

Stormwater Facility Maintenance Manual



2022 Edition

For Municipal and Private
Stormwater Facilities

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Guidance and best management practices (BMPs) are referenced from the Ecology 2019 Stormwater Management Manual for Western Washington.

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Regulatory Requirements

The National Pollutant Discharge Elimination System (NPDES) Municipal Phase II Stormwater Permit issued to the City of Bremerton (City) has specific maintenance requirements to improve and protect water quality of receiving waters of the state. These requirements are summarized below with the goal of providing guidance to owners and operators of municipal and private systems.

This summary does not include other sections in the Permit such as S5.C.1, *Stormwater Planning*; S5.C.2, *Public Education and Outreach*; S5.C.3, *Public Involvement and Participation*; S5.C.4, *MS4 Mapping and Documentation*; S5.C.5, *Illicit Discharge Detection and Elimination*; or S5.C.6, *Controlling Runoff from New Development, Redevelopment and Construction Sites*. See SW Permit for details on these sections.

Operations and Maintenance Requirements from the 2019-24 Stormwater Permit

The City of Bremerton shall implement maintenance standards. These standards are in this Operations and Maintenance Guidance manual, "City of Bremerton Storm Maintenance Manual 2019-V3-2205.PDF". The manual was updated in 2019 and in again in May of 2022 to be consistent with the 2019 version of the Stormwater Management Manual for Western Washington (SWMMWW), the adopted stormwater manual.

Maintenance of Stormwater Facilities Owned or Operated by the City of Bremerton

All municipally owned and operated stormwater facilities will be inspected annually, and inspections will be documented. Municipally owned or operated stormwater treatment and flow control BMPs/facilities will be maintained in accordance with the adopted maintenance standards, or as inspections determine and actions will be documented to provide a record of the maintenance performed.

Stormwater treatment and flow control BMPs/facilities will be inspected after major storm events (24-hour storm event with a 10 year or greater recurrence interval). If spot checks indicate widespread damage/maintenance needs, inspect all stormwater treatment and flow control BMPs/facilities that may be affected. Conduct repairs or take appropriate maintenance action in accordance with maintenance standards established below, based on the results of the inspections. These inspections need to be documented in NPDES Pro or GIS.

Inspect all catch basins and inlets owned or operated by the City **every two years**. Clean catch basins if the inspection indicates cleaning is needed to comply with maintenance standards in this manual. Decant water shall be disposed of in accordance with Appendix 6 - Street Waste Disposal, of the 2019 Western Washington Phase II Municipal Stormwater Permit (see Attachment 3).

The following alternatives to the standard approach of inspecting all catch basins every two years may be applied to all or portions of the system:

- (a) The catch basin inspection schedule of every two years may be changed as appropriate to meet the maintenance standards based on maintenance records of double the length of time of the proposed inspection frequency. In the absence of maintenance records for catch basins, the City may substitute written statements to document a specific, less frequent inspection schedule. Written statements shall be based on actual inspection and maintenance experiences and shall be certified in accordance with G19 – Certification and Signature.

“I certify, under penalty of law, that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that Qualified Personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathering information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for willful violations.”¹

- (b) Inspections every two years may be conducted on a “circuit basis” whereby 25% of catch basins and inlets within each circuit are inspected to identify maintenance needs. Include an inspection of the catch basin immediately upstream of any Municipal Separate Storm Sewer System (MS4) outfall, discharge point, or connections to public or private storm systems, if applicable. Clean all catch basins within a given circuit for which the inspection indicates cleaning is needed to comply with maintenance standards established in the manual (under S5.C.7.a).
- (c) The City may clean all municipally owned pipes, ditches, and catch basins and inlets within a circuit once during the permit term (five years). Circuits selected for this alternative must drain to a single point.

Compliance with the inspection requirements above (S5.C.7.c.i-iii), shall be determined by the presence of an established inspection program achieving at least 95% of required inspections. These inspections need to be documented in NPDES Pro or the Geographic Information System (GIS).

This manual supports requirements of the Permit to implement practices, policies, and procedures to reduce stormwater impacts associated with runoff from all lands owned or maintained by the City. Lands owned or maintained by the City include, but are not limited to: streets, parking lots, roads, highways, buildings, parks, open space, road rights-of-way, maintenance yards, and stormwater treatment and flow control BMPs/facilities.

The following activities are addressed in this manual:

- Pipe cleaning
- Cleaning of culverts that convey stormwater in ditch systems
- Ditch maintenance
- Maintaining roadside areas, including vegetation management

¹ Reference from the Western Washington Phase II Municipal Stormwater Permit – August 1, 2019, Page 47 of 56.

- Application of fertilizers, pesticides, and herbicides according to the instructions for their use, including reducing nutrients and pesticides using alternatives that minimize environmental impacts
- Landscape maintenance and vegetation disposal
- Trash and pet waste management

Maintenance Requirement for Regulated Stormwater Facilities, Private Systems

The Permit requires provisions to be adopted in the Bremerton Municipal Code (BMC) that clarifies responsibility for private system maintenance. BMC 15.04.160 Construction and Maintenance of Private Stormwater Facilities defines these requirements. This manual provides the guidance to meet these requirements.

BMC 15.04.160: Construction and Maintenance of Private Stormwater Facilities

Maintenance of Private Stormwater Facilities

1. The person or persons holding title to the property and the applicant required to construct a stormwater facility shall remain responsible for the facility's continual performance, operation, and maintenance in accordance with the standards and requirements of the Stormwater Management Manual, this chapter, the approved permits, and/or in accordance with the current Engineering Design and Construction Standards and shall remain responsible for any liability as a result of these duties. Language designating the responsible parties shall be printed on the face of the plat documents, covenant, easement or other agreement recorded with the Kitsap County Auditor's Office for each property containing or served by said stormwater drainage facilities. This covenant/easement shall be in a form approved by the City Attorney.
2. All new development and redevelopment that installs or expands existing stormwater infrastructure, treatment and/or quantity control shall submit a maintenance covenant and maintenance plan that will run with the property, their heirs and assigns. The covenant shall include a site plan with details of all components used in the system such as pipes, catch basins, Low Impact Development (LID) BMPs, and green stormwater infrastructure; the covenant shall identify parties responsible and liable for the operation and maintenance of said facilities. The maintenance plan shall include all system components, features, maintenance schedules and reporting requirements. Upon acceptance, the covenant shall be recorded with Kitsap County Auditor's Office.
3. A maintenance covenant shall be recorded for rain gardens, or other green stormwater infrastructure (GSI) installed on private property with Bremerton Utilities financial assistance. The property owner accepts responsibility to maintain and operate the feature as defined in the covenant unless released by the City through a recorded instrument filed with Kitsap County Assessor's Office.

4. A maintenance and inspection report for stormwater systems shall be submitted annually to the Director by February 28th of each year to document maintenance of stormwater facilities for the preceding year. The report shall contain: the date maintenance and/or inspection tasks were completed and a summary of stormwater facilities including catch basins, LID BMPs, quantity and quality features.
 5. The City has authority, per BMC 15.04, to periodically enter upon the property and inspect the stormwater facilities to ensure such compliance and to issue orders requiring maintenance and/or repair. In event that the titleholders or other responsible parties do not affect such maintenance and/or repairs, the Director may abate the condition, by either making the corrections or by termination of the water service until the correction is made and/or by filing a lien against the property.
 6. When an inspection identifies an exceedance of the maintenance standard or a nonconforming, unauthorized condition, maintenance/repair shall be performed in accordance with the following schedule:
 - i Within 30 days for typical maintenance of facilities.
 - ii Within one year for maintenance that requires capital construction of less than twenty-five thousand dollars (\$25,000). (Ord. 5376 §3 (part), 2019: Ord. 5310 §2 (part), 2016: Ord. 5250 §1 (part), 2014: Ord. 5209 §3 (part), 2013)
- The BMC clearly defines the party responsible for maintenance of private stormwater facilities. New development, after 2017, was permitted with a requirement to record a Maintenance agreement and BMC 15.04 addresses requirements for older systems.
 - Inspection of facilities will be completed in accordance with the requirements below.
 - (b) Annual inspections of all stormwater treatment and flow control BMPs/facilities that discharge to the City's MS4 and were permitted by the City, including those permitted in accordance with requirements adopted pursuant to the 2007-2019 Ecology municipal stormwater permits, unless there are maintenance records to justify a different frequency. These inspections will be documented in NPDES Pro or GIS.
 - The BMC establishes enforcement procedures that will be followed as needed to comply with Permit requirements.

Underground Injection Control (UIC) Well Registration

Changes in the 2019 Stormwater Management Manual for Western Washington require owners of some infiltration systems to register them as Underground Injection Control (UIC) wells, if the system meets requirements of Appendix 1. UIC regulations apply to infiltration trenches when perforated pipe is used, and then, provided that the design, operation, and maintenance criteria in this section are met, only the registration requirement applies. Where perforated pipe is not used, the registration requirement does not apply. See [I-4 UIC Program](#) for details in the 2019 Ecology SWMMWW.

If rainwater is overflowing to the surface instead of infiltrating, see appropriate maintenance section for your system. System performance monitoring and maintenance is critical to keep the system working.

Maintaining Stormwater Facilities

All stormwater facilities need to be maintained. Regular maintenance ensures proper functioning, keeps the facility aesthetically appealing, and reduces pollutant accumulation and resuspension. This Stormwater Facility Maintenance Guide was designed to help explain how stormwater facilities work and provide user-friendly guidance on how to maintain facilities to keep them functional and up to standards.

As a facility owner or homeowner's association, you are responsible for regularly maintaining your privately-owned drainage facilities such as ponds, catch basins, treatment vaults, cartridge systems, and pipes. The City maintains stormwater facilities located in public roadways and the public right-of-way, with some exceptions which are called out in Homeowners' Association's (HOA's) Covenants, Conditions, and Restrictions (CCRs) or on the plat.

Maintenance Checklists

The checklists in this guide are for you to use when inspecting and maintaining the stormwater facilities in your neighborhood. If you are missing a particular checklist, or if you have additional facilities not identified or addressed in this guide, please contact your site developer, design engineer, or local jurisdiction to ask for assistance.

The checklists are in table format for ease of use and brevity. Each checklist tells you what part of the feature to check, how often to check, what to check for, and what to do about it. Log sheets are included to help you keep track of when you last surveyed the storm drainage system.

Although it is not intended for the maintenance survey to involve anything too difficult or strenuous, there are a few tools that will make the job easier and safer. These tools include:

- ☐ Gloves
- ☐ A flashlight (to look into catch basins, manholes or pipes)
- ☐ A long pole or broom handle (see below)
- ☐ Some kind of pry bar or lifting tool for pulling manhole and grate covers
- ☐ Standard yard tools, such as a rake and a shovel
- ☐ Tape measure or yardstick

A listing of resources is also included within this packet (see next page). Here you will find the phone numbers of the agencies referred-to in the tables.

SAFETY WARNING:

Due to WISHA/OSHA regulations, you should never stick your head or any part of your body into a manhole or other type of confined space. When looking into a manhole or catch basin, stand above it and use the flashlight to help you see. Use a pole or broom handle that is long enough when you are checking sediment depths in confined spaces. Always properly replace grates and lids.

NO PART OF YOUR BODY SHOULD BREAK THE PLANE OF THE OPEN HOLE.

Checklist Instructions

The following pages contain maintenance checklists covering most of the needs for the components of your drainage system, as well as for some components that you may not have (you can ignore those that do not apply to your system). Contact Bremerton PW&U if there are any components of your drainage system that you do not recognize or are missing from these pages.

You should plan to complete a check for all system components on the following schedule, as per the “How Often” column in the checklists:

Quarterly – Plan to inspect the facility at least once per season, preferably during the following months – January, May, August, and November.

Annually – The best time for an annual inspection is in the late summer, preferably August.

After Storms – Also check all stormwater facilities after major storm events, defined as about one inch or more of precipitation in 24 hours.

Using photocopies of these checklists and the log sheet, check off the problems that you look for each time you do an inspection. Add comments regarding problems found and actions taken on the log sheet. Keep the completed forms in your files for future reference.

You can call the City of Bremerton PW&U at (360) 473-5920 for technical guidance. Please do not hesitate to call, especially if you are unsure whether a situation you have discovered may be a problem.

Resource Listing

If you are unsure whether a problem exists, please contact the City at the number below and ask for technical assistance with your situation. Other resources are listed for your convenience and as references associated with the checklists.

City of Bremerton: Public Works and Utilities Department
(360) 473-5920

Kitsap County: Household Hazardous Waste (HHW) Collection Facility (oil, paint, pesticides, etc.)
(360) 337-5777

Solid Waste Disposal (yard waste, construction waste, contaminated soils, etc.):
(360) 337-4898 or solidwaste@co.kitsap.wa

WSU Kitsap County Extension (Water Resource Ed. Programs, Envir. Stewardship info.):
(360) 228-7300

Log Sheet

Use copies of this log sheet to keep track of when maintenance checks occur and what items, if any, are repaired or replaced. The completed sheets will serve as a record of past maintenance activities and will provide valuable information on how your facilities are operating. Keep all log sheets in a designated area so others can easily access them.

Location: _____	Date Checked: _____
Checked By: _____	/ /20
Name: _____	
Address: _____	
City: _____	Zip: _____ Phone: () _____

<u>Facility and Component Checked</u>	<u>Observations</u> (List things that should be done.)	<u>Follow-up Actions Taken</u>	<u>Date Action Taken</u>

Stormwater Inspection & Maintenance Procedure

Stormwater facilities play an important role in managing the four feet of rainfall we receive in Bremerton in an average year. The term “stormwater facility” refers to any landscaped or structural feature that collects, conveys, cleans, or infiltrates runoff water. There are many types of stormwater facilities, ranging from simple swales and ponds to more complicated filter systems and flow control devices. Your on-site stormwater facilities work together to control runoff water, reduce flooding, and prevent pollution.

Owners of commercial property, multifamily residential property, or single-family residential properties with privately-owned drainage and stormwater facilities are required by City of Bremerton Municipal Code to maintain their facilities to established standards for full functionality (Title 15.04 of the Bremerton Municipal Code). Facility owners are responsible for performing regular inspections of their stormwater facilities, and for performing any maintenance needs identified by the inspections.

Basic maintenance work may be performed by the owner or property manager, although some tasks are best left to an experienced contractor. The inspection of stormwater facilities and any required maintenance work must be completed and reported to Bremerton PW&U by the date specified on the Stormwater Facilities Inspection & Maintenance Annual Reporting Form or as agreed with Bremerton’s PW&U Compliance Inspector.

Instructions and helpful tips for successful facility inspections and maintenance are described in the following four steps:

Step 1. Identify

The first step is facility identification, so you know what types of stormwater facilities you have. Look on the site plan of your property and note the main facility types indicated (such as wet ponds and infiltration basins), along with related drainage components (such as catch basins, pipes and debris barriers). Locate the various facilities on the grounds of your facility.

Drainage systems consist of components for four main purposes: stormwater collection (such as catch basins), conveyance (e.g., pipes and swales), water quality treatment (e.g., wet ponds, cartridge systems, etc.) and flow control (via infiltration and/or surface discharge). To assist you in identifying components, refer to the definitions and illustrations on the pages that follow.

Step 2. Inspect

For all facility components that you have identified, conduct an inspection. You may conduct the inspection yourself and/or with co-owners, or you may use a property manager or vendor to perform the inspection. Refer to the following Stormwater Facility Maintenance Checklists, which describe the maintenance standards for each component, and also identify and describe defects and their remedies.

For each facility, note on the Inspection & Maintenance Checklist the condition of the facility (good, fair or poor), and any problems or other observations.

Do not enter confined spaces such as manholes, large detention storage pipes, or control structure as these are permit required confined spaces. Only trained and certified personnel should enter these spaces or life-threatening injuries can occur.

Step 3. Maintain

For all facility components, if the inspection indicates maintenance is needed, have the work performed by competent personnel. Basic maintenance tasks may be performed by the property owner(s) or property manager, but difficult or potentially dangerous tasks should be performed by a qualified vendor. Be safe! Use caution when inspecting and working on or near facilities and stay out of confined spaces such as catch basins and manholes.

Note the action taken and the date and record this information on the Log Sheet. Mark the check boxes on the Inspection & Maintenance Checklist corresponding to the maintenance accomplished on each facility.

Step 4. Submit

Submit the completed Inspection & Maintenance Checklist by February 28th each year by mail to: Bremerton PW&U Stormwater Maintenance Reports, 100 Oyster Bay Ave N, Bremerton, WA 98312. The completed checklist may be scanned and e-mailed to Bremerton1@ci.bremerton.wa.us referencing Stormwater Maintenance Report.

* * *

Common Stormwater Facilities: Identification and Actions

Note: General actions are described for each facility type below. Please refer to the Stormwater Facility Maintenance Standards for further details.

Ditch:

A V-shaped channel, usually along the side of a road, that collects and conveys runoff.



Actions to keep Ditches functioning:

- Remove debris, litter, and flow obstructions from the ditch
- Do Not fill-in the ditch – prevent dirt, rocks, and weeds from accumulating
- Repair erosion on ditch side-slopes

Culvert:

A pipe that continues conveyance flow from a ditch or swale under the ground surface, typically under driveways and cross-streets. Usually connects (“daylights”) to another ditch, swale, or pond. The end of a pipe or culvert is often surrounded by rock “rip rap” (as in photo below, right) to prevent soil erosion.

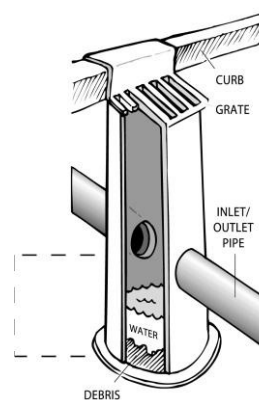


Actions to keep Culverts functioning:

- Remove debris, litter, and obstructions from the openings at the culvert-ends
- Remove soil, sod, and vegetation buildup from the culvert openings
- Replace rock riprap at the culvert ends
- Repair any damage to the culvert ends

Catch Basin (CB):

An underground concrete box structure with a slotted metal grate on top that collects runoff water from the ground surface. Typically located within pavement in parking lots and in the street gutter, usually next to a curb. Grate on top lets water in and keeps larger debris out. Sediment settles in the sump in the bottom (below the pipe openings) and must be removed periodically. Catch basins have an outlet pipe between the grate and the sump, to let the cleaner water flow out to a storm pond or conveyance. Some CBs have both inflow and outflow pipes, to convey collected runoff water through.



Actions to keep Catch Basins functioning:

- Remove litter, leaves, debris, and obstructions from catch basin grates.
- Hire a professional to remove sediment buildup from sump if road is privately owned; catch basins in the public right-of-way are maintained by the City. Catch basins and associated pipes need to be cleaned of all debris once every two years or when the sump is 60% full of debris. Determine the sump capacity by measuring down from the surface to the bottom of the catch basin to get the total depth. Then measure from the ground surface to the inside bottom of the outlet pipe. The difference between the two measurements is the sump depth. When the top of the sediment reaches 60% of the overall capacity it needs to be cleaned out. There is no set number for depth of sediment as each outlet pipe height from the bottom is different.

Biofiltration Swale (or Bio-Swale):

A wide, shallow channel with gently sloping sides and a flat bottom, lined with grass. Swales are designed to provide water quality treatment as the grass filters-out sediment and pollutants. Water infiltrates into the soil as it slowly flows along the swale.



Actions to keep Swales functioning:

- Remove debris, litter and flow obstructions from the swale.
- Mow the swale and maintain healthy grass cover.
- Prevent dirt, rocks and weeds from accumulating, but do not use herbicides.
- Do not fill-in the swale with rocks, bark, etc.
- Aerate the soil to preserve infiltration capacity.

Wet Pond:

A constructed pond with an impermeable liner to maintain a permanent pool of water, which provides for water quality treatment by settling and retention of sediment particles and other pollutants. The cleaner surface water is then conveyed to a nearby infiltration facility (such as a “dry pond”), surface discharge, or piped system. A wet pond provides a basic level of treatment and is common in many neighborhoods.



Actions to keep Wet ponds functioning:

- Remove litter and yard debris from within and around the pond.
- Check inflow and outflow systems and remove any obstructions.
- Remove excess vegetation such as cattails from within the pond.
- Mow the grass and keep it out of the pond.
- Remove noxious weeds, but do not use herbicides (contact the City for advice).

Do not enter the control structure to remove debris as this is a permit required confined space. Only trained personnel should enter this structure so you may need to hire a qualified maintenance crew to clean out the structure.

Constructed Wetland:

A created wetland with a permanent pool of water, like a wet pond but generally shallower and with aquatic emergent plants that provide for a higher level of water quality treatment of the collected stormwater through biological processes.



Actions to keep Constructed Wetlands functioning:

- Remove litter and yard debris from within and around the wetland.
- Check inflow and outflow systems and remove any obstructions.
- Remove excess vegetation such as cattails from within the wetland.
- Remove noxious weeds, but do not use herbicides (contact the City for advice).

Bioretention Cell (or “Rain Garden”):

A garden-like landscaped excavation backfilled with specified soil mixture and plantings. Bioretention is a “low-impact development” (LID) practice that is integrated into a site to retain stormwater near its source. It provides treatment and infiltration of runoff water by passing it slowly through the soil mix and plant roots into the native soil below.



Actions to keep Bioretention Cells and Rain Gardens functioning:

- Remove litter, weeds and fallen leaves. Do not use herbicides or pesticides.
- Check inflow and outflow systems and remove any obstructions.
- Repair erosion, cover bare spots with organic mulch.
- Perform plant maintenance as needed, such as pruning branches.
- Remove dead vegetation and replace dead plants with same varieties.

Debris Barriers and Trash Racks:

A structural device with metal bars, to prevent debris from entering a pipe, spillway, or hydraulic structure.



SAFETY: Do not clean trash rack when flowing! Check trash racks and culvert entrances regularly to prevent plugging during storm events.

Actions to keep Debris Barriers and Trash Racks functioning:

- Remove trash, debris, vegetation, and dirt from around the structure.
- Check inflow and outflow and remove any flow obstructions.
- Remove plants such as alder and willow that tend to grow in the ponds and near the pipe ends.
- Check for structural integrity; hire a professional to fix broken bars or racks.

Infiltration Basin (“Dry Pond”):

A shallow bowl-like depression in the land, with a broad, flat bottom area to collect, temporarily store, and infiltrate stormwater. An infiltration basin is commonly found adjacent to a wet pond, to receive treated water and allow it to infiltrate into the soil.

The infiltration basin is usually lined with grass and drains “dry” between rain events. Some playfields (as in photo below, left) double as infiltration basins by design.



Actions to keep Infiltration Basins functioning:

- Remove litter, yard debris and problem vegetation such as Scotch broom.
- Maintain a healthy grass cover to prevent erosion and weed growth.
- Repair erosion and replace rock riprap at pipe ends.
- Avoid activities within the basin that could cause erosion or soil compaction.
- Avoid using herbicides or pesticides within the basin area.
- Aerate the soil in the bottom area as needed to preserve and enhance infiltration.

Stormwater Facility Maintenance Standards for Municipal and Private Systems

The following pages contain facility-specific maintenance standards, which are intended to be observable conditions for determining whether maintenance actions are required.

Name of site _____		Check if on <u>Subject Site</u>
Group 1: Ponds and Swales		
1a	Detention Ponds & Infiltration Basins ("dry ponds")	<input type="checkbox"/>
1b	Wet ponds and Constructed Wetlands	<input type="checkbox"/>
1c	Biofiltration Swales (or Bio-Swales)	<input type="checkbox"/>
1d	Wet Bio-Swales	<input type="checkbox"/>
1e	Filter Strips	<input type="checkbox"/>
1f	Open Sand Filters	<input type="checkbox"/>
1g	Bioretention Cells (Rain Gardens)	<input type="checkbox"/>
Group 2: Underground Tanks, Vaults and Trenches		
2a	Detention Tanks and Vaults	<input type="checkbox"/>
2b	Wet vaults	<input type="checkbox"/>
2c	Enclosed Sand Filters	<input type="checkbox"/>
2d	Dispersion Trenches	<input type="checkbox"/>
2e	Infiltration Trenches and Galleries	<input type="checkbox"/>
Group 3: Structures and Pre-Treatment		
3a	Control Structures/Flow Restrictors	<input type="checkbox"/>
3b	Catch Basins	<input type="checkbox"/>
3c	Debris Barriers (Trash Racks)	<input type="checkbox"/>
3d	Energy Dissipators	<input type="checkbox"/>
3e	API (Baffle) Oil/Water Separators	<input type="checkbox"/>
3f	Coalescing Plate Oil/Water Separators	<input type="checkbox"/>
3g	Catch Basin Inserts	<input type="checkbox"/>
Group 4: Miscellaneous Facilities and Features		
4a	Downspouts and Roof Drywells	<input type="checkbox"/>
4b	Conveyance Pipes and Ditches	<input type="checkbox"/>
4c	Access Roads	<input type="checkbox"/>
4d	Permeable Pavement	<input type="checkbox"/>
4g	Vegetated Roofs	<input type="checkbox"/>
Group 5: Proprietary Treatment Systems		
5a	Modular Wetland Systems	<input type="checkbox"/>
5b	Filtrerra Tree Vault	<input type="checkbox"/>
5c	Contech Jellyfish Filter	<input type="checkbox"/>
5d	Contech CDS Hydrodynamic Separator	<input type="checkbox"/>
5e	Contech Stormfilter	<input type="checkbox"/>
5f	Other Proprietary System Manufacturers	<input type="checkbox"/>

Group 1 - Ponds and Swales

1a Detention Ponds & Infiltration Basins (“Dry Ponds”)

Detention ponds and infiltration basins are earthen excavations that are “dry” except during and after rains when they contain stormwater temporarily. Detention ponds store water while releasing it gradually; infiltration basins percolate water into the ground.

What to Check	How Often	Problem or Defect	Conditions to Check For	✓ Check	What to do for Desired Condition	✓ Done
Entire Facility	Quarterly	Trash & Debris	Dumping of yard wastes such as grass clippings and branches into pond. Presence of glass, plastic, metal, foam, or paper. There should be no visual evidence of dumping.		Remove and properly dispose all trash /debris.	
	Quarterly	Noxious or Poisonous Vegetation	Any invasive vegetation like Scotch broom, Black berry vines, or any which may constitute a hazard to the public, like poison oak, tansy ragwort, stinging nettles, or		Completely remove invasive, noxious, or non- native vegetation. Do not spray chemicals on vegetation without guidance or City approval.	
	Quarterly	Pollution or Fire Hazard	Presence of chemicals such as natural gas, oil, and gasoline, obnoxious color, odor, or sludge.		First, locate the source of the pollution. Then, call the City of Bremerton Public Works Compliance Division to report the hazard.	
	Quarterly	Rodent Holes	Any evidence of rodent holes if facility is acting as a dam or berm. Water should not be able to flow through the rodent holes.		Eliminate rodents and repair the dam or berm. Contact Kitsap Public Health Department for guidance.	
	Quarterly	Insects	Insects such as wasps and hornets interfering with maintenance activities, or mosquitoes becoming a nuisance.		Eliminate or remove insects. For mosquito control, eliminate stagnant water.	
	Annually	Overgrown Vegetation around pond	Ensure trees/shrubs are not interfering with the facility function or maintenance (i.e. mowing, silt removal, or access).		Prune tree limbs to allow for maintenance. Trees should not be present within ponds.	
	Quarterly	Vegetation not growing or overgrown within pond	Sparse, weedy, or overgrown grass in grassy dry/infiltration ponds. Presence of invasive species or sparse/excessive growth of plants in wetland ponds.		For grassy ponds, selectively thatch, aerate, and re-seed ponds. Grass should be kept under 8" height. In wet ponds, control cattails and unwanted vegetation to less than 25% of pond surface area.	

1a Detention Ponds / Infiltration Basins (Continued)

What to Check	How Often	Problem or Defect	Conditions to Check For	✓ Check	What to do for Desired Condition	✓ Done
Side Slopes	Annually	Erosion	Check around the inlets and outlets for signs of erosion. Check berms for signs of sliding or settling. Action is needed where eroded damage is over 2" deep and where there is potential for continued		Try to determine what has caused the erosion and fix it. Stabilize slopes by reinforcing the slope with rock, planting grass, or compacting the soil. Contact the City of Bremerton for assistance.	
Pond Storage Area	Annually	Sediment Build-Up	Accumulated sediment that exceeds 10% of the designed pond depth unless otherwise specified or affects inlets or outlets of the facility. (If a percolation test pit or test of Infiltration facility indicates facility is only working at 90% of its designed capabilities. If 2 inches or more sediment is present.		Clean out sediment and aerate and/or re-seed the pond if deemed necessary to improve infiltration and control erosion.	
	Quarterly	PVC Pond Liner	Check to see if liner is visible and has more than three 1/4-inch holes, exposed and or torn. An indicator of a torn liner could be the pond no longer holds water. (during long dry periods the water may evaporate)		Repair or replace liner as needed.	
	Quarterly	Clay Liner	Check to see if pond is holding water. (During long dry periods the water may evaporate)		Repair liner to designed state.	
Dikes or Berms	Annually	Settlement	Any part of the dike or berm which has settled more than 4 inches lower than designed.		Build the dike or berm back to the original elevation. If there is significant settling a licensed Civil Engineer should be consulted.	
	Quarterly	Seepage	Check for water flowing through the pond berm.		Repair berm to stop seepage. (Consult a Geotechnical Engineer)	
Emergency Overflow Spillway	Annually	Rocks Missing	Check to see that the rip rap protective area is intact. If any native soil is exposed, cover soil with rock rip rap.		Replace rocks so that all native soil is covered.	

1a Detention Ponds / Infiltration Basins (Continued)

What to Check	How Often	Problem or Defect	Conditions to Check For	✓ Check	What to do for Desired Condition	✓ Done
Side Slopes	Annually	Erosion	Check around the inlets and outlets for signs of erosion. Check berms for signs of sliding or settling. Action is needed where eroded damage is over 2" deep and where there is potential for continued erosion.		Try to determine what has caused the erosion and fix it. Stabilize slopes by reinforcing the slope with rock, planting grass or compacting the soil. Contact the City of Bremerton.	
Pond Storage Area	Annually	Sediment Build-Up	Accumulated sediment that exceeds 10% of the designed pond depth or affects inlets or outlets of the facility. (If a percolation test of infiltration facility indicates facility is only working at 90% of its designed capabilities, or if 2" or more sediment is present.		Clean out sediment and re-seed the pond if deemed necessary to improve infiltration and control erosion.	
	Quarterly	PVC Pond Liner	Check to see if liner is visible and has more than three 1/4-inch holes, exposed and or torn. An indicator of a torn liner could be the pond no longer holds water. (During long dry periods the water may evaporate.)		Repair or replace liner as needed. Note: wetponds or detention ponds may have liners, but infiltration ponds do not have liners.	
	Quarterly	Clay Liner	Check to see if pond is holding water. (During long dry periods the water may evaporate.)		Repair liner to designed state.	
Dikes or Berms	Annually	Settlement	Any part of the dike or berm which has settled more than 4 inches lower than designed.		Build the dike or berm back to the original elevation. If there is significant settling a licensed civil engineer should be consulted.	
	Quarterly	Seepage	Check for water flowing through the pond berm.		Repair berm to stop seepage. (Consult a Geotechnical Engineer)	
Emergency Overflow Spillway	Annually	Rocks Missing	Check to see that the rip rap protective area is intact. If any native soil is exposed, cover soil with rock rip rap.		Replace rocks so that all native soil is covered.	

1a Detention Ponds / Infiltration Basins (Continued)

What to Check	How Often	Problem or Defect	Conditions to Check For	✓ Check	What to do for Desired Condition	✓ Done
Emergency Overflow Spillway (cont.)	Annually	Erosion	Make sure the riprap under the inlet pipe is intact and no native soil is exposed. Check for accumulations of sediment deeper than half the height of the rocks.		Replace rocks and/or clean out sediment.	
	Quarterly	Screen clogged or missing	The bar screen over the outlet should be intact and clear of debris. Water should flow freely through the outlet pipe.		Replace screen if it is not attached. Remove any trash or debris and dispose of properly. Clean out the end pipe if necessary.	
Sediment Trapping Area	Quarterly	Sediment and Debris Buildup	Ensure sediment and debris do not obstruct water flow into the infiltration area.		Clean out the sump area.	
	Annually	Inadequate Sediment Settling Area	Stormwater should not enter the infiltration area without some method of settling-out solids.		Add a sediment trapping area by constructing a sump or berm for settling of solids. This area should be separate from the rest of the facility. Contact City of Bremerton PW&U for guidance.	

1b Wet Ponds and Constructed Wetlands

Wet ponds and constructed wetlands are designed to improve water quality. They have a permanent pool of water, which slows incoming stormwater flows causing sediments and pollutants to settle-out. Constructed wetlands are designed with emergent aquatic plants to provide biological treatment and filtering of runoff water, while wet ponds are typically deeper and utilize the pool volume to reduce pollutant loads.

What to Check	How Often	Problem or Defect	Conditions to Check For	✓ Check	What to do for Desired Condition	✓ Done
Entire Facility	Annually	Water Level	First cell is empty, doesn't hold water.		Line the first cell to maintain at least 4 feet of water. Second cell may drain, but the first cell must remain full to control turbulence of the incoming flow and reduce sediment resuspension.	
	Quarterly	Trash and Debris	Accumulation that exceeds 1 cu. ft. per 1000 sq. ft. of pond area.		Trash and debris removed from pond.	
	Quarterly	Inlet/Outlet Pipe	Inlet/Outlet pipe clogged with sediment and/or debris material.		No clogging or blockage in the inlet and outlet piping.	
	Annually	Sediment Accumulation on Pond Bottom	Accumulated sediment on pond bottom that exceeds the depth of sediment zone plus 6 inches, usually in the first cell of the pond.		Sediment removed from pond bottom.	
	Quarterly	Oil Sheen on Water	Visible and prevalent oil sheen.		Oil removed from water using oil-absorbent pads or vactor truck. Locate and correct oil source. If chronic low levels of oil persist, plant wetland plants such as <i>Juncus effusus</i> (soft rush) which can uptake small concentrations of oil.	
	Quarterly	Erosion	Erosion of the pond's side slopes and/or scouring of pond bottom that exceeds 6 inches, or where continued erosion is prevalent		Slopes stabilized using proper erosion control measures and repair methods.	

1b Wet Ponds and Constructed Wetlands (Continued)

What to Check	How Often	Problem or Defect	Conditions to Check For	✓ Check	What to do for Desired Condition	✓ Done
Entire Facility	Annually	Settlement of Pond Dike/Berm	Any part of these components that has settled 4 inches or lower than the design elevation, or inspector determines dike/berm is unsound.		Dike/berm is repaired to specifications.	
	Annually	Internal Berm	Berm dividing cells should be level.		Berm surface is leveled so that water flows evenly over entire length of berm.	
	Annually	Overflow Spillway	Rock is missing and soil is exposed at top of spillway or outside slope.		Rocks replaced to specifications.	
	Quarterly	PVC Pond Liner	Check to see if liner is visible and has more than three 1/4-inch holes, is exposed and/or torn. An indicator of a torn liner could be the pond no longer holds water (during long dry periods the water may evaporate).		Repair or replace liner as needed. Note: wet ponds usually have liners.	
	Quarterly	Clay Liner	Check to see if pond is holding water (during long dry periods the water may evaporate).		Repair liner to design state.	

1c Biofiltration Swale (Bio-Swale)

A gently-sloped channel with gentle side slopes, lined with grass (and sometimes other vegetation) to slow the flow and allow for water quality treatment and infiltration.

What to Check	How Often	Problem or Defect	Conditions to Check For	✓ Check	What to do for Desired Condition	✓ Done
General	Quarterly	Sediment Accumulation on Grass	Sediment depth exceeds 2 inches.		Remove sediment deposits on grass treatment area of the bio-swale. When finished, swale should be level from side to side and drain freely toward outlet. There should be no areas of standing water once inflow has ceased.	
	Quarterly	Standing Water	When water stands in the swale between storms and does not drain freely.		Any of the following may apply: remove sediment or trash blockages, improve grade from head to foot of swale, remove clogged check dams, add underdrains or convert to a wet biofiltration swale.	
	Quarterly	Flow Spreader	Flow spreader uneven or clogged so that flows are not uniformly distributed through entire swale width.		Level the spreader and clean so that flows are spread evenly over entire swale width.	
	Quarterly	Constant Base flow	Small quantities of water continually flow through the swale, even when it has been dry for weeks, and an eroded, muddy channel has formed in the swale bottom.		Add a low-flow pea-gravel drain the length of the swale or by-pass the base flow around the swale.	
	Quarterly	Poor Vegetation Coverage	Grass is sparse or bare or eroded patches occur in more than 10% of the swale bottom.		Determine why grass growth is poor and correct that condition. Re-plant with plugs of grass from the upper slope: plant in the swale bottom at 8-inch intervals. Or re-seed into loosened, fertile soil.	
	Quarterly	Vegetation	When the grass becomes excessively tall (greater than 10"); when nuisance weeds and other vegetation start to take over.		Mow vegetation or remove nuisance vegetation so that flow not impeded. Grass should be mowed to a height of 3 to 4 inches. Remove grass clippings.	
	Annually	Excessive Shading	Grass growth is poor because sunlight does not reach swale.		If possible, trim back over- hanging limbs and remove brushy vegetation on adjacent slopes.	

1c Biofiltration Swale (Bio-Swale) (Continued)

What to Check	How Often	Problem or Defect	Conditions to Check For	✓ Check	What to do for Desired Condition	✓ Done
Swale	Quarterly	Inlet/Outlet	Inlet/outlet areas clogged with sediment and/or debris.		Remove material so that there is no clogging or blockage in the inlet and outlet area.	
	Quarterly	Trash and Debris Accumulation	Trash and debris accumulated in the bio-swale.		Remove trash and debris from bioswale.	
	Annually	Erosion / Scouring	Eroded or scoured swale bottom due to flow channelization, or higher flows.		For ruts or bare areas less than 12 inches wide, repair the damaged area by filling with crushed gravel. If bare areas are large, generally greater than 12 inches wide, the swale should be re-graded and re-seeded. For smaller bare areas, over seed when bare spots are evident, or take plugs of grass from the upper slope and plant in the swale bottom at 8-inch intervals.	

1d Wet Biofiltration Swale (Wet Bio-Swale)

Similar to a standard Bio-Swale (previous pages), but with modifications due to saturated soil conditions (such as, specific plants that can tolerate wet conditions).

What to Check	How Often	Problem or Defect	Conditions to Check For	✓ Check	What to do for Desired Condition	✓ Done
Swale	Quarterly	Sediment Accumulation	Sediment depth exceeds 2 inches in 10% of the swale treatment area.		Remove sediment deposits in treatment area.	
Swale	Quarterly	Water Depth	Water not retained to a depth of about 4 inches during the wet season.		Build up or repair outlet berm so that water is retained in the wet swale.	
Swale	Quarterly	Wetland Vegetation	Vegetation becomes sparse and does not provide adequate filtration, OR vegetation is crowded out by very dense clumps of cattail, which do not allow water to flow through the clumps.		Determine cause of lack of vigor of vegetation and correct. Replant as needed. For excessive cattail growth, cut cattail shoots back and compost off-site. Note: normally wetland vegetation does not need to be harvested unless die-back is causing oxygen depletion in downstream waters.	
Swale	Quarterly	Inlet/Outlet	Inlet/outlet area clogged with sediment and/or debris.		Remove clogging or blockage in the inlet and outlet areas.	
Swale	Quarterly	Trash and Debris Accumulation	Any plastic, paper or other waste or debris.		Remove trash and debris from wet swale.	
Swale	Quarterly	Erosion / Scouring	Swale has eroded or scoured due to flow channelization, or higher flows.		Check design flows to assure swale is large enough to handle flows. By-pass excess flows to enlarge swale. Replant eroded areas with fibrous- rooted plants such as Juncus effusus (soft rush) in wet areas or snowberry (Symphoricarpos albus) in dryer areas.	

1e Bioretention Basin Maintenance Guide

Inspection Checklist	Y / N		If yes, perform the following maintenance
Are weeds or invasive plants present?			Pull weeds and invasive plants out by the roots to prevent them from returning. Spot treat perennial weeds with vinegar if necessary.
Is there sediment accumulation?			Remove sediment that has accumulated in the inlets, outlets and bottom of the basin with appropriate tools or equipment, avoid compacting bottom.
Are trash, excessive leaves, grass clippings or other debris present?			Remove any debris present.
Is there anything blocking or clogging inlets or outlets?			Remove debris or sediment that may be preventing water from flowing into or out of the basin.
Are there areas of bare soil or erosion?			Add mulch where it has been depleted and add additional plants where necessary. Use appropriate erosion control methods for more serious cases.
Is there standing water 48 or more hours after rainfall?			This is an indication that your bioretention basin is not functioning as designed, likely due to a larger problem that will require further study and action.
If underdrain is present, is there standing water 48 or more hours after rainfall?			Remove any trapped sediment present. If sediment does not appear to be blocking flow, this may be an indication that the underdrain is not functioning as designed and will require further study and action.

1f Filter Strip

A basic filter strip is a flat grassy area that provides treatment of unconcentrated sheet flow runoff from adjacent pavement. Can provide enhanced treatment for metals in runoff water when soil is amended with organic compost and grass is sufficiently dense.

What to Check	How Often	Problem or Defect	Conditions to Check For	✓ Check	What to do for Desired Condition	✓ Done
General	Quarterly	Sediment Accumulation on Grass	Sediment depth exceeds 2 inches.		Remove sediment deposits, re-level so slope is even and flows pass evenly through strip.	
	Quarterly	Vegetation	When the grass becomes excessively tall (greater than 10 inches); when nuisance weeds and other vegetation starts to take over.		Mow grass, control nuisance vegetation, such that flow not impeded. Grass should be mowed to a height between 3-4 inches.	
	Quarterly	Trash and Debris Accumulation	Trash and debris accumulated on the filter strip.		Remove trash and Debris from filter.	
	Quarterly	Erosion / Scouring	Eroded or scoured areas due to flow channelization, or higher flows.		For ruts or bare areas less than 12 inches wide, repair the damaged area by filling with crushed gravel. The grass will creep in over the rock in time. If bare areas are large, generally greater than 12 inches wide, the filter strip should be re-graded and re-seeded. For smaller bare areas, over seed when bare spots are evident.	
	Quarterly	Flow Spreader	Flow spreader uneven or clogged so that flows are not uniformly distributed through entire filter width.		Level the spreader and clean so that flows are spread evenly over entire filter width.	

1g Sand Filter

A typical open sand filter consists of a pre-treatment system to remove sediments, a flow spreader, a sand bed, and underdrain piping. See also Sand Filter Vault.

What to Check	How Often	Problem or Defect	Conditions to Check For	✓ Check	What to do for Desired Condition	✓ Done
Above Ground (open sand filter)	Quarterly	Sediment Accumulation on top layer	Sediment depth exceeds 1/4-inch.		No sediment on the sand filter that would impede permeability of the filter section.	
	Quarterly	Trash and Debris Accumulations	Trash and debris accumulated on sand filter bed.		Remove trash and debris from sand filter bed.	
	Quarterly	Sediment / Debris in Clean-Outs	When the clean-outs become full or partially plugged with sediment and/or debris.		Remove sediment from clean-outs.	
	Quarterly	Sand Filter Media	Drawdown of water through the sand filter media takes longer than 24 hours, and/or flow through the overflow pipes occurs frequently.		Scape top several inches of sand. May require replacement of entire sand filter depth depending on extent of plugging (a sieve analysis is helpful to determine if the lower sand has too high a proportion of fine material).	
	Quarterly	Prolonged Flows	Sand is saturated for prolonged periods of time (several weeks) and does not dry out between storms due to continuous base flow and/or prolonged flows from detention facilities.		Low, continuous flows are limited to a small portion of the facility by using a low wooden divider or slightly depressed sand surface.	
	Quarterly	Short Circuiting	When flows become concentrated over one section of the sand filter rather than dispersed.		Flow and percolation of water through sand filter is uniform and dispersed across the entire filter area.	
	Quarterly	Erosion Damage to Slopes	Erosion over 2-inches deep where cause of damage is prevalent or potential for continued erosion is evident.		Slopes stabilized using proper erosion control measures.	

1g Sand Filter (Continued)

What to Check	How Often	Problem or Defect	Conditions to Check For	✓ Check	What to do for Desired Condition	✓ Done
Above Ground (open sand filter)	Quarterly	Rock Pad Missing or Out of Place	Soil beneath the rock is visible.		Replace or rebuilt rock pads to design specifications.	
	Quarterly	Flow Spreader	Flow spreader uneven or clogged so that flows are not uniformly distributed across sand filter.		Level and clean spreader so that flows are spread evenly over sand filter.	
	Annually	Damaged Pipes	Any part of the piping that is crushed or deformed more than 20% or any other failure to the piping.		Repair or replace Pipe.	

1h Bioretention Cells (Rain Gardens)

A bioretention cell is a shallow, garden-like landscaped depression backfilled with 12 inches or more of a designed soil mixture and specific plantings for varying moisture conditions. Bioretention areas require annual plant, soil, and mulch maintenance to ensure optimum infiltration and pollutant removal capabilities. Most routine maintenance procedures are typical landscape care activities, but other tasks are more typical of drainage facilities.

Table 1. Routine Maintenance

Activity	Schedule	Completed (Date/By)	Objective	What to Do & Notes
Watering: Maintain irrigation system. Fix leaks & breaks, and clear blockages. Hand water as needed for specific plants.	Check system twice annually (such as, in May & July); water only as needed for plant health.		Establish vegetation with a minimum 80% survival rate.	Selected plants should be drought tolerant and not require watering after establishment (2-3 years). Watering may be needed during prolonged dry periods after plants are established.
Weeding: Remove undesired vegetation by hand.	As needed, and especially prior to seed disbursement		Reduce competition for desired vegetation. Improve aesthetics. Exclude undesirable plants.	Periodic weeding is necessary until plants are established. Pull weeds by hand, if possible. Avoid using chemical weed controls. Avoid compacting soil in garden.

Activity	Schedule	Completed (Date/By)	Objective	What to Do & Notes
Prune/control vegetation: Trim excessive growth of branches and remove dead plant material.	Once or twice annually		Maintain plant health and adequate plant coverage. Reduce shading of under-story if species require sun. Maintain soil health and infiltration capability. Maintain clearances from utilities and sight distances.	Depending on aesthetic requirements, occasional pruning and removing dead plant material may be necessary. Remove and dispose of properly. Avoid compacting soil in rain garden.
Clean the entry: Remove any accumulation of debris from flow entrance to garden	Check at least twice annually (such as, in October and January)		Maintain proper flow of stormwater from paved and/or impervious areas to bioretention facility.	Remove debris from curb drops and gutters in flow path to the bioretention area.
Mulching: Replace or add mulch with hand tools to a depth of 2-4 inches.	Once annually, or every two years if runoff pollutant load is low.		Replenish organic material in soil, reduce erosion, prolong good soil moisture level, filter pollutants.	Use compost mulch on the rain garden bottom area and lower side slopes, and wood chips on the upper side slopes and rim (above typical water levels).
Trash, Litter & Debris Removal	As needed, check at least monthly		Maintain aesthetics and prevent clogging of infrastructure.	Remove paper, plastic, and other deleterious material from garden
Maintain access to infrastructure: Clear vegetation within one foot of inlets and outfalls, maintain access pathways.	Annually		Prevent clogging of grates and pipes; prevent encroachment on utilities or other infrastructure; maintain sight lines for traffic; maintain access for inspections.	

Table 2. Non-Routine Maintenance

Activity	Schedule	Completed (Date/By)	Objective	What to Do & Notes
Erosion control: Prevent erosion and sediment movement. Replace soil, plant material, and/or mulch layer in areas where erosion has occurred.	Determined by inspection.		Reduce sediment transport and clogging of infrastructure. Maintain desired plant survival and appearance of facilities.	Properly designed facilities should not have erosion problems. If erosion problems persist, assess: (1) flow volumes vs. garden size, (2) flow velocities and gradients, (3) flow dissipation and erosion protection at the flow entrance.
Remove Sediment: Shovel or rake out sediment within vegetated areas. Vacuum catch basins and sediment traps.	Determined by inspection.		Reduce sediment transport and clogging of infrastructure. Maintain plant survival and appearance of facilities. Maintain proper elevations and ponding depths.	If sediment is deposited in the bioretention area, determine the source within the contributing area and stabilize sediment source to prevent erosion.
Clean underdrains: Jet clean or rotary cut debris/roots from under-drains.	Determined by inspection of clean-outs.		Maintain proper subsurface drainage, ponding depths, and dewatering rates.	Use hydro jetting equipment and rotary root cutting saws to keep pipes clear and working
Clear flow entry: Remove excess vegetation at garden edge with line trimmer, vacuum sweeper, rake and/or shovel.	Determined by inspection.		Prevent accumulation of vegetation at pavement edge and maintain proper sheet flow of stormwater from paved and/or impervious areas to rain garden.	Bioretention facilities should be designed with a proper elevation drop from pavement to vegetated area to prevent blockage of storm flows by vegetation into infiltration area.
Replace plants: Replant bare spots or poor-performing plants per original design or per City guidance.	Determined by inspection.		Maintain dense vegetation cover to prevent erosion, encourage infiltration and exclude weeds.	If specific plants have a high mortality rate, assess the cause, and replace with suitable species.
Replace soil: Remove vegetation and excavate soil.	Determined by inspection (visual) or tests (infiltration, pollutant, or soil fertility).		Maintain infiltration, soil fertility and pollutant removal capability. Save as much plant material as possible for replanting.	Soil mixes for bioretention facilities are designed to maintain long-term fertility and pollutant processing capability. Replacing mulch helps prolong performance & reduce pollutant accumulation.

Activity	Schedule	Completed (Date/By)	Objective	What to Do & Notes
Rebuild or reinforce structures: Various activities to maintain walls, intake and outfall pads, weirs, other hardscape elements	Determined by inspection.		Maintain proper drainage and aesthetics and prevent erosion.	
Regrade or recontour slopes: Maintain proper slopes and replant exposed areas.	Determined by inspection.		Prevent erosion where side slopes have been disturbed by foot or auto traffic intrusion.	

Group 2 - Underground Tanks, Vaults and Trenches

2a Detention Tanks and Vaults

These types of storage structures are usually underground and accessed via a manhole. **DO NOT ENTER ANY TANK OR VAULT without proper training, certification and equipment.**

What to Check	How Often	Problem or Defect	Conditions to Check For	✓ Check	What to do for Desired Condition	✓ Done
Storage Area	Quarterly	Plugged Air Vents	One-half of the cross section of a vent is blocked at any point, or the vent is damaged.		Vents open and functioning.	
	Quarterly	Debris and Sediment	Accumulated sediment depth exceeds 10% of the diameter of the storage area for 1/2 length of storage vault or any point depth exceeds 15% of diameter. (Example: 72-inch storage tank would require cleaning when sediment reaches depth of 7 inches for more than 1/2 length of tank.)		All sediment and debris removed from storage area.	
	Quarterly	Joints Between Tank/Pipe Section	Any openings or voids allowing material to be transported into facility. Will require engineering analysis to determine structural stability.		All joint between tank/pipe sections are sealed.	
	Annually	Tank Pipe Bent Out of Shape	Any part of tank/pipe is bent out of shape more than 10% of its design shape. (Review required by engineer to determine structural stability).		Tank/pipe repaired or replaced to design.	
	Annually	Vault Structure Includes Cracks in Wall, Bottom, Damage to Frame and/or Top Slab	Cracks wider than 1/2-inch and any evidence of soil particles entering the structure through the cracks, or maintenance/inspection personnel determines that the vault is not structurally sound. Cracks wider than 1/2-inch at the joint of any inlet/outlet pipe or any evidence of soil particles entering the vault through the walls.		Vault replaced or repaired to design specifications and is structurally sound. No cracks more than 1/4-inch wide at the joint of the inlet/outlet pipe.	
Manhole	Quarterly	Cover Not in Place	Cover is missing or only partially in place. Any open manhole requires maintenance.		Manhole is closed.	
	Quarterly	Locking Mechanism Not Working	Mechanism cannot be opened by one maintenance person with proper tools. Bolts into frame have less than 1/2 inch of thread (may not apply to self-locking lids).		Mechanism opens with proper tools.	

2a Detention Tanks and Vaults (Continued)

What to Check	How Often	Problem or Defect	Conditions to Check For	✓ Check	What to do for Desired Condition	✓ Done
Manhole	Quarterly	Cover Difficult to Remove	One maintenance person cannot remove lid after applying normal lifting pressure. Intent is to keep cover from sealing off access to maintenance.		Cover can be removed and reinstalled by one maintenance person.	
	Quarterly	Ladder Rungs Unsafe	Ladder is unsafe due to missing rungs, misalignment, not securely attached to structure wall, rust, or cracks.		Ladder meets design standards. Allows maintenance person safe access.	
Catch Basins		See "Catch Basins"	See "Catch Basins"		See "Catch Basins"	

2b Wet Vaults

These types of storage structures are usually underground and accessed via a manhole.
DO NOT ENTER ANY TANK OR VAULT without proper training, certification and equipment.

What to Check	How Often	Problem or Defect	Conditions to Check For	✓ Check	What to do for Desired Condition	✓ Done
Vault	Quarterly	Trash/Debris Accumulation	Trash and debris accumulated in vault, pipe or inlet/outlet (includes floatables and non- floatables).		Remove trash and debris from vault.	
	Quarterly	Sediment Accumulation in Vault	Sediment accumulation in vault bottom exceeds the depth of the sediment zone plus 6-inches.		Remove sediment from vault.	
	Quarterly	Damaged Pipes	Inlet/outlet piping damaged or broken and in need of repair.		Pipe repaired and/or replaced.	
	Quarterly	Access Cover Damaged/Not Working	Cover cannot be opened or removed, especially by one person.		Pipe repaired or replaced to proper working specifications.	
	Quarterly	Ventilation	Ventilation area blocked or plugged.		Blocking material removed or cleared from ventilation area. A specified % of the vault surface area must provide ventilation to the vault interior (see design specifications).	
	Annually	Vault Structure Damage - Includes Cracks in Walls Bottom, Damage to Frame and/or Top Slab	Maintenance/inspection personnel determine that the vault is not structurally sound.		Vault replaced or repairs made so that vault meets design specifications and is structurally sound.	
			Cracks wider than 1/2- inch at the joint of any inlet/ outlet pipe or evidence of soil particles entering through the cracks.		Vault repaired so no cracks exist wider than 1/4 inch at the joint of the inlet/outlet pipe.	
	Annually	Baffles	Baffles corroding, cracking warping and/or showing signs of failure as deemed by maintenance/inspection staff.		Baffles repaired or replaced to specifications.	
	Annually	Access Ladder Damage	Ladder is corroded or deteriorated, not functioning properly, not attached to structure wall, missing rungs, has cracks and/or misaligned. Confined space warning sign missing.		Ladder replaced or repaired to specifications and is safe to use as determined by inspection personnel. Replace sign warning of confined space entry requirements. Ladder and entry notification complies with OSHA standards.	

2c Enclosed Sand Filter

Similar to an open sand filter but installed below grade within a vault.

What to Check	How Often	Problem or Defect	Conditions to Check For	✓ Check	What to do for Desired Condition	✓ Done
Vault	Quarterly	Sediment Accumulation on Sand Media Section	Sediment depth exceeds 1/2 inch.		No sediment deposits on sand filter section that would impede permeability of the filter section.	
	Quarterly	Sediment Accumulation in Pre-Settling Portion of Vault	Sediment accumulation in vault bottom exceeds the depth of sediment zone plus 6 inches.		No sediment deposits in first chamber of vault.	
	Quarterly	Trash/Debris Accumulation	Trash and debris accumulated in vault, or pipe inlet/ outlet, floatables and non-floatables.		Trash and debris removed from vault and inlet/outlet piping.	
	Quarterly	Sediment in Drain Pipes Cleanouts	When drainpipes, cleanouts become full with sediment and/or debris.		Sediment and debris removed.	
	Quarterly	Short Circuiting	When seepage/flow occurs along the vault walls and corners. Sand eroding near inflow area.		Sand filter media section re-laid and compacted along perimeter of vault to form a semi-seal. Erosion protection added to dissipate force of incoming flow and curtail erosion.	
Pipes	Annually	Damaged Pipes	Inlet or outlet piping damaged or broken, in need of repair.		Pipe repaired and/or replaced.	
Vault	Quarterly	Access Cover Damaged/Not Working	Cover cannot be opened, corrosion/ deformation of cover. Maintenance person cannot remove cover using normal lifting pressure.		Cover repaired to proper working specifications or replaced.	
	Quarterly	Ventilation	Ventilation area blocked or plugged		Blocking material removed/cleared from ventilation area. A specified percentage of the vault surface area must provide venting to the vault interior (per design).	

2c Enclosed Sand Filter (Continued)

What to Check	How Often	Problem or Defect	Conditions to Check For	✓ Check	What to do for Desired Condition	✓ Done
Vault	Annually	Vault Structure Damaged; Includes Cracks in Walls, Bottom, Damage to Frame and/or Top Slab.	Cracks wider than 1/2 inch or evidence of soil particles entering the structure through the cracks, or maintenance/inspection personnel determine that the vault is not structurally sound.		Vault replaced or repairs made so that vault meets design specifications and is structurally sound.	
Vault	Annually		Cracks wider than 1/2 inch at the joint of any inlet/outlet pipe or evidence of soil particles entering through the cracks.		Vault repaired so that no cracks exist wider than 1/4 inch at the joint of the inlet/outlet pipe.	
Vault	Annually	Baffles/Internal walls	Baffles or walls corroding, cracking, warping and/or showing signs of failure as determined by maintenance/inspection person.		Baffles repaired or replaced to specifications.	
Vault	Quarterly	Access Ladder Damaged	Ladder is corroded or deteriorated, not functioning properly, not securely attached to structure wall, missing rungs, cracks, and misaligned.		Ladder replaced or repaired to specifications and is safe to use as determined by inspection personnel.	

2d Dispersion Trenches

Dispersion trenches consist of an excavated trench backfilled with drain rock, containing a level perforated pipe, often with a catch basin on the pipe and a notched grade board. They are designed to spread out the flow of water over a broad surface area, to convert pipe flow to sheet flow and reduce the potential for erosion. These structures are typically found at the outlet areas of pipes, ponds or swales.

What to Check	How Often	Problem or Defect	Conditions to Check For	✓ Check	What to do for Desired Condition	✓ Done
Dispersion Trench	Annually	Missing or Moved Rock	Trench should be full of rip rap.		Add large rocks (about 30 lb. each) so that rocks are visible above the edge of the trench.	
Dispersion Trench	Quarterly	Pipe Plugged	Accumulated sediment should not exceed 20% of the depth.		Clean and flush pipe. In severe cases, the rocks will have to be removed, cleaned, and then replaced.	
Dispersion Trench	Quarterly	Perforations Plugged	Ensure that at least half of the perforations in the pipe are not plugged with debris or sediment.		Clean or replace perforated pipe.	
Dispersion Trench	Semi-Annually & After Major Storms	Not Discharging Water Properly	The intent of the dispersion trench is to prevent erosion. Water should flow out of the trench in a uniform "sheet flow." Visually inspect the trench for evidence of water discharging at concentrated points and causing erosion.		If water is not being discharged correctly, the trench must be redesigned or rebuilt to standard. The elevation of the lip of the trench should be the same (level) at all points.	
Dispersion Trench	Semi-Annually & After Major Storms	Water flows out top of catch basin	Water should not flow out during storms smaller than the design storm. Also, ensure that it is not causing (and appears unlikely to cause) damage.		Facility must be rebuilt or redesigned to standards. Pipe is probably plugged or damaged and needs replacement.	
Dispersion Trench	Semi-Annually & After Major Storms	Receiving Area Over- Saturated	Ensure that the water in the receiving area is not causing, and does not have the potential to cause, a landslide.		Stabilize the slope with grass or other vegetation. You might need to use rock or other cover if the condition is severe.	

2e Infiltration Trenches and Galleries

Infiltration trenches and galleries are often used to treat runoff from impervious surfaces, such as roads, sidewalks, and parking lots. Both utilize perforated pipes surrounded by gravel to keep the perforations from becoming clogged and to help disperse the water into the soil.

Typical maintenance schedule and activities for infiltration trenches:

- Replace pea gravel/topsoil/surface filter fabric as needed.
- Monthly:
 - Ensure the contributing area and inlets are clear of debris.
 - Ensure the contributing area is stabilized.
 - Remove sediment and oil/grease from pre-treatment devices.
 - Mow grass filter strips as necessary and remove grass clippings.
- Semi-Annual Inspection:
 - Repair undercut and eroded areas at inflow and outflow.
 - Inspect pre-treatment devices and diversion structures for sediment build up and structural damage.
- Every five years:
 - Disc or otherwise aerate the basin bottom. De-thatch the basin bottom.
 - Scrape basin bottom and remove sediment.
 - Restore original cross section and infiltration rate. Seed or sod to restore ground cover.

Group 3 - Structures and Pre-Treatment

3a Control Structures and Flow Restrictors

Flow control devices are usually placed within manholes, which may be locked. They typically consist of two pipes, one placed above the other. The lower pipe will typically have a cover and a small hole drilled in it to allow for slow release of water. The upper pipe is usually larger to provide an outlet for higher flows and emergency overflows.

What to Check	How Often	Problem or Defect	Conditions to Check for	✓ Check	What to do for Desired Condition	✓ Done
Structure	Quarterly	Trash and Debris (includes Sediment)	Material exceeds 25% of sump depth or 1 foot below orifice plate.		Control structure orifice is not blocked. All trash & debris removed	
		Structural Damage	Structure is not securely attached to manhole wall.		Securely attach structure to wall and outlet pipe.	
			Structure is not in upright position (more than 10% from plumb)		Restore structure to correct position.	
			Connections to outlet pipe are not watertight and show signs of rust.		Pipe connections are watertight; structure repaired or replaced and works as designed.	
			Any holes in structure (other than designed holes).		Structure has no holes other than designed holes.	
Cleanout Gate	Quarterly	Damaged or Missing	Cleanout gate is not watertight or is missing.		Gate is watertight and works as designed.	
			Gate cannot be moved up and down by one maintenance person.		Gate moves up and down easily and is watertight.	
			Chain/rod leading to gate is missing or damaged.		Chain is in place and works as designed.	
			Gate is rusted over 50% of its surface area.		Gate is repaired or replaced to meet design standards.	
Orifice Plate	Quarterly	Damaged or Missing	Control device is not working properly due to missing, displaced, or bent orifice plate.		Plate is in place and works as designed.	
		Obstructions	Trash, debris, sediment or vegetation blocking the plate.		Plate is free of all obstructions and works as designed.	
Overflow Pipe	Quarterly	Obstructions	Any trash or debris blocking (or having the potential of blocking) the overflow pipe.		Pipe is free of all obstructions and works as designed.	
Manhole			See "Detention Tanks and Vaults"		See "Detention Tanks and Vaults"	
Catch Basin			See "Catch Basins"		See "Catch Basins"	

3b Catch Basins

These structures are typically located in the streets. Unless identified through recorded documents, the City of Bremerton is responsible for routine maintenance of the pipes and structures in the public rights-of-way, while the property owner or homeowners' association is responsible for maintenance of pipes and catch basins in private areas, on private streets, and for keeping the grates clear of debris in their areas.

What to Check	How Often	Problem or Defect	Conditions to Check For	✓ Check	What to do for Desired Condition	✓ Done
Catch Basin	Quarterly	Trash & Debris	Trash, leaves or debris which is located immediately in front of the catch basin (CB) opening or is blocking inflow capacity of the basin by more than 10%.		Remove trash, leaves & debris located directly in front of CB or on grate	
			Trash or debris (in basin) that exceeds 60 percent of the sump depth as measured from bottom of basin to invert of the lowest pipe into or out of the basin, but in no case less than a minimum of 6" clearance from the debris surface to the invert of the lowest pipe.		Remove all trash and debris from the catch basin.	
			Trash or debris in any inlet or outlet pipe blocking more than 1/3 of its height.		Inlet and outlet pipes free of trash or debris.	
			Dead animals or vegetation that could generate odors that could cause complaints or dangerous gases (e.g. methane).		Remove dead animals, etc. present within the catch basin.	
	Quarterly	Sediment	Sediment (in basin) exceeds 60% of sump depth as measured from the bottom of basin to invert of lowest pipe into or out of basin, but in no case less than a minimum of 6" clearance from the sediment surface to the invert of lowest pipe.		Remove sediment and pressure wash catch basin lid, walls, and bottom. No sediment in the catch basin	
	Annually	Structure Damage to Frame and/or Top Slab	Top slab has holes larger than 2 square inches or cracks wider than 1/4 inch (Intent is to make sure no material is running into basin).		Top slab is free of holes and cracks.	
			Frame not sitting flush on top slab, i.e., separation of more than 3/4 inch of the frame from the top slab. Frame not securely attached.		Frame is sitting flush on the riser rings or top slab and firmly attached.	
	Annually	Fractures or Cracks in Basin Walls/ Bottom	Maintenance person determines structure is unsound.		Basin replaced or repaired to design standard	
			Grout fillet has separated or cracked wider than 1/2 inch and longer than 1 foot at the joint of any inlet/outlet pipe, or any evidence of soil entering basin.		Pipe regouted and secure at basin wall.	

3b Catch Basins (Continued)

What to Check	How Often	Problem or Defect	Conditions to Check For	✓ Check	What to do for Desired Condition	✓ Done
Catch Basin	Annually	Settlement/Misalignment	If failure of basin has created a safety, function, or design problem.		Replaced or repair to design standards.	
	Quarterly	Vegetation	Vegetation growing across and blocking more than 10% of the basin opening.		Remove vegetation blocking opening to basin.	
			Vegetation growing in inlet/outlet pipe joints that is more than 6 inches tall and less than 6 inches apart.		No vegetation or root growth present.	
		Contamination and Pollution	See "Detention Ponds"		No pollution present.	
	Quarterly	Cover Not in Place	Cover is missing or only partially in place. Any open catch basin requires maintenance.		Catch basin cover is closed	
	Quarterly	Locking Mechanism Not Working	Mechanism cannot be opened by one maintenance person with proper tools. Bolts into frame have less than 1/2 inch of thread.		Mechanism opens with proper tools.	
	Quarterly	Cover Difficult to Remove	One maintenance person cannot remove lid after applying normal lifting pressure. (Intent is keep cover from sealing off access to maintenance.)		Cover can be removed by one maintenance person.	
Catch Basin Cover	Quarterly	Cover Not in Place	Cover is missing or only partially in place. Any open catch basin requires maintenance.		Catch basin cover is closed	
	Quarterly	Locking Mechanism Not Working	Mechanism cannot be opened by one maintenance person with proper tools. Bolts into frame have less than 1/2 inch of thread.		Mechanism opens with proper tools.	
	Quarterly	Cover Difficult to Remove	One maintenance person cannot remove lid after applying normal lifting pressure. (Intent is keep cover from sealing off access to maintenance.)		Cover can be removed by one maintenance person.	

3b Catch Basins (Continued)

What to Check	How Often	Problem or Defect	Conditions to Check For	✓ Check	What to do for Desired Condition	✓ Done
Ladder	Quarterly	Ladder Rungs Unsafe	Ladder is unsafe due to missing rungs, not securely attached to basin wall, misalignment, rust, cracks, or sharp edges.		Ladder meets design standards and allows maintenance person safe access.	
Metal Grates (If Applicable)	Quarterly	Grate opening Unsafe	Grate with opening wider than 7/8 inch.		Grate opening meets design standards.	
	Quarterly	Trash and Debris	Trash and debris that is blocking more than 20% of grate surface influent capacity.		Grate free of trash and debris.	
	Quarterly	Damaged or missing	Grate missing or broken member(s) of the grate.		Grate is in place and meets design standards.	

3c Debris Barriers (Trash Racks)

A metallic screen or similar structural device used to prevent debris from entering a pipe, spillway, or other hydraulic structure.

What to Check	How Often	Problem or Defect	Conditions to Check For	✓ Check	What to do for Desired Condition	✓ Done
General	Quarterly	Trash and Debris	Trash or debris that is plugging more than 20% of the openings in the barrier.		Barrier cleared to design flow capacity.	
Metal	Quarterly	Damaged/ Missing Bars	Bars are bent out of shape more than 3 inches.		Bars in place with no bends more than 3/4 inch.	
			Bars are missing or entire barrier missing.		Bars in place according to design.	
			Bars are loose and rust is causing 50% deterioration to any part of barrier.		Barrier replaced or repaired to design standards.	
	Quarterly	Inlet/Outlet Pipe	Debris barrier missing or not attached to pipe		Barrier firmly attached to pipe	

3d Energy Dissipators

Typically, a rock splash pad at a pipe end or other discharge location, to reduce the velocity and energy of flowing water and prevent erosion. Other means of energy dissipation include drop manholes, stilling basins, and check dams.

What to Check	How Often	Problem or Defect	Conditions to Check For	✓ Check	What to do for Desired Condition	✓ Done
Rock Pad	Quarterly	Missing or Moved Rock	Only one layer of rock exists above native soil in area five square feet or larger, or any exposure of native soil.		Rock pad replaced to design standards.	
	Quarterly	Erosion	Soil erosion in or adjacent to rock pad.		Rock pad replaced to design standards.	
Dispersion Trench	Quarterly	Pipe Plugged with Sediment	Accumulated sediment that exceeds 20% of the design depth.		Pipe cleaned/ flushed so it matches design.	
	Quarterly	Not Discharging Water Properly	Visual evidence of water discharging at concentrated points along trench (normal condition is a "sheet flow" of water along trench). Intent is to prevent erosion damage.		Trench redesigned or rebuilt to standards.	
	Quarterly	Perforations Plugged	Over half of perforations in pipe are plugged with debris and sediment.		Perforated pipe cleaned or replaced.	
	Quarterly	Water Flows Out Top of "Distributor" Catch Basin	Maintenance person observes or receives credible report of water flowing out during any storm less than the design storm or its causing or appears likely to cause damage.		Facility rebuilt or redesigned to standards.	
	Quarterly	Receiving Area Over-Saturated	Water in receiving area is causing or has potential of causing landslide problems.		No danger of landslides.	
Manhole / Chamber	Annually	Worn or Damaged Post, Baffles, Side of Chamber	Structure dissipating flow deteriorates to 1/2 of original size or any concentrated worn spot exceeding one square foot which would make structure unsound.		Structure replaced to design standards.	
		Other Defects	See "Catch Basins"		See "Catch Basins"	

3e Baffle Oil/Water Separators (API Type)

An underground vault or tank designed to separate oil from runoff water via baffles.

What to Check	How Often	Problem or Defect	Conditions to Check For	✓ Check	What to do for Desired Condition	✓ Done
General	Quarterly	Dirty Discharge Water	Inspect discharge water for obvious signs of poor water quality.		Effluent discharge from vault should be clear without thick visible sheen.	
	Quarterly	Sediment Accumulation	Sediment depth in bottom of vault exceeds 6-inches in depth.		Remove sediment deposits that would impede flow through the vault and reduce separation efficiency.	
	Quarterly	Trash and Debris Accumulation	Trash and debris accumulation in vault, or pipe inlet/outlet, floatables and non-floatables.		Remove trash and debris from vault and inlet/outlet piping.	
	Quarterly	Oil Accumulation	Oil accumulations that exceed 1 inch, at the surface of the water.		Extract oil from vault by vactoring. Disposal must be in accordance with state and local rules and regulations.	
	Quarterly	Damaged Pipes	Inlet or outlet piping damaged or broken and in need of repair.		Pipe repaired or replaced.	
	Quarterly	Access Cover Damaged/Not Working	Cover cannot be opened, corrosion/deformation of cover.		Cover repaired to proper working specifications or replaced.	
	Annually	Vault Structure Damage - Cracks in Walls or Bottom, Damage to Frame and/or Top Slab	See "Catch Basins"		Vault replaced or repairs made so that vault meets design specifications and is structurally sound.	
	Annually	Baffles	Baffles corroding, cracking, warping and/or show signs of failure as determined during inspection.		Baffles repaired or replaced to specifications.	
	Annually	Access Ladder Damaged	Ladder is corroded or deteriorated, not securely attached to structure wall, missing rungs, cracks, or misaligned.		Ladder replaced or repaired and meets specifications and is safe to use as determined by inspection.	

3f Coalescing Plate Oil/Water Separators

An underground vault or tank designed to separate oil from runoff water via gravity.

What to Check	How Often	Problem or Defect	Conditions to Check For	✓ Check	What to do for Desired Condition	✓ Done
General	Quarterly	Dirty Discharge Water	Inspect discharge water for obvious signs of poor water quality.		Effluent discharge from vault should be clear with no thick visible sheen.	
	Quarterly	Sediment Accumulation	Sediment depth in bottom of vault exceeds 6 inches in depth and/or visible signs of sediment on plates.		No sediment on vault bottom and plate media, which would impede flow through the vault and reduce separation efficiency.	
	Quarterly	Trash and Debris	Trash and debris accumulated in vault, or pipe inlet/outlet, floatables.		Trash and debris removed from vault.	
	Quarterly	Oil Accumulation	Oil accumulation that exceeds 1 inch at the water surface.		Oil is extracted from vault. Coalescing plates are cleaned. There should be no visible oil depth on water.	
	Annually	Damaged Coalescing Plates	Plate media broken, deformed, cracked and/or showing signs of failure.		Repaired or replaced.	
	Annually	Damaged Pipes	Inlet or outlet piping damaged or broken or in need of repair.		Pipe repaired and or replaced.	
	Annually	Baffles	Baffles showing signs of failure as determined during maintenance/inspection.		Baffles repaired or replaced to specifications.	
	Annually	Vault Structure Damage - Includes Cracks. Damage to Frame and/or Top Slab	Cracks wider than 1/2 inch or evidence of soil particles entering the structure through the cracks, or maintenance/inspection personnel determine that the vault is not structurally sound.		Vault replaced or repairs made so that vault meets design specifications and is structurally sound.	
	Annually		Cracks wider than 1/2 inch at the joint of any inlet/outlet pipe or soil particles entering through the cracks.		Vault repaired to designed condition.	
	Annually	Access Ladder Damaged	Ladder is corroded or deteriorated, not functioning properly, not securely attached to structure wall, missing rungs, cracks, and misaligned.		Replace or repair ladder so it meets specifications and is safe to use as determined by inspection.	

3g Catch Basin Inserts

A structure within a catch basin, with a filter containing a pollutant-removal medium. Generally considered as an alternative to oil-water separators, these are not commonly used for permanent installations, as they tend to be maintenance-intensive.

What to Check	How Often	Problem or Defect	Conditions to Check For	✓ Check	What to do for Desired Condition	✓ Done
General	Quarterly	Sediment Accumulation	When sediment forms a cap over the insert media of the insert and/or unit.		No sediment cap on the insert media and its unit.	
	Quarterly	Trash and Debris Accumulation	Trash and debris accumulate on insert unit creating a blockage/restriction.		Trash and debris removed from insert unit. Runoff freely flows into catch basin.	
	Quarterly	Media Insert Not Removing Oil	Effluent water from media insert has a visible sheen.		Effluent water from media insert is free of oils and has no visible sheen.	
	Quarterly	Media Insert Water Saturated	Catch basin insert is saturated with water and no longer has the capacity to absorb.		Remove and replace media insert	
	Quarterly	Media Insert - Oil Saturated	Media oil saturated due to petroleum spill that drains into catch basin.		Remove and replace media insert.	
	Quarterly	Media Insert Use Beyond Normal Product Life	Media has been used beyond the typical average life of media insert product.		Remove and replace media at regular intervals, depending on insert product.	

Group 4 - Miscellaneous Systems/Facilities and Pervious Pavement

4a Downspouts and Roof Drywells

These facilities dispose of stormwater from roofs and clean impervious surfaces.

What to Check	How Often	Problem or Defect	Conditions to Check For	✓ Check	What to do for Desired Condition	✓ Done
Downspout	Annually	Overflow	Water overflows from the gutter or downspout during rain.		First try cleaning out the gutter and downspouts. If this doesn't solve the problem, a larger drywell may be needed.	
Roof	Annually	Moss	Moss and algae are taking over the shadier parts of the shingles.		Disconnect the flexible part of the downspout that leads to the drywell. Then perform moss removal as desired. Pressure wash or use fatty acid solutions instead of highly toxic pesticides or chlorine bleach. Install a zinc strip as a preventative.	
Downspout inlet screen	Annually	Overflowing gutter	Plugged screen		Remove and clean the screen making sure debris does not get into the downspout.	

4b Conveyance Pipes, Ditches and Swales

These features contain and direct the flow of water from one location to another.

What to Check	How Often	Problem or Defect	Conditions to Check For	✓ Check	What to do for Desired Condition	✓ Done
Pipes	Annually	Debris, & Vegetation	Vegetation should not reduce free movement of water through pipes. Ensure that the protective coating is not damaged or rusted. Dents should not significantly impede flow. Pipe should not have major cracks or flaws allowing water to leak out.		Remove all vegetation so that water flows freely through pipes. Repair or replace pipe.	
Pipes	Once every 5 years	Accumulated sediment supports bacteria growth and holds metals, hydrocarbons, and other stormwater pollutants.	Accumulated sediment should not exceed 20% of the diameter of the pipe. Hydraulically (hydrojet) clean sediment from inside of pipes to remove accumulated pollutants from the pipe.		Clean sediment and debris from inside of all pipes as required by the SW Permit.	
Open Ditches	Quarterly	Trash & Debris	There should not be any yard waste or litter in the ditch.		Remove trash and debris and dispose of them properly.	
	Annually	Sediment Buildup	Accumulated sediment should not exceed 20% of the depth of the ditch.		Clean out ditch of all sediment and debris.	
Open Ditches and Swales	Annually	Overgrowth of Vegetation	Check for vegetation (e.g., weedy shrubs or saplings) that reduces the free movement of water through ditches or swales.		Clear blocking vegetation so that water moves freely through the ditches. Grassy vegetation should be mowed or cut as needed.	
	Quarterly	Erosion	Check around inlets and outlets for signs of erosion. Check slopes for signs of sloughing or settling. Action is needed where eroded damage is over 2" deep and where there is potential for continued erosion.		Eliminate causes of erosion. Stabilize slopes by using the appropriate erosion control procedure (e.g. compact the soil, plant grass, reinforce with rock).	
	Annually	Missing Rocks	Native soil beneath the rock splash pad, check dam, or lining should not be visible.		Replace rocks to design standard.	

4b Conveyance Pipes, Ditches and Swales (Continued)

What to Check	How Often	Problem or Defect	Conditions to Check For	✓ Check	What to do for Desired Condition	✓ Done
Swales	Quarterly	Vegetation	Grass cover is sparse and weedy, or areas are overgrown with woody vegetation.		Aerate soils and re-seed and mulch bare areas. Keep grass less than 8" high. Remove woody growth, re-contour & re-seed as necessary.	
	Quarterly	Homeowner Conversion	Swale has been filled in or blocked by shed, woodpile, shrubbery, etc.		Speak with the homeowner and request that the swale area be restored. Contact the City to report the problem if not rectified voluntarily.	
	Annually	Swale does not drain	Water stands in the swale, or flow velocity is very slow. Stagnation occurs.		A survey may be needed to check grades. Grades should be in 1-5% range if possible. If grade is less than 1%, under-drains may need to be installed.	

4c Access Roads & Easements

These features provide access to drainage facilities for inspection and/or maintenance.

What to Check	How Often	Problem or Defect	Conditions to Check For	✓ Check	What to do for Desired Condition	✓ Done
General	One Time	Access	Check to determine if there is adequate access to your stormwater facilities for maintenance vehicles.		If there is not adequate access, check with the City to determine whether an easement exists. If so, a maintenance road may need to be constructed there.	
Access Road	Quarterly	Blocked Roadway	Debris that could damage vehicle tires (glass or metal).		Clear all potentially damaging material.	
	Annually	Blocked Roadway	Any obstructions which reduce clearance above and along the road to less than 14 feet.		Clear above and along roadway so there is enough clearance.	
Road Surface	Annually	Bad Road Conditions	Check for potholes, ruts, mushy spots, or woody debris that limits access by maintenance vehicles.		Add gravel or remove wood as necessary.	
Shoulders and Ditches	Annually	Erosion	Check for erosion along roadway.		Repair erosion with additional soil or gravel.	

4d Permeable Pavement

What to Check	Recommended Inspection and routine maintenance frequency	Condition when Maintenance is Needed (Standards)	✓ Check	Action Needed (Procedures)	✓ Done
Surface	Annually			<p>Combined pressure wash and vacuum system calibrated to not dislodge wearing course aggregate.</p> <p>Handheld pressure washer or power washer with rotating brushes.</p> <p>Pure vacuum sweepers</p> <p>Note: If the annual/biannual routine maintenance standard to clean the pavement surface is conducted using equipment from the list above, corrective maintenance may not be needed.</p>	
	Annually	Sediment present at the surface of the pavement.		<p>Assess the overall performance of the pavement system during a rain event. If water runs off the pavement and/or there is ponding, then see above.</p> <p>Determine source of sediment loading and evaluate whether or not the source can be reduced or eliminated. If the source cannot be addressed, consider increasing frequency of routine cleaning (e.g., twice per year instead of once per year).</p>	
	Summer	Moss growth inhibits infiltration or poses slip safety hazard.		<p>Sidewalks: Use a stiff broom to remove moss in the summer when it is dry.</p> <p>Parking lots and roadways: Vacuum sweep or stiff broom/power brush for cleaning moss from pavement surface.</p>	
	Annually	Paver block missing or damaged.		Remove individual damaged paver blocks by hand and replace or repair per manufacturer's recommendations.	
	Annually	Loss of aggregate material between paver blocks		Refill per manufacturer's recommendations for interlocking paver sections.	
	Annually	Settlement of surface.		May require resetting.	
Open-celled paving grid with gravel	Biannually	None (routine maintenance)		<p>Remove sediment, debris, trash, vegetation, and other debris deposited onto pavement (rakes and leaf blowers can be used for removing leaves).</p> <p>Follow equipment manufacturer guidelines for cleaning surface.</p>	

What to Check	Recommended Inspection and routine maintenance frequency	Condition when Maintenance is Needed (Standards)	✓ Check	Action Needed (Procedures)	✓ Done
Open-celled paving grid with grass	Annually and during a storm	Aggregate is clogged: Ponding on surface or water flows off the permeable pavement surface during a rain event (does not infiltrate).		Use vacuum truck to remove and replace top course aggregate. Replace aggregate in paving grid per manufacturer's recommendations.	
	Annually	Paving grid missing or damaged.		Remove pins, pry up grid segments, and replace gravel. Replace grid segments where three or more adjacent rings are broken or damaged. Follow manufacturer guidelines for repairing surface.	
	Annually	Settlement of surface.		May require resetting.	
	Annually	Loss of aggregate material in paving grid.		Replenish aggregate material by spreading gravel with a rake (gravel level should be maintained at the same level as the plastic rings or no more than 1/4 inch above the top of rings). See manufacturer's recommendations.	
	Annually	Weeds present		Manually remove weeds. Presence of weeds may indicate that too many fines are present (refer to Actions Needed under "Aggregate is clogged" to address this issue).	
	Annually	None (routine maintenance)		Manually remove weeds. Presence of weeds may indicate that too many fines are present (refer to Actions Needed under "Aggregate is clogged" to address this issue).	
	Biannually	None (routine maintenance)		Remove sediment, debris, trash, vegetation, and other debris deposited onto pavement (rakes and leaf blowers can be used for removing leaves). Follow equipment manufacturer guidelines for cleaning surface.	
	Annually	Aggregate is clogged: Ponding on surface or water flows off the permeable pavement surface during a rain event (does not infiltrate).		Rehabilitate per manufacturer's recommendations.	
	Annually	Paving grid missing or damaged.		Remove pins, pry up grid segments, and replace grass. Replace grid segments where three or more adjacent rings are broken or damaged. Follow manufacturer guidelines for repairing surface.	

What to Check	Recommended Inspection and routine maintenance frequency	Condition when Maintenance is Needed (Standards)	✓ Check	Action Needed (Procedures)	✓ Done
	Annually	Settlement of surface.		May require resetting.	
	Annually	Poor grass coverage in paving grid.		Restore growing medium, reseed or plant, aerate, and/or amend vegetated area as needed. Traffic loading may be inhibiting grass growth; reconsider traffic loading if feasible.	
	As needed	None (routine maintenance)		Use a mulch mower to mow grass.	
Inlets/Outlets/Pipes					
Inlet/outlet pipe	Annually	Pipe is damaged		Repair/replace	
	Annually	Pipe is clogged		Remove roots or debris	
Underdrain pipe	Clean orifice at least biannually (may need more frequent cleaning during wet season).	Plant roots, sediment or debris-reducing capacity of underdrain (may cause prolonged draw-down period).		Jet clean or rotary cut debris/roots from underdrain(s). If underdrains are equipped with a flow restrictor (e.g., orifice) to attenuate flows, the orifice must be cleaned regularly.	
Raised subsurface overflow pipe	Clean orifice at least biannually (may need more frequent cleaning during wet season).	Plant roots, sediment or debris-reducing capacity of underdrain.		Jet clean or rotary cut debris/roots from under-drain(s). If underdrains are equipped with a flow restrictor (e.g., orifice) to attenuate flows, the orifice must be cleaned regularly.	
Outlet structure	Annually and after major storms.	Sediment, vegetation, or debris-reducing capacity of outlet structure.		Clear the blockage. Identify the source of the blockage and take actions to prevent future blockages.	
Overflow	Biannually	Native soil is exposed, or other signs of erosion damage are present at discharge point.		Repair erosion and stabilize surface.	
Aggregate Storage Reservoir					
Observation port	Annually and after major storms.	Water remains in the storage aggregate longer than anticipated by design after the end of a storm.		If immediate cause of extended ponding is not identified, schedule investigation of subsurface materials or other potential causes of system failure.	
Vegetation					
Adjacent large shrubs or trees	As needed	Vegetation related fallout clogs or will potentially clog voids.		Sweep leaf litter and sediment to prevent surface clogging and ponding. Prevent large root systems from damaging subsurface structural components.	

What to Check	Recommended Inspection and routine maintenance frequency	Condition when Maintenance is Needed (Standards)	✓ Check	Action Needed (Procedures)	✓ Done
	Once in May and Once in September	Vegetation growing beyond facility edge onto sidewalks, paths, and street edge.		Edging and trimming of planted areas to control groundcovers and shrubs from overreaching the sidewalks, paths and street edge improves appearance and reduces clogging of permeable pavements by leaf litter, mulch and soil.	
Leaves, needles, and organic debris	In fall (October to December) after leaf drop (1-3 times, depending on canopy cover).	Accumulation of organic debris and leaf litter.		Use leaf blower or vacuum to blow or remove leaves, evergreen needles, and debris (i.e., flowers, blossoms) off of and away from permeable pavement.	
Note that the inspection and routine maintenance frequencies listed above are recommended by Ecology. They do not supersede or replace the municipal stormwater permit requirements for inspection frequency required of municipal stormwater permittees for "stormwater treatment and flow control BMPs/facilities".					

4e Vegetated Roofs

Action Needed (Procedures)	Objective	Schedule	Notes	✓ Check	✓ Done
Structural and Drainage Components					
Clear inlet pipes: Remove soil substrate, vegetation, or other debris.	Maintain free drainage of inlet pipes.	Twice annually.			
Inspect drainpipe: Check for cracks settling and proper alignment and correct and re-compact soils or fill material surrounding pipe, if necessary.	Maintain free drainage of inlet pipes.	Twice annually.			
Inspect fire ventilation points for proper operation	Fire and safety.	Twice annually.			
Maintain egress and ingress: Clear routes of obstructions and maintained to design standards.	Fire and safety.	Twice annually.			

Action Needed (Procedures)	Objective	Schedule	Notes	✓ Check	✓ Done
Insects: (see note)			Roof garden design should provide drainage rates that do not allow pooling of water for periods that promote insect larvae development. If standing water is present for extended periods correct drainage problem. Chemical sprays should not be used.		
Prevent release of contaminants: Identify activities (mechanical systems maintenance, pet access, etc.) that can potentially release pollutants to the roof garden and establish agreements to prevent release.	Water quality protection.	During construction of roof and then as determined by inspection.	Any cause of pollutant release should be corrected as soon as identified and the pollutant removed.		
Invasive or nuisance plants: Remove manually and without herbicide applications.	Promote selected plant growth and survival, maintain aesthetics.	Twice annually.	At a minimum, schedule weeding with inspections to coincide with important horticultural cycles (e.g., prior to major weed varieties dispersing seeds).		
Removing and replacing dead material: (see note)	See note.	Once annually.	Normally, dead plant material will be recycled on the roof; however specific plants or aesthetic considerations may warrant removing and replacing dead material (see manufacturer's recommendations).		
Fertilization: If necessary, apply by hand (see note)	Plant growth and survival.	Determined by inspection.	Extensive roof gardens should be designed to not require fertilization after plant establishment. If fertilization is necessary during plant establishment or for plant health and survivability after establishment, use an encapsulated, slow-release fertilizer (excessive		

Action Needed (Procedures)	Objective	Schedule	Notes	✓ Check	✓ Done
			fertilization can contribute to increased nutrient loads in the stormwater system and receiving waters).		
Mulching: (see note)			Avoid application of mulch on extensive roof gardens. Mulch should be used only in unusual situations and according to the roof garden provider guidelines. In conventional landscaping mulch enhances moisture retention; however, moisture control on a vegetated roof should be through proper soil/growth media design. Mulch will also increase establishment of weeds.		
Irrigate: Use subsurface or drip irrigation.		Determined by inspection and only when absolutely necessary for plant survival.	Surface irrigation systems on extensive roof gardens can promote weed establishment, root development near the drier sur-face layer of the soil substrate and increase plant dependence on irrigation. Accordingly, subsurface irrigation methods are preferred. If surface irrigation is the only method available, use drip irrigation to deliver water to the base of the plant.		

Group 5 - Proprietary Treatment Systems

Group 5 Proprietary Treatment Systems

Recommended maintenance actions for proprietary systems follows manufactures guidance to keep the systems performing as designed. As a general rule, these systems require semi-annual inspection and at least annual maintenance which in some cases requires replacement of filter media or associated components. See appropriate section for each system to determine maintenance frequency. If you have a system not included in this manual, let us know at Bremerton1@ci.bremerton.wa.us and we will update with current details.

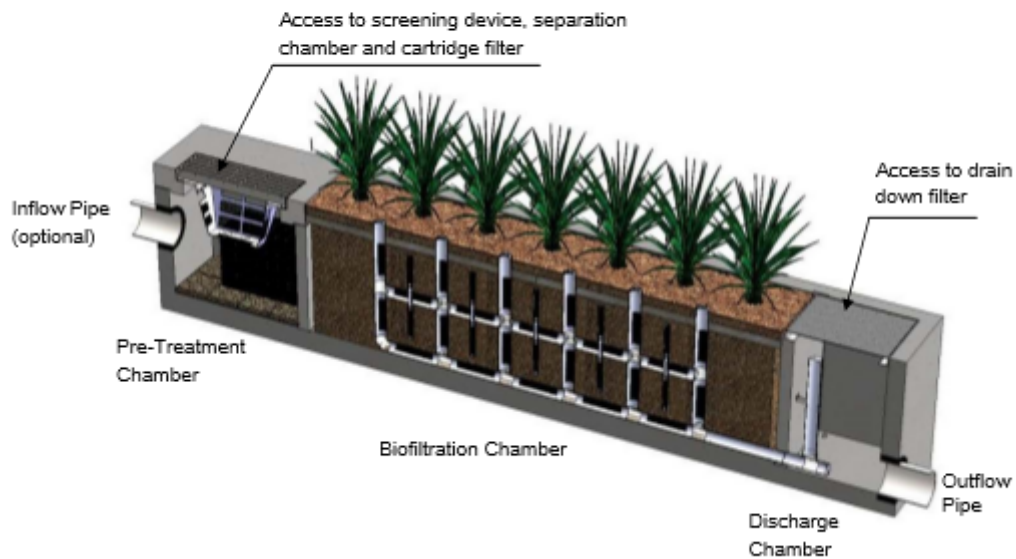
5a Modular Wetlands Systems®

Bio Clean's Modular Wetlands Systems® combine a pretreatment chamber which includes changeable filter media in the primary chamber, with biofiltration to remove TSS, metals, nutrients, hydrocarbons, and bacteria. These come in curb, grate, vault, and downspout types. General maintenance actions are based on needs identified in an inspection and maintenance report. The form was developed by the manufacturer is on the following pages. For additional information is visit their website, <https://biocleanenvironmental.com/modular-wetlands-system-linear/>. **Maintenance of these systems requires confined space entry which can only be performed by trained and certified personnel. Do not enter these vaults unless you are following the WISHA Confined Space regulations with appropriate equipment and training.**

Maintenance Summary

- Remove Trash from Screening Device – average maintenance interval is 6 to 12 months.
 - *(5 minute average service time).*
- Remove Sediment from Separation Chamber – average maintenance interval is 12 to 24 months.
 - *(10 minute average service time).*
- Replace Cartridge Filter Media – average maintenance interval 12 to 24 months.
 - *(10-15 minute per cartridge average service time).*
- Replace Drain Down Filter Media – average maintenance interval is 12 to 24 months.
 - *(5 minute average service time).*
- Trim Vegetation – average maintenance interval is 6 to 12 months.
 - *(Service time varies).*

System Diagram





Inspection Report Modular Wetlands System



Project Name _____		For Office Use Only (Reviewed By) _____ (Date) _____ Office personnel to complete section to the left.
Project Address _____ (City) _____ (Zip Code) _____		
Owner / Management Company _____		
Contact _____	Phone () _____ - _____	
Inspector Name _____		Date ____ / ____ / ____ Time ____ AM / PM
Type of Inspection <input type="checkbox"/> Routine <input type="checkbox"/> Follow Up <input type="checkbox"/> Complaint <input type="checkbox"/> Storm Storm Event in Last 72-hours? <input type="checkbox"/> No <input type="checkbox"/> Yes		
Weather Condition _____		Additional Notes _____

Inspection Checklist

Modular Wetland System Type (Curb, Grate or UG Vault): _____ Size (22', 14' or etc.): _____

Structural Integrity:	Yes	No	Comments
Damage to pre-treatment access cover (manhole cover/grate) or cannot be opened using normal lifting pressure?			
Damage to discharge chamber access cover (manhole cover/grate) or cannot be opened using normal lifting pressure?			
Does the MWS unit show signs of structural deterioration (cracks in the wall, damage to frame)?			
Is the inlet/outlet pipe or drain down pipe damaged or otherwise not functioning properly?			
Working Condition:			
Is there evidence of illicit discharge or excessive oil, grease, or other automobile fluids entering and clogging the unit?			
Is there standing water in inappropriate areas after a dry period?			
Is the filter insert (if applicable) at capacity and/or is there an accumulation of debris/trash on the shelf system?			
Does the depth of sediment/trash/debris suggest a blockage of the inflow pipe, bypass or cartridge filter? If yes specify which one in the comments section. Note depth of accumulation in in pre-treatment chamber.			Depth: _____
Does the cartridge filter media need replacement in pre-treatment chamber and/or discharge chamber?			Chamber: _____
Any signs of improper functioning in the discharge chamber? Note issues in comments section.			
Other Inspection Items:			
Is there an accumulation of sediment/trash/debris in the wetland media (if applicable)?			
Is it evident that the plants are alive and healthy (if applicable)? Please note Plant Information below.			
Is there a septic or foul odor coming from inside the system?			

Waste:	Yes	No
Sediment / Silt / Clay		
Trash / Bags / Bottles		
Green Waste / Leaves / Foliage		

Recommended Maintenance	
No Cleaning Needed	
Schedule Maintenance as Planned	
Needs Immediate Maintenance	

Plant Information	
Damage to Plants	
Plant Replacement	
Plant Trimming	

Additional Notes: _____



Cleaning and Maintenance Report Modular Wetlands System



Project Name _____		For Office Use Only (Reviewed By) _____ (Date) _____ Office personnel to complete section to the left.
Project Address _____ (city) (Zip Code)		
Owner / Management Company _____		
Contact _____	Phone () - _____	
Inspector Name _____	Date ____/____/____	Time ____ AM / PM
Type of Inspection <input type="checkbox"/> Routine <input type="checkbox"/> Follow Up <input type="checkbox"/> Complaint <input type="checkbox"/> Storm		
Storm Event in Last 72-hours? <input type="checkbox"/> No <input type="checkbox"/> Yes		
Weather Condition _____		Additional Notes _____

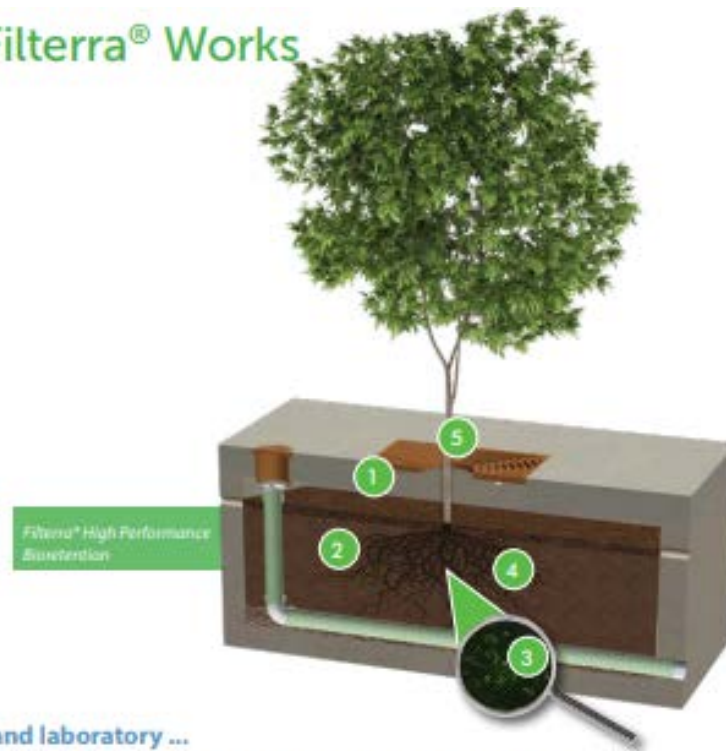
Site Map #	GPS Coordinates of Insert	Manufacturer / Description / Sizing	Trash Accumulation	Foliage Accumulation	Sediment Accumulation	Total Debris Accumulation	Condition of Media 25/50/75/100 (will be changed @ 75%)	Operational Per Manufactures' Specifications (If not, why?)
	Lat:	MWS Catch Basins						
	Long:							
		MWS Sedimentation Basin						
		Media Filter Condition						
		Plant Condition						
		Drain Down Media Condition						
		Discharge Chamber Condition						
		Drain Down Pipe Condition						
		Inlet and Outlet Pipe Condition						
Comments:								

5b Filterra® Tree Vault

Filterra Tree Vaults are similar to bioretention, but suitable for higher flows and amounts of pollutants. More information is available at the manufacturer's website.

<https://www.conteches.com/stormwater-management/biofiltration-bioretention/filterra>

How the Filterra® Works



Tested in the field and laboratory ...

- 1 Stormwater enters the Filterra through a pipe, curb inlet, or sheet flow and ponds over the pretreatment mulch layer, capturing heavy sediment and debris. Organics and microorganisms within the mulch trap and degrade metals and hydrocarbons. The mulch also provides water retention for the system's vegetation.
- 2 Stormwater flows through engineered Filterra media which filters fine pollutants and nutrients. Organic material in the media removes dissolved metals and acts as a food source for root-zone microorganisms. Treated water exits through an underdrain pipe or infiltrates (if designed accordingly).
- 3 Rootzone microorganisms digest and transform pollutants into forms easily absorbed by plants.
- 4 Plant roots absorb stormwater and pollutants that were transformed by microorganisms, regenerating the media's pollutant removal capacity. The roots grow, provide a hospitable environment for the rootzone microorganisms and penetrate the media, maintaining hydraulic conductivity.
- 5 The plant trunk and foliage utilize nutrients such as Nitrogen and Phosphorus for plant health, sequester heavy metals into the biomass, and provide evapotranspiration of residual water within the system.

Each maintenance visit consists of the following general tasks:

- Inspection of Filterra and surrounding area
- Removal of tree grate and erosion control stones
- Removal of debris, trash, and mulch
- Mulch replacement
- Plant health evaluation and pruning or replacement as necessary
- Clean area around Filterra
- Complete paperwork

Maintenance Checklist

Drainage System Failure	Problem	Conditions to Check	Condition that Should Exist	Actions
Inlet	Excessive sediment or trash accumulation.	Accumulated sediments or trash impair free flow of water into Filterra.	Inlet should be free of obstructions allowing free distributed flow of water into Filterra.	Sediments and/or trash should be removed.
Mulch Cover	Trash and floatable debris accumulation.	Excessive trash and/or debris accumulation.	Minimal trash or other debris on mulch cover.	Trash and debris should be removed and mulch cover raked level. Ensure bark nugget mulch is not used.
Mulch Cover	"Ponding" of water on mulch cover.	"Ponding" in unit could be indicative of clogging due to excessive fine sediment accumulation or spill of petroleum oils.	Stormwater should drain freely and evenly through mulch cover.	Recommend contact manufacturer and replace mulch as a minimum.
Vegetation	Plants not growing or in poor condition.	Soil/mulch too wet, evidence of spill. Incorrect plant selection. Pest infestation. Vandalism to plants.	Plants should be healthy and pest free.	Contact manufacturer for advice.
Vegetation	Plant growth excessive.	Plants should be appropriate to the species and location of Filterra.		Trim/prune plants in accordance with typical landscaping and safety needs.
Structure	Structure has visible cracks.	Cracks wider than 1/2 inch or evidence of soil particles entering the structure through the cracks.		Vault should be repaired.

Maintenance is ideally to be performed twice annually.

Filterra Inspection & Maintenance Log

Filterra System Size/Model: _____ Location: _____

[illegible]

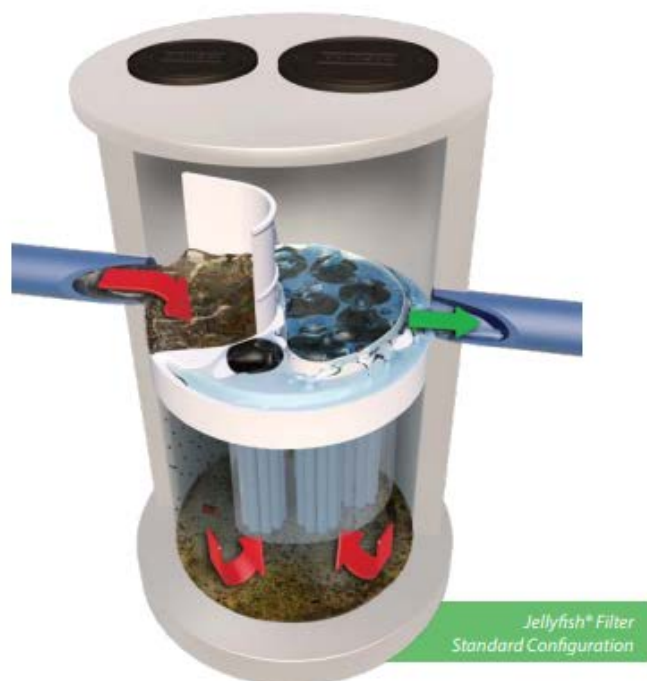
5c Contech Jellyfish® Filter

The Jellyfish filter is a stormwater treatment featuring high flow pretreatment and membrane filtration in a stand-alone system. Jellyfish removes trash, oil, suspended sediment, and pollutants including phosphorus, nitrogen, metals and hydrocarbons. More information is available at <https://www.conteches.com/stormwater-management/treatment/jellyfish-filter>.

How the Jellyfish® Filter Treats Stormwater

Tested in the field and laboratory ...

- Stormwater enters the Jellyfish through the inlet pipe and traps floating pollutants behind the maintenance access wall and below the cartridge deck.
- Water is conveyed below the cartridge deck where a separation skirt around the cartridges isolates oil, trash and debris outside the filtration zone.
- Water is directed to the filtration zone and up through the top of the cartridge where it exits via the outlet pipe.
- The membrane filters provide a very large surface area to effectively remove fine sand and silt-sized particles, and a high percentage of particulate-bound pollutants such as nitrogen, phosphorus, metals, and hydrocarbons while ensuring long-lasting treatment.
- As influent flow subsides, the water in the backwash pool flows back into the lower chamber. This passive backwash extends cartridge life.
- The draindown cartridge(s) located outside the backwash pool enables water levels to balance.



The inspection and maintenance log below is provided by the manufacturer. For personal safety and to protect the filter from damage, follow the manufacturer's full protocol for inspections and maintenance, in Appendix 2 of this manual.

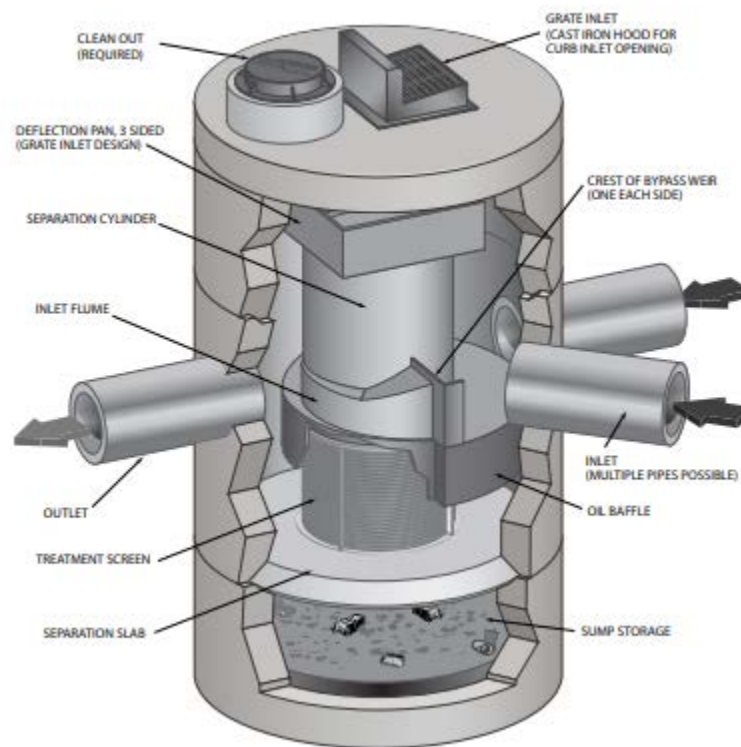
Jellyfish Filter Inspection and Maintenance Log

Owner: _____ Jellyfish Model No.: _____
 Location: _____ GPS Coordinates: _____
 Land Use: Commercial: _____ Industrial: _____ Service Station: _____
 Road/Highway: _____ Airport: _____ Residential: _____ Parking Lot: _____

Date/Time:						
Inspector:						
Maintenance Contractor:						
Visible Oil Present: (Y/N)						
Oil Quantity Removed						
Floatable Debris Present: (Y/N)						
Floatable Debris removed: (Y/N)						
Water Depth in Backwash Pool						
Draindown Cartridges externally rinsed and re-commissioned: (Y/N)						
New tentacles put on Cartridges: (Y/N)						
Hi-Flo cartridges externally rinsed and recommissioned (Y/N):						
New tentacles put on Hi-Flo Cartridges: (Y/N)						
Sediment Depth Measured: (Y/N)						
Sediment Depth (inches or mm):						
Sediment Removed: (Y/N)						
Cartridge Lids intact: (Y/N)						
Observed Damage:						
Comments:						

5d Contech CDS Hydrodynamic Separator®

The CDS hydrodynamic separator uses swirl concentration and continuous deflective separation to screen, separate, and trap trash, debris sediment, and hydrocarbons from stormwater runoff. The CDS system should be inspected at regular intervals and maintained when necessary to ensure optimum performance. The rate at which the system collects pollutants will depend more heavily on site activities than the size of the unit. For example, unstable soils or heavy winter sanding will cause the grit chamber to fill more quickly but regular sweeping of paved surfaces will slow accumulation.



The water depth to sediment (see inspection log below) is determined by taking two measurements with a stadia rod: one measurement from the manhole opening to the top of the sediment pile and the other from the manhole opening to the water surface. If the difference between these measurements is less than the values listed in the table below, the system should be cleaned out.

For optimum performance, the system should be cleaned out when the floating hydrocarbon layer accumulates to an appreciable thickness. In the event of an oil spill, the system should be cleaned immediately and thoroughly with high pressure water cleaning system, do not use soaps or detergents.

CDS Inspection & Maintenance Log

CDS Model: _____ Location: _____

Date	Water depth to sediment ¹	Floatable Layer Thickness ²	Describe Maintenance Performed	Maintenance Personnel	Comments

1. The water depth to sediment is determined by taking two measurements with a stadia rod: one measurement from the manhole opening to the top of the sediment pile and the other from the manhole opening to the water surface. If the difference between these measurements is less than the values listed in table 1 the system should be cleaned out. **Note: to avoid underestimating the volume of sediment in the chamber, the measuring device must be carefully lowered to the top of the sediment pile.**
2. For optimum performance, the system should be cleaned out when the floating hydrocarbon layer accumulates to an appreciable thickness. In the event of an oil spill, the system should be cleaned immediately.

7

CDS Model	Diameter		Distance from Water Surface to Top of Sediment Pile		Sediment Storage Capacity	
	ft	m	ft	m	y ³	m ³
CDS1515	3	0.9	3.0	0.9	0.5	0.4
CDS2015	4	1.2	3.0	0.9	0.9	0.7
CDS2015	5	1.5	3.0	0.9	1.3	1.0
CDS2020	5	1.5	3.5	1.1	1.3	1.0
CDS2025	5	1.5	4.0	1.2	1.3	1.0
CDS3020	6	1.8	4.0	1.2	2.1	1.6
CDS3025	6	1.8	4.0	1.2	2.1	1.6
CDS3030	6	1.8	4.6	1.4	2.1	1.6
CDS3035	6	1.8	5.0	1.5	2.1	1.6
CDS4030	8	2.4	4.6	1.4	5.6	4.3
CDS4040	8	2.4	5.7	1.7	5.6	4.3
CDS4045	8	2.4	6.2	1.9	5.6	4.3
CDS5640	10	3.0	6.3	1.9	8.7	6.7
CDS5653	10	3.0	7.7	2.3	8.7	6.7
CDS5668	10	3.0	9.3	2.8	8.7	6.7
CDS5678	10	3.0	10.3	3.1	8.7	6.7

Table 1: CDS Maintenance Indicators and Sediment Storage Capacities

Note: To avoid underestimating the volume of sediment in the chamber, carefully lower the measuring device to the top of the sediment pile. Finer silty particles at the top of the pile may be more difficult to feel with a measuring stick. These finer particles typically offer less resistance to the end of the rod than larger particles toward the bottom of the pile.

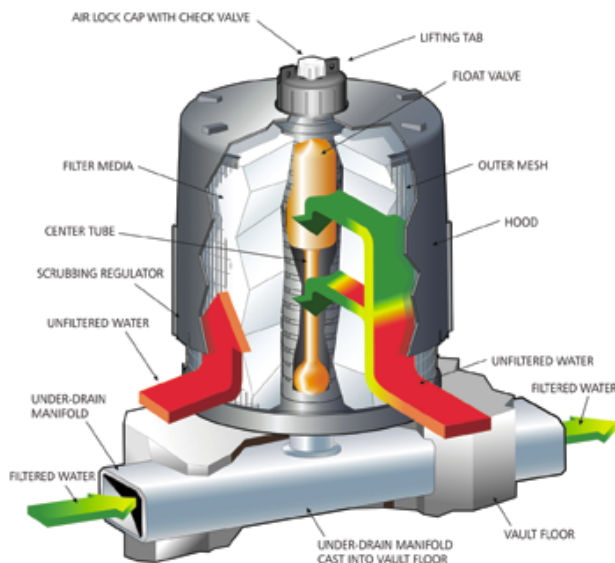


5e Contech Stormfilter®

The Stormfilter® uses rechargeable, media-filled cartridges to absorb and retain the most challenging pollutants from stormwater runoff, including total suspended solids, hydrocarbons, nutrients, metals and other common pollutants.

How the StormFilter Treats Stormwater

- During a storm, runoff passes through the filtration media and starts filling the cartridge center tube. The air inside the hood is purged through a one-way check valve as the water rises.
- When water reaches the top of the float, buoyant forces pull the float free and allow filtered water to exit the cartridge. A siphon is established within each cartridge that draws water uniformly across the full height of the media bed ensuring even distribution of pollutants and prolonged media longevity.
- After the storm, the water level in the structure starts falling. A hanging water column remains under the cartridge hood until the water level reaches the scrubbing regulators at the bottom of the hood.
- Air then rushes through the regulators, breaking the siphon and creating air bubbles that agitate the surface of the filter media, causing accumulated sediment to settle on the treatment bay floor. This unique surface-cleaning mechanism prevents surface blinding and further extends cartridge life.



Maintenance and Inspection Forms have been provided by the manufacturer. Complete instructions can be found on the manufacturer's website, in Maintenance Guides.
<https://www.conteches.com/technical-guides/search> .

Inspection Report

Date: _____ Personnel: _____

Location: _____ System Size: _____

System Type: Vault ☐ Cast-In-Place ☐ Linear Catch Basin ☐ Manhole ☐ Other ☐

Sediment Thickness in Forebay: _____ Date: _____

Sediment Depth on Vault Floor: _____

Structural Damage: _____

Estimated Flow from Drainage Pipes (if available): _____

Cartridges Submerged: Yes ☐ No ☐ Depth of Standing Water: _____

StormFilter Maintenance Activities (check off if done and give description)

☐ Trash and Debris Removal: _____

☐ Minor Structural Repairs: _____

☐ Drainage Area Report _____

Excessive Oil Loading: Yes ☐ No ☐ Source: _____

Sediment Accumulation on Pavement: Yes ☐ No ☐ Source: _____

Erosion of Landscaped Areas: Yes ☐ No ☐ Source: _____

Items Needing Further Work: _____

Owners should contact the local public works department and inquire about how the department disposes of their street waste residuals.

Other Comments:

Review the condition reports from the previous inspection visits.

StormFilter Maintenance Report

Date: _____ Personnel: _____

Location: _____ System Size: _____

System Type: Vault ☐ Cast-In-Place ☐ Linear Catch Basin ☐ Manhole ☐ Other ☐

List Safety Procedures and Equipment Used: _____

System Observations

Months in Service: _____

Oil in Forebay (if present): Yes ☐ No ☐

Sediment Depth in Forebay (if present): _____

Sediment Depth on Vault Floor: _____

Structural Damage: _____

Drainage Area Report

Excessive Oil Loading: Yes ☐ No ☐ Source: _____

Sediment Accumulation on Pavement: Yes ☐ No ☐ Source: _____

Erosion of Landscaped Areas: Yes ☐ No ☐ Source: _____

StormFilter Cartridge Replacement Maintenance Activities

Remove Trash and Debris: Yes ☐ No ☐ Details: _____

Replace Cartridges: Yes ☐ No ☐ Details: _____

Sediment Removed: Yes ☐ No ☐ Details: _____

Quantity of Sediment Removed (estimate?): _____

Minor Structural Repairs: Yes ☐ No ☐ Details: _____

Residuals (debris, sediment) Disposal Methods: _____

Notes:

5f BioPod®

BioPod™ Biofilter with StormMix™ Biofiltration Media Description

The BioPod™ Biofilter System is a stormwater biofiltration treatment system used to remove pollutants from stormwater runoff. Impervious surfaces and other urban and suburban landscapes generate a variety of contaminants that can enter stormwater and pollute downstream receiving waters unless treatment is provided. The BioPod system uses proprietary StormMix™ biofiltration media to capture and retain pollutants including total suspended solids (TSS), metals, nutrients, gross solids, trash, and debris as well as petroleum hydrocarbons.

Function

The BioPod system uses engineered, high-flow rate filter media to remove stormwater pollutants, allowing for a smaller footprint than conventional bioretention systems. Contained within a compact precast concrete vault, the BioPod system consists of a biofiltration chamber and an optional integrated high-flow bypass with a contoured inlet rack to minimize scour. The biofiltration chamber is filled with horizontal layers of aggregate (which may or may not include an underdrain), biofiltration media and mulch. Stormwater passes vertically down through the mulch and biofiltration media for treatment. The mulch provides pretreatment by retaining most of the solids or sediment. The biofiltration media provides further treatment by retaining finer sediment and dissolved pollutants. The aggregate allows the media bed to drain evenly for discharge through an underdrain pipe or by infiltration.



BioPod Media Module

Configuration

The BioPod system can be configured with either an internal or external bypass. The internal bypass allows both water quality and bypass flows to enter the treatment vault. The water quality flows are directed to the biofiltration chamber while the excess flows are diverted over the bypass weir without entering the biofiltration chamber. Both the treatment and bypass flows are combined in the outlet area prior to discharge from the structure. BioPod units without an internal bypass are designed such that only treatment flows enter the treatment structure. When the system has exceeded its treatment capacity, ponding will force bypass flows to continue down the gutter to the nearest standard catch basin or other external bypass structure.

The BioPod system can be configured as a tree box filter with tree and grated inlet, as a planter box filter with shrubs, grasses and an open top, or as an underground filter with access risers, doors, and a subsurface inlet pipe. The optional internal bypass may be incorporated with any of these configurations. In addition, an open bottom configuration may be used to promote infiltration and groundwater recharge. The configuration and size of the BioPod system is designed to meet the requirements of a specific project.

Inspection & Maintenance Overview

State and local regulations require all stormwater management systems to be inspected on a regular basis and maintained as necessary to ensure performance and protect downstream receiving waters. Without maintenance, excessive pollutant buildup can limit system performance by reducing the operating capacity of the system and increasing the potential for scouring of pollutants during periods of high flow.

Maintenance Frequency

Periodic inspection is essential for consistent system performance and is easily completed. Inspection is typically conducted a minimum of twice per year, but since pollutant transport and deposition varies from site to site, a site-specific maintenance frequency should be established during the first two or three years of operation.

Inspection Equipment

The following equipment is helpful when conducting BioPod inspections from the surface (**do not enter the confined space**):

- Recording device (pen and paper form, voice recorder, iPad, etc.)
- Suitable clothing (appropriate footwear, gloves, hardhat, safety glasses, etc.)
- Traffic control equipment (cones, barricades, signage, flagging, etc.)
- Manhole hook or pry bar
- Flashlight
- Tape measure

Inspection Procedures

BioPod inspections are visual and are conducted without entering the unit. To complete an inspection, safety measures including traffic control should be deployed before the access covers or tree grates are removed. Once the covers have been removed, the following items should be checked and recorded (see form provided) to determine whether maintenance is required:

If the BioPod unit is equipped with an internal bypass, inspect the contoured inlet rack and outlet chamber, and note whether there are any broken or missing parts. In the unlikely event that internal parts are broken or missing, contact Oldcastle Stormwater at (800) 579-8819 to determine appropriate corrective action.

Note whether the curb inlet, inlet pipe, or – if the unit is equipped with an internal bypass – the inlet rack is blocked or obstructed.

If the unit is equipped with an internal bypass, observe, quantify, and record the accumulation of trash and debris in the inlet rack. The significance of accumulated trash and debris is a matter of judgment. Often, much of the trash and debris may be removed manually at the time of inspection if a separate maintenance visit is not yet warranted.

If it has not rained within the past 24 hours, note whether standing water is observed in the biofiltration chamber.

Finally, observe, quantify, and record presence of invasive vegetation and the amount of trash and debris and sediment load in the biofiltration chamber. Erosion of the mulch and biofiltration media bed should also be recorded. Sediment load may be rated light, medium, or heavy depending on the conditions. Loading characteristics may be determined as follows:

- Light sediment load – Sediment is difficult to distinguish among the mulch fibers at the top of the mulch layer; the mulch appears almost new.
- Medium sediment load – Sediment accumulation is apparent and may be concentrated in some areas; probing the mulch layer reveals lighter sediment loads under the top 1" of mulch.
- Heavy sediment load – Sediment is readily apparent across the entire top of the mulch layer; individual mulch fibers are difficult to distinguish; probing the mulch layer reveals heavy sediment load under the top 1" of mulch.

Often, much of the invasive vegetation and trash and debris may be removed manually at the time of inspection if a separate maintenance visit is not yet warranted.

Maintenance Indicators

Maintenance should be scheduled if any of the following conditions are identified during inspection:

The concrete structure is damaged or the tree grate or access cover is damaged or missing.

The curb inlet or inlet rack is obstructed.

Standing water is observed in the biofiltration chamber more than 24 hours after a rainfall event (use discretion if the BioPod is located downstream of a storage system that attenuates flow).

Trash and debris in the inlet rack cannot be easily removed at the time of inspection.

Trash and debris, invasive vegetation or sediment load in the biofiltration chamber is heavy or excessive erosion has occurred.

Maintenance Equipment

The following equipment is helpful when conducting BioPod maintenance:

- Suitable clothing (appropriate footwear, gloves, hardhat, safety glasses, etc.)
- Traffic control equipment (cones, barricades, signage, flagging, etc.)
- Manhole hook or pry bar
- Flashlight
- Tape measure
- Rake, hoe, shovel and broom
- Bucket
- Pruners
- Vacuum truck (optional)

If entry into the vault is required, then use WISHA Confined Space Entry policies and procedures to complete this work.



BioPod Media Vault

Maintenance Procedures

Maintenance should be conducted during dry weather when no flows are entering the system. All maintenance may be conducted without entering the BioPod structure. Once safety measures such as traffic control are deployed, the access covers may be removed, and the following activities may be conducted to complete maintenance:

Remove all trash and debris from the curb inlet and inlet rack manually or by using a vacuum truck as required.

Remove all trash and debris and invasive vegetation from the biofiltration chamber manually or by using a vacuum truck as required.

If the sediment load is medium or light but erosion of the biofiltration media bed is evident, redistribute the mulch with a rake or replace missing mulch as appropriate. If erosion persists, rocks may be placed in the eroded area to help dissipate energy and prevent recurring erosion. If the sediment load is heavy, remove the mulch layer using a hoe, rake, shovel, and bucket, or by using a vacuum truck as required. If the sediment load is particularly heavy, inspect the surface of the biofiltration media once the mulch has been removed. If the media appears clogged with sediment, remove, and replace one or two inches of biofiltration media prior to replacing the mulch layer.

Replace the access covers and sweep the area around the BioPod to leave the site clean. All material removed from the BioPod during maintenance must be disposed of in accordance with local environmental regulations. In most cases, the material may be handled in the same manner as disposal of material removed from sumped catch basins or manholes.

Natural, shredded hardwood mulch should be used in the BioPod. Timely replacement of the mulch layer according to the maintenance indicators described above should protect the biofiltration media below the mulch layer from clogging due to sediment accumulation. However, whenever the mulch is replaced, the BioPod should be visited 24 hours after the next major storm event to ensure that there is no standing water in the biofiltration chamber. Standing water indicates that the biofiltration media below the mulch layer is clogged and must be replaced. Please contact Oldcastle Infrastructure at (800) 579-8819 to purchase the proprietary StormMix™ biofiltration media.

BioPod Inspection & Maintenance Log	
BioPod Model_____	Inspection Date_____
Location_____	
<i>Condition of Internal Components</i>	Notes:
<input type="checkbox"/> Good <input type="checkbox"/> Damaged <input type="checkbox"/> Missing	
<i>Curb Inlet or Inlet Rack Blocked</i>	Notes:
<input type="checkbox"/> Yes <input type="checkbox"/> No	
<i>Standing Water in Biofiltration Chamber</i>	Notes:
<input type="checkbox"/> Yes <input type="checkbox"/> No	
<i>Trash and Debris in Inlet Rack</i>	Notes:
<input type="checkbox"/> Yes <input type="checkbox"/> No	
<i>Trash and Debris in Biofiltration Chamber</i>	Notes:
<input type="checkbox"/> Yes <input type="checkbox"/> No	
<i>Invasive Vegetation in Biofiltration Chamber</i>	Notes:
<input type="checkbox"/> Yes <input type="checkbox"/> No	
<i>Sediment in Biofiltration Chamber</i>	Notes:
<input type="checkbox"/> Light <input type="checkbox"/> Medium <input type="checkbox"/> Heavy	
<i>Erosion in Biofiltration Chamber</i>	Notes:
<input type="checkbox"/> Yes <input type="checkbox"/> No	
<i>Maintenance Requirements</i>	
<input type="checkbox"/> Yes - Schedule Maintenance <input type="checkbox"/> No - Schedule Re-Inspection	

5g Other Proprietary System Manufacturers

Other proprietary stormwater systems include:

Gullywasher catchbasin inserts, blue filter gabions

- <http://gullywasher.com/>

BayFilter stormwater filter cartridge

- Manufactured by BaySaver Technologies
- <https://baysaver.com/stormwater-filters/>

BioChar filters, catch basin inserts, and other products

- <http://stormwaterbiochar.com/>

AquaShield stormwater treatments

- <https://www.aquashieldinc.com/>

Rotondo Environmental Solutions stormwater treatments

- <http://www.rotondo-es.com/Products.html>

StormwaterRx treatment systems

- <https://stormwaterx.com>

Glossary of Stormwater Terms

Best Management Practices (BMPs) – Structural features or procedures that reduce the adverse impacts of development on the quantity and/or quality of runoff water.

Biofilter (Swale) – A wider and flatter vegetated version of a ditch over which runoff flows at a uniform depth and velocity. Biofilters perform best when vegetation has a thick mat of roots, leaves, and stems at the soil interface (such as grass).

Biofiltration – The process through which pollutant concentrations in runoff water are reduced by filtering runoff through vegetation.

Bioretention – The process through which pollutants in runoff water are reduced by filtering through a designed soil mixture and plant complex and infiltrating into the native soil below.

The chemical, biological and physical properties of plants, soil microbes, and the soil mixture's mineral aggregate and organic matter transforms, removes and retains stormwater pollutants.

Buffer – The zone along a sensitive aquatic area that provides protection, stability, shading, slope and bank stabilization, and input of organic debris and coarse sediments to streams. It allows room for variation in aquatic system boundaries, attenuation of surface water flows, habitat for wildlife, and protection from disturbance or intrusion by humans or domestic animals.

Catch Basin – An inlet box set into the ground, usually rectangular and made of concrete, capped with a grate that allows stormwater to enter. A sump in the bottom catch's sediment.

Check Dam – A dam (of rock, logs, etc.) built in a gully or drainage channel to reduce flow velocity, minimize erosive scouring, promote sediment deposition, and/or enhance infiltration.

Compost Stormwater Filter – A treatment facility that removes sediment and pollutants from stormwater by percolating water through a layer of specially-prepared Bigleaf maple compost. Clean water exits the bottom of the facility through a pipe.

Constructed Wetland – A wet pond with dead storage at various depths and planted with wetland plants to enhance its treatment capabilities.

Control Structure or Flow Restrictor – A manhole and/or pipe structure with a flow- regulating or metering device such as a weir or plates with small holes known as orifices. The structure controls the rate at which water leaves the pond.

Conveyance – A mechanism or device for transporting water, including gutters, pipes, channels (natural or man-made), culverts, manholes, etc.

Critical Areas – Areas such as wetlands, streams, steep slopes, etc., as defined by ordinance or resolution by the jurisdiction. Also known as environmentally-sensitive areas.

Culvert – A conveyance device (e.g. concrete, metal or plastic pipe) which conveys water from a ditch, swale, or stream under (usually across) a roadway, driveway or embankment.

Dead Storage – The volume of storage in a wet pond below the outlet which does not drain

after a storm event. This pool provides stormwater treatment by settling-out sediments.

Detention Facility – A facility (e.g. a pond, vault, or pipe) in which surface water or stormwater is temporarily stored.

Detention Pond – A detention facility in the form of an open pond. Water is collected and detained in the pond as it's released at a reduced rate.

Dispersion Trench – An open-top trench filled with rip rap or gravel that takes the discharge from a pond, spreads it out, and releases the flow out along its entire length. Dispersion trenches are used to spread-out discharge water to simulate unconcentrated “sheet flow” of stormwater from an area, and are often used to protect sensitive areas.

Drainage System – A combination of facilities for the collection, conveyance, containment, treatment, discharge and/or disposal of stormwater runoff.

Drop Structure – A structure for dropping water to a lower elevation and/or dissipating energy. A drop may be vertical or inclined.

Dry Pond – Casual name for an Infiltration Basin, a detention facility that drains completely after a storm. This type of pond has a pipe outlet at the bottom.

Easement – A legal encumbrance placed against a property's title to reserve access. Drainage easements typically provide access to pipes and/or ponds, and are generally 15 to 20 feet wide.

Emergency Overflow or Spillway – An area on the top edge of a pond that is slightly lower in elevation and is normally lined with riprap for erosion protection. The emergency overflow is used only if the primary and secondary outlets of the pond fail, in the event of extreme storms, or if the infiltration capability of the pond becomes significantly diminished. If the emergency overflow ever comes into play, it may mean that the pond needs to be upgraded.

Energy Dissipator – A rock pad at an outlet (of a pipe, channel, etc.) designed to slow the flow velocity, spread out the water leaving the outlet, and reduce the potential for erosion.

Freeboard – The vertical distance between the design high water mark and the top rim of a pond (or other structure). Most ponds have one to two feet of freeboard to prevent them from overflowing.

Infiltration – The soaking of water through the soil surface into the ground (percolation is essentially the same thing). Many ponds are designed to infiltrate or retain stormwater, and thus do not have a regularly used discharge pipe.

Infiltration Facility (or Structure) – A facility (pond or trench) which retains and percolates stormwater into the ground, having no discharge (to any surface water) under normal operating conditions.

Junction – Point where two or more drainage pipes or channels converge (e.g. a manhole).

Jurisdiction – City or county, such as the City of Bremerton or Kitsap County (as applicable).

Lined Pond or Conveyance – A facility, the bottom and sides of which have been made impervious (using, for example, a plastic liner or clay/silt soil layer) to the transmission of liquids.

Live Storage – The volume of storage in a pond above the outlet, which drains after a storm event. This storage capacity provides flood control and habitat protection for nearby streams.

Manhole – A larger version of the catch basin, often a cylindrical concrete structure with a circular solid lid. Manholes allow access to buried pipes (such as storm sewers) for maintenance.

Natural Channel – A stream, creek, river, lake, wetland, estuary, gully, swale, ravine, or any open conduit where water will concentrate and flow intermittently or continuously.

Oil-Water Separator – A structure or device used to remove oil and greasy solids from water. They operate by using gravity separation of liquids that have different densities. Many catch basins have a down-turned plastic elbow that provides some oil-water separation.

Outfall – The point where water flows from a man-made conduit, channel, or drain into a water body or other natural drainage feature.

Retention Facility – A facility that is designed to retain water and allow for infiltration.

Retention Pond – A retention facility that is an open basin or “pond.”

Revetments – Materials such as rock or keystones used to sustain an embankment, such as in a retaining wall.

Riprap – Broken rock, cobbles, or boulders placed on earth surfaces, such as on top of a berm for the emergency overflow, along steep slopes, or at the outlet of a pipe, for protection against the erosive action of water. Also used for entrances to construction sites, to prevent sediment tracking.

Runoff – The portion of water originating as precipitation that becomes surface flow. See “stormwater” below.

Sand Filter – A treatment facility that removes pollutants and sediments from stormwater by percolating stormwater through a layer of sand. Clean water exits the bottom of the facility through a pipe.

Stormwater – The portion of precipitation that falls on property and that does not naturally percolate into the ground or evaporate, but flows via overland flow, interflow, pipes or other features into a defined surface water body or a constructed infiltration facility.

Swale – A shallow surface drainage conveyance with relatively gentle side slopes, generally with flow depths less than 1 foot. A broad and flat-bottomed ditch. See “biofilter.”

Trash Rack or Bar Screen – A device (usually a screen or bars) that fits over a pipe opening to prevent large debris such as rocks or branches from entering and partially blocking the pipe.

Wet Pond – A stormwater treatment pond designed with a “dead storage” volume to maintain a continuous or seasonal static water level below the pond outlet elevation.

Appendix 1

UIC Wells Registration Required

(As defined in 2019 SWMMWW)

Infiltration BMPs, General Information

The 2019 Stormwater Management Manual for Western Washington, Volume V-Chapter 5, page 723, introduces infiltration BMPs and associated design criteria that was used to design and construct your system. Below are system configurations approved by Ecology that help reduce runoff quantity and or provide treatment. Guidance is provided in the preceding sections for maintenance requirements. The information below is from the 2019 SWMMWW.

An infiltration BMP is typically an impoundment, such as a basin, trench, or bioretention swale whose soil may remove pollutants from stormwater. Permeable pavement is a non-impoundment type of infiltration BMP. Stormwater dry wells receiving uncontaminated or properly treated stormwater can also be considered an infiltration BMP. See Underground Injection Control Program, [Chapter 173-218 WAC](#).

Infiltration BMPs are used as Flow Control BMPs, and in some cases can also be used as Runoff Treatment BMPs. Infiltration BMPs used as Flow Control BMPs convey stormwater runoff from new development or redevelopment to the ground and ground water after appropriate Runoff Treatment. Infiltration BMPs used as Runoff Treatment BMPs rely either on the soil profile or on a treatment layer within the BMP to provide Runoff Treatment. Infiltration BMPs can help accomplish the following:

- Ground water recharge.
- Discharge of uncontaminated or properly treated stormwater to dry-wells in compliance with Ecology's UIC regulations ([Chapter 173-218 WAC](#)).
- Retrofits in limited land areas: [BMP T7.20: Infiltration Trenches](#) can be considered for residential lots, commercial areas, parking lots, and open space areas.
- Flood control.
- Streambank erosion control.

Infiltration refers to the use of the filtration, adsorption, and biological properties of native soils, with or without amendments, to remove pollutants as stormwater soaks into the ground. Infiltration can provide multiple benefits including pollutant removal, peak flow control, ground water recharge, and flood control.

UIC regulations apply to infiltration trenches when perforated pipe is used, and then, provided that the design, operation, and maintenance criteria in this section are met, only the registration requirement applies. Where perforated pipe is not used, the registration requirement does not apply. See [I-4 UIC Program](#) for details in the 2019 Ecology SWMMWW.

Due to the multiple hydrologic benefits of infiltration, Ecology encourages infiltration to the maximum extent practicable. Sites that can fully infiltrate are not required to provide additional Runoff Treatment or Flow Control BMPs. Hard surfaces that are not fully infiltrated should be partially infiltrated to the maximum extent practicable.

Figure V-5.6: Parking Lot Perimeter Trench Design

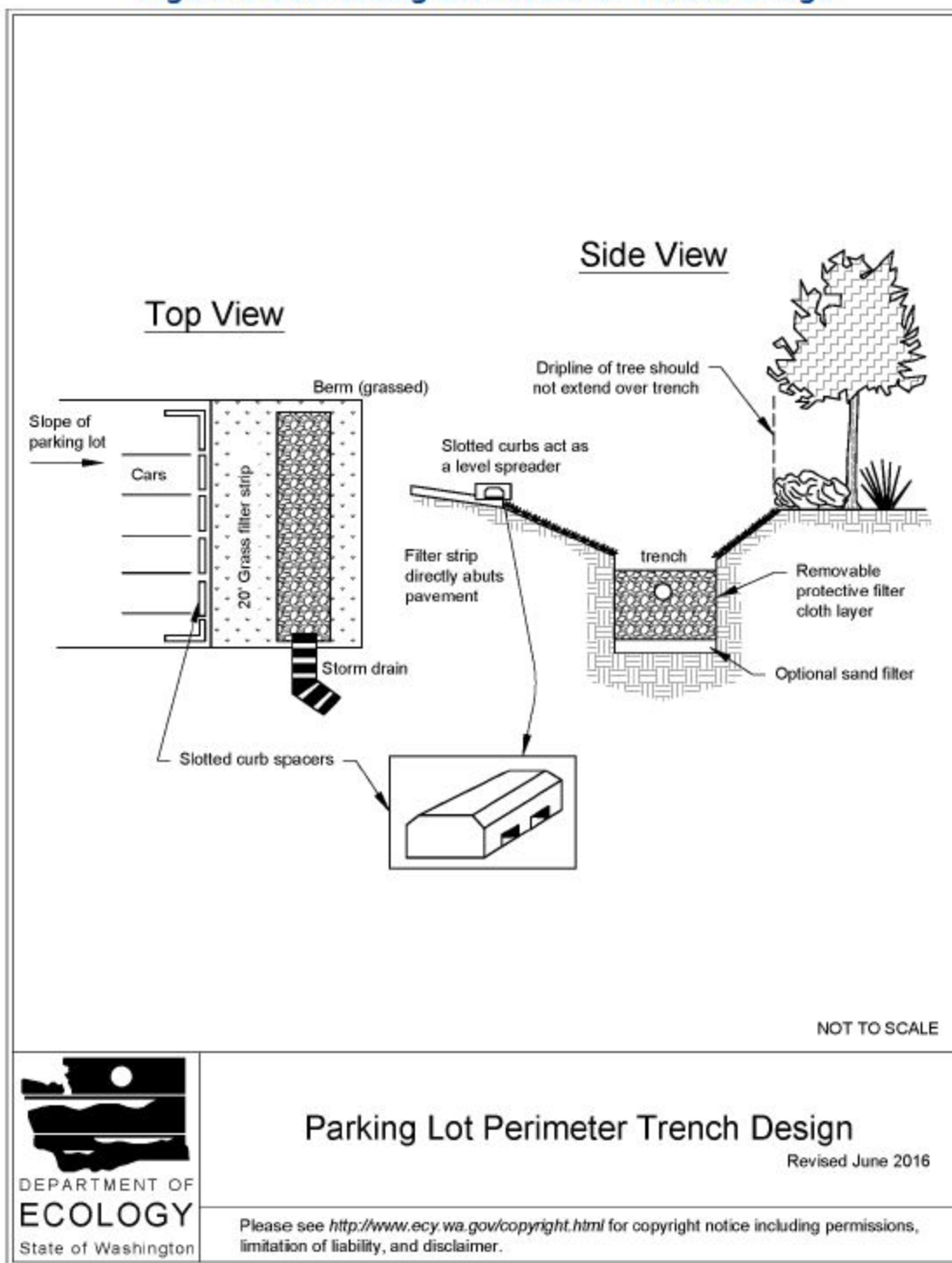


Figure V-5.8: Oversized Pipe Trench Design

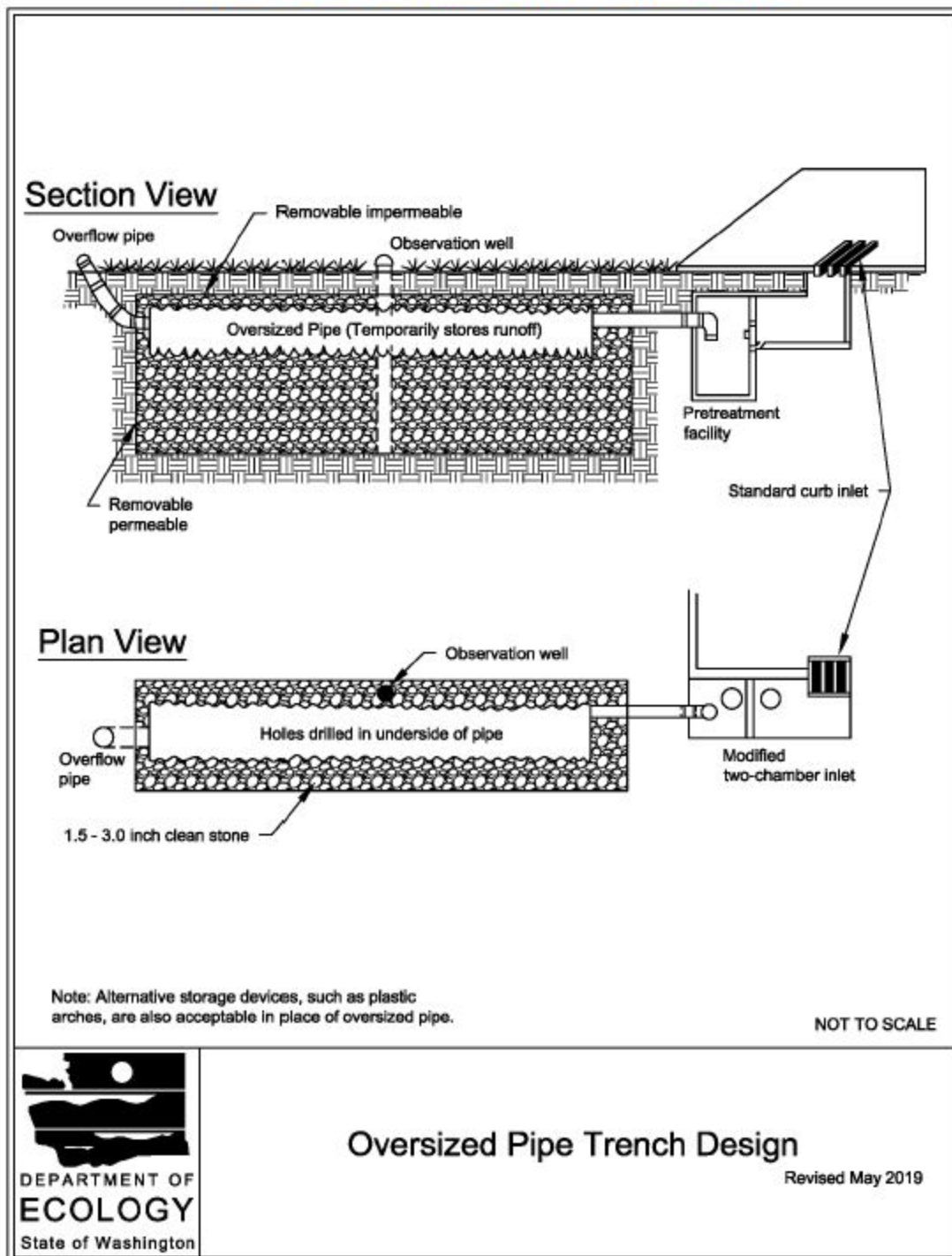


Figure V-5.10: Underground Trench with Oil/Grit Chamber

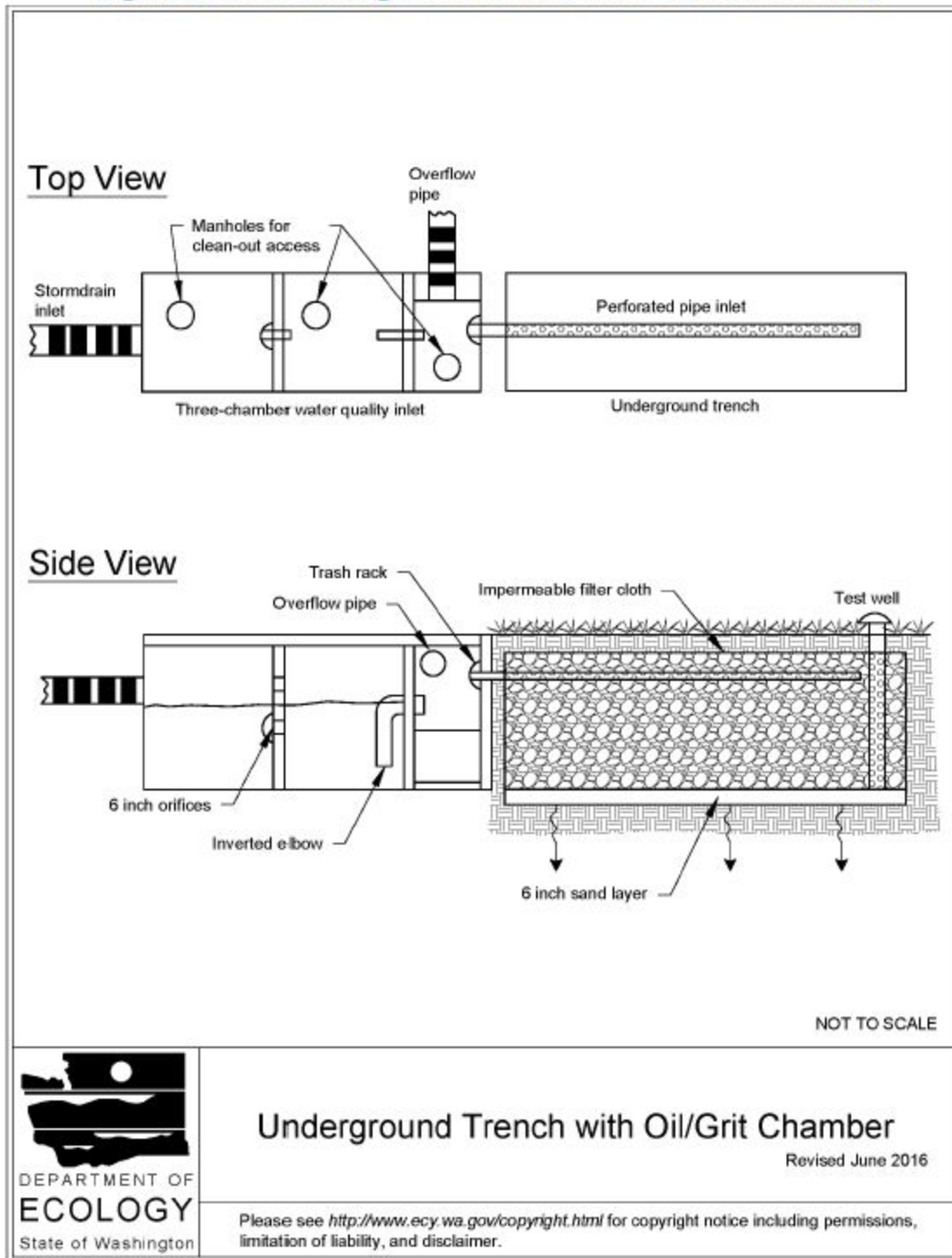


Figure V-5.13: Typical Bioretention w/Underdrain

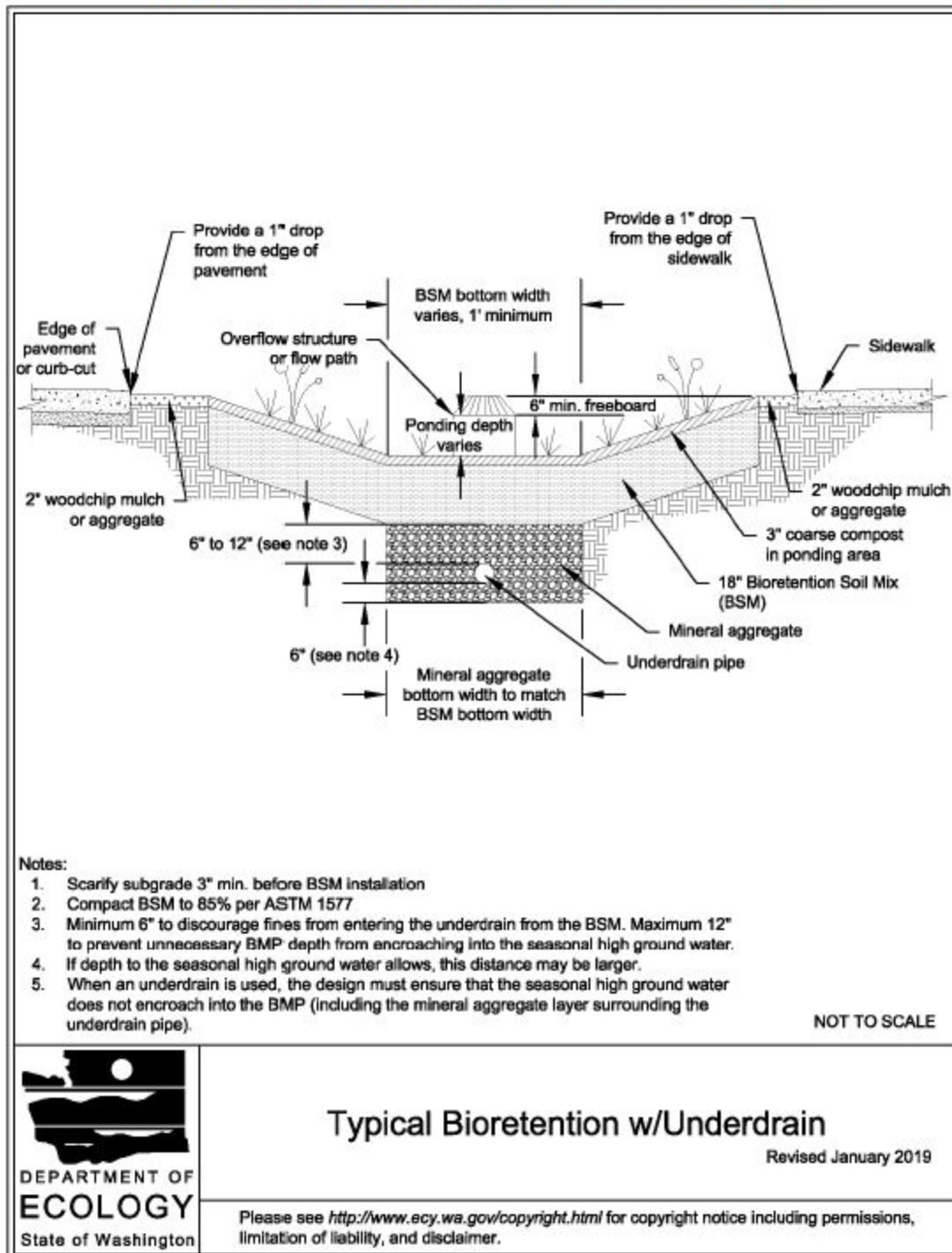


Figure V-5.16: Typical Infiltration Drywell – Type 1

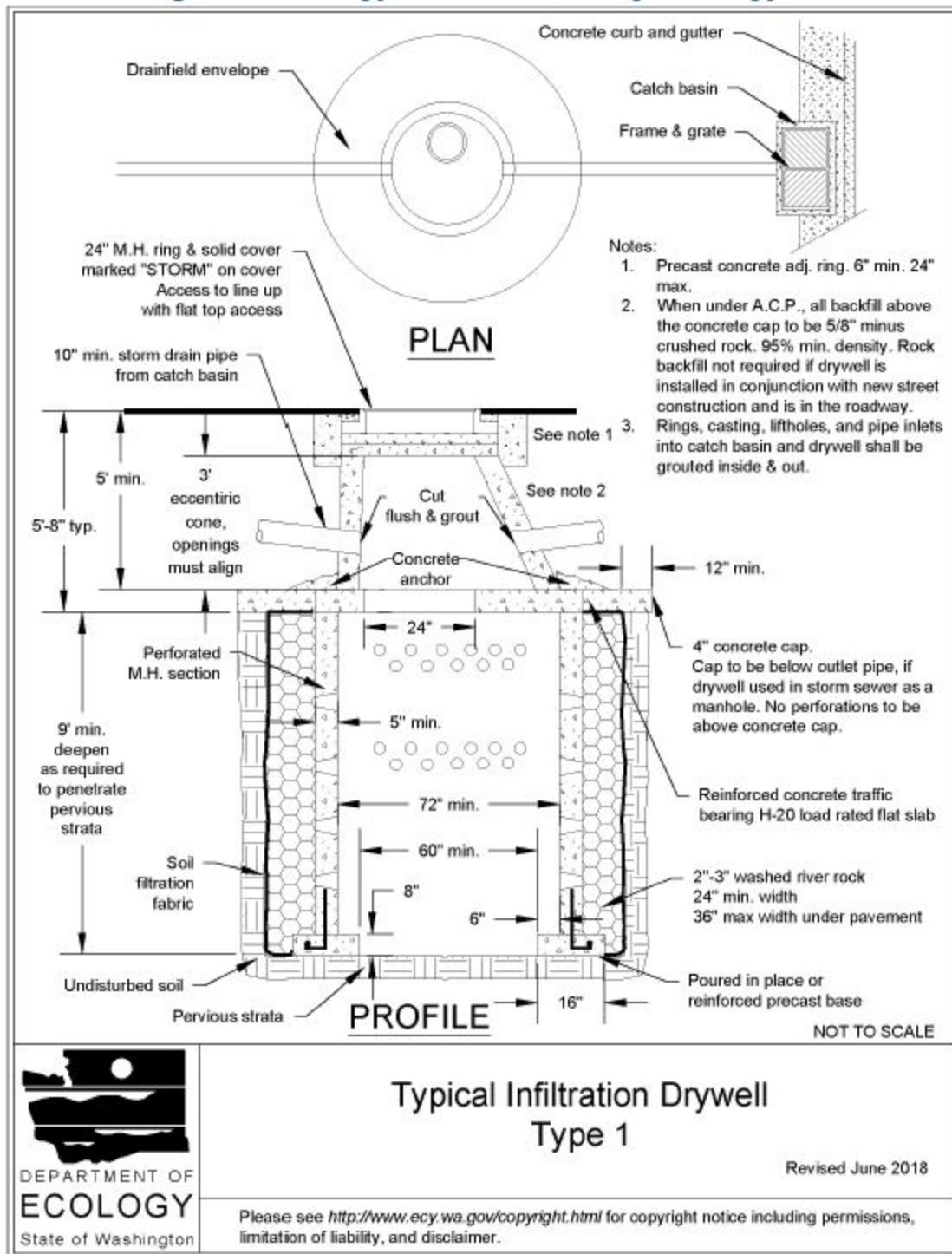
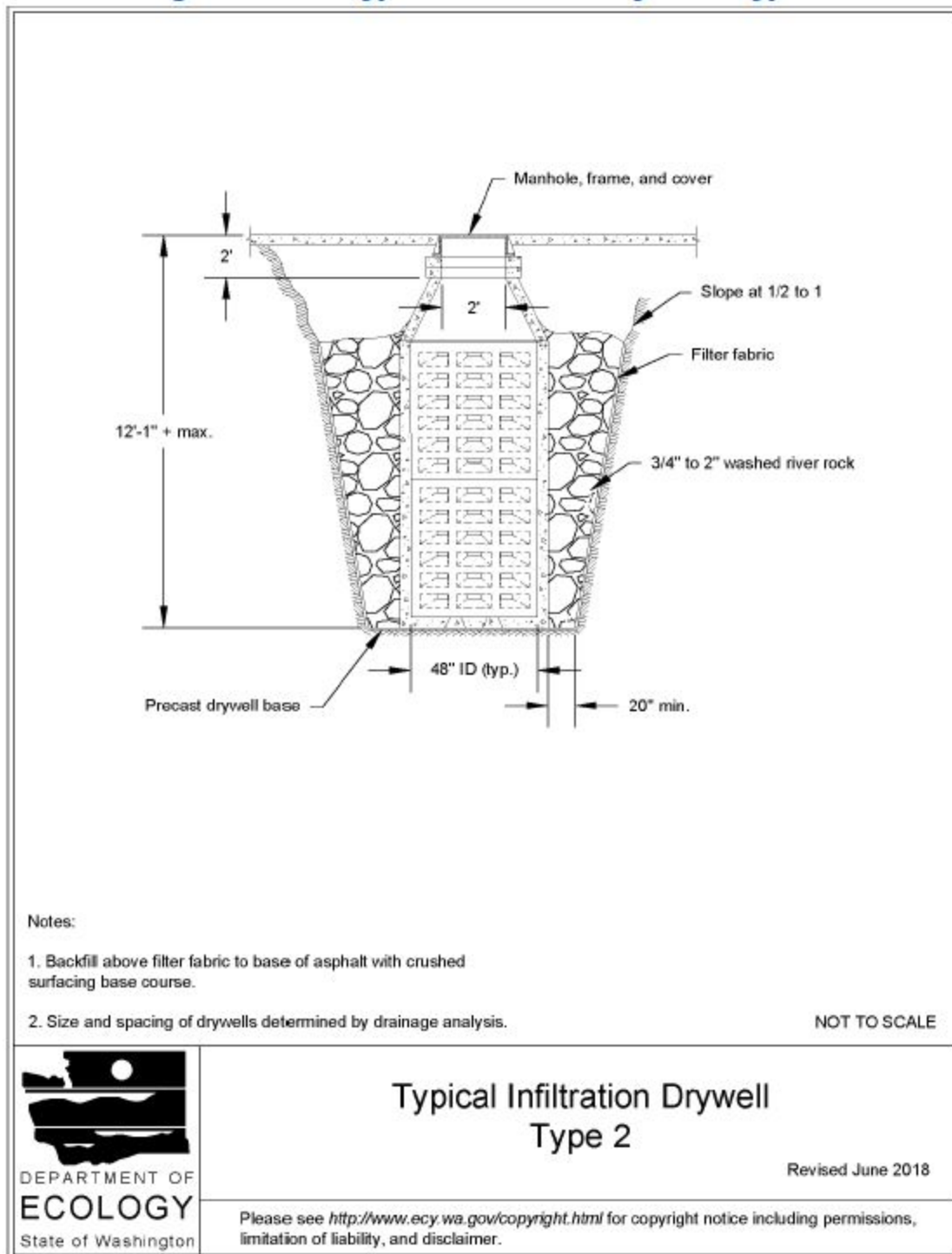


Figure V-5.17: Typical Infiltration Drywell – Type 2



**Figure V-6.1: Sand Filtration Basin Preceded by Presettling Basin
(Variation of a Basic Sand Filter)**

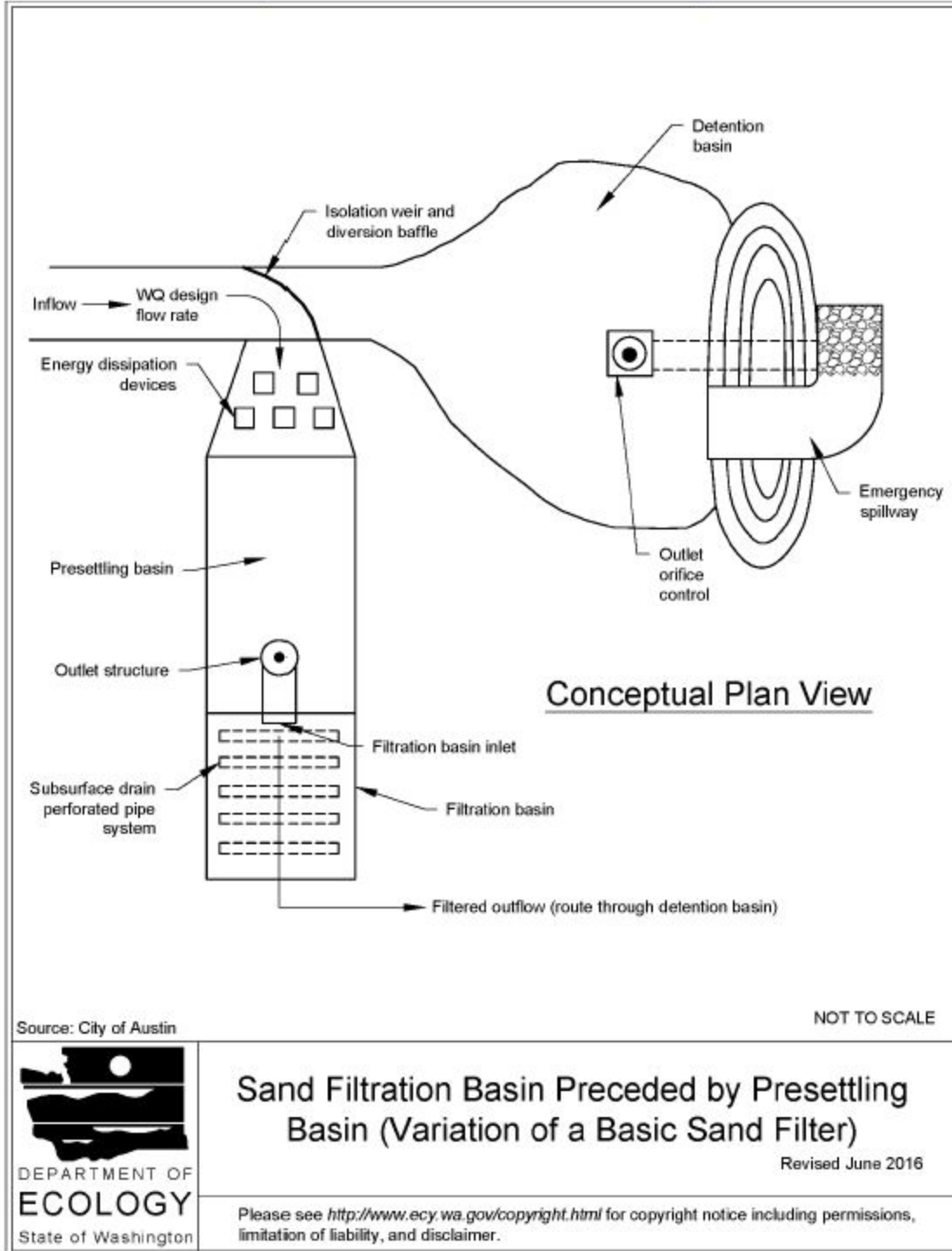


Figure V-6.2: Sand Filter with Pretreatment Cell (Plan View)

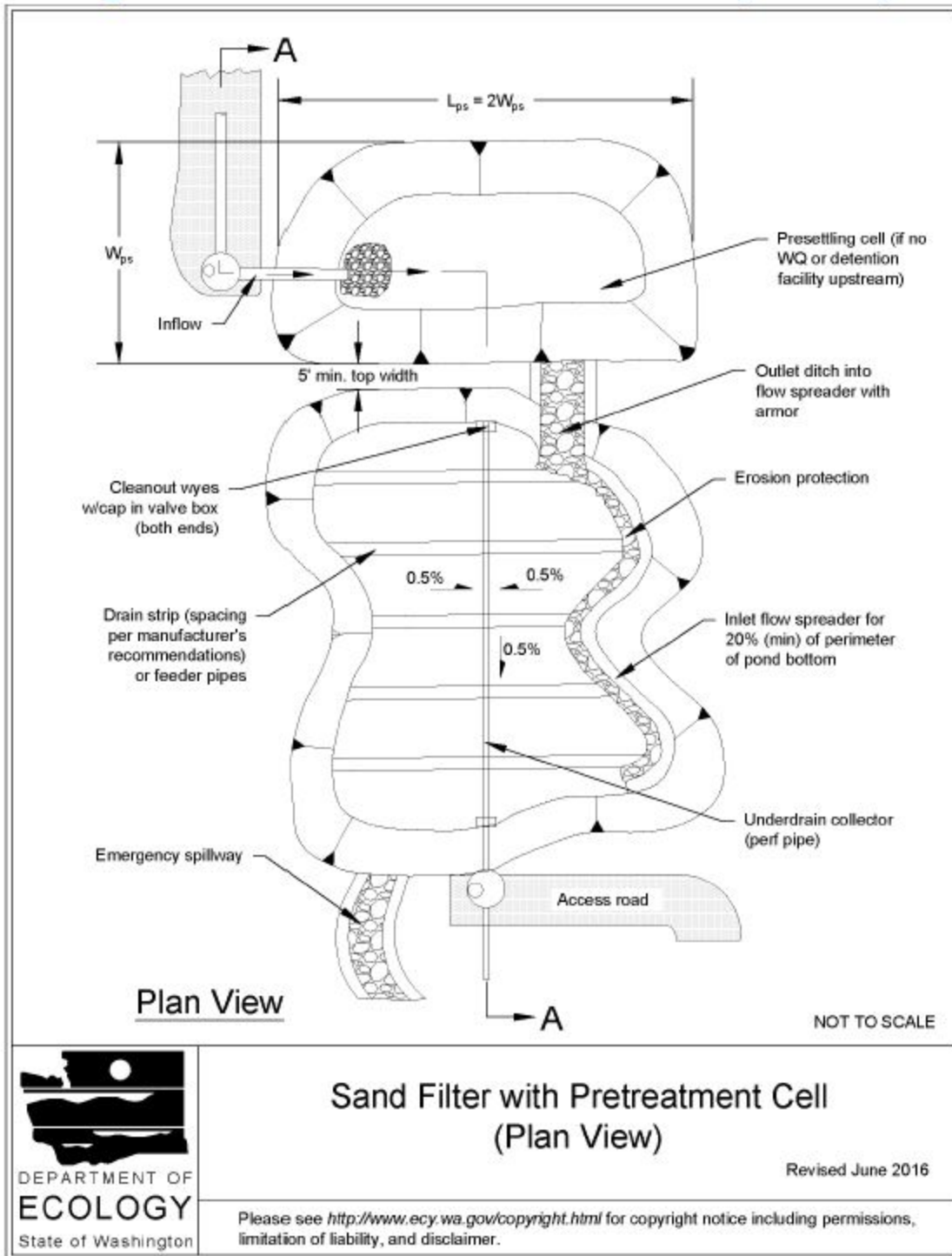


Figure V-6.4: Sand Filter with Level Spreader (Plan View)

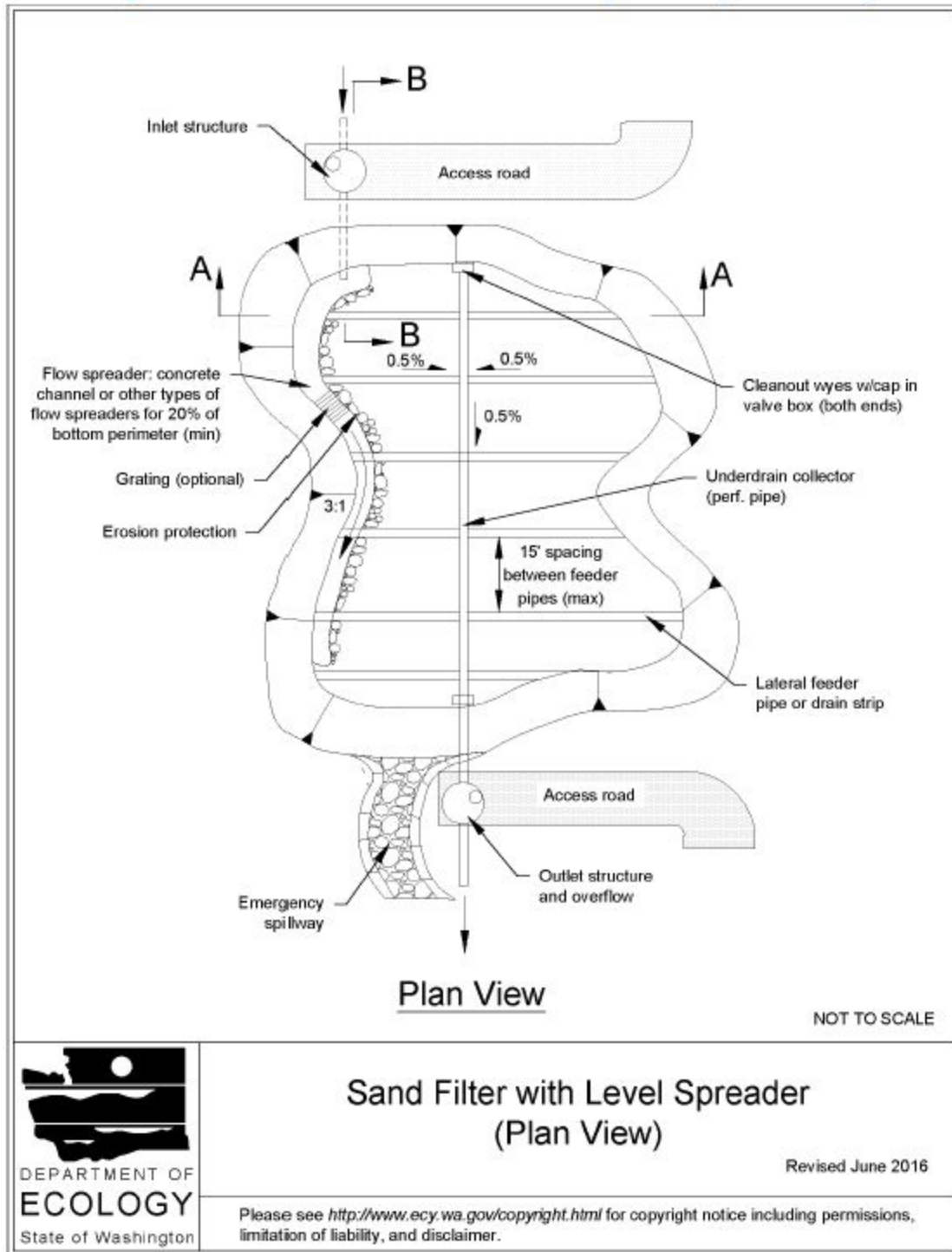


Figure V-6.10: Media Filter Drain: Cross Section

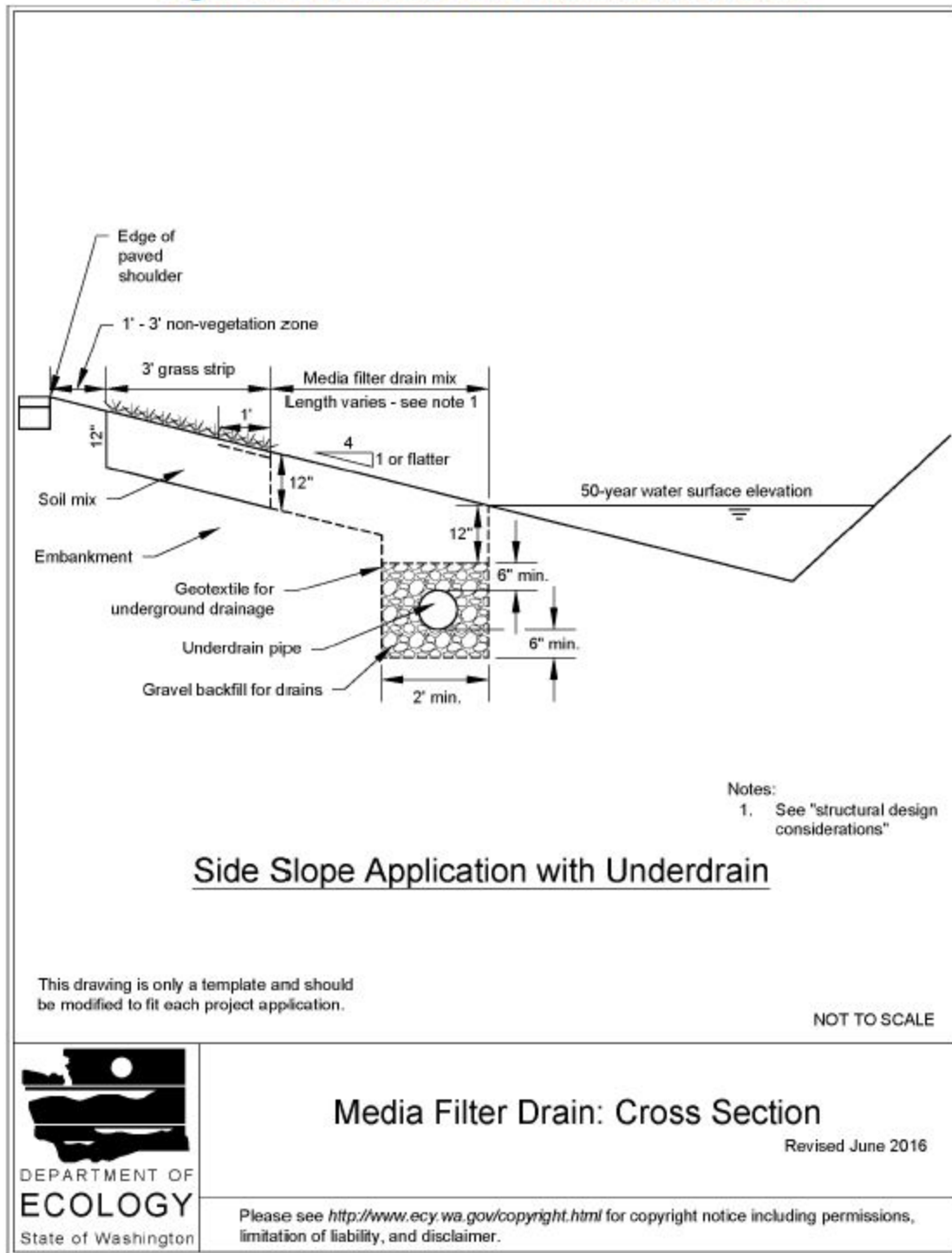


Figure V-6.11: Dual Media Filter Drain: Cross Section

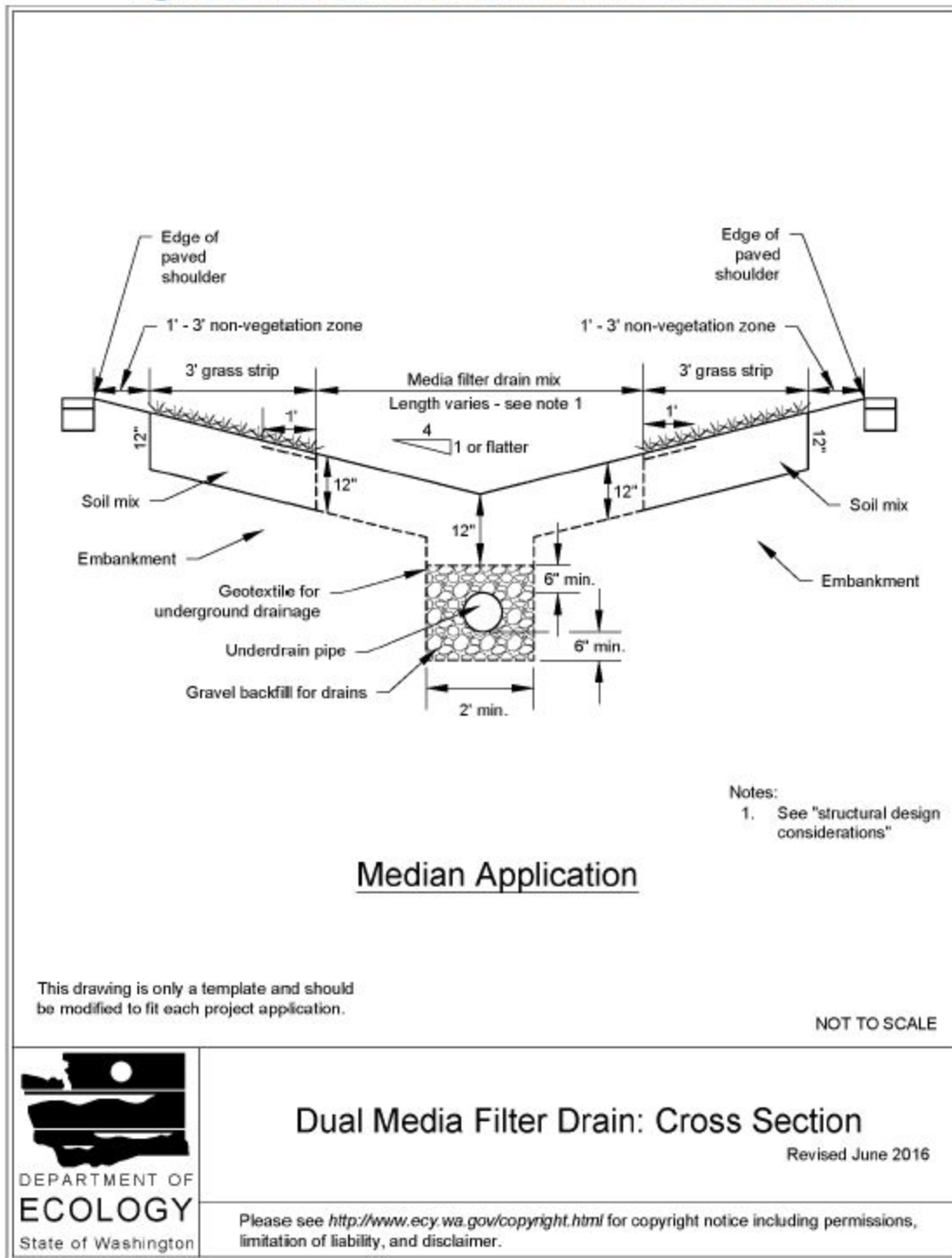
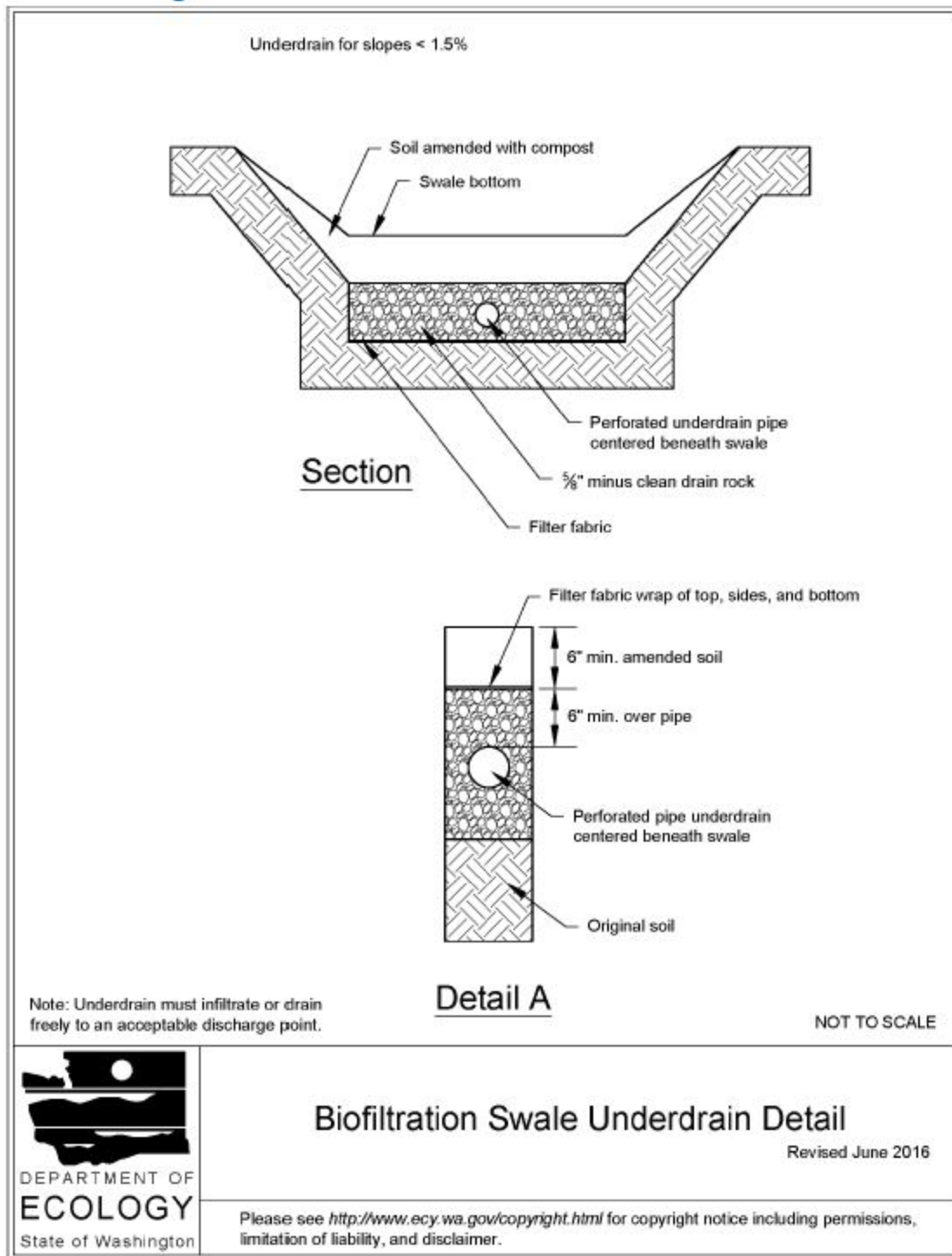


Figure V-7.3: Biofiltration Swale Underdrain Detail



Appendix 2

Complete Inspection and Maintenance Protocol for the Jellyfish Filter

Contech Jellyfish Filter Owner's Manual, Rev. 01/21

**Jellyfish® Filter
Owner's Manual**



Jellyfish® Filter

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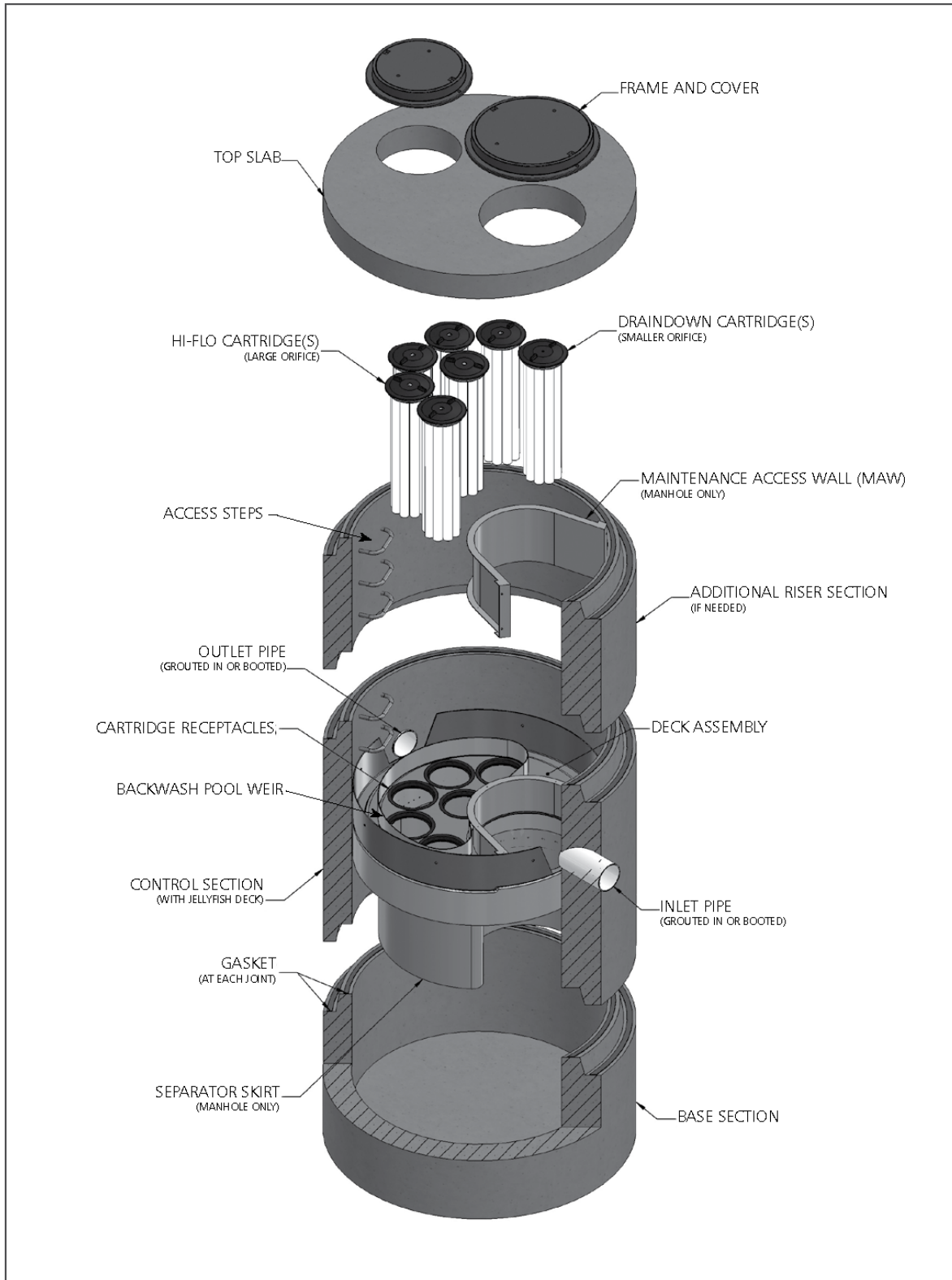
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THANK YOU FOR PURCHASING THE JELLYFISH® FILTER!

Contech Engineered Solutions would like to thank you for selecting the Jellyfish Filter to meet your project's stormwater treatment needs. With proper inspection and maintenance, the Jellyfish Filter is designed to deliver ongoing, high levels of stormwater pollutant removal.

If you have any questions, please feel free to call us or e-mail us:

Contech Engineered Solutions
 9025 Centre Pointe Drive, Suite 400 | West Chester, OH 45069
 513-645-7000 | 800-338-1122
www.ContechES.com
info@conteches.com



WARNINGS / CAUTION

1. FALL PROTECTION may be required.
2. WATCH YOUR STEP if standing on the Jellyfish Filter Deck at any time; Great care and safety must be taken while walking or maneuvering on the Jellyfish Filter Deck. Attentive care must be taken while standing on the Jellyfish Filter Deck at all times to prevent stepping onto a lid, into or through a cartridge hole or slipping on the deck.
3. The Jellyfish Filter Deck can be SLIPPERY WHEN WET.
4. If the Top Slab, Covers or Hatches have not yet been installed, or are removed for any reason, great care must be taken to NOT DROP ANYTHING ONTO THE JELLYFISH FILTER DECK. The Jellyfish Filter Deck and Cartridge Receptacle Rings can be damaged under high impact loads. This type of activity voids all warranties. All damaged items to be replaced at owner's expense.
5. Maximum deck load 2 persons, total weight 450 lbs.

Safety Notice

Jobsite safety is a topic and practice addressed comprehensively by others. The inclusions here are intended to be reminders to whole areas of Safety Practice that are the responsibility of the Owner(s), Manager(s) and Contractor(s). OSHA and Canadian OSH, and Federal, State/Provincial, and Local Jurisdiction Safety Standards apply on any given site or project. The knowledge and applicability of those responsibilities is the Contractor's responsibility and outside the scope of Contech Engineered Solutions.

Confined Space Entry

Secure all equipment and perform all training to meet applicable local and OSHA regulations regarding confined space entry. It is the Contractor's or entry personnel's responsibility to proceed safely at all times.

Personal Safety Equipment

Contractor is responsible to provide and wear appropriate personal protection equipment as needed including, but not limited to safety boots, hard hat, reflective vest, protective eyewear, gloves and fall protection equipment as necessary. Make sure all equipment is staffed with trained and/or certified personnel, and all equipment is checked for proper operation and safety features prior to use.

- Fall protection equipment
- Eye protection
- Safety boots
- Ear protection
- Gloves
- Ventilation and respiratory protection
- Hard hat
- Maintenance and protection of traffic plan

Chapter 1

1.0 – Owner Specific Jellyfish Filter Product Information

Below you will find a reference page that can be filled out according to your Jellyfish Filter specification to help you easily inspect, maintain and order parts for your system.

Owner Name:	
Phone Number:	
Site Address:	
Site GPS Coordinates/unit location:	
Unit Location Description:	
Jellyfish Filter Model No.:	
Contech Project & Sequence Number	
No. of Hi-Flo Cartridges	
No. of Cartridges:	
Length of Draindown Cartridges:	
No. of Blank Cartridge Lids:	
Bypass Configuration (Online/Offline):	

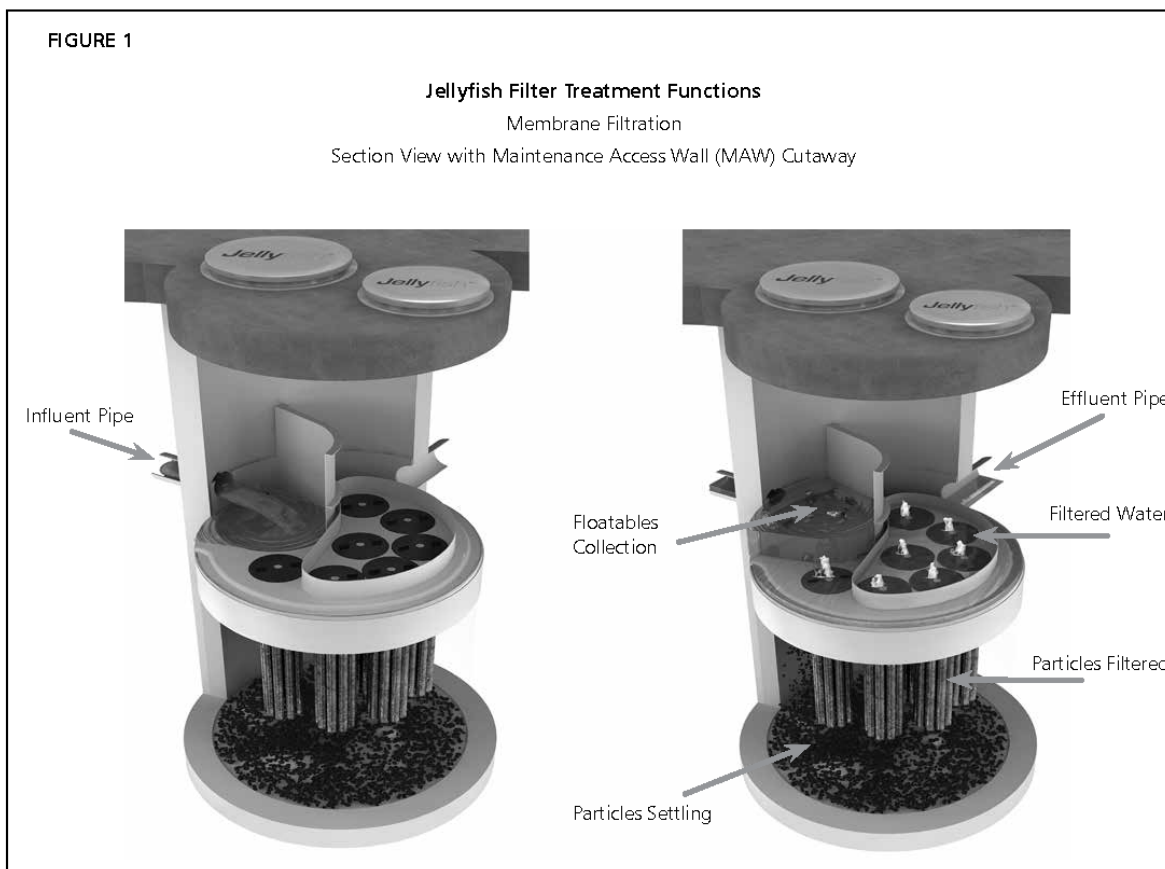
Notes:

Chapter 2

2.0 – Jellyfish Filter System Operations and Functions

The Jellyfish Filter is an engineered stormwater quality treatment technology that removes a high level and wide variety of stormwater pollutants. Each Jellyfish Filter cartridge consists of eleven membrane - encased filter elements (“filtration tentacles”) attached to a cartridge head plate. The filtration tentacles provide a large filtration surface area, resulting in high flow and high pollutant removal capacity.

The Jellyfish Filter functions are depicted in Figure 1 below.

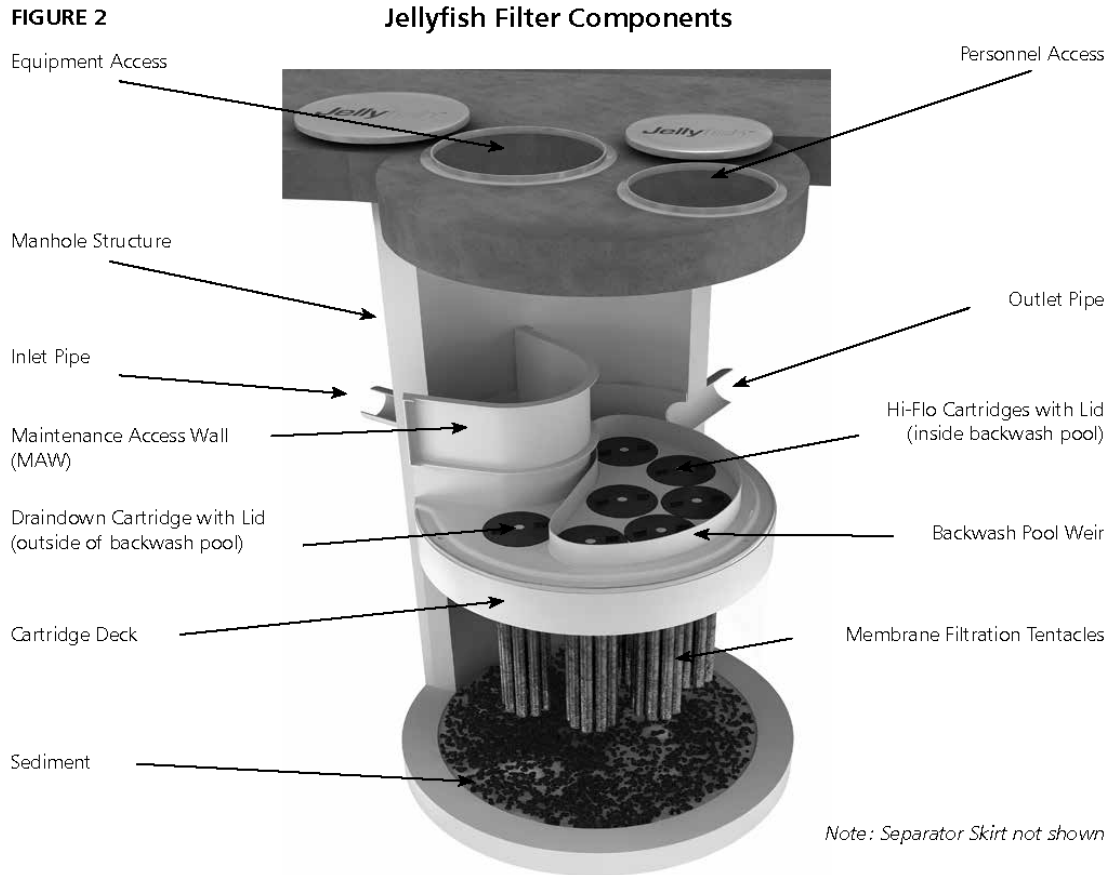


Jellyfish Filter cartridges are backwashed after each peak storm event, which removes accumulated sediment from the membranes. This backwash process extends the service life of the cartridges and increases the time between maintenance events.

For additional details on the operation and pollutant capabilities of the Jellyfish Filter please refer to additional details on our website at www.ContechES.com.

2.1 – Components and Cartridges

The Jellyfish Filter and components are depicted in Figure 2 below.



Tentacles are available in various lengths as depicted in Table 1 below.

Table 1 – Cartridge Lengths / Weights and Cartridge Lid Orifice Diameters

Cartridge Lengths	Dry Weight	Hi-Flo Orifice Diameter	Draindown Orifice Diameter
15 inches (381 mm)	10 lbs (4.5 kg)	35 mm	20 mm
27 inches (686 mm)	14.5 lbs (6.6 kg)	45 mm	25 mm
40 inches (1,016 mm)	19.5 lbs (8.9 kg)	55 mm	30 mm
54 inches (1,372 mm)	25 lbs (11.4 kg)	70 mm	35 mm

2.2 – Jellyfish Membrane Filtration Cartridge Assembly

The Jellyfish Filter utilizes multiple membrane filtration cartridges. Each cartridge consists of removable cylindrical filtration “tentacles” attached to a cartridge head plate. Each filtration tentacle has a threaded pipe nipple and o-ring. To attach, insert the top pipe nipples with the o-ring through the head plate holes and secure with locking nuts. Hex nuts to be hand tightened and checked with a wrench as shown below.

2.3 – Jellyfish Membrane Filtration Cartridge Installation

- Cartridge installation will be performed by trained individuals and coordinated with the installing site Contractor. Flow diversion devices are required to be in place until the site is stabilized (final paving and landscaping in place). Failure to address this step completely will reduce the time between required maintenance.
- Descend to the cartridge deck (see Safety Notice and page 3).
- Refer to Contech's submittal drawings to determine proper quantity and placement of Hi-Flo, Draindown and Blank cartridges with appropriate lids. Lower the Jellyfish membrane filtration cartridges into the cartridge receptacles within the cartridge deck. It is possible that not all cartridge receptacles will be filled with a filter cartridge. In that case, a blank headplate and blank cartridge lid (no orifice) would be installed.



Cartridge Assembly

Do not force the tentacles down into the cartridge receptade, as this may damage the membranes. Apply downward pressure on the cartridge head plate to seat the lubricated rim gasket (thick circular gasket surrounding the circumference of the head plate) into the cartridge receptade. (See Figure 3 for details on approved lubricants for use with rim gasket.)

- Examine the cartridge lids to differentiate lids with a small orifice, a large orifice, and no orifice.
 - Lids with a small orifice are to be inserted into the Draindown cartridge receptades, outside of the backwash pool weir.
 - Lids with a large orifice are to be inserted into the Hi-Flo cartridge receptacles within the backwash pool weir.
 - Lids with no orifice (blank cartridge lids) and a blank headplate are to be inserted into unoccupied cartridge receptacles.
- To install a cartridge lid, align both cartridge lid male threads with the cartridge receptade female threads before rotating approximately 1/3 of a full rotation until firmly seated. Use of an approved rim gasket lubricant may facilitate installation.

3.0 Inspection and Maintenance Overview

The primary purpose of the Jellyfish® Filter is to capture and remove pollutants from stormwater runoff. As with any filtration system, these pollutants must be removed to maintain the filter's maximum treatment performance. Regular inspection and maintenance are required to insure proper functioning of the system.

Maintenance frequencies and requirements are site specific and vary depending on pollutant loading. Additional maintenance activities may be required in the event of non-storm event runoff, such as base-flow or seasonal flow, an upstream chemical spill or due to excessive sediment loading from site erosion or extreme runoff events. It is a good practice to inspect the system after major storm events.

Inspection activities are typically conducted from surface observations and include:

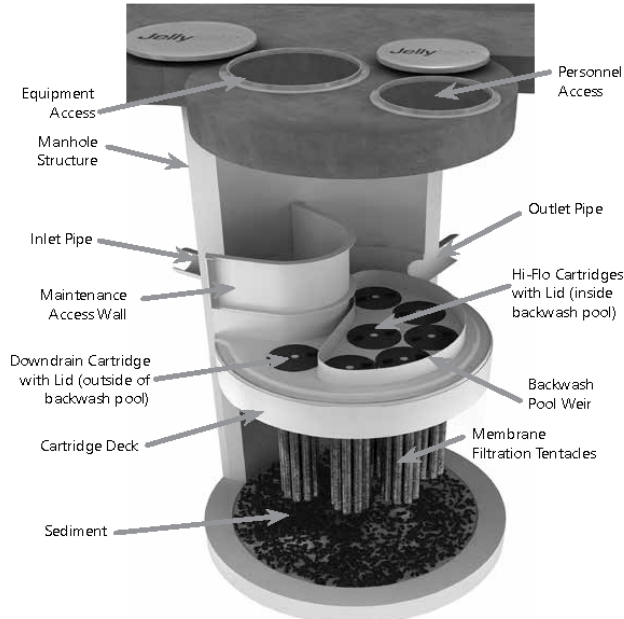
- Observe if standing water is present
- Observe if there is any physical damage to the deck or cartridge lids
- Observe the amount of debris in the Maintenance Access Wall (MAW) or inlet bay for vault systems

Maintenance activities include:

- Removal of oil, floatable trash and debris
- Removal of collected sediments
- Rinsing and re-installing the filter cartridges
- Replace filter cartridge tentacles, as needed

4.0 Inspection Timing

Inspection of the Jellyfish Filter is key in determining the maintenance requirements for, and to develop a history of, the site's pollutant loading characteristics. In general, inspections should be performed at the times indicated below; *or per the approved project stormwater quality documents (if applicable), whichever is more frequent.*



Note: Separator Skirt not shown

1. A minimum of quarterly inspections during the first year of operation to assess the sediment and floatable pollutant accumulation, and to ensure proper functioning of the system.
2. Inspection frequency in subsequent years is based on the inspection and maintenance plan developed in the first year of operation. Minimum frequency should be once per year.
3. Inspection is recommended after each major storm event.
4. Inspection is required immediately after an upstream oil, fuel or other chemical spill.

5.0 Inspection Procedure

The following procedure is recommended when performing inspections:

1. Provide traffic control measures as necessary.
2. Inspect the MAW or inlet bay for floatable pollutants such as trash, debris, and oil sheen.
3. Measure oil and sediment depth in several locations, by lowering a sediment probe until contact is made with the floor of the structure. Record sediment depth, and presences of any oil layers.
4. Inspect cartridge lids. Missing or damaged cartridge lids to be replaced.
5. Inspect the MAW (where appropriate), cartridge deck and receptacles, and backwash pool weir, for damaged or broken components.

5.1 Dry weather inspections

- Inspect the cartridge deck for standing water, and/or sediment on the deck.
- No standing water under normal operating conditions.
- Standing water inside the backwash pool, but not outside the backwash pool indicates, that the filter cartridges need to be rinsed.



Inspection Utilizing Sediment Probe

- Standing water outside the backwash pool is not anticipated and may indicate a backwater condition caused by high water elevation in the receiving water body, or possibly a blockage in downstream infrastructure.
- Any appreciable sediment ($\geq 1/16"$) accumulated on the deck surface should be removed.

5.2 Wet weather inspections

- Observe the rate and movement of water in the unit. Note the depth of water above deck elevation within the MAW or inlet bay.
- Less than 6 inches, flow should be exiting the cartridge lids of each of the draindown cartridges (i.e. cartridges located outside the backwash pool).
- Greater than 6 inches, flow should be exiting the cartridge lids of each of the draindown cartridges and each of the hi-flo cartridges (i.e. cartridges located inside the backwash pool), and water should be overflowing the backwash pool weir.
- 18 inches or greater and relatively little flow is exiting the cartridge lids and outlet pipe, this condition indicates that the filter cartridges need to be rinsed.

6.0 Maintenance Requirements

Required maintenance for the Jellyfish Filter is based upon results of the most recent inspection, historical maintenance records, or the site specific water quality management plan; whichever is more frequent. In general, maintenance requires some combination of the following:

1. Sediment removal for depths reaching 12 inches or greater, or within 3 years of the most recent sediment cleaning, whichever occurs sooner.
2. Floatable trash, debris, and oil removal.
3. Deck cleaned and free from sediment.
4. Filter cartridges rinsed and re-installed as required by the most recent inspection results, or within 12 months of the most recent filter rinsing, whichever occurs sooner.
5. Replace tentacles if rinsing does not restore adequate hydraulic capacity, remove accumulated sediment, or if damaged or missing. It is recommended that tentacles should remain in service no longer than 5 years before replacement.
6. Damaged or missing cartridge deck components must be repaired or replaced as indicated by results of the most recent inspection.
7. The unit must be cleaned out and filter cartridges inspected immediately after an upstream oil, fuel, or chemical spill. Filter cartridge tentacles should be replaced if damaged or compromised by the spill.

7.0 Maintenance Procedure

The following procedures are recommended when maintaining the Jellyfish Filter:

1. Provide traffic control measures as necessary.
2. Open all covers and hatches. Use ventilation equipment as required, according to confined space entry procedures. *Caution: Dropping objects onto the cartridge deck may cause damage.*
3. Perform Inspection Procedure prior to maintenance activity.

4. To access the cartridge deck for filter cartridge service, descend into the structure and step directly onto the deck. *Caution: Do not step onto the maintenance access wall (MAW) or backwash pool weir, as damage may result. Note that the cartridge deck may be slippery.*
5. Maximum weight of maintenance crew and equipment on the cartridge deck not to exceed 450 lbs.

7.1 Filter Cartridge Removal

1. Remove a cartridge lid.
2. Remove cartridges from the deck using the lifting loops in the cartridge head plate. Rope or a lifting device (available from Contech) should be used. *Caution: Should a snag occur, do not force the cartridge upward as damage to the tentacles may result. Wet cartridges typically weigh between 100 and 125 lbs.*
3. Replace and secure the cartridge lid on the exposed empty receptacle as a safety precaution. Contech does not recommend exposing more than one empty cartridge receptacle at a time.

7.2 Filter Cartridge Rinsing

1. Remove all 11 tentacles from the cartridge head plate. Take care not to lose or damage the O-ring seal as well as the plastic threaded nut and connector.
2. Position tentacles in a container (or over the MAW), with the



Cartridge Removal & Lifting Device



threaded connector (open end) facing down, so rinse water is flushed through the membrane and captured in the container.

3. Using the Jellyfish rinse tool (available from Contech) or a low-pressure garden hose sprayer, direct water spray onto the tentacle membrane, sweeping from top to bottom along the length of the tentacle. Rinse until all sediment is removed from the membrane. *Caution: Do not use a high pressure sprayer or focused stream of water on the membrane. Excessive water pressure may damage the membrane.*
4. Collected rinse water is typically removed by vacuum hose.

5. Reassemble cartridges as detailed later in this document. Reuse O-rings and nuts, ensuring proper placement on each tentacle.

7.3 Sediment and Floatables Extraction

1. Perform vacuum cleaning of the Jellyfish Filter only after filter cartridges have been removed from the system. Access the lower chamber for vacuum cleaning only through the maintenance access wall (MAW) opening. Be careful not to damage the flexible plastic separator skirt that is attached to the underside of the deck on manhole systems. Do not lower the vacuum wand through a cartridge receptacle, as damage to the receptacle will result.
2. Vacuum floatable trash, debris, and oil, from the MAW opening or inlet bay. Alternatively, floatable solids may be removed by a net or skimmer.
3. Pressure wash cartridge deck and receptacles to remove all



Rinsing Cartridge with Contech Rinse Tool

sediment and debris. Sediment should be rinsed into the sump area. Take care not to flush rinse water into the outlet pipe.

4. Remove water from the sump area. Vacuum or pump equipment should only be introduced through the MAW or inlet bay.
5. Remove the sediment from the bottom of the unit through the MAW or inlet bay opening.
6. For larger diameter Jellyfish Filter manholes (≥ 8 -ft) and some



Vacuuming Sump Through MAW

vaults complete sediment removal may be facilitated by removing a cartridge lid from an empty receptacle and inserting a jetting wand (not a vacuum wand) through the receptacle. Use the sprayer to rinse loosened sediment toward the vacuum hose in the MAW opening, being careful not to damage the receptacle.

7.4 Filter Cartridge Reinstallation and Replacement

1. Cartridges should be installed after the deck has been cleaned. It is important that the receptacle surfaces be free from grit and debris.
2. Remove cartridge lid from deck and carefully lower the filter cartridge into the receptacle until head plate gasket is seated squarely in receptacle. *Caution: Do not force the cartridge downward; damage may occur.*
3. Replace the cartridge lid and check to see that both male threads are properly seated before rotating approximately 1/3 of a full rotation until firmly seated. Use of an approved rim gasket lubricant may facilitate installation. See next page for additional details.
4. If rinsing is ineffective in removing sediment from the tentacles, or if tentacles are damaged, provisions must be made to replace the spent or damaged tentacles with new tentacles. Contact Contech to order replacement tentacles.

7.5 Chemical Spills

Caution: If a chemical spill has been captured, do not attempt maintenance. Immediately contact the local hazard response agency and contact Contech.

7.6 Material Disposal

The accumulated sediment found in stormwater treatment and conveyance systems must be handled and disposed of in accordance with regulatory protocols. It is possible for sediments to contain measurable concentrations of heavy metals and organic chemicals (such as pesticides and petroleum products). Areas with the greatest potential for high pollutant loading include industrial areas and heavily traveled roads. Sediments and water must be disposed of in accordance with all applicable waste disposal regulations. When scheduling maintenance, consideration must be made for the disposal of solid and liquid wastes. This typically requires coordination with a local landfill for solid waste disposal. For liquid waste disposal a number of options are available including a municipal vacuum truck decant facility, local waste water treatment plant or on-site treatment and discharge.

Jellyfish Filter Components & Filter Cartridge Assembly and Installation

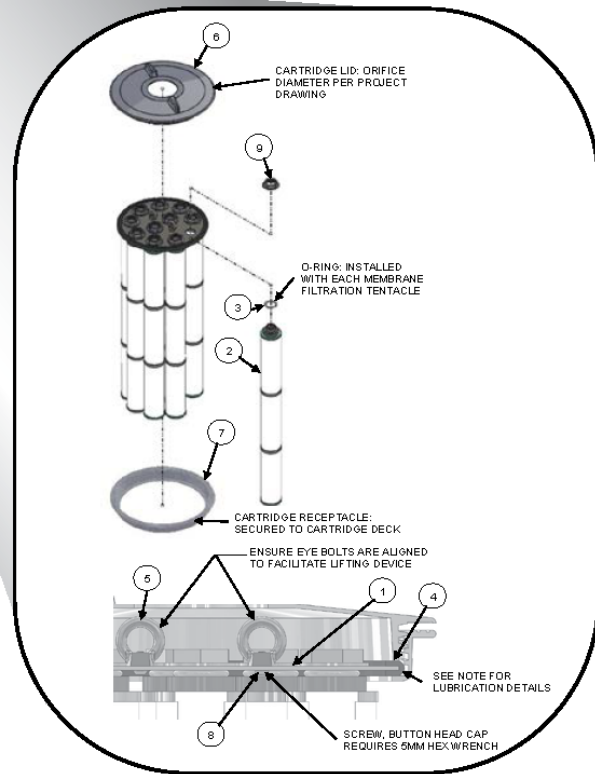
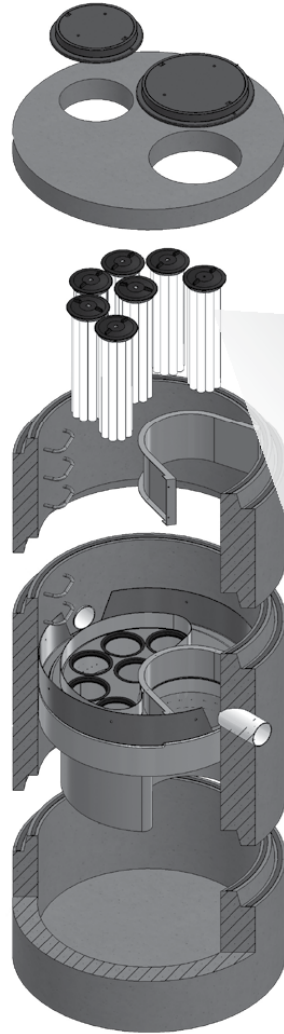


TABLE 1: BOM

ITEM NO.	DESCRIPTION
1	JF HEAD PLATE
2	JF TENTACLE
3	JF O-RING
4	JF HEAD PLATE GASKET
5	JF CARTRIDGE EYELET
6	JF 14IN COVER
7	JF RECEPTACLE
8	SCREW M6X14MM SS
9	JF CARTRIDGE NUT

TABLE 2: APPROVED GASKET LUBRICANTS

PART NO.	MFR	DESCRIPTION
78713	LA-CO	LUBRI-JOINT
40501	HERCULES	DUCK BUTTER
30600	OATEY	PIPE LUBRICANT
PSLUBXL10	PROSELECT	PIPE JOINT LUBRICANT

NOTES:

Head Plate Gasket Installation:

Install Head Plate Gasket (Item 4) onto the Head Plate (Item 1) and liberally apply a lubricant from Table 2: Approved Gasket Lubricants onto the gasket where it contacts the Receptacle (Item 7) and Cartridge Lid (Item 6). Follow Lubricant manufacturer's instructions.

Lid Assembly:

Rotate Cartridge Lid counter-clockwise until both male threads drop down and properly seat. Then rotate Cartridge Lid clockwise approximately one-third of a full rotation until Cartridge Lid is firmly secured, creating a watertight seal.

Jellyfish Filter Inspection and Maintenance Log

Owner: _____ Jellyfish Model No.: _____

Location: _____ GPS Coordinates: _____

Land Use: Commercial: _____ Industrial: _____ Service Station: _____

 Road/Highway: _____ Airport: _____ Residential: _____ Parking Lot: _____

Date/Time:					
Inspector:					
Maintenance Contractor:					
Visible Oil Present: (Y/N)					
Oil Quantity Removed					
Floatable Debris Present: (Y/N)					
Floatable Debris removed: (Y/N)					
Water Depth in Backwash Pool					
Cartridges externally rinsed/re-commissioned: (Y/N)					
New tentacles put on Cartridges: (Y/N)					
Sediment Depth Measured: (Y/N)					
Sediment Depth (inches or mm):					
Sediment Removed: (Y/N)					
Cartridge Lids intact: (Y/N)					
Observed Damage:					
Comments:					

Appendix 3

**Western Washington Phase II
Municipal Stormwater Permit
Appendix 6, Street Waste Disposal**

Dated: August 1, 2019

APPENDIX 6 – Street Waste Disposal

Street Waste Liquids General Procedures

Street waste collection should emphasize retention of solids in preference to liquids. Street waste solids are the principal objective in street waste collection and are substantially easier to store and treat than liquids.

Street waste liquids require treatment before their discharge. Street waste liquids, which include, but are not limited to, educator and street sweeping truck decant and drainage from piles and containers, usually contain high amounts of suspended and total solids, and absorbed metals. Treatment requirements depend on the discharge location.

Discharges to sanitary sewer and storm sewer systems must be approved by the entity responsible for operation and maintenance of the system. Ecology will not generally require waste discharge permits for discharge of stormwater decant to sanitary sewers or to stormwater treatment BMPs constructed and maintained in accordance with Ecology's *Stormwater Management Manual for Western Washington*.

The following order of preference, for disposal of catch basin decant liquid and water removed from stormwater treatment facilities, is **required**.

1. Discharge of street waste decant liquids to a municipal sanitary sewer connected to a Public Owned Treatment Works (POTW) is the preferred disposal option. Discharge to a municipal sanitary sewer requires the approval of the sewer authority. Approvals for discharge to a POTW will likely contain pretreatment, quantity, and location conditions to protect the POTW.

2. Discharge of street waste decant liquids may be allowed into a Basic or Enhanced Stormwater Treatment BMP, if option 1 is not available. Street waste liquid may be discharged back into the storm sewer system under the following conditions only:

- The preferred disposal option of discharge to sanitary sewer is not reasonably available, **and**
- The discharge is to a Basic or Enhanced Stormwater Treatment Facility. If pretreatment does not remove visible sheen from oils, the treatment facility must be able to prevent the discharge of oils causing a visible sheen, **and**
- The discharge from the educator truck is as near to the inlet of the treatment facility as is practical, to minimize contamination or recontamination of the collection system, **and**
- The storm sewer system owner/operator has granted approval and has determined that the stormwater treatment facility will accommodate the increased loading. Pretreatment conditions to protect the stormwater treatment BMP may be issued as part of the approval process. Following local pretreatment conditions is a requirement of this Permit.

- Flocculants for the pretreatment of street waste liquids must be non-toxic under the circumstances of use and must be approved in advance by the Department of Ecology.

The reasonable availability of sanitary sewer discharge will be determined by the Permittee, by evaluating such factors as distance, time of travel, load restrictions, and capacity of the stormwater treatment facility.

3. Water removed from stormwater ponds, vaults and oversized catch basins may be returned to the storm sewer system. Stormwater ponds, vaults, and oversized catch basins contain substantial amounts of liquid, which hampers the collection of solids and pose problems if the removed waste must be hauled away from the site. Water removed from these facilities may be discharged back into the pond, vault, or catch basin provided:

- Clear water removed from a stormwater treatment structure may be discharged directly to a down gradient cell of a treatment pond or into the storm sewer system.
- Turbid water may be discharged back into the structure it was removed from if:
 - The removed water has been stored in a clean container (eductor truck, Baker tank or other appropriate container or facility used specifically for handling stormwater or clean water); **and**
 - There will be no discharge from the treatment structure for at least 24 hours.
- The discharge must be approved by the storm sewer system owner/operator.

Street Waste Solids

Soils generated from maintenance of the MS4 may be reclaimed, recycled or reused when allowed by local codes and ordinances. Soils that are identified as contaminated, pursuant to Chapter 173-350 WAC, shall be disposed of at a qualified solid waste disposal facility.