contractor/ permit authority for all costs associated with performance of the work to bring the facility into compliance with the permit conditions.

Facility condition reports must be submitted to the BES Watershed Revegetation Program (WRP phone no. 503-823-2335). WRP staff will use the report to inspect the facility and finalize the report and will send confirmation of inspection to the contractor.

- 1. **3-month establishment report and inspection:** Contractor/permit authority shall report on the condition of the facility, including landscape maintenance activities conducted to date and the schedule of anticipated upcoming activities, plant health and mortality, current percent cover of non-desirable vegetation, and any structural or functional concerns and/or observations.
- 2. **10-month establishment report and inspection:** Contractor/permit authority shall report on the condition of the facility, including landscape maintenance activities conducted to date and the schedule of anticipated upcoming activities, plant health and mortality, current percent cover of non-desirable vegetation, and any structural or functional concerns and/or observations.

If the facility does not pass BES inspection, BES will submit a letter to the contractor/ permit authority describing necessary remedial actions to be performed. This letter shall serve as final notice to the contractor/permit authority and its sureties that failure to correct the deficiencies in accordance with the permit conditions and prior to the end of the warranty period will result in the City performing the work and seeking reimbursement from the contractor/permit authority for all costs associated with the City performing the work.

- **3. 18-month establishment report and inspection:** Contractor/permit authority shall report on the condition of the facility, including landscape maintenance activities conducted to date and the schedule of anticipated upcoming activities, plant health and mortality, current percent cover of non-desirable vegetation, and any structural or functional concerns and/or observations.
- 4. **24-month establishment report and inspection**: Contractor/permit authority shall report on the condition of the facility, including landscape maintenance activities conducted to date and the schedule of anticipated upcoming activities, plant health and mortality, current percent cover of non-desirable vegetation, and any structural or functional concerns and/or observations.

At this time, if <u>all</u> inspections have passed, the warranty period ends and the facility is turned over to BES for long-term maintenance.

3.3 O&M SUBMITTAL DOCUMENTS AND GUIDANCE

3.3.1 O&M Specifications: Simplified Approach

The specifications on the following pages can be used for private facilities that use the Simplified Approach.

The main objectives of the O&M Specifications are to:

- Identify all facilities, runoff sources, and discharge points that require maintenance.
- Provide long-term guidance on what items to address in order to prevent system deterioration and failure.
- Provide a schedule for maintenance and regular operation.

Page
3-9
3-10
3-11
3-12
3-13
3-14
3-15
3-16
3-17

Simplified Operations and Maintenance Specifications ECOROOFS

What To Look For	What To Do		
Structural Components , including the waterproof membrane, shall be operated and maintained in accordance with the manufacturer's and design specifications.			
 Clogged drains 	 Repair any leaks or structural deficiencies. 		
	Remove sediment and debris if necessary		
 Tears or perforation of membrane 	 Contact manufacturer for repair or replacement. 		
Vegetation shall cover 90% of the facility.			
Dead or stressed vegetation	Replant per original planting plan,		
	Irrigate and mulch as needed.		
 Dry grass or other plants 	Prune tall, dry grasses and remove clippings.		
> Weeds	Manually remove weeds. Do not use pesticides.		
Growing Medium shall sustain healthy plant cover and infiltrate within 48 hours.			
 Exposed soil 	Cover with plants and mulch as needed.		
Eroded soils and gullies	 Fill, hand tamp or lightly compact, and plant vegetation to disperse flow. 		
Crusting, dry, or shrinking medium	Rake or amend to restore filtration or flow.		
 Ponding or excessive moisture 	Amend soils and clear drains.		

Annual Maintenance Schedule

Summer: Make necessary repairs. Improve growing medium as needed. Clear drains. Irrigate as needed. *Fall:* Replant exposed soil and dead plants. Remove sediment and debris from drains. Provide erosion control for bare soil if necessary.

Winter: Monitor infiltration/flow-through rates. Clear drains as needed.

Spring: Replant exposed soil and dead plants. Remove sediment and debris from drains.

All seasons: Weed as necessary.

Maintenance Records: Record date, description, and contractor (if applicable) for all repairs, landscape maintenance, and facility cleanout activities. Keep work orders and invoices on file and make available upon request of the City inspector.

Access: Maintain ingress/egress to design standards.

Irrigation: Adjust irrigation program or consult professional to set system at correct watering system.

Infiltration/Flow Control: All facilities shall drain within 48 hours. Record time/date, weather, and site conditions when ponding occurs.

Pollution Prevention: All sites shall implement best management practices to prevent hazardous wastes from contaminating stormwater. Record time/date, weather, and site conditions when site activities contaminate stormwater.

Vectors (Mosquitoes & Rodents): Ecoroof shall not harbor mosquito larvae or rodents that pose a threat to public health or that undermine the facility structure. Record time/date, weather, and site conditions when vector activity observed. Record when vector abatement started and ended.

Simplified Operations and Maintenance Specifications SWALES

What To Look For	What To Do		
Structural Components, including inlets and outlets/overflows, shall freely convey stormwater.			
Clogged inlets or outlets	Remove sediment and debris from catch basins, trench drains, curb inlets, and pipes to maintain at least 50% conveyance capacity at all times.		
 Cracked drain pipes 	 Repair/seal cracks. Replace when repair is 		
 Check dams 	insufficient.		
	Maintain 4- to 10-inch-deep rock check dams at 12- to		
	20-foot intervals.		
Vegetation shall cover 90% of the facility.			
Dead or strained vegetation	Replant per original planting plan, or substitute from SWMM Appendix F.4 plant list.		
	Irrigate as needed. Mulch banks annually. DO NOT apply fertilizers, herbicides, or pesticides.		
Tall grass and vegetation	Cut back grass and prune overgrowth 1-2 times a		
> Weeds	vear.		
	Manually remove weeds. Remove all plant debris.		
Growing/Filter Medium , including soil and gravels, shall sustain healthy plant cover and infiltrate within 48			
➢ Gullies	Fill, lightly compact, and plant vegetation to disperse flow.		
> Erosion	 Replace splash blocks or inlet gravel/rock. 		
 Slope slippage 	 Stabilize 3:1 slopes/banks with plantings from 		
	SWMM Appendix F.4 plant list.		
Ponding	Rake, till, or amend to restore infiltration rate.		

Annual Maintenance Schedule

Summer: Make structural repairs. Improve filter medium as needed. Clear drains. Irrigate as needed. *Fall:* Replant exposed soil and replace dead plants. Remove sediment and plant debris. *Winter:* Monitor infiltration/flow-through rates. Clear inlets and outlets/overflows to maintain conveyance.

Spring: Remove sediment and plant debris. Replant exposed soil and replace dead plants. Mulch. *All seasons:* Weed as necessary.

Maintenance Records: Record date, description, and contractor (if applicable) for all structural repairs, landscape maintenance, and facility cleanout activities. Keep work orders and invoices on file and make available upon request of the City inspector.

Access: Maintain ingress/egress to design standards.

Infiltration/Flow Control: All facilities shall drain within 48 hours. Record time/date, weather, and site conditions when ponding occurs.

Pollution Prevention: All sites shall implement best management practices to prevent hazardous or solid wastes or excessive oil and sediment from contaminating stormwater. Contact Spill Prevention & Citizen Response at 503-823-7180 for immediate assistance responding to spills. Record time/date, weather, and site conditions if site activities contaminate stormwater.

Simplified Operations and Maintenance Specifications PLANTERS

W	What To Look For		hat To Do	
St	Structural Components, including inlets and outlets/overflows, shall freely convey stormwater.			
A	Clogged inlets or outlets	٨	Remove sediment and debris from catch basins, trench drains, curb inlets, and pipes to maintain at least 50% conveyance capacity at all times.	
AA	Liner and foundation Cracked drain pipes	۶	Repair/seal cracks. Replace when repair is insufficient.	
Ve	getation shall cover 90% of the facility.			
A	Dead or strained vegetation	A A	Replant per original planting plan, or substitute from SWMM Appendix F.4 plant list. Irrigate as needed. Mulch annually. DO NOT apply fertilizers, herbicides, or pesticides.	
AA	Tall or overgrown plants Weeds	A A	Prune to allow sight lines and foot traffic. Manually remove weeds. Remove all plant debris.	
Growing/Filter Medium , including soil and gravels, shall sustain healthy plant cover and infiltrate within 48 hours.				
٨	Gullies	۶	Fill, lightly compact, and plant vegetation to disperse flow.	
۶	Erosion	>	Replace splash blocks or inlet gravel/rock.	
٨	Ponding	A A	Stabilize soils with plantings from SWMM Appendix F4. Rake, till, or amend to restore infiltration rate.	

Annual Maintenance Schedule

Summer. Make any structural repairs. Improve filter medium as needed. Clear drain. Irrigate as needed. *Fall.* Replant exposed soil and replace dead plants. Remove sediment and plant debris. *Winter.* Monitor infiltration/flow-through rates. Clear inlets and outlets/overflows to maintain conveyance. *Spring.* Remove sediment and plant debris. Replant exposed soil and replace dead plants. Mulch.

All seasons. Weed as necessary.

Maintenance Records: Record date, description, and contractor (if applicable) for all structural repairs, landscape maintenance, and facility cleanout activities. Keep work orders and invoices on file and make available upon request of the City inspector.

Access: Maintain ingress/egress to design standards.

Infiltration/Flow Control: All facilities shall drain within 48 hours. Record time/date, weather, and site conditions when ponding occurs.

Pollution Prevention: All sites shall implement best management practices to prevent hazardous or solid wastes or excessive oil and sediment from contaminating stormwater. Contact Spill Prevention & Citizen Response at 503-823-7180 for immediate assistance responding to spills. Record time/date, weather, and site conditions if site activities contaminate stormwater.

Simplified Operations and Maintenance Specifications BASINS

What To Look For	What To Do		
Structural Components, including inlets and outlets/over	erflows, shall freely convey stormwater.		
 Clogged inlets or outlets 	Remove sediment and debris from catch basins, trench drains, curb inlets, and pipes to maintain at least 50% conveyance capacity at all times.		
Cracked drain pipes or grates	▶ Repair/seal cracks. Replace when repair is insufficient.		
> Check dams	Maintain 4- to 10-inch-deep rock check dams at 12- to		
	20-foot intervals.		
Vegetation shall cover 90% of the facility.			
Dead or strained vegetation	Replant per original planting plan, or substitute from SWMM Appendix E 4 plant list		
	Swinin Appendix F.4 plant list.		
	apply fertilizers, herbicides, or pesticides.		
> Tall grass and vegetation	Cut back grass and prune overgrowth 1-2 times a year.		
> Weeds	> Manually remove weeds. Remove all plant debris.		
Growing/Filter Medium, including soil and gravels, shall sustain healthy plant cover and infiltrate within 48 hours.			
> Gullies	\succ Fill, lightly compact, and install plant vegetation to		
	disperse flow.		
Erosion	Replace splash blocks or inlet gravel/rock.		
Slope slippage	Stabilize 3:1 slopes/banks with plantings from SWMM		
	Appendix F.4.		
> Ponding	Rake, till, or amend to restore infiltration rate.		

Maintenance Schedule:

Summer. Make any structural repairs. Improve filter medium as needed. Clear drain. Irrigate as needed. *Fall.* Replant exposed soil and replace dead plants. Remove sediment and plant debris. *Winter.* Monitor infiltration/flow-through rates. Clear inlets and outlets/overflows to maintain conveyance. *Spring.* Remove sediment and plant debris. Replant exposed soil and replace dead plants. Mulch. *All seasons.* Weed as necessary.

Maintenance Records: Record date, description, and contractor (if applicable) for all structural repairs, landscape maintenance, and facility cleanout activities. Keep work orders and invoices on file and make available upon request of the City inspector.

Access: Maintain ingress/egress, including access roads, to design standards.

Infiltration/Flow Control: All facilities shall drain within 48 hours. Record time/date, weather, and site conditions when ponding occurs.

Pollution Prevention: All sites shall implement best management practices to prevent hazardous or solid wastes or excessive oil and sediment from contaminating stormwater. Contact Spill Prevention & Citizen Response at 503-823-7180 for immediate assistance responding to spills. Record time/date, weather, and site conditions if site activities contaminate stormwater.

Simplified Operations and Maintenance Specifications DRYWELLS AND SOAKAGE TRENCHES

What To Look For	What To Do		
Structural Components include pipes, manholes (drywells), and rock/sand reservoirs (soakage trenches), storm chambers, and silt traps (soakage trenches).			
 Clogged inlets, reservoirs, manholes, or silt traps Debris or garbage build up Cracked drain pipes or manholes 	 Clean gutters, rain drains, and silt traps twice a year. Clear piping to facility when blockage occurs. Repair/seal cracks. Replace when repair is insufficient. 		
Vegetation includes surface cover and nearby plantings.			
Large shrubs and trees	Prevent large root systems from damaging subsurface structural components.		
Filter Layer includes rock/gravel bed.			
Ponding water	 Clear piping through facility when ponding occurs. Replace rock/sand reservoirs as necessary. Tilling of subgrade below reservoir may be necessary (for trenches) prior to backfill. May require decommissioning and replacement (for drywells or trenches). 		

Maintenance Schedule:

Summer. Make necessary structural repairs. Clean silt traps.

Fall. Clean gutters and rain drains.

Winter. Monitor infiltration rate.

Spring. Clean gutters and rain drains.

Maintenance Records: Record date, description, and contractor (if applicable) for all structural repairs, landscape maintenance, and facility cleanout activities. Keep work orders and invoices on file and make available upon request of the City inspector.

Access: Maintain ingress/egress to design standards.

Infiltration/Flow Control: All facilities shall drain within 48 hours. Record time/date, weather, and site conditions when ponding occurs.

Pollution Prevention: All sites shall implement best management practices to prevent hazardous or solid wastes or excessive oil and sediment from contaminating stormwater. Contact Spill Prevention & Citizen Response at 503-823-7180 for immediate assistance responding to spills. Record time/date, weather, and site conditions if site activities contaminate stormwater.

Simplified Operations and Maintenance Specifications PERVIOUS PAVEMENT

What To Look For	What To Do	
Structural Components, including surface mate	rials, shall evenly infiltrate stormwater.	
Clogged surface	 Vacuum sweep at least twice a year. Powerwash annually or as needed. Do not use surfactants. 	
 Cracked or moving edge restraints Cracked or settled pavement 	 Repair per manufacturer's specifications. 	
Vegetation		
 Large shrubs or trees Woods 	 Sweep leaf litter and sediment to prevent surface clogging and ponding. Prevent large root systems from damaging subsurface structural components. Dermachla payors: menually remease woods. Do 	
Weeds	Permeable pavers: manually remove weeds. Do not use herbicides. Mow, torch, or inoculate with preferred vegetation. Many pavers are designed to have pore space vegetation.	
Filter Medium		
 Aggregate loss in pavers from settling and from powerwashing 	 Replace paver pore space with aggregate from original design. 	

Maintenance Schedule:

Summer. Make necessary structural repairs. Fall. Vacuum sweep. Winter. Monitor infiltration rate. Spring. Powerwash, with proper disposal. Vacuum sweep. All seasons. Weed as necessary.

Maintenance Records. Record date, description, and contractor (if applicable) for all structural repairs, landscape maintenance, and facility cleanout activities. Keep work orders and invoices on file and make available upon request of the City inspector.

Infiltration/Flow Control: All facilities shall drain within 48 hours. Record time/date, weather, and site conditions when ponding occurs.

Pollution Prevention: All sites shall implement best management practices to prevent hazardous or solid wastes or excessive oil and sediment from contaminating stormwater. Contact Spill Prevention & Citizen Response at 503-823-7180 for immediate assistance responding to spills. Record time/date, weather, and site conditions if site activities contaminate stormwater.

Simplified Operations and Maintenance Specifications VEGETATED FILTERS

What To Look For	What To Do	
Structural Components , including inlets and outlets, che and infiltrate stormwater.	ck dams, and flow spreader, shall slowly and evenly treat	
Clogged inlets or outlets	Remove sediment, debris, and vegetation blockage from catch basins, trench drains, curb inlets, and pipes to maintain at least 50% conveyance capacity at all times.	
> Ineffective flow spreaders	 Clear accumulated silt. 	
 Cracked drain pipes 	 Repair/seal cracks. Replace when repair is insufficient. 	
Vegetation shall cover 90% of the facility.		
Dead or strained vegetation	Manually remove sediment accumulation.	
	Replant per planting plan, or substitute from SWMM Appendix F.4 plant list.	
	 Irrigate as needed. Mulch annually. DO NOT apply fertilizers, herbicides, or pesticides. 	
➤ Tall grass	Cut back to 4-6 inches 1-2 times each year.	
> Weeds	Manually remove weeds. Remove plant debris.	
Growing/Filter Medium, including soil and gravels, shall sustain healthy plant cover and infiltrate within 48 hours.		
Erosion and gullies	 Fill, lightly compact, and install flow spreader/plant 	
	vegetation to disperse flow. Restore or create outfalls,	
	checkdams, or splash blocks where necessary.	
Slope slippage	Stabilize slopes.	
Ponding	Rake, till, or amend to restore infiltration rate.	

Maintenance Schedule:

Summer. Make any structural repairs. Improve filter medium as needed. Clear drain. Mow. Irrigate as needed. *Fall*. Replant exposed soil and replace dead plants. Remove sediment and plant debris.

Winter. Monitor infiltration/flow-through rates. Clear inlets and outlets/overflows to maintain conveyance. *Spring*. Remove sediment and plant debris. Replant exposed soil and replace dead plants. *All seasons*. Weed as necessary.

Maintenance Records: Record date, description, and contractor (if applicable) for all structural repairs, landscape maintenance, and facility cleanout activities. Keep work orders and invoices on file and make available upon request of the City inspector.

Access: Maintain ingress/egress to design standards.

Infiltration/Flow Control: All facilities shall drain within 48 hours. Record time/date, weather, and site conditions when ponding occurs.

Pollution Prevention: All sites shall implement best management practices to prevent hazardous or solid wastes or excessive oil and sediment from contaminating stormwater. Contact Spill Prevention & Citizen Response at 503-823-7180 for immediate assistance responding to spills. Record time/date, weather, and site conditions if site activities contaminate stormwater.

Operations and Maintenance Specifications SAND FILTERS

What To Look For	What To Do		
Structural Components, including inlets and outlets/overflows, shall freely convey stormwater.			
Clogged inlets or outlets	 Remove sediment and debris from silt traps, trench drains, inlets, and pipes to maintain at least 50% conveyance capacity at all times. Manually remove sediment accumulation 		
Cracked drain pipes, liners, walls, or traps	 Repair/seal cracks. Replace when repair is insufficient. 		
Vegetation			
WeedsLarge shrubs and trees	 Manually remove weeds. Remove all plant debris. Prevent large root systems from damaging subsurface structural components. DO NOT apply herbicides or pesticides. 		
Filter Medium, including sand and gravels or similar material, shall infiltrate within 48 hours.			
> Ponding	Rake and remove layer of oil and sediment and restore infiltration rate.		
➤ Gullies	 Fill, lightly compact, and install flow spreader/plant vegetation to disperse flow. 		
➢ Erosion	\triangleright Restore outfalls or splash blocks where necessary.		

Maintenance Schedule:

Summer. Make necessary structural repairs.
Fall. Rake to remove oil and sediment.
Winter. Monitor flow-through rates. Clear inlets and outlets/overflows to maintain conveyance.
Spring. Rake to remove oil and sediment.
All seasons. Weed as necessary.

Maintenance Records: Record date description and contractor (if applicable) for all structural rerestors.

Maintenance Records: Record date, description, and contractor (if applicable) for all structural repairs, landscape maintenance, and facility cleanout activities. Keep work orders and invoices on file and make available upon request of the City inspector.

Access: Maintain ingress/egress to design standards.

Infiltration/Flow Control: All facilities shall drain within 48 hours. Record time/date, weather, and site conditions when ponding occurs.

Pollution Prevention: All sites shall implement best management practices to prevent hazardous or solid wastes or excessive oil and sediment from contaminating stormwater. Contact Spill Prevention & Citizen Response at 503-823-7180 for immediate assistance responding to spills. Record time/date, weather, and site conditions if site activities contaminate stormwater.

Catch Basins

The performance of catch basins for removing sediment and other pollutants depends on routine maintenance to retain the storage available in the sump in order to capture sediment and most floatables.

- Remove debris and sediment every 6 months (or when one-third full of sediment).
- Dewater and dispose of sediment properly. Test sediment that has a heavy oil sheen and/or odors to determine the appropriate disposal.
- Maintain the hooded outlet to prevent floatable materials, such as trash and debris, from entering the storm drain system.
- Maintain the grate as designed for safety reasons and to prevent trash and debris from collecting in the catch basin.
- > Repair/seal cracks. Replace when repair is insufficient.
- ➤ Keep a log of the amount of sediment collected and the date of removal.

3.3.2 O&M Plan for Presumptive and Performance Approach

A site-specific O&M Plan is required for:

- Private facilities that use the Presumptive Approach or Performance Approach.
- Public facilities are required to have an O&M Plan during the warranty period (see Section 3.2.3). The O&M Plan for these facilities is preliminary and is in effect until the facility is turned over to the City.

If the applicant enters into an agreement with the Watershed Revegetation Program, the owner is not responsible for establishing the vegetation. Refer to Section 2.3.2 for the list of services the WRP provides.

The site-specific O&M Plan is a component of the Stormwater Management Report. It defines the O&M procedures, schedule, and persons responsible for implementing and documenting O&M activities. The O&M Plan must fully assess the requirements of the site and the proposed stormwater infrastructure.

Exhibit 3-2 outlines the requirements for a site-specific O&M Plan. The following text then gives additional information about each of the outline sections.

Exhibit 3-2: O&M Plan Outline

I.	Description
	 Summary of overall Stormwater Management Plan.
	• Table identifying each stormwater facility, including stormwater source, square
	footage treated, and discharge point.
	Specific location of stormwater facilities
	 Identification of who will assume responsibility for ongoing operations.
II.	Schedule
	• When and how often facilities will be inspected.
	• Specific intervals between particular O&M duties.
	• Definition of what size storms require additional inspections.
	• Irrigation schedule.
III.	Procedures
	• Specific procedures for each facility type.
	• Likely deficiencies and corrective actions.
	Course of action for unexpected deficiencies.
IV.	Who Shares Financial Responsibility
v.	Inspection and Maintenance Logs
	• Example and instructions for maintaining required logs.
Chapte	r 3: Operations and Maintenance 3-18

I. Description

The summary of the Stormwater Management Plan (SMP) should adequately describe the overall objectives and expectations. The extent of the summary will depend on the intricacy of the stormwater design. The summary should include the Stormwater Hierarchy, specifically whether the treated stormwater is infiltrated onsite or discharged offsite.

A table must be included that identifies each stormwater facility, including the facility type, size, location, source of stormwater (rooftop, parking lot, or road runoff), source area (square footage) treated by the facility, discharge point, and accessibility.

The location of each stormwater facility must be identified on a site map. The location must be clarified by a measurement from a permanent structure or GPS coordinates.

The party responsible for current and ongoing O&M activities must be identified. The name of the responsible party must be updated as needed whenever the facility is inspected under BES's Maintenance Inspection Program (MIP).

II. Schedule

Facilities must be inspected at least:

- Quarterly for the first 2 years
- Twice a year thereafter
- Within 48 hours of major rainfall events (more than 1 inch of rain over a 24-hour period)

Some inspections are recommended more often, as noted under the **Facility Maintenance Guidelines** beginning on page **3-21**. For at least the first 2 years, inspections should be conducted with the facility drawings and the O&M Plan in hand to help the inspector understand how the facility is supposed to function. The O&M Plan will help the inspector recognize signs that indicate diminished performance (for example, sediment accumulation, vegetation die-off, or ponding water for more than 48 hours after a storm).

An irrigation schedule must also be provided.

III. Procedures

Each type of facility must have its own section that describes the duties required to maintain that facility and keep it in working order. It is expected that variations in facilities as well as variations in sources (rooftop, parking lot, or roadway runoff) will result in different procedures. The **Facility Maintenance Guidelines** beginning on page **3-21** detail the types of procedures necessary for facility maintenance. Probable deficiencies or typical problems and their solutions must also be described.

IV. Financial Responsibility

The party fiscally responsible for operating and maintaining the stormwater facility must be designated.

V. Inspection and Maintenance Logs

City Code requires facility owners to keep an Inspection and Maintenance Log. In general, the log should note all inspection dates, the facility components that were inspected, and any maintenance or repairs performed. The intent is to demonstrate compliance with O&M requirements.

If there is a manufactured facility or a maintenance contract with the manufacturer, the manufacturer's maintenance logs should generally include the same type of information and level of detail shown in the sample monitoring log that is included in the **Sample O&M Plan** on page **3-36**. Owners who are not sure their log sheet is sufficient can call Environmental Services at 503-823-7740 to get review and approval of their forms.

Facility Maintenance Guidelines

This section contains specific procedures for each type of maintenance activity.² These documents should be used for guidance in developing a site-specific O&M Plan under the Presumptive Approach or Performance Approach.

Maintenance Activity	Page
Sediment and Oil Removal and Disposal	3-22
Vegetation Management	3-25
Erosion, Bank Failure, and Channel Formation	3-28
Structural Repairs or Replacement	3-29
Ponding Water	3-30
Pests	3-31
Pollution You Can See or Smell	3-33
Safety	3-34
Paying for Maintenance	3-35

² These procedures are excerpted directly from BES's *Operations & Maintenance for Private Property Owners* (Publication WS 0646).

SEDIMENT AND OIL REMOVAL AND DISPOSAL

FACILITIES AND SYSTEM COMPONENTS THIS APPLIES TO

- **Vegetated facilities:** ecoroofs, infiltration basins, planters, ponds, sand filters, swales, trees, vegetated filters, and wetlands.
- **Structural facilities:** catch basins, curb cuts, inlets, manufactured facilities, piping, sedimentation manholes, and vaults.
- **Underground infiltration facilities:** soakage trenches and drywells.
- Pervious pavement

IMPORTANCE TO FACILITY PERFORMANCE

The purpose of a stormwater treatment facility is to remove pollutants, including suspended solids, by capturing sediment. Sediment can include dirt, leaves, and litter. These materials can restrict or clog the facility. Timely removal of sediment will improve infiltration rates and water quality and prevent clogging and flooding.

WHAT TO LOOK FOR

Check the depth of accumulated sediments. Sediment markers can be placed in the facility to help identify depths. Remove sediment when:

Vegetated Facilities:

- Sediment is filled to 30% of capacity (4 inches deep in a vegetated facility),
- Sediment depth is damaging or killing vegetation, or
- Sediment is preventing the facility from draining in the time specified in the O&M Plan.

Structural Facilities:

- At least once a year, or when
- Sediment is filled to 30% of capacity (1½ feet deep in a sediment manhole or 6 inches deep in a vault).

Underground Infiltration Facilities and Pervious Pavement:

• Sediment is preventing the facility from draining in the time specified in the O&M Plan.

WHAT TO DO

Sediment often can be removed by hand. Large facilities and underground facilities will need to be cleaned with heavy equipment by trained professionals.

• Remove sediment during dry months when it is easier to remove, weighs less, and creates fewer secondary environmental impacts (such as wet sediment running off the site).

Note: It is illegal to hose sediments through your system.

SEDIMENT AND OIL REMOVAL AND DISPOSAL (continued)

WHAT TO DO (continued)

Vegetated Facilities:

- Use rakes and shovels to dig out accumulated sediment.
- Avoid damage to existing vegetation.
- If sediment is deep, plants may need to be removed in order to excavate sediment.
- Reseed and mulch disturbed areas to prevent erosion.
- Excavate sand or gravel and clean or replace.

Structural Facilities, Soakage Trenches, and Pervious Pavement:

- Catch basins: Clean debris off the grate and bars. Lift the grate and use a bucket to remove water and a shovel to dig out sediment.
- Curb cuts, piping, and other conveyance facilities: Use a shovel, router, air hose, or other dry method to clear sediment and debris.
- Soakage trenches: Excavate sand or gravel and clean or replace.
- Pervious pavement: Remove accumulated sediment from the surface with a dry broom, vacuum system, or other hand tools.

HIRING PROFESSIONALS

Cleaning certain facilities will require professional assistance:

- Underground facilities, such as manholes, drywells, and manufactured facilities, must be cleaned by a vactor truck. Do not enter these facilities. They are defined by the Oregon Occupational Safety and Health Division as confined spaces and require proper certification to enter.
- Certain components, such as collection basins, piping, or pervious pavement systems, may require vacuuming with a vactor truck or street sweeping equipment.

DISPOSAL

When deciding how to dispose of sediment, consider the types of activities and pollutants onsite. Sediment from commercial or industrial sites is usually not considered hazardous waste. However, as the generator of this waste, you are responsible for deciding how to properly manage the removed solids.

Contaminated Water and Sediment

Catch basins and stormwater facilities in areas used for chemical or hazardous waste storage, material handling, or equipment maintenance may collect the chemicals used in these activities from spills or via stormwater runoff. If you observe an oily sheen, odors, discoloration, or other signs of pollution, hire a

SEDIMENT AND OIL REMOVAL AND DISPOSAL (continued)

Contaminated Water and Sediment (continued)

professional laboratory or sampling firm to assess whether the material needs specialized hauling, treatment, or disposal to comply with Oregon State Department of Environmental Quality (DEQ) rules. If you need assistance deciding whether the solids should be managed as hazardous waste, contact DEQ.

Non-Contaminated Water and Sediment

Dispose of the water in a sanitary sewer through a shop drain, sink, toilet, or other appropriate drain. If the pollutant load is non-hazardous, water may also be spread across onsite vegetation. Let the solids dry out, then properly dispose of them. Temporary erosion control measures may be needed to contain the material onsite. Dry materials may be reused elsewhere on your site, may be eligible for reuse by others, or can be disposed of at a designated solid waste facility.

REDUCING SEDIMENT ACCUMULATION AND POLLUTION IN THE FACILITY

- Minimize outside sources of sediment, such as eroding soil upstream of the facility.
- Sweep paved areas on the property regularly.
- Make sure chemical and waste storage areas are not exposed to rainfall and stormwater runoff.
- Do not let water from washing vehicles or equipment drain to the stormwater facility.

ADDITIONAL RESOURCES

Catch basin cleaning, material handling, and other best management practices:

Bureau of Environmental Services, Industrial Stormwater Section www.portlandonline.com/bes/index.cfm?c=34618

Hazardous waste:

DEQ 503-229-5913, email hw@deq.state.or.us, www.deq.state.or.us/wmc/hw/hw.htm

Sediment removal:

Look in yellow pages under "Sewage" or "Waste Disposal."

VEGETATION MANAGEMENT

FACILITIES THIS APPLIES TO

• **Vegetated facilities:** ecoroofs, infiltration basins, planters, ponds, sand filters, swales, trees, vegetated filters, and wetlands.

IMPORTANCE TO FACILITY PERFORMANCE

Plants play an important role in stormwater facilities. They absorb water, improve infiltration rates of soil, prevent erosion by stabilizing soil, cool water, and capture pollutants. Plants create habitat for birds and other wildlife and provide aesthetic value to a property. Proper maintenance of vegetation improves the appearance and performance of facilities.

WHAT TO LOOK FOR

When identifying maintenance needs, it is helpful to have a copy of the landscape plan; this shows the required plants for the facility. Facilities should be checked for maintenance needs quarterly for the first 2 years and twice a year after that.

A facility needs maintenance when:

- Areas of soil are bare.
- Vegetation is buried by sediment.
- Vegetation appears unhealthy or has died.
- Nuisance and invasive plants are present.
- Vegetation is compromising the facility's structure by blocking inlets or outlets, or roots are intruding into a component of the facility.
- Dropped leaves and other debris are contributing to sediment accumulation or are blocking inlets or outlets.

WHAT TO DO

Maintenance activities can easily be incorporated into existing site landscape maintenance contracts. Vegetation can be maintained with a formal or more natural appearance, depending on your preference.

General Maintenance

- Remove dropped leaves, dead plants, and grass and other plant clippings. Plant debris adds nutrient pollution as it breaks down and can clog facility piping and reduce infiltration.
- Avoid using fertilizers, herbicides, or pesticides in the facility. These products add to the pollution problems the facilities are designed to remedy.

VEGETATION MANAGEMENT (continued)

General Maintenance (continued)

- Use mulch to inhibit weed growth, retain moisture, and add nutrients. Replenish when needed. Ensure that mulch does not inhibit water flow in the flow path.
- Irrigate all new plantings as needed for the first 2 years.

Caring for Wanted Vegetation

Facility owners are responsible for maintaining healthy vegetation and must replace any plants that have died or been removed.

- You are required to maintain vegetation to the density approved on your landscape plan or specified in the facility description in **Chapter 2**.
- Replant with vegetation approved for use in the original planting plan or from the recommended plant list in **Appendix F.4**.
- Plant in late fall or early spring so plant roots can establish during the cool, rainy seasons, before summer.
- Amend, aerate, and/or till compacted soils before replanting by adding compost to increase nutrients and enhance soil texture.
- If plants are not surviving, determine the reason for the plant die-off. Survivability may be improved by planting vegetation better suited for the site conditions or by irrigating more. You may need to test planting bed soils for pH, moisture, and other factors such as nutrient levels, soil structure, and organic matter content.
- Grassy facilities are designed for routine mowing. Mow at least twice a year.
- Grass should be mowed to keep it 4 to 9 inches tall.
- Grass that is at least 4 inches tall captures more pollutants and is hardier. Grass over 10 inches tall is considered a nuisance by City regulations.

Nuisance and Unwanted Vegetation

- Remove nuisance and invasive vegetation such as Himalayan blackberry, English ivy, and reed canarygrass before it goes to seed in the spring. Do additional weeding in the fall. A list of nuisance plants can be found in the Portland Plant List. (See Additional Resources, below.)
- Immediately remove vegetation that is clogging or impeding flow into the facility.
- Remove potentially large and deep-rooted trees or bushes when they might impede the flow path or compromise facility structures.
- Provide erosion control on any dirt exposed by vegetation removal.

VEGETATION MANAGEMENT (continued)

Wildlife

Vegetated facilities create habitat, especially for birds. The Migratory Bird Treaty Act protects all native bird species. Birds and other animals will generally adjust to human activity. However, there are simple measures that should be taken to avoid disturbance:

• Walk the site before you do maintenance. Look for nests, burrows, and animals in the facility. Reroute around animal areas by at least a few yards.

ADDITIONAL RESOURCES

City of Portland resources:

Naturescaping courses, native and invasive plant posters: www.portlandonline.com/bes/index.cfm?c=dcbec

Environmental Services Watershed Revegetation Program: www.portlandonline.com/bes/index.cfm?c=dffci

Portland Plant List (native and nuisance plants) www.portlandonline.com/shared/cfm/image.cfm?id=58951

Plant identification:

Native Plant Society: 503-460-3198 www.npsoregon.org/ Master Gardeners: www.orst.edu/extension/mg/

Native plant nurseries:

Plant Native: www.plantnative.org

EROSION, BANK FAILURE, AND CHANNEL FORMATION

FACILITIES THIS APPLIES TO

• **Vegetated facilities:** ecoroofs, infiltration basins, planters, ponds, sand filters, swales, trees, vegetated filters, and wetlands.

IMPORTANCE TO FACILITY PERFORMANCE

Stormwater flowing through a facility can cause erosion. Erosion can increase sediment buildup, clog outlets, reduce water quality benefits, add to pollution, and cause facility components to fail. Eroded channels create an easy path for water to travel down, reducing the ability of the facility to filter pollutants and infiltrate water.

WHAT TO LOOK FOR

Any area with erosion more than 2 inches deep needs maintenance. Signs of erosion and common locations are:

- The formation of flow-restricting channels in the bottom of the facility, around inlet pipes and curb cuts, or at overflows.
- Undercutting, scouring, and slumping along banks or berms.
- Channels and undercutting through check dams. (Check dams are small berms built across a facility to slow water and create small areas of ponding.)

WHAT TO DO

- Fill the eroded area with soil, compact it lightly, and cover with mulch, compost, seed, sod, or other erosion prevention materials.
- Plant banks with deep or heavily rooted plants to permanently stabilize soil.
- Plant the bottom of the facility with grass or grass-like plants to slow water and stabilize soil.
- Install or repair structures designed to dissipate energy and spread flow, such as splash blocks on downspouts, or riprap around inlet pipes and curb cuts.
- Install temporary erosion prevention and sediment control measures in accordance with the *City of Portland Erosion Control Manual* until the problem is resolved and permanent measures are fully established.
- If erosion continues to be a problem, consult a professional to determine the cause and a solution.

STRUCTURAL REPAIRS OR REPLACEMENT

FACILITIES THIS APPLIES TO

Most stormwater facilities have some structural components. Some facilities, such as vaults, drywells, and sediment manholes, are completely structural. In vegetated facilities, structural components often control how water enters, travels through, or exits a facility. Common structural components include:

- Inflow and outflow pipes, curb cuts, and trenches
- Valves, orifices, trash racks, and pipes
- Concrete, metal, and plastic structures and components such as curbs, retaining walls, manholes, drywells vaults, and filters
- Earthworks such as embankments, check dams, dikes, berms and side slopes
- Riprap and other flow-spreading elements
- Access roads, gates, and signs

IMPORTANCE TO FACILITY PERFORMANCE

These elements need to be in good working order to route flows into a facility and for the facility to function properly.

WHAT TO LOOK FOR

Look at the general condition of these elements. Do they need repair or replacement? Are they still properly aligned? Look for:

- Cracks, scratches, dents, rust, or other conditions of wear.
- Loose fittings, broken or missing components.
- Insufficient oil/grease for moving parts.
- Appropriate gravel cover or bedding to support the structures.
- Misaligned parts or other impediments to the component's ability to still pass flow and contain sediment.

MAINTENANCE

- Immediately repair or replace any major damage to prevent catastrophic failure. This includes any structural component that is cracked, loose, or askew. You may need to consult a professional engineer or hire a trained contractor to design and perform any repairs.
- Minor damage, such as dents or rust spots, may not need immediate replacement, but should be monitored.

Maintain access to the facility by keeping the access route open and structurally sound, fence gates and vault lids oiled, and locks functioning. Access must be available in an emergency.

PONDING WATER

FACILITIES THIS APPLIES TO

- **Vegetated facilities:** dry ponds, infiltration basins, planters, sand filters, swales, and vegetated filter strips.
- Underground infiltration facilities: soakage trenches and drywells.
- Structural facilities: manufactured facilities and pervious pavement.

Note: Some facilities are specifically designed to always hold water, such as wet ponds, spill control manholes, and sedimentation manholes.

IMPORTANCE TO FACILITY PERFORMANCE

Most facilities are designed to drain in a certain amount of time. This varies from 2 to 48 hours, depending on the type of facility. This time is stated in the facility design description in **Chapter 2** and in the O&M Plan. Ponding water for over 48 hours is usually a sign that the facility's outlet is clogged or the facility is not infiltrating properly.

WHAT TO LOOK FOR

- Clogging of overflows or outlets with debris, trash, or other obstructions.
- Fine sediments filtering into the soil or other filtration media (such as sand or gravel) that can prevent proper infiltration.
- Water that has remained ponded for more than 48 hours.

MAINTENANCE

- For surface facilities, first try raking the top few inches of soil to break up clogged sections and restore water flow.
- Clean out overflows and outlets with hand tools, if possible. Difficult or hard-to-access blockages may require a professional contractor.
- Identify sources of sediment and debris to prevent them from entering the facility. Simple actions such as sweeping a parking lot regularly can keep sediment out of facilities.
- Make sure the facility has enough vegetation. Vegetation absorbs water, and roots help keep soil loose so it can infiltrate water.

For more thorough instructions on removing sediment, see Sediment and Oil Removal and Disposal, above. Sediment accumulated in stormwater facilities may be considered hazardous waste and must be handled and disposed of properly. If ponding still occurs, contact a landscape architect or engineer for more assistance.

FACILITIES THIS APPLIES TO

• All types of facilities.

IMPORTANCE TO FACILITY PERFORMANCE

Mosquitoes can breed in ponded or other stagnant water. Vegetated areas can be attractive habitat for rats, nutria, beaver, and a variety of birds and amphibians. While some species are desirable, others can be public health or nuisance concerns. In particular, mosquitoes and rats can breed quickly and cause a public health hazard if not removed. The presence of pests does not necessarily impact the ability of your facility to treat and manage stormwater, but may indicate maintenance needs, such as lack of proper infiltration.

WHAT TO LOOK FOR

- Check for mosquito larvae in any system with open, slow, or non-moving waters, especially during warmer weather. Larvae look like tiny wiggling sticks floating perpendicular to the water's surface.
- Look for nutria, rat, and other animal droppings year round. Also check for structural indicators such as beaver dams and rodent holes and burrows.

WHAT TO DO

Mosquitoes

- The best way to avoid breeding mosquitoes is to prevent ponding water. Mosquitoes need standing water to lay their eggs and for their larvae and pupae to develop. Most stormwater facilities are designed to drain in at least 48 hours. If your facility is not draining properly, see Ponding Water and Sediment and Oil Removal and Disposal, above.
- As a temporary control for mosquitoes, the county or other licensed professionals can apply pesticides to kill mosquito larvae in the water or adult insects in the air.
- Enclosed facilities, such as ponds, may be eligible to receive gambusia fish (also known as mosquito fish) from the county. Gambusia feed on mosquito larvae. See Additional Resources, below, for contact information.

Rats

Rats need shelter, food, and water to survive.

- Remove plant debris that may provide shelter for rats from the facility.
- Remove fruits and nuts that fall to the ground.
- Fill in burrows.
- Contact Multnomah County Vector Control for trapping and removal.

PESTS (continued)

Other Wildlife

Other non-native and invasive animal species may take up residence in your facility. Contact the Oregon Department of Fish and Wildlife (ODFW) to help identify these species and suggest removal processes. Permits from ODFW are required to capture and relocate native wildlife.

Some common non-native species are:

- Opossum
- Fox squirrel
- Eastern cottontail
- Bullfrog

- NutriaRed-eared slider turtle
- Eastern gray squirrel
- Egyptian goose
- Snapping turtle

ADDITIONAL RESOURCES

Rats and mosquitoes:

Multnomah County Vector Control Online: www.mchealth.org/vector Phone: 503-988-3464 email: vector.nuisance@co.multnomah.or.us

Other wildlife:

Oregon Department of Fish and Wildlife Online: www.dfw.state.or.us/wildlife/ Main Phone 503-947-6000 or 800-720-ODFW (6339)

POLLUTION YOU CAN SEE OR SMELL

FACILITIES THIS APPLIES TO

• All types of facilities.

IMPORTANCE TO FACILITY PERFORMANCE

Stormwater facilities often collect a variety of trash and debris. Trash and debris, especially floating debris, can clog pipes or treatment media. It can also cause odors through decay or by collecting spilled or dumped materials. Stormwater facilities are designed to help prevent pollutants from entering rivers and streams. Any visible water quality pollutants may wash out of the facility, spreading the pollution problem.

WHAT TO LOOK FOR

- Check monthly for trash and debris.
- Check for any unusual or unpleasant smells from sources, such as:
 - Natural plant decay or algae
 - A spill or leak (e.g., gasoline or sewage)
- Check for visible pollution, such as:
 - Sheens
 - Turbid (cloudy) water
 - Access
 - Discoloration
 - Other pollutants on the surface of the water

WHAT TO DO

- Regularly remove trash and plant debris.
- Remove accumulated sediment. (See Sediment and Oil Removal and Disposal, above.)
- Make sure inlets and outlets are not clogged.
- Identify the source of trash, debris, or pollutants, such as a spill, leak, or illicit discharge. Store hazardous material under cover. Ensure garbage bins are closed on solid waste containers.
- If there is evidence of a spill or leak, contact a professional laboratory or sampling firm to assess whether the material needs specialized removal, treatment, and disposal. Use trained professional staff for any cleanup and remediation.

SAFETY

In addition to keeping the facility in good working order, maintenance should also strive to meet safety and aesthetic goals that benefit the community and protect site workers. Consider establishing maintenance triggers and practices that respond to the following issues. Keep in mind the safety of both the employees who maintain the facility and the general public.

WHAT TO LOOK FOR

Site Conditions

Conditions such as steep slopes, slick surfaces, covers in disrepair, and vegetation debris can create a falling hazard to employees and visitors.

Public Safety

Some facilities, such as ponds and wetlands, can be "attractive nuisances" that attract undesirable activity, vandalism, or use that could be harmful to public safety. Consider the safety features now in place at the facility.

WHAT TO DO

- Use barrier plantings or fencing to bar entry into the facility area.
- Install road bollards, lighting, and signage to discourage illegal dumping.
- Avoid maintaining facilities in wet weather to reduce the risk of injuries from slipping. Always make sure that appropriate safety gear (e.g., harness, gloves, face shields, safety line) is used.
- For underground facilities, avoid entering anything defined as a confined space. Vaults, deep ponds, manufactured facilities, or manholes are examples of confined spaces. These areas require special permits, training, and entry techniques. Some can be inspected and cleaned from above without entering. Always use caution when working with underground facilities. You are legally required to meet Oregon Occupational Safety and Health Division (OR-OSHA) requirements for such activities.

Note: Remember that any modifications made to the facility must also be addressed in the site's *O&M Plan.*

ADDITIONAL RESOURCES

Confined space entry:

OR-OSHA (confined space entry requirements) 503-229-5910 www.orosha.org/subjects/confined_spaces.html

PAYING FOR MAINTENANCE

Specific maintenance costs depend on the characteristics of the facility, the site, and the area draining to the facility. The general rule of thumb is that annual maintenance costs will be 5 to 10 percent of the facility's total capital cost. Routine, scheduled maintenance can help keep overall costs down by addressing problems before they require major attention.

FINANCING MAINTENANCE

Clearly designate the entity responsible for long-term operations and maintenance.

Determine how to finance maintenance needs. A facility maintenance fund is recommended for both capital maintenance procedures (e.g., facility replacement and non-routine maintenance such as sediment removal, facility component repair or replacement, major replanting, or safety structure construction) and operating maintenance procedures (routine activities such as facility inspection, debris removal, and vegetation management). For homeowner associations, this could be a portion of homeowner fees or a specific assessment.

HOW MUCH TO SAVE

- An average of 5 to 10 percent per year of the facility's capital cost for annual routine maintenance.
- A percentage of the non-routine maintenance costs per year (e.g., for sediment removal, vegetation replacement), based on the needed frequency. For example, if the facility is designed to need mechanical sediment removal every five years, 20 percent of the total cost should be put aside each year.
- An additional 3 to 5 percent of the facility's capital cost per year for eventual facility replacement (based on the facility's life expectancy). Most of these facilities have a life expectancy of 25 to 50 years.

Vegetated Facilities

- Most required routine maintenance (excluding major repair and replacement) is estimated to have an annual cost of \$200 to \$600 dollars per acre of facility, above current landscape maintenance costs. Costs can vary, depending on the types and level of maintenance practices used.
- The cost and intensity of maintenance activities are usually higher during the 2-year plant establishment period. During that time, plants will need additional watering, and plants that die will need to be replaced.

Stormwater Operations & Maintenance Plan Ulysses S. Grant Middle School 2008 Gym with Parking and Play Area Expansion

February 29, 2008

Prepared by: Mr. Consultant Project Manager Stormwater Consulting LLC Portland, OR 97222

RESPONSIBILITY

The facility is to be maintained by Portland Public Schools. The preparer has worked closely with PPS personnel to design a system that can be easily maintained by maintenance staff and as educational projects for students.

PPS contact is Jane Doe, PPS Maintenance Manager, (503) 555-0884.

A copy of the O&M Plan shall be provided to all property owners and tenants.

DESCRIPTION

All of the runoff from the new gym rooftop will infiltrate into the ground through onsite swales and basins or overflow to an existing drywell. Water from the parking lot and paved areas will be treated by an infiltration planter with maximum infiltration; overflow will be directed to the combined sewer overflow. *See attached site plan.*

Facility Name	Туре	Size (sf)	Area Treated	IA Treated (sf)	Discharge Point
SW - A	Swale	360	Roof	3,000	Infiltration with overflow to trench – B
TR – B	Infiltration trench	100	Roof	3,000	Overflow from SW- A
BA – C	Basin	300	Roof	2,400	Infiltration with overflow to existing drywell
PL – D	Infiltration planter	250	Parking lot	3,200	Infiltration with overflow to sewer
PL – E	Flow- through planter	150	Playground	2,200	To sewer
PP - F	Pervious pavers	1,200	Playground & parking	1,200	Infiltration

FACILITIES DESCRIPTION TABLE

- Infiltration planters are landscaped reservoirs used to detain and filter stormwater runoff, allowing pollutants to settle and filter out as stormwater infiltrates into the ground. Higher flows are allowed to overflow the planter and flow to a trench.
- Flow-through planters are landscaped reservoirs used to detain and filter stormwater runoff, allowing pollutants to settle and filter out as stormwater percolates through the growing medium and landscaped area. Water is collected from the base and directed to the sewer. Higher flows are allowed to overflow the planter and flow to the combined sewer.
- Swales are vegetation-lined depressions with a longitudinal slope. They are used to detain, filter, and infiltrate stormwater. They are also used to direct stormwater away from the foundation and to the trench through two vertical 4-inch overflow pipes.
- * Basins are vegetation-lined depressions used to detain, filter, and infiltrate stormwater. The basin is sized to infiltrate all of the water directed to it, but it does have two vertical 4-inch overflow pipes directed to an existing drywell.
- Permeable pavers are a pervious pavement with an underlying stone reservoir that temporarily stores and treats surface runoff, with final discharge through infiltration.
- * Infiltration trenches are excavated areas lined with filter fabric, filled with gravel, and covered; water is piped to the top of the gravel lens. The trench detains the stormwater and allows for full infiltration.

INSPECTION/MAINTENANCE SCHEDULE

Each part of the system shall be inspected and maintained quarterly and within 48 hours after each major storm event. For this O&M Plan, a major storm event is defined as 1.0 inches of rain in 24 hours or more. All components of the storm system as described above must be inspected and maintained frequently or they will cease to function effectively. The facility owner shall keep a log, recording all inspection dates, observations, and maintenance activities. Receipts shall be saved when maintenance is performed and there is record of expense.

INSPECTION / MAINTENANCE PROCEDURES

The following items shall be inspected and maintained as stated:

Planters and Swales

- Vegetation or roots from large shrubs and trees that limit access or interfere with planter operations shall be prevented.
- Fallen leaves and debris from deciduous plant foliage shall be raked and removed biannually.
- Nuisance and prohibited vegetation of all species shall be removed biannually. Invasive vegetation shall be removed and replaced.
- Dead vegetation shall be removed to maintain less than 10% of area coverage or when planter function is impaired. Vegetation shall be replaced within 3 months or immediately if the season is appropriate in order to maintain cover density and control erosion where soils are exposed.
- The infiltration planter shall infiltrate within 48 hours after a storm event. If water continues to pond after that time, sources of possible clogging shall be identified and corrected. If necessary, the top layers shall be tilled and amended with compost; if this is not sufficient, they shall be removed and replaced with new freely draining growing medium.
- Inlets and outlets shall be inspected quarterly and after any large rain even.
- Any trash or debris that collects in the planter and may inhibit planter function shall be removed quarterly.

Permeable Pavers

- Vegetation, large shrubs, and trees that limit access or interfere with porous pavement operations shall be pruned.
- Vacuum sweeping of the pavers and the area draining to the pavers shall be implemented.
- More aggregate material shall be added to refill drainage voids in pavers if necessary after cleaning.
- Leaves and debris shall be raked and removed biannually.
- Poisonous, nuisance, dead, or odor-producing vegetation shall be removed.
- Pavers or pavement settling more than ¹/₂ inch or visible damage shall be replaced or repaired.

Catch Basins, Trench Drains, and Piped Storm System

- Sediment shall be removed biannually.
- Debris shall be removed from inlets and outlets quarterly.
- Quarterly inspection for clogging shall be performed.
- Grates shall be tamper proof.

Source Control measures prevent pollutants from mixing with stormwater. Typical non-structural control measures include raking and removing leaves, street sweeping, vacuum sweeping, and limited and controlled application of pesticides, herbicides, and fertilizers.

- Source control measures shall be inspected and maintained quarterly.
- Signage shall be maintained.

Spill Prevention measures shall be exercised when handling substances that can contaminate stormwater. Virtually all sites, including residential and commercial, present dangers from spills. It is important to exercise caution when handling substances that can contaminate stormwater. Activities that pose the chance of hazardous material spills shall not take place near collection facilities.

- The proper authority and the property owner shall be contacted immediately if a spill is observed.
- A spill kit shall be kept near spill-prone operations and refreshed annually.
- Employees shall be trained on spill control measures.
- Shut-off valves shall be tested quarterly.
- Releases of pollutants shall be corrected within 12 hours.

Insects and Rodents shall not be harbored in any part of the storm system.

- Pest control measures shall be taken when insects/rodents are found to be present. Standing water and food sources shall be prevented.
- If sprays are considered, a mosquito larvicide such as Bacillus thurendensis or Altoside formulations can be applied only if absolutely necessary and shall not be used where it will enter groundwater or come into contact with any standing water. Sprays shall be applied only by licensed individuals or contractors.
- Holes in the ground located in and around the storm system shall be filled.
- Outfalls draining into vegetated swales shall be inspected and cleaned regularly to ensure no rodent activity, which can clog or decrease the efficiency of the storm system.

Access shall be maintained for all facilities so operations and maintenance can be performed as regularly scheduled.

• Existing drywells shall be raised with a locking manhole cover to ensure access.

SAMPLE STORMWATER FACILITY MONITORING LOG

- **Infiltration/Flow Control** All facilities shall drain within 48 hours. Time/date, weather, and site conditions when ponding occurs shall be recorded.
- **Pollution Prevention** All sites shall implement best management practices to prevent hazardous wastes, litter, or excessive oil and sediment from contaminating stormwater. Contact Spill Prevention & Citizen Response at 503-823-7180 for immediate assistance with responding to spills. Record time/date, weather, and site conditions if site activities are found to contaminate stormwater.
- **Vectors** (mosquitoes and rodents) Stormwater facilities shall not harbor mosquito larvae or rats that pose a threat to public health or that undermine the facility structure. Monitor standing water for small wiggling sticks perpendicular to the water's surface. Note holes/burrows in and around facilities. Call Multnomah County Vector Control at 503-988-3464 for immediate assistance with eradicating vectors. Record time/date, weather, and site conditions when vector activity is observed.

Maintenance:

Record date, description, and contractor (if applicable) for all structural repairs, landscape maintenance, and facility cleanout activities.

SAMPLE

Date: 10/1/07 Initia	alBJK
Work performed by: AAA Landscaper under	r 3yr contract
Work performed: Replanted parking lot swa	le with sedges & rushes.

Details: *Work Order on file and available upon request.

Date:	Initials:	
Work performed by:		
Work performed:		
-		_
Details:		
		-
Date:	Initials:	
Work performed by:		
Work performed:		
		_
Detailer		

SAMPLE O&M PLAN FOR PRESUMPTIVE & PERFORMANCE APPROACH

Date: Work performed by:	Initials:	
Work performed:		
Details:		-
		_
Date:	Initials:	
Work performed by:		
		_
Details:		-
·		_
Date:	Initials:	
Work performed by:		
Work performed:		
Details:		-
		_
Date	Initiale	
Date: Work performed by:	Initials:	
Date: Work performed by: Work performed:	Initials:	-
Date: Work performed by: Work performed: Details:	Initials:	
Date: Work performed by: Work performed: Details:	Initials:	-
Date: Work performed by: Work performed: Details:	Initials:	- - - -
Date: Work performed: Work performed: Details: Date:	Initials:	- -
Date: Work performed by: Work performed: Details: Date: Work performed by: Work performed:	Initials:	-
Date: Work performed by: Work performed: Details: Date: Work performed by: Work performed:	Initials:	- - - -
Date: Work performed by: Work performed: Details: Date: Work performed by: Work performed: Details:	Initials:	- - - - -
Date: Work performed by: Work performed: Details: Date: Work performed by: Work performed: Details:	Initials:	- - - -
Date: Work performed by: Work performed: Details: Work performed by: Work performed: Details: Details:	Initials:	- - - - -
Date: Work performed by: Work performed: Details: Work performed by: Work performed: Details: Date: Work performed by:	Initials:	- - - - -
Date: Work performed by: Work performed: Details: Work performed by: Work performed: Details: Date: Work performed by:	Initials:	- - - -
Date:	Initials:	- - - - - - - -

3.4 O&M ENFORCEMENT

The City has the right to ensure site compliance with the recorded O&M Form filed with BES and the county Department of Assessment and Taxation. City Code section 17.38.040.C.2 states:

Failure to properly operate or maintain the water quality or quantity control facility according to the operation and maintenance plan may result in an enforcement action, including civil penalty, as specified in 17.38.045, Enforcement.

The enforcement section of City Code authorizes BES right of entry to the property for inspections of the facility, the ability to issue a code violation, and the ability to take enforcement actions (such as compliance orders, stop work orders, etc.) and levy civil penalties of up to \$500 a day per violation. The details of the BES enforcement process can be found in the stormwater discharge enforcement rules available in the City of Portland policy documents on the City Auditor's Office website at: http://www.portlandonline.com/auditor/index.cfm?c=28044&a=154207

In general, BES inspectors will strive to work with site owners and operators to ensure proper facility operation and maintenance. If technical assistance still does not yield tangible operation or maintenance improvements, however, BES may take enforcement action. BES staff will provide technical assistance every 1 to 5 years. The inspector provides a report addressed to the property owner and/or site manager and follows up on the prescribed corrective action plan (if any) first by telephone and second by written notice.

3.5 O&M REVISIONS

Any proposed revisions or modifications made to an approved O&M Form and site plan requires a **new O&M Form and site plan to be recorded with the county and resubmitted to BES for O&M review and approval**. Facility owners may opt to modify their O&M Form to make it consistent with updated O&M procedures in revised versions of the *Stormwater Management Manual*.

Modifications include changes to the point of discharge, source of runoff, structural or vegetated components. For example, decommissioning a catch basin or drywell or retrofitting a swale to a basin to capture additional roof or lot runoff must be documented via a recorded O&M Form. Owners/managers can send updated site maps and maintenance contacts to BES stormwater staff (ph: 503-823-5559).