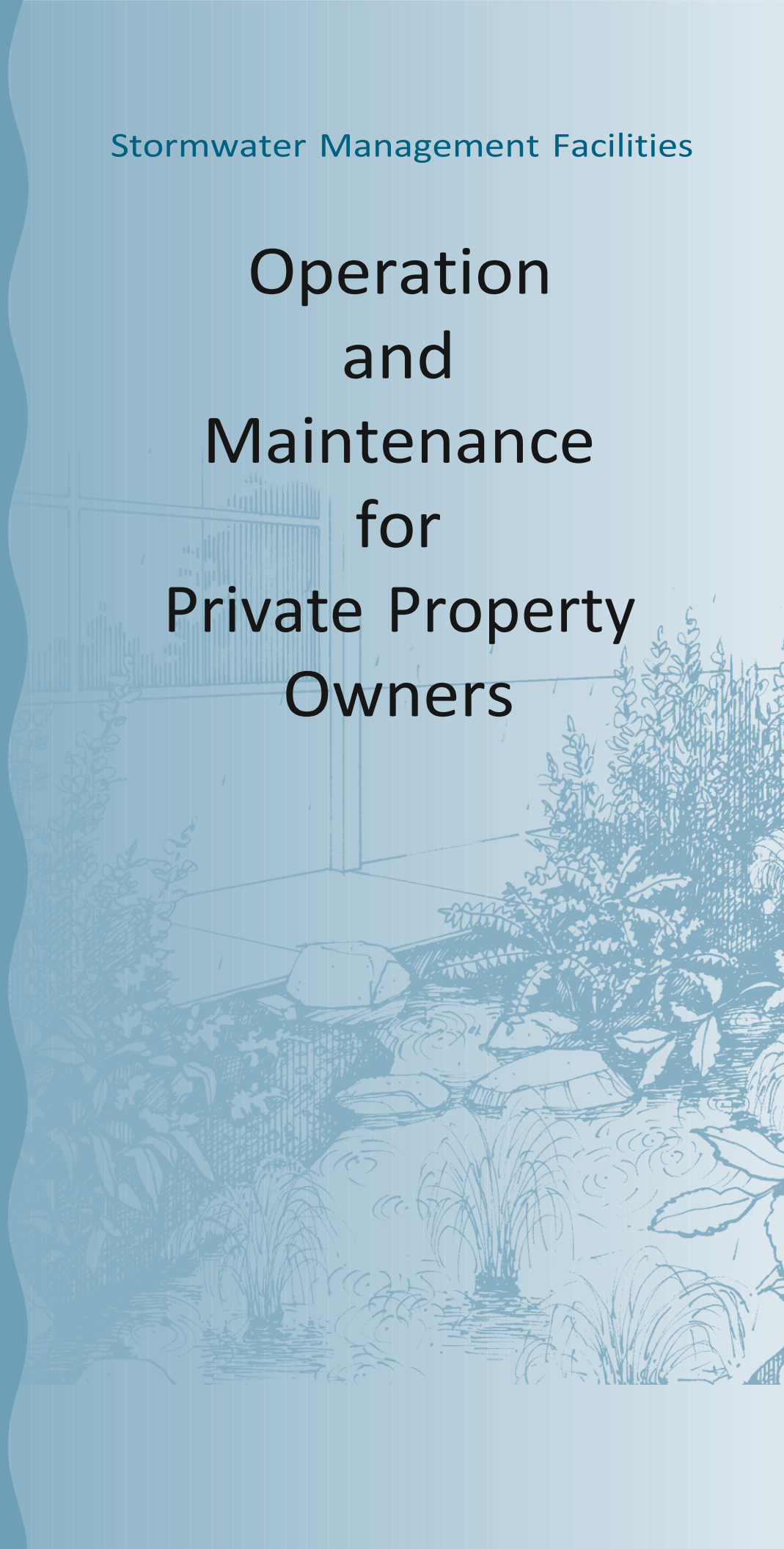


Stormwater Management Facilities

Operation and Maintenance for Private Property Owners



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CARING FOR YOUR FACILITY Thank You

As the owner of a stormwater management facility, you are making a meaningful contribution to the health of West Linn's rivers and streams. This handbook will help you maintain your facility to make sure it performs the work it is designed to accomplish.

What Are Stormwater Management Facilities?

Stormwater facilities are any combination of landscape and structural features that slow, filter, or infiltrate (absorb) runoff on your property after a rainfall. Types of facilities include vegetated systems (planters, swales, ponds, wetlands, etc.), disposal systems (drywells and soakage trenches), and structural systems (W.Q. Manholes, Oil/Water Separators). The common purpose is to control the quality and quantity of stormwater runoff from your site to help safeguard our valuable waterways.

Property Owner Responsibilities

Property owners are legally responsible for inspecting and maintaining the stormwater management facilities on their sites. Required maintenance is outlined in this manual along with providing additional information about what you need to do, why, and how.

Maintenance Agreement

In most cases, a Maintenance Agreement is recorded with the county as part of your property title. If you don't have a Maintenance Agreement for your Stormwater Management Facility, you are required to obtain one through the West Linn Engineering Department (503) 722-5500.

The steps we take today will greatly influence West Linn's environmental health and quality of life for years to come. Individual actions can make a big difference. Thank you for the significant part you and your stormwater management facility are playing.

The Problem with Stormwater Runoff

When it rains in West Linn, the stormwater runs off impervious surfaces (such as roofs and paved areas) instead of soaking into the ground. Conventional stormwater management directs runoff into drains and pipes that carry it offsite and eventually discharge it into a river or stream. This approach has a number of harmful effects:

- Impervious areas generate large volumes of runoff relatively quickly. The increased volume and speed of the runoff can cause flooding and erosion and destroy natural habitat.
- The runoff picks up a variety of pollutants including oil, pesticides, metals, chemicals, and sediment that harm water quality and fish habitat.
- During warm weather, the runoff absorbs heat from impervious surfaces. This increases the temperature of the receiving waters and has negative impacts on fish and other aquatic life.
- Less water is able to infiltrate into the ground. This reduces groundwater recharge, which reduces summer flows in streams.

As West Linn continues to grow and develop, these negative impacts will increase unless we do things differently.

A Better Way to Flow

The City of West Linn and community members are actively pursuing a variety of measures to reduce stormwater impacts. One important approach is to manage stormwater on the property where it originates.

Onsite stormwater management uses processes that mimic nature. Onsite facilities allow runoff to soak into the ground, help filter out pollutants and slow the flow rate of runoff leaving your site. This significantly reduces the volume and pollution levels in stormwater leaving your property and ending up in rivers and streams. Our homes, properties, vehicles, and actions all contribute to the problem of urban runoff. Onsite stormwater management lets us all be part of the solution. Many onsite measures can also provide a variety of other benefits to property owners. For example, vegetated facilities can increase urban wildlife habitat, add aesthetic value to the property and neighborhood, and decrease landscape maintenance and water use.

What Else Is The City Doing?

Onsite management is just one component of a comprehensive citywide program to limit stormwater runoff impacts. Here are some other steps the City is taking:

- The City requires onsite stormwater management for new construction and redevelopment on public and private property.
- Natural areas, especially riparian areas adjacent to rivers and streams, help filter out pollution, control erosion, and provide shade, food, and habitat for fish and wildlife. The City uses a variety of measures to preserve these critical areas, including development restrictions, land use zoning requirements, land and easement acquisition programs.
- The City restores stream banks; constructs facilities to manage the quality and quantity of runoff entering the storm sewer system; and builds, retrofits, or otherwise enhances buildings, roads, parks, and stormwater drainage systems to improve conditions.
- The City continually demonstrates and develops new ways to operate and maintain streets, sewers, and facilities in ways that reduce stormwater impacts.
- In partnership with numerous other organizations, the City provides education, technical assistance aimed at reducing stormwater impacts and promoting watershed health.

The Fish Connection Chinook salmon and steelhead trout in the lower Columbia River and upper Willamette River were listed in 1998 and 1999 as threatened species under the federal Endangered Species Act (ESA). These river systems include all rivers and streams within West Linn. Stormwater runoff has substantial impacts on the water quality and habitat these fish depend on. By reducing those impacts, we are taking direct action on behalf of the threatened species, as well as other fish and wildlife that are under stress.

INSPECTING AND MAINTAINING YOUR FACILITY

Protecting Your Resources

It is essential to maintain your facility so it functions as intended and limits off-site environmental impacts. You are required to check your facility 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. This section identifies general guidelines on what to look for and how to maintain your facility. It also notes non-routine maintenance that may require professional assistance.

Inspection Schedule: How often?

It is recommended that you inspect your facility at least:

- Quarterly for the first two years
- Twice a year thereafter, and
- Within 48 hours of major rainfall events (more than one inch of rain over a 24-hour period). Some inspections are recommended more often, as noted in the following text.

For at least the first two years, you should conduct inspections with the facility drawings to help you understand how the facility is supposed to function. This section will help you recognize signs that indicate diminished performance (for example, sediment accumulation, vegetation die-off, or ponding water for more than 24 hours after a storm).

Inspection and Maintenance Logs

City Code requires you to keep inspection and maintenance logs for your facility. In general, the logs should note inspection dates, the facility components inspected, and any maintenance or repairs made. It is also a good idea to track the rate of sediment accumulation and record visual observations about the facility and its components. We encourage you to use the sample log on the following page. If you have a manufactured facility or have a maintenance contract with the manufacturer, assure that their maintenance logs generally include the same type of information and level of detail.

Facility Inspection and Maintenance Log (one sheet can be used per facility or for an entire site)

Facility Name: _____ Date _____ Inspector's Name _____

(Inapplicable fields shaded out) Fill in percentages or depth numbers when possible.

Facility Component	Trash/Debris	Erosion/Bank Failure/Channel Formation	Sediment Accumulation	Vegetation	Structural Deficiency (list)	Ponding Water	Pests	Odors	Visible Sheen, etc.	Maintenance Action Taken
Access Road/Structure										
Inlet										
Facility Structure										
Sedimentation Facility										
Treatment Media										
Vegetation										
Outlet Orifice										
Bypass Overflow										
Fence, Signs, Valves, etc.										

Other Observations

Sediment Removal and Disposal

This Applies To Vegetated Facilities: Eco roofs, 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

Impact on 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, water quality, and help 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 4" deep,
- 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 the basin is half-full of sediment.

Underground Infiltration Facilities and Pervious Pavement:

- Sediment is preventing the facility from draining in the time specified manufactures guidelines.

What to Do

Often sediment 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.

Doing it yourself - 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, you need to consider the types of activities and pollutants on site. 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 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 vegetation onsite.

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 Your Facility

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

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: Eco roofs, 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 your facility.

What To Look For

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

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.
- Use mulch to inhibit weed growth, retain moisture, and add nutrients. Replenish when needed. Ensure mulch does not inhibit water flow.
- Irrigate all new plantings as needed for the first two 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.
- Replant with vegetation approved for use in the original planting plan.

- Plant in late fall or early spring so plant roots can establish during the cool, rainy seasons, before summer.
- Amend and aerate 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.

Mowing

- Grassy facilities are designed for routine mowing. Mow at least twice a year.
- Grass should be mowed to keep it 4" to 9" tall. Grass that is at least 4" tall captures more pollutants and is hardier. Grass over 10" 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 canary grass, before it goes to seed in the spring. Do additional weeding in the fall. A list of nuisance plants can be found in the West Linn website. 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.

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:

- Avoid maintenance during bird nesting season from early March to late July. Prune and mow during late summer. Many baby birds will spend some time on the ground after leaving a nest.
- 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:

www.clackamas.us/vector/

www.westlinnoregon.gov/publicworks/stormwater

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, Channel Formation

Facilities This Applies To

Vegetated Facilities: Eco roofs, 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 build up, 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 two inches deep needs maintenance. Signs of erosion and common locations:

- 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. See the Public Works Standards on City website for requirements.
- If erosion continues to be a problem, consult a professional to determine the cause and a solution.

Structural Deficiencies

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 and drywells.
- 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.

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 Operations and Maintenance plan for the type of facility. Ponding water is usually a sign that the facility's outlet is clogged or it 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 (like 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 like 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 the "Sediment Removal and Disposal" section of this handbook. 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.

Pests

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 drop-pings 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 mosquitos 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 the "Ponding Water" and "Sediment Removal and Disposal" sections of this handbook.
- 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, like ponds, may be eligible to receive Gambia fish (also known as mosquito fish) from the county. Gambia feed on mosquito larvae. See 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.
- Trap and remove individual animals.

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
- Eastern gray squirrel

- Nutria
- Bullfrog
- Snapping turtle
- Fox Squirrel
- Eastern Cottontail
- Egyptian Goose
- Red-eared Slider Turtle

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)

Email: odfw.info@state.or.us

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.

Any unusual or unpleasant smells from sources such as:

- Natural plant decay.
- Dying plants trapped under sediment.
- A spill or a leak (e.g., gasoline or sewage).

Visible pollution such as:

- Sheens
- Turbid (cloudy) water
- Discoloration, or
- Other pollutants on the surface of the water.

What to Do

- Regularly remove trash and plant debris.
- Remove accumulated sediment (see “Sediment Removal and Disposal” in this handbook).
- Make sure inlets and outlets are not clogged.

- Identify the source of trash, debris or pollutant, such as a spill, leak, or illicit discharge. 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 your 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 your facility and the general public.

What to Look For

Site Conditions

Conditions, such as steep slopes, slick surfaces, 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” attracting undesirable activity, vandalism, or use that could be harmful to public safety. Consider the safety features now in place at your 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 any-thing 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.

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% 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

You need to determine how you will finance your 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 5 to 10% per year of the facility's capital cost for annual routine maintenance.
- A percentage of the non-routine maintenance costs per year (i.e. 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% of the total cost should be put aside each year.
- An additional 3 to 5% 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 two-year plant establishment period. During this time, plants will need additional watering and plants that die will need to be replaced.

O&M Facility Specific Specifications

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

- provide long term guidance on individual stormwater management facility O&M in order to prevent system deterioration and failure
- provide a list of visual indicators to prompt effective maintenance activities necessary to restore optimal performance. The list below is covered in the following pages, along with annual maintenance schedules and corrective actions.

- Trees
- Downspout extension
- Swales
- Basins
- Pervious Pavement
- Water Quality Manholes
- Oil/Water Separators
- Detention Pipes, Vaults, and Tanks

TREES

Maintenance Indicator	Corrective Action
Dead or stressed tree	Replant per original planting plan.
	Irrigate as needed.
	Mulch or amend soil as needed.
	Prune branches and dead limbs or remove clippings.
	Manually remove weeds. Do not use pesticides.

Trees - Annual Maintenance Schedule

All seasons: Mulch or amend soil as needed. Prune tree as necessary to protect sight lines. Irrigate and seed as needed. Inspect trees for damage and disease.

Maintenance Records: All facility operators are required to keep an annual inspection and maintenance log. Record date, description, and contractor (if applicable) for all landscape maintenance. Keep work orders and invoices on file and make available upon request of the City inspector.

Irrigation: Adjust irrigation program or consult a professional to set the system at the correct watering system. Irrigation is required during the establishment period to ensure tree survival. Hand watering is preferred, but a drip irrigation system may also be used.

Pollution Prevention: All sites shall implement best management practices (BMPs) to prevent hazardous wastes from contaminating stormwater. Record the time/date, weather, and site conditions when site activities contaminate stormwater. Record the time/date and description of the corrective action taken.

DOWNSPOUT EXTENSION

<i>Maintenance Indicator</i>	<i>Corrective Action</i>
Clogged gutter or downspouts	Remove sediment, debris, and downspouts, gutters, and pipes to maintain at least 50% conveyance at all times. Recommend cleaning at least twice a year, or more often depending on the presence of overhanging trees.
Damaged or missing pipes, gutters and downspouts	Repair or replace broken gutters and downspouts as needed. Identify possible leaks and verify that roof flashing directs water into gutters. Look for low spots or sagging areas along the gutter line and repair as needed with new hangers.
Blocked downspout extension	Clear any buildup of soil, bark dust, and or vegetative growth from around downspout extension and or splash blocks. Verify that there is sufficient slope so that water flow away from the foundation.

Vegetation shall cover 90% of the receiving area.

Structural Components shall freely convey stormwater.

Dead or Strained vegetation	Replant per original planting plan. Irrigate as needed. Mulch as needed. DO NOT apply fertilizers, herbicides, or pesticides.
Tall grass	Cut back to 4-6 inches, once or twice 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, erosion, and or exposed soils	Fill-in and lightly compact areas of erosion with soil mix. Restore or create splash blocks where necessary.
Scouring at the inlet(s)	Replace splash blocks or inlet gravel/rock.
Ponding	Remove the top 2-4 inches of sediment at the end of the downspout extension and replace with soil mix. Rake, till or amend with soil mix to restore infiltration rate.

Downspout Extension - Annual Maintenance Schedule

Summer: Make structural repairs. Clean gutters and downspouts. Remove any build-up of weeds or organic debris.

Fall: Replant exposed soil and replace dead plants. Remove sediment and plant debris.

Winter: Clear gutters and downspouts to maintain conveyance.

Spring: Remove sediment and plant debris. Replant exposed soil and replace dead plants.

All seasons: Weed as necessary.

Maintenance Records: All facility operators are required to keep an annual inspection and maintenance log. Record the 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 them 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 the time/date, weather, and site conditions when ponding occurs.

Pollution Prevention: All sites shall implement BMPs to prevent hazardous or solid wastes or excessive oil and sediment from contaminating stormwater. Record the time/date, weather, and site conditions if site activities contaminate stormwater. Record the time/date and description of corrective action taken.

SWALES

<i>Maintenance Indicator</i>	<i>Corrective Action</i>
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.
Broken inlets or outlets	Repair or replace broken downspouts, curb cuts, standpipes, and screens as needed.
Cracked or exposed drain pipes	Repair/seal cracks. Replace when repair is insufficient. Cover with 6 inches of growing medium to prevent freeze/thaw and UV damage.
Check Dams missing, scattered or with gaps	Maintain rock check dams as per standard details.
Vegetation shall cover 75% of facility.	
Dead or Strained vegetation	Replant per original planting plan. Irrigate as needed. Mulch as needed. DO NOT apply fertilizers, herbicides, or pesticides.
Tall grass and vegetation	Prune to allow sight lines and foot traffic. Prune to ensure inlets and outlets freely convey stormwater into and out of facility.
Growing/Filter Medium, including soil and gravels, shall sustain healthy plant cover and infiltrate within 48 hours.	
Erosion and or exposed soils	Fill-in and lightly compact areas of erosion with soil mix. Stabilize soils with plants.
Scouring at the inlet(s)	Replace splash blocks or inlet gravel/rock.
Ponding	Remove the top 2-4 inches of sediment at the end of the downspout extension and replace with soil mix. Rake, till or amend with soil mix to restore infiltration rate.
Slope slippage	Stabilize 3:1 slopes/banks with plantings.

Swales - 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 as needed, but do not block the inlets, outlets, or flow path with mulch.

All seasons: Weed as necessary.

Maintenance Records: All facility operators are required to keep an annual inspection and maintenance log. 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 BMPs to prevent hazardous or solid wastes or excessive oil and sediment from contaminating stormwater. Record the time/date, weather, and site conditions if site activities contaminate stormwater. Record the time/date and description of corrective action taken.

BASINS

<i>Maintenance Indicator</i>	<i>Corrective Action</i>
Clogged inlets or outlets	Remove sediment and debris from catch basins, drains, curb inlets, and pipes to maintain 50% conveyance at all times
Broken inlets or outlets, including grates	Repair or replace broken downspouts, curb cuts, standpipes, and screens as needed.
Cracked or exposed drain pipes	Repair/seal cracks. Replace when repair is insufficient. Cover with 6 inches of growing medium to prevent freeze/thaw and UV damage.
Check dams	Maintain rock check dams per design standards.
Vegetation shall cover 90% of the facility	Plant per original planting plan, or substitute from plant list.
Tall grass and vegetation	Prune to allow sight lines and foot traffic. Prune to ensure inlets and outlets freely convey stormwater into and/or out of the facility.
Weeds	Manually remove weeds.
Growing/Filter Medium, including soil and gravels, shall sustain healthy plant cover and infiltrate within 48 hours.	
Erosion and or exposed soils	Fill-in and lightly compact areas of erosion with soil mix. Stabilize soils with plants.
Scouring at the inlet(s)	Replace splash blocks or inlet gravel/rock.
Ponding	Remove the top 2-4 inches of sediment at the end of the downspout extension and replace with soil mix. Rake, till or amend with soil mix to restore infiltration rate.
Slope slippage	Stabilize 3:1 slopes/banks with plantings.

Structural Components shall freely convey stormwater.

Basins - 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 as needed, but do not block the inlets, outlets, or flow path with mulch.

All seasons: Weed as necessary.

Maintenance Records: All facility operators are required to keep an annual inspection and maintenance log. 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 BMPs to prevent hazardous or solid wastes or excessive oil and sediment from contaminating stormwater. Record the time/date, weather, and site conditions if site activities contaminate stormwater. Record the time/date and description of corrective action taken.

PERVIOUS PAVEMENT

<i>Maintenance Indicator</i>	<i>Corrective Action</i>
Clogged surface	Vacuum or dry sweep at least twice a year.
Unraveling or settled pavement	Repair per manufacturer specifications. Do not apply sealants to pervious pavement.
Vegetation	Sweep leaf litter and sediment to prevent surface clogging and ponding.
Large shrubs or trees	Prevent large root systems from damaging subsurface structural components.
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	Replace paver pore space with aggregate per original design.

Pervious Pavement - Annual Maintenance Schedule

Summer: Make necessary structural repairs.

Fall: Vacuum sweep.

Winter: Monitor infiltration rate.

Spring: Vacuum sweep.

All seasons: Weed as necessary.

Maintenance Records: All facility operators are required to keep an annual inspection and maintenance log. 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 the time/date, weather, and site conditions when ponding occurs.

Pollution Prevention: All sites shall implement BMPs to prevent hazardous or solid wastes or excessive oil and sediment from contaminating stormwater. Do not apply, transfer, or store chemicals or fine grained material on pervious pavement. Record the time/date, weather, and site conditions if site activities contaminate stormwater. Record the date/time and description of corrective action taken.

Water Quality Manholes

ONLY professionals with Occupational Safety and Health Administration (OSHA) confined space certification may enter water quality manholes.

Structural Components, including inlets, outlets, concrete chambers, pipes and covers, shall be operated and maintained in accordance with the manufacturer's and design specifications

Maintenance Indicator	Corrective Action
Missing elbow or T	Install elbow or T on outlet.
Hand pull stuck (spill control MH)	Remove rust, dirt, and oils from the pull handle and valve. Remove items blocking the valve and pull handle. Do not use any solvents or chemicals in water quality MH's.
Clogged catch basins, gutters, inlets or pipes	Remove sediment, oil, and debris from catch basins when 1/3 full and from gutters, inlets, outlets and pipes to maintain at least 50% conveyance capacity at all times.
Diminished capacity of manhole	Remove oil, sediment, and debris when sediment is 30% of the capacity or oil is 1 inch deep.
Cracked drain pipe or concrete	Repair with grout or City-approved material or replace when cracks are 1 inch wide or more.
Vegetation, including surface cover and nearby plantings.	
Large shrubs and trees	Prevent large root systems from damaging subsurface structural components.

W.Q. Manholes - Annual Maintenance Schedule

Summer: Make necessary structural repairs. Remove sediment, oil, and debris from conveyance system and manholes.

Winter: Monitor water level and sediment level.

Spring: Test the pull handle of the spill control manhole.

Maintenance Records: All facility operators are required to keep an annual inspection and maintenance log. Record the date and description (and cost and contractor for hired work) for all structural repairs, landscape maintenance, and cleaning activities. Keep contracts and receipts for maintenance work on file and prepare to make available to City inspectors upon request.

Access: Maintenance equipment and labor shall have safe access to facilities at all times.

Oil/Water Separators

<i>Maintenance Indicator</i>	<i>Corrective Action</i>
Clogged catch basins, inlets or pipes	Remove sediment, oil and debris from catch basins when 1/3 full and from gutters, inlets, outlets and pipes to maintain at least 50% of conveyance capacity at all times.
Diminished capacity of coalescing plates or vault	Vector vault when sediment is 4 inches deep or when oil is 2 inches deep or when oil covers 50% of the coalescing plates.
	Close effluent shutoff valve before cleaning facility. Clean coalescing plates upstream or in the facility. Use low pressure, cool temperature, and biodegradable chemicals if necessary.
Saturated absorbent pads or socks	Change absorbent pads or socks when 50% of surface is coated in oil and sediment.
Missing elbow or T	Install elbow or T on outlet.
Cracked pipe or vault	Repair with grout or City-approved material or replace when cracks are 1 inch wide or more.
Vegetation, including surface cover and nearby plantings.	
Large shrubs and trees	Prevent large root systems from damaging subsurface structural components.

Oil/Water Separators - Annual Maintenance Schedule

Summer: Remove sediment, oil, and debris from conveyance system. Make necessary structural repairs.

Fall: Test shutoff valve. Clean vault and/or coalescing plates. Change absorbent pads or socks.

Winter: Monitor.

Spring: Test shutoff valve. Clean vault and/or coalescing plates. Change absorbent pads or socks.

Maintenance Records:

All facility operators are required to keep an annual inspection and maintenance log. Record date, description, and contractor (if applicable) for all structural repairs, landscape maintenance, and facility cleanout activities.

Access: Maintain ingress/egress to design standards.

Detention Pipes, Vaults, and Tanks

Only professionals with OSHA confined space certification should enter below-ground stormwater systems.

Structural Components including inlets, outlets, pipes, vaults, and/or tanks shall be operated and maintained in accordance with the manufacturer and design specifications.

Maintenance Indicator	Corrective Action
Clogged inlets or outlet	Remove sediment, oil and debris from catch basins when 1/3 full and from gutters, inlets, outlets and pipes to maintain at least 50% of conveyance capacity at all times.
Diminished pipe, vault or tank capacity	Remove oil, sediment, and debris when sediment is at 30% capacity or oil is 2 inches deep.
	Close effluent shutoff valve before cleaning facility. Clean coalescing plates upstream or in the facility. Use low pressure, cool temperature, and biodegradable chemicals if necessary.
Cracked pipe or vault or tank	Repair with grout or City-approved material or replace when cracks are 1 inch wide or more.
Vegetation, including surface cover and nearby plantings.	
Large shrubs and trees	Prevent large root systems from damaging subsurface structural components.

Detention Pipes, Vaults, and Tank - Annual Maintenance Schedule

Summer: Remove sediment, oil and debris from conveyance system and pipes, vaults and tanks. Make necessary structural repairs.

Winter: Monitor flow through rate.

Spring: Inspect the pipes, vaults, and tanks for structural concerns and sediment accumulation.

All Seasons: Clean gutters/rain drains as needed.

Maintenance Records: All facility operators are required to keep an annual inspection and maintenance log. Record date, description, and contractor (if applicable) for all structural repairs, landscape maintenance, and facility cleanout activities and mail the information to West Linn Public Works, 4100 Norfolk St. West Linn, OR 97068 Attention: Private Stormwater Facility Program by October 1st.

WHERE TO GET MORE HELP

Go to: westlinnoregon.gov/public-works/stormwater/private-stormwater-facility-program

Spills: 911 or Tualatin Valley Fire & Rescue (www.tvfr.com)

Building permit requirements: www.westlinnoregon.gov/building/building-permit

Other Information Sources

Professional maintenance services phone book references:

Vegetation Management

- “Landscape Contractors”

Sediment Removal and Disposal

- “Sewage,” or
- “Waste Disposal”

Facility Alterations

- “Landscape Architects” or
- “Engineers - Civil”

Manufactured Facilities:

- Find the specific manufacturer

Confined Space Entry

Oregon Occupational Safety and Health Division (OR-OSHA):

503-229-5910, www.orosha.org/subjects/confined_spaces.html

Wildlife and Pests

Clackamas County Vector Control: www.clackamas.us/vector or 503-655-8394

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 Clackamas Vector Control at 503-655-8394 for immediate assistance to eradicate vectors. Record the time/date, weather, and site conditions when vector activity is observed.

Other pest issues

Look in yellow pages under “Pest Control”

Oregon Department of Fish and Wildlife

Information about non-native and invasive animal species and removal processes: 503-947-6000 or 800-720-ODFW [6339], www.dfw.state.or.us/wildlife

Audubon Wildlife Care Center: Help with injured animals and animal identification questions: 503-292-0304, www.audubon.org

Native Plant Nurseries: Plant Native: www.plantnative.com

OTHER WAYS TO PROTECT OUR RIVERS AND STREAMS

There are many other actions you can take to protect our rivers and streams. For more information, call Environmental Services Division at 503-656-6081 or visit www.cleanriverspdx.org

In Your Home or Business

- Use nontoxic cleaners.
- Properly dispose of hazardous materials.
- Conserve energy: switch to compact fluorescent bulbs, turn down the heat, do the laundry with cold water, and purchase energy-efficient appliances.
- Use water wisely: fix leaks, use low-flow showerheads, use only the water you need.

In Your Yard

- Plant native vegetation.
- Consider planting perennials versus annuals.
- Sweep instead of hose.
- Cover bare soil with mulch or plants.
- Compost yard debris.
- Disconnect downspouts (where appropriate).
- Use drip irrigation.

In and Out of Your Car

- Properly maintain vehicles.
- Wash vehicles where water is recycled.
- Drive less: use transit, bike, walk, or carpool.
- Recycle motor oil.
- Clean up spills or leaks.

In Your Community

- Volunteer for tree planting, cleanup, stream restoration, or ivy removal projects.
- Report spills and illegal dumping to Environmental Services Division Chief, Mike Cardwell: (call 503-742-8620).
- Don't litter, and pick up litter when you see it.
- Pick up pet waste and put it in the garbage or toilet.

In Parks and Natural Areas

- Stay on designated hiking trails and biking areas.
- Keep dogs on leashes and away from the stream banks and water. Scoop up after them.

