

# 2022 OPERATIONS & MAINTENANCE MANUAL

Port of Tacoma  
October 2022

## TABLE OF CONTENTS

INTRODUCTION.....	1
Purpose of this Manual .....	1
Operation and Maintenance Program.....	1
Why Maintain Storm Sewer Facilities?.....	3
Installation, Repair, and Replacement of Enclosed Drainage Systems .....	3
Minor Culvert Repair (not in a stream) .....	4
Major Culvert Repair .....	4
What You Should Be Doing? .....	4
Where to Find More Information? .....	4
Method for Creating This Manual .....	5
Manual Layout.....	5
Maintenance Goals.....	5
Safety .....	6
Materials Handling .....	6
TYPES OF STORMWATER FACILITIES .....	7
Catch Basins & Inlets.....	8
Manholes.....	10
Storm Pipe .....	10
Dry Drainage Ditches.....	11
Water-Bearing Drainage Ditches .....	12
Detention Ponds.....	12
Oil/Water Separators and Buried Wet-Vaults .....	14
Wet Biofiltration Swales and Treatment Wetlands .....	16
Catch Basin Inserts .....	17
Biofiltration Swales .....	17
Bioretention Facilities .....	18
Infiltration Basins and Ponds.....	19
Drainage Trenches (Infiltration Trenches).....	20
Drywells.....	21
Sand Filters.....	22
Energy Dissipators.....	24
Debris Barriers/Trash Racks .....	25

Downspout Boxes .....	26
Flow Control Structures .....	26
Proprietary Treatment Unit .....	26
Vegetation Management .....	27
General Goals and Philosophy .....	27
General Practices .....	27
Vegetation and Pest Management in Stormwater Control Facilities .....	29
Vegetation and Pest Management in Stormwater Facility Wetland Areas .....	31
Pesticide/Herbicide Handling Information .....	32

#### Appendix A: Maintenance Standards

Appendix B: Water Quality Monitoring and Protection Plan for the Port of Tacoma Stormwater Infrastructure Maintenance Program (NWS-2017-0032-WRD, WQC #15819)

#### Appendix C: Proprietary and Non-Proprietary O&M Manuals and Checklists

## INTRODUCTION

### PURPOSE OF THIS MANUAL

This manual is intended to meet all storm sewer systems operation and maintenance requirements under the Phase I Municipal Stormwater Permit, issued July 1, 2019, and effective from August 1, 2019 to July 31, 2024 (Permit, MS4 Permit). The MS4 Permit applies to Port of Tacoma (Port) operations, as well as properties owned and operated by the Port. The following sections describe the specific requirements of the Permit.

### OPERATION AND MAINTENANCE PROGRAM

The Port's program must include an operation and maintenance (O&M) program for all stormwater treatment and flow control facilities and catch basins to ensure that BMPs continue to function properly.

Each of these types of facilities is required to have minimum performance measures that are as protective, or more protective than those specified in Appendix C of Volume 4 of the City of Tacoma July 2021 Stormwater Management Manual. For existing stormwater facilities which do not have maintenance standards, the Port must develop a maintenance standard.

The purpose of the maintenance standard is to determine if maintenance is required. The maintenance standard is not a measure of the facility's required condition at all times between inspections. Exceeding the maintenance standards between inspections and/or maintenance is not a permit violation. As the Port is located within the City of Tacoma, the Port will comply with the City of Tacoma Stormwater Code. Where City Stormwater Code requirements are more stringent than Permit requirements, the City Stormwater Code will apply.

According to the Permit, the O&M Manual must meet the following minimum criteria (Special Condition S6.E.6):

*The SWMP shall include an operation and maintenance program for all stormwater treatment and flow control BMPs/facilities, and catch basins to ensure that BMPs continue to function properly.*

*Minimum Performance Measures:*

a. *Each Permittee shall implement an Operation and Maintenance (O&M) manual for all stormwater treatment and flow control BMPs/facilities and catch basins that are under the functional control of the Permittee and which discharge stormwater to its MS4, or to an interconnected MS4.*

*(i) Retain a copy of the O&M manual in the appropriate Permittee department and routinely update following discovery or construction of new stormwater facilities.*

(ii) The operation and maintenance manual shall establish facility-specific maintenance standards that are as protective, or more protective, than those specified in the Stormwater Management Manual for Western Washington. For existing stormwater facilities which do not have maintenance standards, the Permittee shall develop a maintenance standard. Each Permittee shall update maintenance standards, as necessary, to meet the requirements of this section.

(iii) The purpose of the maintenance standard is to determine if maintenance is required. The maintenance standard is not a measure of the facility's required condition at all times between inspections. Exceeding the maintenance standards between inspections and/or maintenance is not a permit violation. Maintenance actions shall be performed within the time frames specified in S6.E.6.b.ii.

b. The Permittee will manage maintenance activities to inspect all stormwater facilities listed in the O&M manual annually and take appropriate maintenance action in accordance with the O&M manual.

(i) The Permittee may change the inspection frequency to less than annually, provided the maintenance standards are still met. Reducing the annual inspection frequency shall be based on maintenance records of double the length of time of the proposed inspection frequency. In the absence of maintenance records, the Permittee may substitute written statements to document a specific less frequent inspection schedule. Written statements shall be based on actual inspection and maintenance experience and shall be certified in accordance with G19 Certification and Signature.

(ii) Unless there are circumstances beyond the Permittee's control, when an inspection identifies an exceedance of the maintenance standard, maintenance shall be performed:

- (1) Within 1 year for wet pool facilities and retention/detention ponds.
- (2) Within 1 year for typical maintenance of facilities, except catch basins.
- (3) Within 6 months for catch basins.
- (4) Within 2 years for maintenance that requires capital construction of less than \$25,000.

Circumstances beyond the Permittee's control include denial or delay of access by property owners, denial or delay of necessary permit approvals, and unexpected reallocations of maintenance staff to perform emergency work. For each exceedance of the required timeframe, the Permittee shall document the circumstances and how they were beyond their control.

- c. The Permittee shall provide appropriate training for Permittee maintenance staff.
- d. The Permittee will maintain records of inspections and maintenance activities.

This O&M Manual applies to property under the Port's functional control where the Port is responsible for planning, staffing, and conducting operation and maintenance activities.

## WHY MAINTAIN STORM SEWER FACILITIES?

Stormwater facilities are specific drainage features such as catch basins, oil/water separators, ditches, and biofiltration swales. Activities are maintenance activities associated with operating stormwater facilities such as vegetation management and small repair projects.

Along with keeping the site from flooding, properly maintained storm sewers can help reduce surface water and groundwater pollution. Storm sewer maintenance is necessary to ensure that facilities are functioning properly to protect streams, lakes, wetlands, and groundwater.

Proper maintenance helps assure that:

- Storm sewers operate as designed.
- Storm sewers are cleaned of the pollutants that they trap, such as sediment and oils, so that the storm sewers are not overwhelmed and become pollutant sources.
- Sources of pollutants to storm sewers (such as leaky dumpsters, vaults full of sediment) are remedied.

## INSTALLATION, REPAIR, AND REPLACEMENT OF ENCLOSED DRAINAGE SYSTEMS

This activity includes tasks such as repair and replacement of pipe, catch basins, drywells and manholes. It also includes drainage projects that add new pipes, catch basins, or infiltration structures. Source control BMPs are required for activities such as concrete cutting.

- Minimize vegetation removal.
- If work is near a stream or wetland, there are likely regulatory requirement. Contact Environmental Programs for more information and assistance
- If work is performed under contract, specify BMP performance under inspection/contract administration.
- Prevent debris, oils, cleaning agents, and sediment from entering waterways.
- Minimize work in wet weather. This will reduce the problems of containing sediment.
- Carry spill control kit to contain and clean up possible small spills in the work area.

### Protect storm drains

- Cover storm sewer inlets, catch basins and open manholes to block sediment-bearing water.
- If runoff contains sediment, use gravel-filled filter bags or an equivalent product to build berms around inlets.
- Catch basin inserts are also an acceptable sediment trapping option.
- At stream crossings, trap materials using screens or another form of containment.
- Use BMPs to protect roadside ditches during wet weather.
- Avoid using water to clean up work sites. Sweep or vacuum dust and debris from the repair job. Do not wash materials into storm sewers.

- Place stockpiles away from drainage ways. Cover stockpiles or contain them with berms or other containment devices if there is a chance that materials will erode into a storm drain or water body.

### MINOR CULVERT REPAIR (NOT IN A STREAM)

This includes the replacement or repair of culverts and inlets less than 6 feet in diameter. It applies only to structures that are in ditches built specifically for drainage that do not carry water during dry weather. If there is any question about whether the ditch is a storm drain or a stream, a consultation with the Washington Department of Fish and Wildlife should be completed. Contact Environmental Compliance staff for assistance and to communicate with the regulatory agency (contact information is listed in the Introduction).

- Comply with stormwater and erosion control requirements.
- Minimize vegetation removal. If work is near a stream or wetland, there are likely regulatory requirements. Contact Environmental Compliance for assistance.
- Other than to address a threat to public safety or property due to flooding, perform work during the dry season.
- Minimize soil disturbance.
- Use sediment controls to trap any sediment and prevent sediment from entering storm sewer and water bodies. Sediment trapping BMPs are used to the extent practical during emergencies.
- Use cover BMPs to prevent erosion of bare soil. Vegetate bare soils.

### MAJOR CULVERT REPAIR

This includes the replacement or repair of culverts and inlets greater than 6 feet in diameter or bridging a stream or ditch with flowing water during dry weather. If there is any question about whether the ditch is a storm drain or a stream, contact Environmental Compliance staff for assistance (contact information is listed in the Introduction).

These projects must meet all regulatory requirements, including the ones listed below.

- State Environmental Policy Act
- Shoreline Management
- Hydraulic Project Approval
- Flood Plain

### WHAT YOU SHOULD BE DOING?

This manual describes the steps the Port must take to ensure that the Port storm sewers, facilities and BMPs meet water quality requirements.

### WHERE TO FIND MORE INFORMATION?

The following resources provide more information on storm sewer maintenance and water quality Best Management Practices (BMPs).

- City of Tacoma Surface Water Management Manual:  
[https://cityoftacoma.org/UserFiles/Servers/Server\\_6/File/cms/Surfacewater/SWMM\\_2021%20Final/2021TacomaSWMM.20210819%20-%20FINAL.pdf](https://cityoftacoma.org/UserFiles/Servers/Server_6/File/cms/Surfacewater/SWMM_2021%20Final/2021TacomaSWMM.20210819%20-%20FINAL.pdf)
- WA Dept. of Ecology Western Washington Stormwater Management Manual:  
<http://www.ecy.wa.gov/programs/wq/stormwater/tech.html>
- WA Dept. of Transportation Highway Runoff Manual:  
<https://www.wsdot.wa.gov/Publications/Manuals/M31-16.htm>

For more information on the Port's O&M permit requirements, Environmental Compliance staff can be contacted below.

- Ben Nield - [bnielde@portoftacoma.com](mailto:bnielde@portoftacoma.com), 253-241-0297
- Anita Fichthorn - [afichthorn@portoftacoma.com](mailto:afichthorn@portoftacoma.com), 253-830-5379

## METHOD FOR CREATING THIS MANUAL

This manual draws on other maintenance manuals to create the Operations and Maintenance manual for the Port of Tacoma. Along with documenting current state standards and practices, this manual includes maintenance practices from the 2021 City of Tacoma Storm Water Management Manual.

## MANUAL LAYOUT

The manual provides the framework to meet Phase I Permit requirements for the O&M Program. Maintenance standards are included in Appendix A of this manual for guidance. Maintenance records are maintained in NPDES Pro and Maximo. This manual also includes general maintenance activities such as pesticide use and vegetation management.

For each type of stormwater facility or activity, this manual:

- Briefly describes the facility or activity.
- Includes detailed information on inspection, cleaning, and repairs, as well as safety, materials handling and vegetation management where appropriate.
- Includes maintenance standards.

Descriptions and maintenance information on proprietary devices, such as the Jellyfish Treatment systems and Modular Wetlands treatment systems are included in Appendix C, the Manufacturer Operation and Maintenance Manuals section.

## MAINTENANCE GOALS

Maintenance of stormwater facilities is performed to maintain functionality and meet desired treatment goals. Maintenance goals are specified for each drainage feature or activity. They include both performance and appearance of the facility, and the need to prevent maintenance work itself from causing harm. Where applicable, these goals include:

- Minimize sediment and pollutant discharges from the work area
- Prevent parking areas, roads, drainage systems, facilities, and property from becoming pollutant sources
- Minimize vegetation removal where feasible
- Maintain or restore the intended infrastructure function
- Prevent or reduce flooding
- Meet public expectations for aesthetics
- Preserve native plants
- Protect infrastructure

## SAFETY

Work inside "confined" spaces include, but are not limited to underground vaults, tanks, storage bins, manholes, pits, and pipelines. Confined spaces are classified as non-permit or permit-required when there is the potential to contain a hazardous atmosphere, engulf an entrant, other recognized safety/health hazards. Refer to Washington State Department of Labor and Industries confined space WAC 296-809 and OSHA for which standards apply. Port Maintenance has a trailer with the OSHA-required confined space entry equipment and staff have been trained on the procedures and equipment.

## MATERIALS HANDLING

Waste disposal from maintenance of drainage facilities shall be conducted in accordance with federal, state, and local regulations, including the Minimum Functional Standards for Solid Waste Handling Chapter 173-304 WAC; guidelines for disposal of waste materials; and where appropriate, Dangerous Waste Regulations, Chapter 173-303 WAC.

Removed sediment must be properly disposed as solid waste. Water should be disposed of in a sanitary sewer, or at an approved facility. Oily water should be disposed of at an approved facility. Used oil absorbents should be recycled or disposed according to the manufacturer's instructions.

## TYPES OF STORMWATER FACILITIES

This manual provides a set of minimum standards and practices for maintaining stormwater facilities at the Port. Recommended inspection frequencies are adapted from City SWMM, manufacturer's manuals, and Port-specific maintenance standards.

### **MANUFACTURER OR PROPRIETARY MAINTENANCE MANUALS**

Manufactured stormwater facilities such as Filterra biofiltration vaults, Storm Filter and oil/water separators often have maintenance requirements and manuals specified or written by the manufacturer. Larger or more complex stormwater facilities may include specifications for maintenance and vegetation management that provide specific detail beyond this manual.

Where the Maintenance and Environmental staff determines that other manuals or plans provide equal or greater level of maintenance and water quality protection, they should be followed.

### **NON-PROPRIETARY TREATMENT UNITS**

The Port may require development and implementation of a site-specific maintenance plan for complex or unusual facilities. The plan is required when the general provisions of this manual do not provide sufficient detail for inspection, maintenance, vegetation management, and repair practices to operate the facility.

## CATCH BASINS & INLETS

Catch basins trap sediment and some oils that can pollute water bodies. They need to be inspected annually and cleaned when necessary to remove accumulated sediment, fluids, and trash. Figures 1 and 2 on the next pages show different types of catch basins.

### Inspection

Inspect catch basins at least once per year. The City of Tacoma SWMM requires:

- Monthly from October - April and after any major storm event (1" in 24 hours).
- Annual inspections preferably in September.

Periodically inspect the catch basin and surrounding areas for pollutants such as leaks from dumpsters, minor spills, and oil dumping. Act to have the pollutant source removed.

### Cleaning

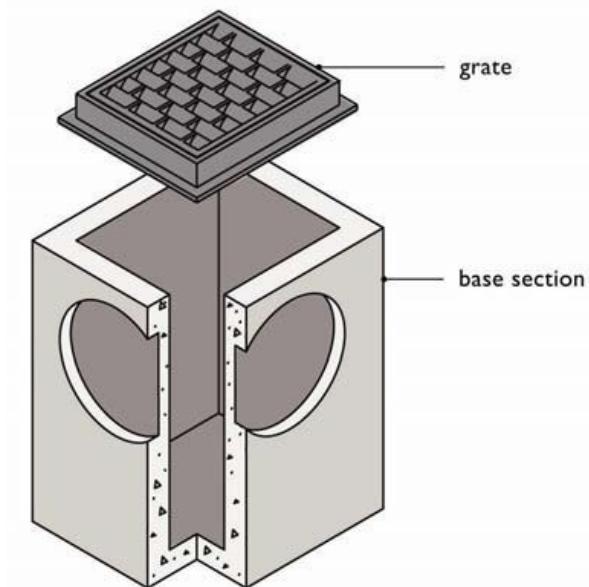
Catch basins must be cleaned when they become 60 percent full. The Port recommends cleaning catch basins when they become one third full to maintain sediment-trapping capacity.

Catch basin and manhole cleaning should be performed in a way that keeps removed sediment and water from being discharged back into the storm sewer. A good time to clean them is at the end of the dry season. Clean putrid materials from catch basins when discovered or reported. Keep the inlet cleared of debris and litter.

### Repairs

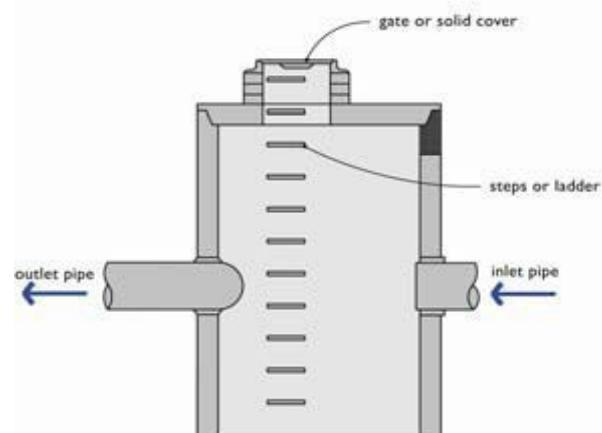
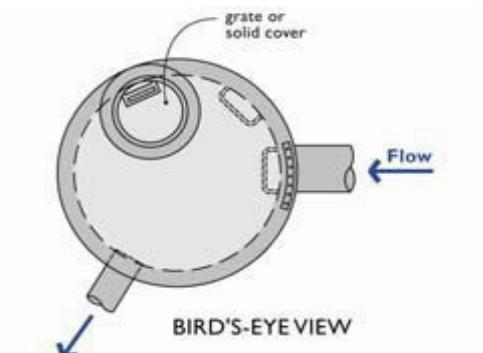
Repair any damage that prevents the catch basin from functioning as designed. An example is a broken or missing outlet elbow.

Follow the practices described under the activity: Installation, Repair and Replacement of Enclosed Drainage Systems.



**Type 1**

**Figure 1:** Catch basin Type 1



**Type 2**

**Figure 2:** Catch Basin Type 2

## MANHOLES

Manholes are large cylindrical vaults usually set at storm sewer pipe connections. Never enter a manhole without OSHA approved training and equipment. There is a considerable risk of poisonous gas and injury.

### Inspection

Inspect the manhole once per year. Check the frame and lid for cracks and wear, such as rocking lids or lids moved by traffic. The City of Tacoma SWMM requires:

- Monthly from October - April and after any major storm event (1" in 24 hours).
- Annual inspections, preferably in September.

Periodically inspect the manhole and surrounding areas for pollutants such as leaks from dumpsters, minor spills, and oil dumping. Take action to have the pollutant source removed.

### Cleaning

Clean manholes when there is a blockage of a water flow path. Cleaning should be performed in a way that makes certain removed sediment and water is not discharged back into the storm sewer.

### Repairs

Repair all security and access features so they are fully functional. This includes locking lids, covers, and ladder rungs. Replace broken parts or lids that rock or are moved by traffic. Follow the practice described under the Activity: Installation, Repair and Replacement of Enclosed Drainage Systems.

## STORM PIPE

Storm sewer pipes convey stormwater. Pipes are built from many materials and are sometimes perforated to allow stormwater to infiltrate into the ground. Storm pipes are cleaned to remove sediment or blockages when problems are identified. Storm pipes must be clear of obstructions and breaks to prevent localized flooding.

The City of Tacoma SWMM does not include inspection requirements or maintenance standards for storm pipes.

### Inspection

Pipes are difficult to inspect, requiring special equipment and training. Port Maintenance conducts all pipe cleaning. The closed-circuit television (CCTV) inspections are usually conducted by a contractor. All inspection findings should be documented and reported so that repairs or additional cleaning can be scheduled.

## Cleaning

Pipes are recommended to be cleaned when sediment depth is greater than 20 percent of pipe diameter. When cleaning a pipe, minimize sediment and debris discharges from pipes to the storm sewer. Install downstream debris traps (where applicable) before cleaning and then remove material.

Generally, use mechanical methods to remove root obstructions from inside storm sewer pipes. Do not put root-dissolving chemicals in storm sewer pipes. If there is a problem, remove the vegetation over the line.

Sediment and debris from pipes should be disposed in the garbage as solid waste.

## Repairs

Recommend repairing pipes when a dent or break closes more than 20 percent of the pipe diameter.

Repair pipes damaged by rust or deterioration. Follow the practice described under the Activity: Installation, Repair and Replacement of Enclosed Drainage Systems.

## DRY DRAINAGE DITCHES

Ditches are manmade open channels that carry only stormwater. Ditches are maintained to prevent localized flooding by draining stormwater. Maintenance activities include removing sediment, debris, and overgrown vegetation. Protecting water quality dictates minimizing vegetation removal and preventing erosion. For further instruction on inspection and maintenance of ditches, refer to the Water Quality Monitoring and Protection Plan in Appendix B.

## Inspection

Inspect ditches during routine site maintenance or at least once per year. The City of Tacoma SWMM requires annual inspections, preferably in September.

## Cleaning

- Land disturbing activities that remove vegetation or disturb soil are subject to erosion control requirements of the Port's MS4 Permit.
- If feasible, remove small amounts of sediment by hand when performing routine site maintenance.
- Vegetation should only be removed when it reduces free movement of water through the ditch. Never remove more vegetation than is absolutely needed.
- Only remove sediment when it reaches 20 percent of the ditch depth or affects the historic or designed hydraulic capacity.
- Alternate cleaning, leaving untouched sections to act as sediment-trapping filters between worked areas.

- Trap sediment that is generated by ditch maintenance to keep it from entering water bodies.
- Use sediment-trapping BMPs such as fabric fencing or filter bags at the lower end of each excavated area.
- Prevent sediment from eroding when ditch work is performed.
- Perform work during dry weather unless there is an emergency such as property or road flooding.
- Vegetate bare soils by hydroseeding or cover bare soils with an approved BMP. Hand seed for smaller areas.

## WATER-BEARING DRAINAGE DITCHES

Many manmade drainage ditches carry water when it is not raining. This water comes from groundwater seeps and wetlands. These ditches can be recognized by the presence of wetland plants such as cattails. Any work that disturbs these channels may be subject to a variety of environmental regulations.

Water-bearing drainage ditches require permits for work. Requirements of county, state, and federal laws and permits may apply. Contact Water Quality staff for information on acquiring authorization under the programmatic ditch permit prior to beginning work (see contact information in the Introduction).

For further instruction on inspection and maintenance of ditches refer to the Water Quality Monitoring and Protection Plan for the Port of Tacoma Stormwater Infrastructure Maintenance Program (NWS-2017-0032-WRD, WQC #15819), located in Appendix B.

## DETENTION PONDS

Detention facilities are designed to hold and slowly release stormwater by use of a pond and specially designed control structure. Styles vary greatly from well-manicured to natural appearing. Generally, vegetation that is more natural is preferred for reduced maintenance and wildlife habitat.

### Inspection

- Identify and report pollutant sources to the facility.
- Inspect the facility for oil and other pollutants and remove any pollutants greater in volume than a surface sheen.
- Monthly from October - April and after any major storm event (1" in 24 hours).
- Annual inspections preferably in September.

### Cleaning

Trash is required to be removed when it exceeds 5 cubic foot per 1000 square feet by the City of Tacoma SWMM. The Port recommends cleaning detention facilities when trash exceeds 1 cubic foot per 1000 square foot in order to maximize performance of the facility.

Sediment should be removed when it accumulates to 10 percent designed pond depth.

### **Vegetation Management**

Mow or control vegetation to match surrounding area or sustain any other intended use of the facility, such as wildlife habitat or recreation.

Stormwater control facilities are, in effect, water body buffers in which pesticides, herbicides and fertilizer should not be used. Use mechanical methods to control weeds.

Trees should not be allowed to grow on emergency overflows and berms that are over 4 feet high. Trees can block flows and roots can lead to berm failure. Remove any trees. Remove larger roots (where the base of the tree is greater than 4 inches) and restore the berm.

See Vegetation Management section for more information.

### **Repairs**

Repair and seed bare areas. Repair eroded slopes when rills form, where the cause of damage is present, or there is potential for future erosion. Use cover BMPs on exposed soils.

Rodent holes on a dam or berm can pipe water. Destroy the rodents, preferably by trapping, and repair the dam or berm.

Repair the liner if it is visible and repair or replace where there are more than three holes greater than  $\frac{1}{4}$  inch diameter.

If berms or dams show signs of settlement or sinkholes, serious problems may be occurring. Consult a licensed professional engineer to determine the cause of the settlement or sinkhole.

Spillway areas should be completely covered by more than one layer of rock.

## OIL/WATER SEPARATORS AND BURIED WET-VAULTS

An oil/water separator is an underground vault that treats stormwater by mechanically separating oil from water. The oil rises to the surface and floats on the water and sediment settles to the bottom. Buried wet vaults are similar to oil/water separators in that they are sub-surface vaults that separate sediment and floating materials from stormwater. These facilities have special problems for maintenance and should be serviced by contractors. The main issues are working in confined spaces and properly handling any sludge and oil cleaned from vaults or oil/water separators. Figures 3 and 4 on the next page below show diagrams of an oil/water separator.

### Inspection

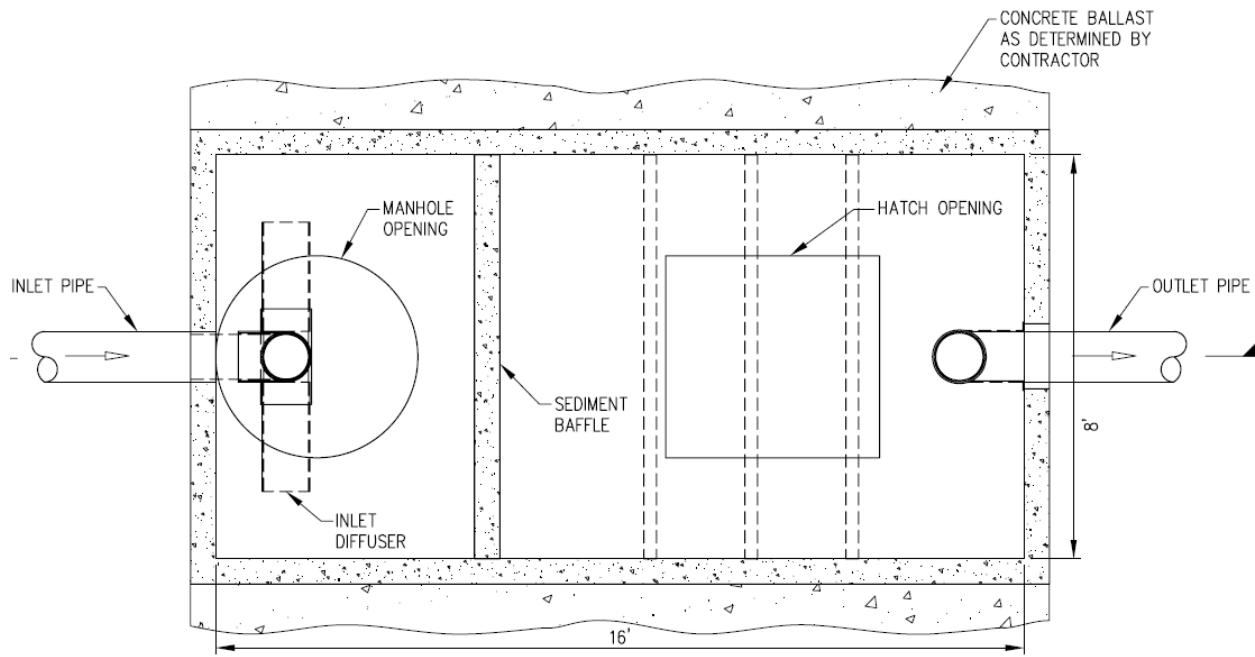
- Periodically check stormwater flow out of the facility. It should be clear and not have a thick visible oil sheen.
- Annually check for cracks large enough to let soil enter the vault, broken or defective plates and baffles, and crushed or damaged pipes.
- Periodically inspect the surrounding areas for pollutants such as leaks from dumpsters, minor spills, and oil dumping.
- Take action to have the pollutant source removed.
- Inspect water levels after an extended dry period to check for leakage.
- Monthly from October - April and after any major storm event (1" in 24 hours).
- Annual inspections preferably in September.

### Cleaning

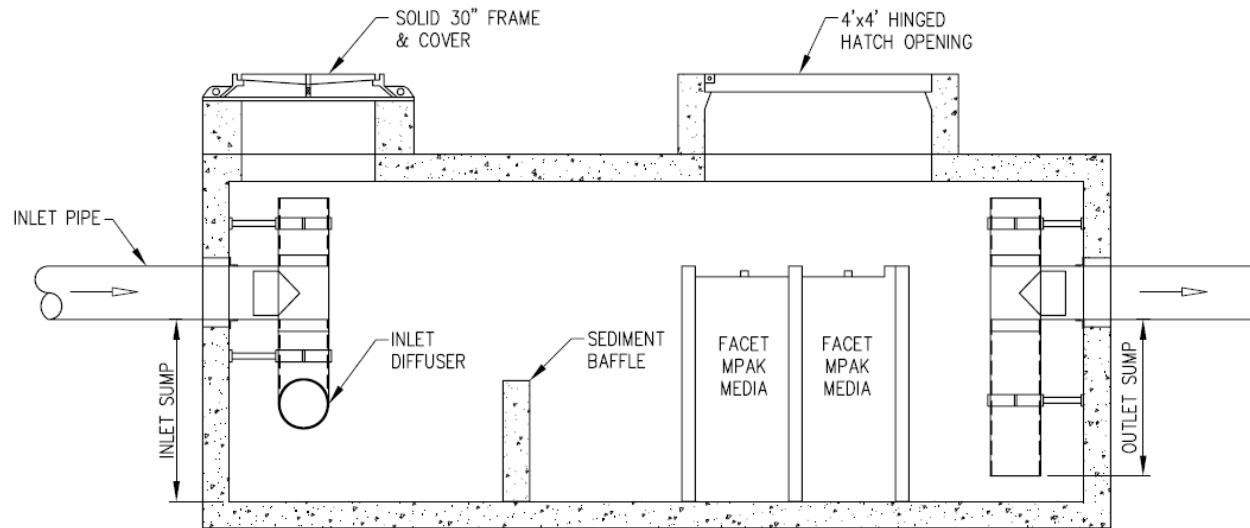
- Remove trash and litter from the vault, inlet and piping.
- Remove oil when it reaches one-inch thickness.
- Remove sediment when it accumulates to 6 inches depth.

### Repairs

- Repair any cracked or defective plates or baffles. Cracks are repaired so that no cracks greater than  $\frac{1}{4}$  inch are found. Repair any leaks that allow water levels to drop and cause oil to be washed from the unit.
- Repair all security and access features so they are fully functional. This includes locking lids, covers, and ladder rungs.
- Follow the practice described under the section for Enclosed Drainage Systems.



**Figure 3:** Oil/Water Separator – Plan View



**Figure 4:** Oil/Water Separator – Profile View

## WET BIOFILTRATION SWALES AND TREATMENT WETLANDS

Wet biofiltration swales and treatment wetlands use dense vegetation and settling to filter sediment and oily materials out of stormwater. These stormwater treatment devices must be properly maintained to sustain pollutant removal capacity. In some cases, biofiltration swales that were designed to drain between storms remain wet and need to be rebuilt or converted to wetland swales. A designed wet biofiltration swale uses wetland plants instead of grass.

### Inspection

- Swales are easy to inspect and need to be well maintained to treat stormwater.
- Make frequent visual inspections for problems such as bare ground, sediment and oily material.
- Identify and remove pollutant sources to the swale.
- Biannually (Spring and Fall) and after any major storm event (1" in 24 hours).

### Cleaning

- Clear inlets and outlets to prevent blockage.
- Remove litter and trash when accumulation exceeds one cubic foot (about one and a half, five-gallon buckets) per thousand square feet.
- Where possible, use a rake and shovel to hand remove sediment accumulations greater than 2 inches thick in 10 percent of the treatment area.

### Vegetation Management

Sparse vegetation or dense clumps of cattail do not properly treat stormwater. Try to find the cause of the problem and fix it. Cut back excessive cattail shoots.

Normally, wetland vegetation does not need to be harvested unless there is an excessive die back that causes water quality problems. If there is a problem with grass dying due to the swale being flooded during the wet season, there are two options: plant varieties that can stand being flooded or find a way to fix the swale so it drains better.

Outside of the treatment area, preserve healthy vegetation or reestablish vegetation where needed. Seed bare spots. Use cover BMPs on bare soils.

Trees and shrubbery should be allowed to grow unless they interfere with facility function or maintenance activities. Any cut trees should be salvaged for habitat enhancement or converted to mulch or firewood.

Stormwater control facilities are, in effect, water body buffers where pesticides and fertilizer are not used. See Vegetation Management section for more information.

### Repairs

- Often swales have problems due to flooding or erosion. Where possible, correct the underlying problem before trying to repair the symptom.

- Repair any defect that causes the wet swale to dry out during the wet season.
- Replace stormwater facility signs that are broken, damaged, or stolen.

## CATCH BASIN INSERTS

Catch basin inserts are becoming more widely used to trap sediment and oil entering catch basins. Some involve some type of filter media and oil-absorbent pads. Others are filter fabric type inserts, sometimes referred to as catch basin sock filters.

### Inspection

It is recommended to inspect per the manufacturer's specifications, and that catch basin inserts be inspected at least annually. Periodically inspect the catch basin and surrounding areas for pollutants such as leaks from dumpsters, minor spills, and oil dumping. Take action to have the pollutant source removed.

### Cleaning

For inserts containing filter media, the media is removed, then cleaned or disposed. It is easier to remove the filter after it has drained and dried. If this is not possible, consider contracting the service or de-watering the filter in a container.

Remove trash and litter from the filter.

If discharges have an oily sheen, replace the oil-trapping media. If the oil trapping media is full, remove it and replace it with a new one or if manufacturer's specifications allow, clean and replace it.

If sediment clogs media, clean it following manufacturer's specifications or replace the filter.

### Repairs

Replace any media after typical service life.

## BIOFILTRATION SWALES

Biofiltration swales use grass or other dense vegetation to filter sediment and oily materials out of stormwater. Usually, they look like flat-bottomed channels with grass growing in them. Swales are stormwater treatment devices that must be properly maintained to sustain pollutant removal capacity.

### Inspection

- Swales are easy to inspect and need to be well maintained to treat stormwater.
- Make frequent visual inspections for problems such as bare ground, sediment and oily material.
- Identify and remove pollutant sources to the swale.
- Monthly from October - April and after any major storm event (1" in 24 hours).

## Cleaning

- Clear inlets and outlets to prevent blockage.
- Remove litter when mowing or litter accumulation exceeds one cubic foot (about one and a half five-gallon buckets)
- Where possible, use a rake and shovel to hand remove sediment accumulations greater than 2 inches thick.

## Vegetation Management

- Mow to keep grass at the optimum height (6 inches). Mow to no less than 4 inches height.
- Remove clippings from the treatment area in the base of the swale. Clippings may be raked or blown onto the side slopes. If the swale has vertical walls or no side slopes, the clippings must be removed.
- Preserve healthy vegetation or reestablish vegetation where needed. Seed bare spots. Use cover BMPs on bare soils. These include hydroseeding or mulches. Trees and shrubbery should be allowed to grow unless they interfere with facility function or maintenance activities.
- Stormwater control facilities are, in effect, water body buffers where pesticides and fertilizer are not used.
- See Vegetation Management section for more information.

## Repairs

Often swales have problems due to flooding or erosion. Where possible, correct the underlying problem before trying to repair the symptom.

Level spreaders must be in proper working order for swales to function properly. Where level spreaders are damaged, sunken, or bypassed by erosion, repair them to design standard.

If there is a problem with grass dying due to the swale being flooded during the wet season, there are two options: convert the swale to plant varieties that can stand being flooded or find a way to fix the swale so it drains better.

## BIORETENTION FACILITIES

Bioretention facilities are engineered depressions or shallow basins used to slow and treat on-site stormwater runoff. Stormwater is directed to the basin and then percolates through the system where it is treated through physical, chemical and biological processes.

The following bioretention facility is located at the Port:

- West Hylebos Log Yard Stormwater Treatment Facilities

## Inspection

- Identify and report pollutant sources to the facility.

- Inspect the facility for oil and other pollutants and remove any pollutants greater in volume than a surface sheen.

Reference shop drawings in Maintenance Shop for current treatment design. See NPDES Pro and SharePoint for maintenance inspection checklists and related maintenance information.

## Cleaning

- Clean out trash and debris when present and remove excess sediment to the extent that infiltration rate is reduced.
- Remove accumulated leaves if there is a risk of clogging outlet structure or water flow is impeded.

## Vegetation Management

- Remove noxious vegetation.
- Stormwater control facilities are, in effect, water body buffers in which pesticides, herbicides and fertilizer should not be used. Use mechanical methods to control weeds.
- Trees should not be allowed to interfere with operation of the facility or access for maintenance.
- See Vegetation Management section for more information.

## Repairs

Repair damaged pipes, concrete structures and bar screens.

### INFILTRATION BASINS AND PONDS

Infiltration facilities dispose of water by soaking it into the ground. These are open facilities that may either drain rapidly and have grass bases or have perpetual ponds that rise and fall with stormwater flows. Infiltration facilities may be designed to handle all of the runoff from an area or they may overflow and bypass larger storms.

Since the facility is designed to pass water into the ground, anything that can cause the base to clog is a large concern. Generally, infiltration basins are managed like detention ponds but with greater emphasis on keeping the capacity to infiltrate stormwater.

## Inspection

- Check once per year after a rainstorm to see if the facility is draining as intended. Inspect annually for all features.
- A thorough inspection of the observation points should be made if there is a decrease in retention basin capacity. Inspection points can include monitoring ports built into the base of the facility and water table depth monitoring wells. Water levels in these inspection points can provide information about the performance of the facility.
- Identify and remove pollutant sources to the facility. Inspect the facility for oil and other pollutants and remove any pollutants greater in volume than a surface sheen.
- Monthly from October - April and after any major storm event (1" in 24 hours).

- Annual inspections, preferably done in September.

## Cleaning

- Trash is required to be removed when it exceeds 5 cubic feet per 1,000 square feet. The Port recommends removing trash when it exceeds 1 cubic foot per 1000 square feet.
- Remove sediment when it accumulates to 2 inches or if the facility does not drain between storms or meet 90 percent of design capabilities.
- If the facility has a sediment trap, clean out the sediment when one-half foot accumulates.

## Vegetation Management

Mow or control vegetation to match surrounding area or sustain any other intended use of the facility, such as wildlife habitat or recreation.

Stormwater control facilities are, in effect, water body buffers where pesticides and fertilizer should not be used. Use mechanical methods to control weeds. See the Vegetation Management section for details.

Trees should not be allowed to grow on emergency overflows and berms that are over 4 feet high. Trees can block flows and roots can lead to berm failure. Remove any trees. Remove larger roots (where the base of the tree is greater than 4 inches) and restore the berm.

## Repairs

If the facility is overflowing for storms it was designed to infiltrate, it needs to be repaired. This requires removing accumulated sediment and cleaning or rebuilding the system so that it works according to design.

Repair and seed bare areas. Repair eroded slopes when rills form, where the cause of damage is present, or there is potential for future erosion. Use cover BMPs on exposed soils.

Rodent holes on a dam or berm can pipe water. Destroy rodents, preferably by trapping, and repair the dam or berm.

Spillway areas should be completely covered by more than one layer of rock.

## DRAINAGE TRENCHES (INFILTRATION TRENCHES)

Drainage trenches are subsurface gravel-lined drain fields built to infiltrate stormwater into the ground. They have a large, perforated pipe in a bed of sorted gravel. Fine oil sediment can clog drain fields and lead to localized street flooding. Also, pollutants discharged into drain field can migrate into groundwater. Drainage trenches were often installed in closed topographic depressions, areas with well-drained soils, or areas having inadequate storm sewers.

## Inspection

Some drainage trenches have special inspection wells or cleanout manholes. They should be inspected at once a year and no less than once every five years.

A thorough inspection of the observation points should be made if there is a decrease in capacity. Inspection points can include, inspection ports, monitoring ports built into the trench, and water table depth monitoring wells. Water levels in these inspection points can provide information about the performance of the facility.

If there is a problem with slow drainage or the facility design rate needs to be verified.

Periodically inspect the surrounding areas for pollutants such as leaks from dumpsters, minor spills, and oil dumping. Take action to have the pollutant source removed.

Monthly from October - April and after any major storm events (1" in 24 hours).

Annual inspections preferably done in September.

### **Cleaning**

- If a drainage trench begins to clog, try cleaning the perforated drainpipe.
- Cleaning should be performed in a way that makes certain removed sediment and water is not discharged back into the storm sewer.

### **Repairs**

- Repairing a clogged drainage trench will likely involve excavation and replacement of part or all of the facility.
- Follow the practice described in the section for Enclosed Drainage Systems.

## DRYWELLS

Drywells are perforated, open-bottomed manholes used to infiltrate stormwater into the ground. While not the intended use, drywells trap sediment and some of the oily pollutants in runoff. Drywells are more likely to fill with oily sediment in areas that lack swales or other treatment facilities. Fine oil sediment can clog drywells and lead to localize street flooding. Also, pollutants discharged into drywells can migrate into groundwater. Drywells were often installed in closed topographic depressions, areas with well-drained soils, or areas having inadequate storm sewers. Often, drywells contain groundwater. Because drywells can be easily clogged and tend to concentrate pollutants in one place; pollution and sediment control practices should be used to protect them.

### **Inspection**

- Drywells should be inspected at least once a year during the wet season (October - April) and no less than once every five years.
- Periodically inspect the drywell and surrounding areas for pollutants such as leaks from dumpsters, minor spills, and oil dumping. Take action to have the pollutant source removed.

- If a problem with flooding or slow drainage occurs, observe, or inspect the drywell for infiltration rate and observe water level depths if monitoring wells are installed.
- See Catch Basins, Manholes and Inlets Inspection Checklist for inspection components.

## Cleaning

Clean out drywells when sediment depth is greater than 1/3 of the distance between the base and inlet pipe.

Drywell cleaning should be performed in a way that makes certain removed sediment and water is not discharged back into the storm sewer.

## Repairs

Work in drywells requires special OSHA-required confined space equipment and procedures. The most practical method for cleaning drywells may be to contract with a sewer-cleaning contractor.

If the drywell does not dissipate stormwater, it should be replaced or repaired.

It is possible to restore some drywell capacity by water-jetting clogged openings. Another option is installing a new drywell or drainage trench, and converting the clogged drywell into a sediment trap. This has the advantage of providing a sediment trap and some amount of spill trapping. The sediment trap conversion requires grouting the holes, covering the base with concrete, and adding piping.

If there is standing water in a drywell, it probably reaches the water table. Drywells in the water table should be rebuilt to prevent stormwater from going directly into groundwater. Repair all security and access features so they are fully functional. This includes locking lids, covers, and ladder rungs.

Follow the practice described in the section for Enclosed Drainage Systems.

## SAND FILTERS

Sand filters treat stormwater by filtering it through a bed of sand into an under-drain beneath the sand. They are effective at removing pollutants but must be carefully designed and well maintained. Sand filters may have serious maintenance problems in sites with excessive sediment. Along with normal maintenance, the filter media needs replacement periodically. Consult engineer's operation manual written for the sand filter or have a licensed professional engineer assist in media replacement. Sand filters are either above ground and open to view or below ground in vaults. Above ground filters are much easier to maintain. Below ground units require special training and equipment approved by OSHA for any work.

The following enhanced sand filters are installed at the Port:

- Custom Biofiltration Units (former Filterra units)
- Custom Filtration Vaults at Taylor Way
- Repurposed Up-Flos at Terminal 7

## Inspection

Aboveground filters are easy to inspect and need to be well maintained to treat stormwater. Make frequent visual inspections for problems such as overtopping or bypasses, taking longer than 24 hours to draw down, and channels. Make a complete inspection of all features at least once a year.

Underground units must be inspected for all features at least once per year. More frequent inspections should be performed as a part of routine site maintenance. Check for indicators that the facility is not functioning. Examples include checking stormwater effluent for oil sheen, checking for overflowing, and checking for short circuiting.

Identify and remove pollutant sources.

Above and below ground Sand Filters inspected Monthly from October - April and after any major storm event (1' in 24 hours).

Annual inspections preferably done in September.

There are site-specific media blends for these units. Reference shop drawings in Maintenance Shop for current treatment design. See NPDES Pro and SharePoint for maintenance inspection checklists and related maintenance information.

## Cleaning

- Clean out accumulated sediment when it accumulates to 1/2-inch depth.
- Remove any trash or litter from the sand bed and other parts of the facility. Rake up and remove accumulations of leaves or other plant debris that wash into the facility and begin to form a mat.
- Clean sediment out of pre-settling chambers when 6 inches of sediment accumulates.
- Clean out any drainpipes or clean outs that become filled with sediment.

## Vegetation Management

- Aboveground sand filters may or may not be designed with a vegetation surface. If a facility has vegetation, follow the maintenance procedures for a stormwater biofiltration swale.
- If it does not have designed vegetation, mechanically remove vegetation before it begins to cover parts of the facility.
- Remove all clippings or pulled weeds from the facility.

## Repairs

- Where possible, correct the underlying problem before trying to repair the symptom.
- If it takes more than 24 hours for a storm to drain through the sand media or it frequently overflows, the sand media needs to be serviced. This problem is caused by fine particles clogging the sand filter. Have a licensed professional engineer oversee this procedure. At

the very least, the upper few inches will need to be replaced. Sieve analyses may be helpful for determining the depth that needs to be removed and replaced with new sand. Replace clogged sand with the type of sand specified by the designer or approved by a Public Works Department Engineer.

- If there are prolonged, low rate flows into the facility due to groundwater seeps or detention facilities, route them to a smaller part of the facility using a low wood divider or shallow channel.
- The flow spreader must be level and spread flow evenly across the filter. Immediately repair any defects in the flow spreader.
- If parts of the sand filter erode, find ways to correct the problem by compacting the sand or protecting the eroding area with geotextile or other means.
- Replace or repair any damaged pipes.
- Repair any cracked or defective plates or baffles. Cracks are repaired so that no cracks greater than  $\frac{1}{4}$  inch are found.
- Repair any joints that are cracked and allow soil into the facility.
- Repair all security and access features so they are fully functional. This includes locking lids, covers, and ladder rungs.
- Follow the practice described in the section for Enclosed Drainage Systems.

## ENERGY DISSIPATORS

Energy dissipaters are critical for preventing erosion at storm drain outfalls. There are a variety of designs including wire gabion baskets, rock splash pads, trenches, and specially designed pools or manholes.

### Inspection

- Inspect at least once per year.
- Monthly from October - April and after any major storm event (1" in 24 hours).
- Annual inspections preferably done in September.

### Cleaning

Dispersion Trench: Remove sediment from pipe when it reaches 20 percent of pipe diameter.

### Repairs

Follow the practice described in the section for Enclosed Drainage Systems.

- **Rock Pads:** Replace missing or moved rock to cover exposed soil and meet design standards.
- **Dispersion Trench:**
  - Repair conditions that cause concentrated flow along the trench.
  - Clean pipe perforations when one half of them are plugged or if flows bypass or overflow the trench.
- **Manhole/Chamber:**

- When the structure deteriorates to one half its original size or it becomes structurally unsound, replace it to the design standards.

## DEBRIS BARRIERS/TRASH RACKS

Trash racks are barred covers to pipe openings. They prevent large objects from entering pipes and keep pets and people out of pipes.

### Inspection

- Inspect trash racks at least once per year.
- Monthly from October - April and after any major storm event (1" in 24 hours).
- Annual inspections preferably done in September.

### Cleaning

Clean trash racks when debris is plugging more than 20 percent of the openings.

### Repairs

- Immediately replace missing racks and missing bars.
- Replace bars that are deteriorated to the point where they may be easily removed.
- Bend bent bars back into position. Follow the practices described under the activity: Installation, Repair and Replacement of Enclosed Drainage Systems.

## Access Roads and Easements -Operation and Maintenance Practices

Many stormwater facilities have access roads to bring in heavy equipment for facility maintenance. These roads should be maintained for inspection access and ease of equipment access.

### Inspection

Inspect once a year or when facilities are maintained.

### Cleaning

Remove litter when mowing or litter accumulation exceeds one cubic foot (about one and a half five-gallon buckets) per 1,000 square feet. Remove any debris that blocks roads or may damage tires.

### Vegetation Management

Manage vegetation as for the rest of the facility.

### Repairs

- Correct any bare or eroded soils by seeding or cover BMP.
- Repair road surfaces when they may lead to erosion or limit equipment access.

## DOWNSPOUT BOXES

Downspout Boxes treat stormwater by filtering it through a bed of Bioretention Soil Mix (BSM) and pea gravel into an under-drain beneath the gravel. Along with normal maintenance, the filter media needs replacement periodically.

### Inspection

- Downspout Boxes are easy to inspect and need to be well maintained.
- Make frequent visual inspections for problems such as overtopping or bypasses or standing water.
- Make a complete inspection of all features at least twice a year (or as needed). When sampling shows the media is no longer effective, remove and replace media.
- Annual inspections should be done during wet season (October - April).

### Cleaning

Remove trash and debris from filter bed.

### Vegetation Management

Provide irrigation to the plants as necessary. Trim/prune vegetation or remove nuisance vegetation to not impede flow.

## FLOW CONTROL STRUCTURES

### Inspection

Inspect the manhole once per year. Check the frame and lid for cracks and wear, such as rocking lids or lids moved by traffic.

Periodically inspect the manhole and surrounding areas for pollutants such as leaks from dumpsters, minor spills, and oil dumping. Take action to have the pollutant source removed.

### Cleaning

Clean manholes when there is a blockage of a water flow path. Cleaning should be performed in a way that makes certain removed sediment and water is not discharged back into the storm sewer.

### Repairs

Repair all security and access features so they are fully functional. This includes locking lids, covers, and ladder rungs. Replace broken parts or lids that rock or are moved by traffic. Follow the practice described in the section for Enclosed Drainage Systems.

## PROPRIETARY TREATMENT UNITS

The following proprietary treatment units are in place at the Port:

- JellyFish Stormwater Treatment Technology
- Modular Wetlands

See Appendix A for Manufactured Media Filters Maintenance Standard and Appendix C for Manufacturer Operation and Maintenance Manuals.

## VEGETATION MANAGEMENT

### GENERAL GOALS AND PHILOSOPHY

The Port of Tacoma recognizes the importance of keeping polluted runoff out of Commencement Bay. All landscape management decisions for controlling unwanted vegetation, diseases, and pests should follow Integrated Pest Management principles and decision-making rationale. These are:

- Proper planning and management decisions begin the IPM process.
- Order of preference of pest control, where feasible:
  1. Cultural methods of vegetation and pest control are preferred and are first employed.
  2. Mechanical means of vegetation and pest control
  3. Biological methods of vegetation and pest control
  4. Botanical and synthetic pesticides may be used only when no other feasible methods exist.

### GENERAL PRACTICES

#### **Use Only Appropriate Plants**

The use of native plants requires less maintenance included watering and fertilizer.

#### **Mulching**

Mulches and other ground coverings are useful during the installation and restoration of landscapes as well as their ongoing maintenance. Mulches meet a variety of needs. They suppress weeds, help to retain moisture around plants, reduce possible erosion, and provide visual enhancement.

Always consider the possible impacts when using mulches, which may include:

- Inadvertent introduction of non-native weeds and diseases to the site.
- Leaching of substances such as tannins from the mulch into nearby waterways.

- Migration of mulch material into waterways.
- Nutrient leaching into waterways.

## VEGETATION AND PEST MANAGEMENT IN STORMWATER CONTROL FACILITIES

Stormwater control facilities include biofiltration treatment swales, treatment wetlands, treatment ponds, detention ponds, open channels, and infiltration basins. Stormwater control facilities discharge to surface water or groundwater either directly or through pipes or ditches. Many facilities are built to remove pollutants from stormwater.

Generally, vegetation should be maintained to blend into surrounding areas. Stormwater facilities can provide habitat for aquatic life and birds. Promoting natural vegetation where feasible improves habitat. Swales often blend into intensively managed landscapes. Pond perimeters can include natural vegetation.

The use of pesticides and, in most cases fertilizer, is not compatible with the task of pollutant removal or the direct connection of stormwater facilities to streams and groundwater.

### **Features of Stormwater Facilities:**

- There is a mix of native and non-native plants
- Generally not used by the public
- Include areas managed to promote design function, such as turf in swales
- Managed landscapes may be nearby

### **Objectives for Stormwater Facilities:**

- Maintain healthy plant communities
- Minimize need for chemical intervention
- Control invasive plants where feasible
- No bare soil areas are allowed
- Tolerance for natural appearance and weeds

### **Practices**

- The vegetation management focus is establishing and maintaining healthy low-maintenance native plantings and sustaining the design function of vegetated filters such as biofiltration swales. This includes controlling invasive plants where feasible, and planting cover on bare soils.
- In some cases, the original plantings may not be appropriate for the actual condition at a facility. One example is a frequently flooded swale that cannot support normal turf. In cases like this, replace turf with appropriate wetland plants if the underlying drainage problem cannot be fixed.
- Consider the use of soil amendments such as compost before using fertilizer.

- Limit mulch use to covering bare soil while establishing plantings.
- Chemical use should be avoided within 25 feet of any area that holds or conveys surface water or stormwater. This includes the base of a biofiltration swale.
- Trees or shrubs that block access roads may be trimmed (or removed if within the access road) at the time of when access is required for maintenance by heavy equipment.
- Trees that pose a risk to stormwater structures due to root growth may be removed and replaced by smaller shrubs.

## VEGETATION AND PEST MANAGEMENT IN STORMWATER FACILITY WETLAND AREAS

Stormwater Facility Wetlands are built to treat stormwater. As water bodies, treatment wetlands connect to streams and groundwater. Wetlands also host insects, fish, amphibians, and birds that are sensitive to horticultural chemicals. Because of this, chemical use should be minimized in wetland buffers. Wetland management has a low tolerance for invasive or non-native plants.

Practices listed here only apply to parts of wetlands that are not subject to inundation during the growing season.

### Features of Constructed Wetlands:

- Limited public access
- Plants may or may not be well established depending on age and condition

### Objectives for Constructed Wetlands:

- Maintain healthy plant communities
- Minimize need for chemical intervention
- Low tolerance of invasive plants, non-natives
- Bare soil areas are not allowed

### Practices

- There should be a plan for establishing and maintaining vegetation in a newly created wetland facility. If there is a plan, follow it. If there is not a plan, follow these practices.
- Maintenance focuses on establishing and sustaining healthy native plantings. This includes more vigorously controlling invasive plants. It also includes covering for bare soils.
- Consider the use of soil amendments such as compost before using fertilizer. Limit mulch use to covering bare soil while establishing plantings.
- Chemical intervention is minimized and is avoided; if possible, within 25 feet of areas subject to inundation during the growing season.

## PESTICIDE/HERBICIDE HANDLING INFORMATION

The Port intends to protect human health and minimize its environmental footprint from the use of pesticides and herbicides. Pesticides and herbicides are used on Port premises for the control of vegetation, noxious weeds, and pests.

### **POLICY:**

When selecting pest or weed control chemical products to be applied, the Port will use products that impose the lowest risk to human health and the environment, and still perform the task with reasonable efficiency.

Maintenance Department maintains Public Pesticide Operators Certification for pesticides and herbicides. Maintenance employees designated by the Director of Maintenance are responsible for ensuring that all regulations for approved pesticide and herbicide storage, handling, and application are followed. Any procedural problems experienced during application resulting in questionable or noncompliance activity shall be reported to the Maintenance Director for resolution.

### **PROCEDURE:**

- The Port's Contracts and Purchasing Department should provide a copy of the Port's Certified Pesticide Operators' Certificates to the Vendor thereby allowing the Port Maintenance Department personnel to order the pesticide and herbicide products. Non-certified personnel can assist the Certified Operator. In that event, the Certified Operator must remain on site with the assistant and the level of involvement by the assistant will be governed by the Licensed Public Operator.
- Regarding the pesticide and herbicide container labeling, storage, application and disposal, Port Maintenance Department is responsible for making sure the Port's operation meets the Federal Insecticide, Fungicide and Rodenticide Act requirements.
- Original packaging of a product usually provides acceptable labeling. If the product is stored in a receptacle other than its original package, a copy of the original label will be attached.
- Labeling will be maintained on empty product containers until after they have been triple-rinsed.
- Safety data sheets will be maintained in the Parts Department and on the job site.
- Product storage should have proper security and signs.
- Product shall be protected from weather, locked from non-Port personnel access, and will have proper signs and warnings posted and clearly visible outside of the storage area.
- The applicator and tank (if not triple rinsed), when not in use, shall be secured and signed the same as stored product.
- Applicator/Site Signs shall meet Washington Administration Code requirements. Powered applicators will be prominently labeled with "Port of Tacoma", the Port phone number, and "Vegetation Management Application".

- Product applications requiring a "Restricted Entry Interval" shall not be left unattended without first posting proper signs.
- Spills will be properly cleaned up per manufacturer's instructions. Spill prevention will consist of:
  - Properly securing product during transportation to application site;
  - Closing and securing valves and lids before transporting product or applicator, empty or full;
  - Mixing product for application on site to reduce clean-up and spill hazards; and
  - Protecting stored product from damage.

### **Specific Training**

To protect the health and safety of workers, the Maintenance Director is responsible for ensuring the Facilities Maintenance employees responsible for pesticide application are trained and certified by the Washington State Department of Agriculture in the safe use of pesticides, or the Maintenance Director hires employees who have already been trained and certified. Certificates and information on training should be forwarded to Human Resources for incorporation into the Employee Training database.

### **Recordkeeping**

If applicable, the Port Maintenance should keep a compliance file that includes:

- A Pesticide Application Log will be kept by the Certified Operator doing the application. Completed logs pages will be sent to and kept by the Maintenance Director.
- Pesticide Applicators' certification and training records.
- Pesticide contractor records when they make applications on Port property.

### **REFERENCES:**

2021 City of Tacoma Stormwater Management Manual

Federal EPA Insecticide, Fungicide and Rodenticide Act, 1995 Worker Protection Standard (WPS) amendment

OSHA§ 1917.25 Fumigants, Pesticides, Insecticides and Hazardous Preservatives



## APPENDIX A:

# Maintenance Standards

# Table of Contents: Maintenance Standards

- #1 - Maintenance Standard for Detention Ponds
- #2 - Maintenance Standard for Infiltration Ponds/Basins
- #3 - Maintenance Standard for Infiltration Trenches
- #4 - Maintenance Standard for Closed Detention Systems (Tanks/Vaults)
- #5- Maintenance Standard for Control Structure/Flow Restrictor
- #6a - Maintenance Standard for Catch Basins/Manholes
- #6b - Maintenance Standard for Catch Basin Inserts
- #7 - Maintenance Standard for Debris Barriers
- #8 - Maintenance Standard for Energy Dissipaters
- #9 - Maintenance Standard for Biofiltration Swales
- #10 -Maintenance Standard for Wet Biofiltration Swales
- #11 - Maintenance Standard for Filter Strips
- #12 - Maintenance Standard for Wet Ponds
- #14 - Maintenance Standard for Wet Vaults
- #15 - Maintenance Standard for Sand Filters (above ground/open)
- #16 - Maintenance Standard for Sand Filters (below ground/enclosed)
- #17 - Maintenance Standard for Baffle Oil/Water Separators - American Petroleum Institute
- #18 - Maintenance Standard for Coalescing Plate Oil/Water Separators
- #22 - Maintenance Standard for Bioretention Facilities
- #29 - Maintenance Standard for Concerns for Stormwater Facilities
- #33a - Maintenance Standard for Media Filter Drains
- #33b - Maintenance Standard for Manufactured Media Filters

### Maintenance Standards - Detention Ponds

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed	Inspection Frequency
General	Trash & Debris	<p>Any trash and debris which exceed 5 cubic feet per 1,000 square feet. In general, there should be no visual evidence of dumping. (This is about equal to the amount of trash it would take to fill up one 32-gallon garbage can.)</p> <p>If less than threshold all trash and debris will be removed as part of next scheduled maintenance.</p>	Trash and debris cleared from site.	Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)
	Poisonous Vegetation and noxious weeds	<p>Any poisonous or nuisance vegetation which may constitute a hazard to maintenance personnel or the public.</p> <p>Any evidence of noxious weeds as defined by State or local regulations. (Apply requirements of adopted IPM policies for the use of herbicides).</p>	<p>No danger of poisonous vegetation where maintenance personnel or the public might normally be. (Coordinate with local health department)</p> <p>Complete eradication of noxious weeds may not be possible. Compliance with State or local eradication policies required.</p>	Annually (preferably Sept.)
	Contaminants and Pollution	Any evidence of oil, gasoline, contaminants or other pollutants (Coordinate removal/cleanup with local water quality response agency. Contact Anita Fichthorn at 253-830-5379 or Pollution Hotline – 253-383-2429 for coordination efforts.)	No contaminants or pollutants present.	Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)
	Rodent Holes	Any evidence of rodent holes if facility is acting as a dam or berm, or any evidence of water piping through dam or berm via rodent holes.	Rodents destroyed and dam or berm repaired. (Coordinate with local health department; coordinate with Ecology Dam Safety Office if pond exceeds 10 acre-feet.)	Monthly from Oct. – Apr.

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed	Inspection Frequency
	Beaver Dams	Dam results in change or function of the facility.	Facility is returned to design function. (Coordinate trapping of beavers and removal of dams with appropriate permitting agencies)	Monthly from Oct. – Apr.
	Insects	When insects such as wasps and hornets interfere with maintenance activities.	Insects destroyed or removed from site. Apply insecticides in compliance with adopted IPM policies.	Annually (preferably Sept.)
	Tree Growth and Hazard Trees	Tree growth does not allow maintenance and inspection access or interferes with maintenance activity (i.e., slope mowing, silt removal, vactoring, or equipment movements). If trees are not interfering with access or maintenance, do not remove  If dead, diseased, or dying trees are identified, use a certified Arborist to determine health of tree or removal requirements.	Trees do not hinder maintenance activities. Harvested trees should be recycled into mulch or other beneficial uses (e.g., alders for firewood).  Remove hazard trees	Annually (preferably Sept.)
Side Slopes of Pond	Erosion	Eroded damage over 2 inches deep where cause of damage is still present or where there is potential for continued erosion.  Any erosion observed on a compacted berm embankment.	Slopes should be stabilized using appropriate erosion control measure(s); e.g., rock reinforcement, planting of grass, compaction. If erosion is occurring on compacted berms a licensed engineer in the state of Washington should be consulted to resolve source of erosion.	Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)
Storage Area	Sediment	Accumulated sediment that exceeds 10% of the designed pond depth unless otherwise specified or affects inletting or outletting condition of the facility.	Sediment cleaned out to designed pond shape and depth; pond reseeded if necessary to control erosion.	Monthly from Oct. – Apr.

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed	Inspection Frequency
	Liner (if Applicable)	Liner is visible and has more than three 1/4-inch holes in it.	Liner repaired or replaced. Liner is fully covered.	Monthly from Oct. – Apr.
Ponds/Berms/ Dikes	Settlements	<p>Any part of berm which has settled 4 inches lower than the design elevation If settlement is apparent, measure berm to determine amount of settlement</p> <p>Settling can be an indication of more severe problems with the berm or outlet works. A licensed engineer in the state of Washington should be consulted to determine the source of the settlement.</p>	Dike is built back to the design elevation.	Annually (preferably Sept.)
	Piping	<p>Discernable water flow through pond berm. Ongoing erosion with potential for erosion to continue. (Recommend a geotechnical engineer be called in to inspect and evaluate condition and recommend repair of condition.)</p>	Piping eliminated. Erosion potential resolved.	Annually (preferably Sept.)
Emergency/ Overflow Spillway and Berms over 4 feet in height over 4 feet in height	Tree Growth	<p>Tree growth on emergency spillways creates blockage problems and may cause failure of the berm due to uncontrolled overtopping.</p> <p>Tree growth on berms over 4 feet in height may lead to piping through the berm which could lead to failure of the berm.</p>	Trees should be removed. If root system is small (base less than 4 inches) the root system may be left in place. Otherwise, the roots should be removed and the berm restored. A licensed engineer in the State of Washington should be consulted for proper berm/spillway restoration.	Annually (preferably Sept.)
	Piping	<p>Discernable water flow through pond berm. Ongoing erosion with potential for erosion to continue.</p> <p>Recommend a Geotechnical engineer be called in to inspect and evaluate condition and recommend repair of condition.</p>	Piping eliminated. Erosion potential resolved.	Annually (preferably Sept.)

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed	Inspection Frequency
Emergency Over-flow/Spillway	Rock Missing	Only one layer of rock exists above native soil in area five square feet or larger, or any exposure of native soil at the top of outflow path of spillway.  (Rip-rap on inside slopes need not be replaced.)	Rocks and pad depth are restored to design standards.	Annually (preferably Sept.)
	Erosion	Erosion damage over 2 inches deep where cause of damage is still present or where there is potential for continued erosion. Any erosion observed on a compacted berm embankment over 2" deep.	Slopes should be stabilized using appropriate erosion control measure(s); e.g., rock reinforcement, planting of grass, compaction. If erosion is occurring on compacted berms a licensed Civil Engineer should be consulted to resolve source of erosion.	Annually (preferably Sept.)

### Maintenance Standards – Infiltration Ponds/Basins

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed	Inspection Frequency
General	Trash & Debris	Trash and debris in pre-settling basin, sump, or observation well/port.	Trash and debris cleared from site.	Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)
	Poisonous Vegetation and noxious weeds	<p>Any poisonous or nuisance vegetation which may constitute a hazard to maintenance personnel or the public.</p> <p>Any evidence of noxious weeds as defined by State or local regulations. (Apply requirements of adopted IPM policies for the use of herbicides).</p>	<p>No danger of poisonous vegetation where maintenance personnel or the public might normally be. (Coordinate with local health department)</p> <p>Complete eradication of noxious weeds may not be possible. Compliance with State or local eradication policies required</p>	Annually (preferably Sept.)
	Contaminants and Pollution	Any evidence of oil, gasoline, contaminants or other pollutants (Contact Environmental Compliance to help coordinate removal/cleanup with local water quality response agency).	No contaminants or pollutants present.	Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)
	Insects	When insects such as wasps and hornets interfere with maintenance activities.	Insects destroyed or removed from site. Apply insecticides in compliance with adopted integrated pest management policies.	Annually (preferably Sept.)
	Tree Growth and Dense Vegetation	Tree growth and dense vegetation that impedes inspection, maintenance access or interferes with maintenance activity (i.e., slop mowing, silt removal, vactoring, or equipment movements).	<p>Trees and vegetation that do not hinder inspection or maintenance activities.</p> <p>Harvested trees should be recycled into mulch or other beneficial uses.</p>	Annually (preferably Sept.)

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed	Inspection Frequency
Trenches	Observation Well (Use surface of trench if well is not present)	Water ponds at surface during storm events. Water visible in observation well 48 hours after storm event.	Remove and replace rock layer and geomembrane or clean rock and geomembrane. Check underdrain pipe for sediment accumulation and remove sediment.	Annually (preferably Sept.) and after any major storm event (1" in 24 hours)
Emergency/Overflow Spillway and Berms over 4 feet in height	Tree Growth	<p>Tree growth on emergency spillways creates blockage problems and may cause failure of the berm due to uncontrolled overtopping.</p> <p>Tree growth on berms over 4 feet in height may lead to piping through the berm which could lead to failure of the berm.</p>	<p>Trees should be removed. If root system is small (base less than 4 inches), the root system may be left in place. Otherwise, the roots should be removed and the berm restored. A licensed engineer in the State of Washington should be consulted for proper berm/spillway restoration.</p>	Annually (preferably Sept.)
	Erosion	<p>Erosion damage over 2 inches deep where cause of damage is still present or where there is potential for continued erosion.</p> <p>Any erosion observed on a compacted berm embankment.</p>	<p>Slopes should be stabilized using appropriate erosion control measure(s); e.g., rock reinforcement, planting of grass, compaction.</p> <p>If erosion is occurring on compacted berms, a licensed Civil Engineer should be consulted to resolve source of erosion.</p>	Annually (preferably Sept.)
Pre-settling Sump	Facility or sump filled with Sediment and/or debris	6" or designed sediment trap depth of sediment.	Sediment is removed.	Monthly from Oct. – Apr.

## Maintenance Standards – Infiltration Trenches

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed	Inspection Frequency
General	Trash & Debris	Trash and debris in presettling basin, sump, or observation well/port.	Trash and debris cleared from site.	Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)
	Poisonous Vegetation and noxious weeds	<p>Any poisonous or nuisance vegetation which may constitute a hazard to maintenance personnel or the public.</p> <p>Any evidence of noxious weeds as defined by State or local regulations. (Apply requirements of adopted IPM policies for the use of herbicides).</p>	<p>No danger of poisonous vegetation where maintenance personnel or the public might normally be. (Coordinate with local health department.)</p> <p>Complete eradication of noxious weeds may not be possible. Compliance with State or local eradication policies required.</p>	Annually (preferably Sept.)
	Contaminants and Pollution	Any evidence of oil, gasoline, contaminants or other pollutants (Coordinate removal/cleanup with local water quality response agency).	<p>No contaminants or pollutants present.</p> <p>Coordinate removal/cleanup with Environmental Compliance.</p>	Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)
	Water Not infiltrating	Water ponding on surface or visible in observation well 24 hours after storm event.	Sediment is removed and/or facility is cleaned so that infiltration system works according to design. Remove any sediment from surface inlet if applicable.	Monthly from Oct. – Apr.
	Insects	When insects such as wasps and hornets interfere with maintenance activities.	Insects destroyed or removed from site. Apply insecticides in compliance with adopted integrated pest management policies.	Annually (preferably Sept.)

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed	Inspection Frequency
	Tree Growth and Dense Vegetation	Tree growth and dense vegetation that impedes inspection, maintenance access or interferes with maintenance activity (i.e., slope mowing, silt removal, vacating, or equipment movements).	Trees and vegetation that do not hinder inspection or maintenance activities. Harvested trees should be recycled into mulch or other beneficial uses.	Annually (preferably Sept.)
Trenches	Observation Well (use surface of trench if well is not present)	Water ponds at surface during storm events. Water visible in observation well 48 hours after storm event.	Remove and replace rock layer and geomembrane or clean rock and geomembrane. Check underdrain pipe for sediment accumulation and remove sediment.	Annually (preferably Sept.) and after any major storm event (1" in 24 hours)
Emergency/Overflow Spillway and Berms over 4 feet in height	Erosion	Erosion damage over 2 inches deep where cause of damage is still present or where there is potential for continued erosion. Any erosion observed on a compacted berm embankment.	Slopes should be stabilized using appropriate erosion control measure(s); e.g., rock reinforcement, planting of grass, compaction. If erosion is occurring on compacted berms a licensed Civil Engineer should be consulted to resolve source of erosion.	Annually (preferably Sept.)
Presettling Sump	Facility or sump filled with sediment and/or debris	6 inches or designed sediment trap depth of sediment.	Sediment is removed.	Monthly from Oct. – Apr.

### Maintenance Standards – Closed Detention Systems (Tanks/Vaults)

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed	Inspection Frequency
Storage Area	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.	Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)
	Debris and Sediment	Accumulated sediment depth exceeds 10 percent of the diameter of the storage area for one- half length of storage vault or any point depth exceeds 15 percent of diameter.  (Example: 72-inch storage tank would require cleaning when sediment reaches depth of 7 inches for more than one-half length of tank.)	All sediment and debris removed from storage area.	Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)
	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 joints between tank/pipe sections are sealed.	Annually (preferably Sept.)
	Tank Pipe Bent Out of Shape	Any part of tank/pipe is bent out of shape more than 10 percent of is design shape. (Will require engineering analysis to determine structural stability.)	Tank/pipe repaired or replaced to design.	Annually (preferably Sept.)
	Vault Structure Includes Cracks or Damage in Wall, Bottom, Frame or Top Slab	Cracks wider than one-half inch at the joint of any inlet/outlet pipe or any evidence of soil particles entering the vault through the walls.	No cracks more than one-fourth inch wide at the joint of the inlet/outlet pipe.	Annually (preferably Sept.)
Manhole	Cover Not in Place	Cover is missing or only partially in place. Any open manhole requires maintenance.	Manhole is closed.	Annually (preferably Sept.)

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed	Inspection Frequency
	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.	Annually (preferably Sept.)
	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.	Annually (preferably Sept.)
	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.	Annually (preferably Sept.)
General	Insects	When insects such as wasps and hornets interfere with maintenance activities.	Insects destroyed or removed from site. Apply insecticides in compliance with adopted integrated pest management policies.	Annually (preferably Sept.)
Catch Basin – General	"Dump no pollutants" stencil or stamp not visible	Stencil or stamp should be visible and easily read.	Warning signs (e.g., "Dump No Waste- Drains to Stream") shall be painted or embossed on or adjacent to all storm drain inlets.	Annually (preferably Sept.)

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed	Inspection Frequency
Catch Basin - General	Trash & Debris	Trash or debris which is located immediately in front of the catch basin opening or is blocking inletting capacity of the basin by more than 10%.	No trash or debris located immediately in front of catch basin or on grate opening.	Monthly from Oct. - Apr. and after any major storm event (1" in 24 hours)
		Trash or debris (in the basin) that exceeds 60 percent of the sump depth as measured from the bottom of basin to invert of the lowest pipe into or out of the basin, but in no case less than a minimum of six inches clearance from the debris surface to the invert of the lowest pipe.	No trash or debris in the catch basin. Inlet and outlet pipes free of trash or debris.	
		Trash or debris in any inlet or outlet pipe blocking more than one-third of its height.	No dead animals or vegetation present within the catch basin.	
	Sediment	Sediment (in the basin) that exceeds 60 percent of the sump depth as measured from the 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 inches clearance from the sediment surface to the invert of the lowest pipe.	No sediment in the catch basin.	Monthly from Oct. - Apr. and after any major storm event (1" in 24 hours)
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). 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.	Top slab is free of holes and cracks. Frame is sitting flush on the riser rings or top slab and firmly attached.	Annually (preferably Sept.)

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed	Inspection Frequency
	Fractures or Cracks in Basin Walls/ Bottom	Maintenance person judges that structure is unsound.  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 particles entering catch basin through cracks.	Basin replaced or repaired to design standards.  Pipe is re-grouted and secure at basin wall.	Annually (preferably Sept.)
	Settlement/ Misalignment	If failure of basin has created a safety, function, or design problem.	Basin replaced or repaired to design standards.	Annually (preferably Sept.)
	Vegetation	Vegetation growing across and blocking more than 10% of the basin opening. Vegetation growing in inlet/outlet pipe joints that is more than six inches tall and less than six inches apart.	No vegetation blocking opening to basin. No vegetation or root growth present.	Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)
	Contamination and Pollution	Any evidence of oil, gasoline, contaminants or other pollutants.	No contaminants or pollutants present. Coordinate removal/cleanup with Environmental Compliance.	Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)
Catch Basin Cover	Cover Not in Place	Cover is missing or only partially in place. Any open catch basin requires maintenance.	Cover/grate is in place, meets design standards, and is secured	Annually (preferably Sept.)
	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.	Annually (preferably Sept.)
	Cover Difficult to Remove	One maintenance person cannot remove lid after applying normal lifting pressure. (Intent is to keep the cover from sealing off access to maintenance.)	Cover can be removed by one maintenance person.	Annually (preferably Sept.)

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed	Inspection Frequency
Catch Basin Ladder	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.	Annually (preferably Sept.)
Metal Grates (if applicable)	Grate opening Unsafe	Grate with opening wider than 7/8 inch.	Grate opening meets design standards.	Annually (preferably Sept.)
	Trash and Debris	Trash and debris that is blocking more than 20% of grate surface inletting capacity.	Grate free of trash and debris.	Annually (preferably Sept.)
	Damaged or Missing	Grate missing or broken member(s) of the grate.	Grate is in place, meets the design standards, and is installed and aligned with the flow path.	Annually (preferably Sept.)

## Maintenance Standards – Control Structure/Flow Restrictor

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed	Inspection Frequency
General	Trash & Debris	Material exceeds 25% of sump depth or 1 foot below orifice plate.	Control structure orifice is not blocked. All trash and debris removed.	Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)
	Structural Damage	Structure is not securely attached to manhole wall. Structure is not in upright position (allow up to 10% from plumb). Connections to outlet pipe are not watertight and show signs of rust. Any holes - other than designed holes - in the structure.	Structure securely attached to wall and outlet pipe. Structure in correct position. Connections to outlet pipe are watertight; structure repaired or replaced and works as designed. Structure has no holes other than designed holes.	Annually (preferably Sept.)
	Insects	When insects such as wasps and hornets interfere with maintenance activities.	Insects destroyed or removed from site. Apply insecticides in compliance with adopted integrated pest management policies.	Annually (preferably Sept.)
Cleanout Gate	Damaged or Missing	Cleanout gate is not watertight or is missing. Gate cannot be moved up and down by one maintenance person. Chain/rod leading to gate is missing or damaged. Gate is rusted over 50 percent of its surface area.	Gate is watertight and works as designed. Gate moves up and down easily and is watertight. Chain is in place and works as designed. Gate is repaired or replaced to meet design standards.	Annually (preferably Sept.)
Orifice Plate	Damaged or Missing	Control device is not working properly due to missing, out of place, or bent orifice plate.	Plate is in place and works as designed.	Annually (preferably Sept.)
	Obstructions	Any trash, debris, sediment, or vegetation blocking the plate.	Plate is free of all obstructions and works as designed.	Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed	Inspection Frequency
Overflow Pipe	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.	Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)
Manhole	Cover Not in Place	Cover is missing or only partially in place. Any open manhole requires maintenance.	Manhole is closed.	Annually (preferably Sept.)
	Locking Mechanism Not Working	Mechanism cannot be opened by one maintenance person with proper tools. Bolts into frame have less than one-half inch of thread (may not apply to self-locking lids).	Mechanism opens with proper tools.	Annually (preferably Sept.)
	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.	Annually (preferably Sept.)
	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.	Annually (preferably Sept.)
Catch Basin – General	“Dump no pollutants” stencil or stamp not visible	Stencil or stamp should be visible and easily read.	Warning signs (e.g., “Dump No Waste-Drains to Stream”) shall be painted or embossed on or adjacent to all storm drain inlets.	Annually (preferably Sept.)

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed	Inspection Frequency
Catch Basin – General	Trash & Debris	<p>Trash or debris which is located immediately in front of the catch basin opening or is blocking inletting capacity of the basin by more than 10%.</p> <p>Trash or debris (in the basin) that exceeds 60 percent of the sump depth as measured from the bottom of basin to invert of the lowest pipe into or out of the basin, but in no case less than a minimum of six inches clearance from the debris surface to the invert of the lowest pipe.</p> <p>Trash or debris in any inlet or outlet pipe blocking more than one-third of its height.</p> <p>Dead animals or vegetation that could generate odors that could cause complaints or dangerous gases (e.g., methane).</p>	<p>No trash or debris located immediately in front of catch basin or on grate opening.</p> <p>No trash or debris in the catch basin.</p> <p>Inlet and outlet pipes free of trash or debris.</p> <p>No dead animals or vegetation present within the catch basin.</p>	Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)
	Sediment	Sediment (in the basin) that exceeds 60 percent of the sump depth as measured from the 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 inches clearance from the sediment surface to the invert of the lowest pipe.	No sediment in the catch basin.	Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed	Inspection Frequency
	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). 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.	Top slab is free of holes and cracks. Frame is sitting flush on the riser rings or top slab and firmly attached.	Annually (preferably Sept.)
	Fractures or Cracks in Basin Walls/ Bottom	Maintenance person judges that structure is unsound.  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 particles entering catch basin through cracks.	Basin replaced or repaired to design standards.  Pipe is re-grouted and secure at basin wall.	Annually (preferably Sept.)
	Settlement/ Misalignment	If failure of basin has created a safety, function, or design problem.	Basin replaced or repaired to design standards.	Annually (preferably Sept.)
	Vegetation	Vegetation growing across and blocking more than 10% of the basin opening.  Vegetation growing in inlet/outlet pipe joints that is more than six inches tall and less than six inches apart.	No vegetation blocking opening to basin. No vegetation or root growth present.	Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)
	Contamination and Pollution	Any evidence of oil, gasoline, contaminants or other pollutants.	No contaminants or pollutants present. Coordinate removal/cleanup with Environmental Compliance.	Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)
Catch Basin Cover	Cover Not in Place	Cover is missing or only partially in place. Any open catch basin requires maintenance.	Cover/grate is in place, meets design standards, and is secured	Annually (preferably Sept.)

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed	Inspection Frequency
	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.	Annually (preferably Sept.)
	Cover Difficult to Remove	One maintenance person cannot remove lid after applying normal lifting pressure. (Intent is to keep the cover from sealing off access to maintenance.)	Cover can be removed by one maintenance person.	Annually (preferably Sept.)
Catch Basin Ladder	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.	Annually (preferably Sept.)
Metal Grates (if applicable)	Grate opening Unsafe	Grate with opening wider than 7/8 inch.	Grate opening meets design standards.	Annually (preferably Sept.)
	Trash and Debris	Trash and debris that is blocking more than 20% of grate surface inletting capacity.	Grate free of trash and debris.	Annually (preferably Sept.)
	Damaged or Missing	Grate missing or broken member(s) of the grate.	Grate is in place, meets the design standards, and is installed and aligned with the flow path.	Annually (preferably Sept.)

## Maintenance Standards – Catch Basins

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed	Inspection Frequency
General	"Dump no pollutants" stencil or stamp not visible	Stencil or stamp should be visible and easily read.	Warning signs (e.g., "Dump No Waste- Drains to Stream") shall be painted or embossed on or adjacent to all storm drain inlets.	Annually (preferably Sept.)
	Trash & Debris	<p>Trash or debris which is located immediately in front of the catch basin opening or is blocking inletting capacity of the basin by more than 10%.</p> <p>Trash or debris (in the basin) that exceeds 60 percent of the sump depth as measured from the bottom of basin to invert of the lowest pipe into or out of the basin, but in no case less than a minimum of six inches clearance from the debris surface to the invert of the lowest pipe.</p> <p>Trash or debris in any inlet or outlet pipe blocking more than one-third of its height.</p> <p>Dead animals or vegetation that could generate odors that could cause complaints or dangerous gases (e.g., methane).</p>	<p>No trash or debris located immediately in front of catch basin or on grate opening.</p> <p>No trash or debris in the catch basin.</p> <p>Inlet and outlet pipes free of trash or debris.</p> <p>No dead animals or vegetation present within the catch basin.</p>	Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)
	Sediment	Sediment (in the basin) that exceeds 60 percent of the sump depth as measured from the 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 inches clearance from the sediment surface to the invert of the lowest pipe.	No sediment in the catch basin.	Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed	Inspection Frequency
	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). 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.	Top slab is free of holes and cracks. Frame is sitting flush on the riser rings or top slab and firmly attached.	Annually (preferably Sept.)
	Fractures or Cracks in Basin Walls/ Bottom	Maintenance person judges that structure is unsound.  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 particles entering catch basin through cracks.	Basin replaced or repaired to design standards.  Pipe is re-grouted and secure at basin wall.	Annually (preferably Sept.)
	Settlement/ Misalignment	If failure of basin has created a safety, function, or design problem.	Basin replaced or repaired to design standards.	Annually (preferably Sept.)
	Vegetation	Vegetation growing across and blocking more than 10% of the basin opening. Vegetation growing in inlet/outlet pipe joints that is more than six inches tall and less than six inches apart.	No vegetation blocking opening to basin. No vegetation or root growth present.	Monthly from Oct. - Apr. and after any major storm event (1" in 24 hours)
	Contamination and Pollution	Any evidence of oil, gasoline, contaminants or other pollutants.	No contaminants or pollutants present. Coordinate removal/cleanup with Environmental Compliance.	Monthly from Oct. - Apr. and after any major storm event (1" in 24 hours)
Catch Basin Cover	Cover Not in Place	Cover is missing or only partially in place. Any open catch basin requires maintenance.	Cover/grate is in place, meets design standards, and is secured	Annually (preferably Sept.)

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed	Inspection Frequency
	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.	Annually (preferably Sept.)
	Cover Difficult to Remove	One maintenance person cannot remove lid after applying normal lifting pressure. (Intent is to keep the cover from sealing off access to maintenance.)	Cover can be removed by one maintenance person.	Annually (preferably Sept.)
Catch Basin Ladder	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.	Annually (preferably Sept.)
Metal Grates (if applicable)	Grate Opening Unsafe	Grate with opening wider than 7/8 inch.	Grate opening meets design standards.	Annually (preferably Sept.)
	Trash and Debris	Trash and debris that is blocking more than 20% of grate surface inletting capacity.	Grate free of trash and debris.	Annually (preferably Sept.)
	Damaged or Missing	Grate missing or broken member(s) of the grate.	Grate is in place, meets the design standards, and is installed and aligned with the flow path.	Annually (preferably Sept.)

### Maintenance Standards – Catch Basin Inserts

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed	Inspection Frequency
General	Trash & Debris Accumulation	Trash or debris accumulates on insert unit creating a blockage/restriction	Trash and debris removed from insert unit. Runoff freely flows into catch basin.	Annually (preferably Sept.)
	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.	Annually (preferably Sept.)
	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.	Annually (preferably Sept.)
	Media Insert - Water Saturated	Catch basin insert is saturated with water and no longer has the capacity to absorb.	Remove and replace media insert.	Annually (preferably Sept.)
	Media Insert - Oil Saturated	Media oil saturated due to petroleum spill that drains into catch basin.	Remove and replace media insert.	Annually (preferably Sept.)
	Media Insert Used Beyond Product Life	Media has been used beyond the typical average life of media insert product.	Remove and replace media insert.	Annually (preferably Sept.)

## Maintenance Standards – Debris Barrier

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed	Inspection Frequency
General	Trash & Debris	Trash or debris that is plugging more than 20% of the openings in the barrier.	Barrier cleared to design flow capacity.	Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)
	Insects	When insects such as wasps and hornets interfere with maintenance activities.	Insects destroyed or removed from site. Apply insecticides in compliance with adopted integrated pest management policies.	Annually (preferably Sept.)
	Damaged/ Missing Bars.	Bars are bent out of shape more than 3 inches. Bars are missing or entire barrier missing.  Bars are loose and rust is causing 50% deterioration to any part of barrier.	Bars in place with no bends more than 3/4 inch. Bars in place according to design.  Barrier replaced or repaired to design standards.	Annually (preferably Sept.)
	Inlet/Outlet Pipe	Debris barrier missing or not attached to pipe	Barrier firmly attached to pipe	Annually (preferably Sept.)

## Maintenance Standards – Energy Dissipators

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed	Inspection Frequency
External:				
Rock Pad	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.	Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)
	Erosion	Soil erosion in or adjacent to rock pad.	Rock pad replaced to design standards.	Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)
Dispersion Trench				
Dispersion Trench	Pipe Plugged with Sediment	Accumulated sediment that exceeds 20% of the design depth.	Pipe cleaned/flushed so that it matches design.	Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)
	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.	Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)
	Perforations Plugged	Over 1/2 of perforations in pipe are plugged with debris and sediment.	Perforated pipe cleaned or replaced.	Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)
	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.	Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)
	Receiving Area Over-Saturated	Water in receiving area is causing or has potential of causing landslide problems.	No danger of landslides.	Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)
Flowpath	No or Minimal Vegetation	Vegetation removed or dead. Vegetation replaced by hard surface.	Design vegetated flowpath is restored.	Spring or Summer

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed	Inspection Frequency
Internal:				
Manhole/Chamber	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.	Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)
	Trash and Debris	Trash or debris (in the basin) that exceeds 60 percent of the sump depth as measured from the bottom of basin to invert of the lowest pipe into or out of the basin, but in no case less than a minimum of six inches clearance from the debris surface to the invert of the lowest pipe.  Trash or debris in any inlet or outlet pipe blocking more than one-third of its height.  Dead animals or vegetation that could generate odors that could cause complaints or dangerous gases (e.g., methane).	No trash or debris located immediately in front of catch basin/manhole or on grate opening.  No trash or debris in the manhole/chamber. Inlet and outlet pipes free of trash or debris.  No dead animals or vegetation present within the manhole/chamber.	Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)
	Sediment	Sediment (in the basin) that exceeds 60 percent of the sump depth as measured from the 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 inches clearance from the sediment surface to the invert of the lowest pipe.	No sediment in the catch basin.	Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed	Inspection Frequency
	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). 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.	Top slab is free of holes and cracks. Frame is sitting flush on the riser rings or top slab and firmly attached.	Annually (preferably Sept.)
	Fractures or Cracks in Basin Walls/Bottom	Maintenance person judges that structure is unsound.  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 particles entering catch basin through cracks.	Basin replaced or repaired to design standards.  Pipe is re-grouted and secure at basin wall.	Annually (preferably Sept.)
	Settlement/ Misalignment	If failure of basin has created a safety, function, or design problem.	Basin replaced or repaired to design standards.	Annually (preferably Sept.)
	Contamination and Pollution	Any evidence of oil, gasoline, contaminants or other pollutants.	No contaminants or pollutants present. Coordinate removal/ cleanup with Environmental	Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)
Manhole/ Chamber Cover	Cover Not in Place	Cover is missing or only partially in place. Any open catch basin requires maintenance.	Cover/grate is in place, meets design standards, and is secured.	Annually (preferably Sept.)
	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.	Annually (preferably Sept.)
	Cover Difficult to Remove	One maintenance person cannot remove lid after applying normal lifting pressure. (Intent is to keep the cover from sealing off access to maintenance.)	Cover can be removed by one maintenance person.	Annually (preferably Sept.)

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed	Inspection Frequency
	Insects	When insects such as wasps and hornets interfere with maintenance activities.	Insects destroyed or removed from site. Apply insecticides in compliance with adopted integrated pest management policies.	Annually (preferably Sept.)

### Maintenance Standards – Biofiltration Swale

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed	Inspection Frequency
General	Sediment Accumulation on Grass	Sediment depth exceeds 2 inches or inhibits vegetation growth in 10 percent or more of swale.	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.	Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)
	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.	Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)
	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.	Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)
	Inlet/Outlet Pipe	Debris barrier missing or not attached to pipe	Barrier firmly attached to pipe	Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)
	Constant Baseflow	When 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 baseflow around the swale.	Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)
	Poor Vegetation Coverage	When 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. Replant with plugs of grass from the upper slope: plant in the swale bottom at 8-inch intervals or re-seed into loosened, fertile soil.	Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed	Inspection Frequency
	Vegetation	When the grass becomes excessively tall (greater than 10- inches); when nuisance weeds and other vegetation starts 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.	Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)
	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.	Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)
	Inlet/Outlet/Underdrain	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.  If underdrain, avoid vehicular traffic on swale bottom.	Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)
	Trash and Debris Accumulation	Trash and debris accumulated in the bio-swale.	Remove trash and debris from bioswale. Reseed, resod, and regrade, as needed. Clean curb cuts and level spreaders as needed.	Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)
	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 regraded and re-seeded. For smaller bare areas, overseed when bare spots are evident, or take plugs of grass from the upper slope and plant in the swale bottom at 8-inch intervals.	Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed	Inspection Frequency
	Insects	When insects such as wasps and hornets interfere with maintenance activities.	Insects destroyed or removed from site. Apply insecticides in compliance with adopted integrated pest management policies.	Annually (preferably Sept.)

## Maintenance Standards – Wet Biofiltration Swale

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed	Inspection Frequency
General	Sediment Accumulation on Grass	Sediment depth exceeds 2 inches or inhibits vegetation growth in 10 percent or more of swale.	Remove sediment deposits in treatment area.	Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)
	Water Depth	Water not retained to a depth of about 4 inches during the wet season.	Build up or repair outlet berm so that the water is retained in the wet swale.	Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)
	Wetland Vegetation	When 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. Replant with plugs of grass from the upper slope: plant in the swale bottom at 8-inch intervals or re-seed into loosened, fertile soil.	Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)
	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.	Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)
	Trash and Debris Accumulation	Any trash and debris which exceeds 5 cubic feet per 1,000 square feet (this is about equal to the amount of trash it would take to fill up one 32-gallon garbage can). In general, there should be no visual evidence of dumping. If less than threshold all trash and debris will be removed as part of next scheduled maintenance.	Remove trash and debris from wet swale.	Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed	Inspection Frequency
	Erosion/Scouring	Eroded or scoured swale bottom due to flow channelization, or higher flows.	Check design flows to assure swale is large enough to handle flows. By-pass excess flows or enlarge swale. Replant eroded areas with fibrous-rooted plants such as <i>Juncus effusus</i> (soft rush) in wet areas or snowberry ( <i>Symphoricarpos albus</i> ) in drier areas, or as recommended by a wetland specialist.	Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)
	Insects	When insects such as wasps and hornets interfere with maintenance activities.	Insects destroyed or removed from site. Apply insecticides in compliance with adopted integrated pest management policies.	Annually (preferably Sept.)

## Maintenance Standards – Filter Strips

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed	Inspection Frequency
General	Sediment Accumulation on Grass	Sediment depth exceeds 2 inches.	Remove sediment deposits, re-level so slope is even and flows pass evenly through the strip.	Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)
	Trash and Debris Accumulation	Trash and debris accumulated on the filter strip.	Trash and debris removed from filter.	Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)
	Vegetation	When the grass becomes excessively tall (greater than 10 inches); when nuisance weeds and other vegetation start to take over.	Mow grass, control nuisance vegetation, such that flow is not impeded. Grass should be mowed to a height between 3-4 inches.	Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)
	Erosion and 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 regraded and re-seeded. For smaller bare areas, overseed when bare spots are evident.	Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)
	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.	Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)
	Insects	When insects such as wasps and hornets interfere with maintenance activities.	Insects destroyed or removed from site. Apply insecticides in compliance with adopted integrated pest management policies.	Annually (preferably Sept.)

## Maintenance Standards – Wetponds

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed	Inspection Frequency
General	Water Level	First cell is empty, doesn't hold water.	Line the first cell to maintain at least 4 feet of water. Although the second cell may drain, the first cell must remain full to control turbulences of the incoming flow and reduce sediment resuspension.	Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)
	Trash and Debris	Accumulation that exceeds 1 cubic foot per 1000 square feet of pond area.	Trash and debris removed from pond.	Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)
	Poisonous Vegetation and Noxious Weeds	Any poisonous or nuisance vegetation which may constitute a hazard to maintenance personnel or the public. Any evidence of noxious weeds as defined in State and Local Regulations. (Apply requirements of adopted integrated vegetation management (IVM) policies for the use of herbicides.)	No danger of poisonous vegetation where maintenance personnel or the public might normally be. (Coordinate with the Pierce County Noxious Weed Control Board). Complete eradication of noxious weeds may not be possible, however compliance with state or local eradication policies are required.	Biannually (Spring and Fall)
	Inlet/Outlet Pipe	Inlet and/or outlet pipe clogged with sediment and/or debris material.	No clogging or blockage in the inlet and outlet piping.	Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)
	Sediment Accumulation in Pond Bottom	Sediment accumulation in pond bottom that exceeds the depth of sediment zone plus 6 inches, usually in the first cell.	Sediment removed from pond bottom. (If sediment contamination is a potential problem, sediment should be tested regularly to determine leaching potential prior to disposal.)	Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)
	Vegetation	Vegetation is overgrown or sparse.	Trim vegetation as necessary to keep pond free of leaves and maintain aesthetic appearance. Revegetate bare sloped areas. Regrade before revegetation as needed.	Monthly

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed	Inspection Frequency
	Oil Sheen on Water	Prevalent and visible oil sheen.	Oil removed from water using oil absorbent pads or vactor truck. Source of oil located and corrected. If chronic low levels of oil persist, plant wetlands plants such as Juncus effusus (soft rush) which can uptake small concentrations of oil.	Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)
	Erosion	Erosion of the pond's side slopes and/or scouring of the pond bottom that exceeds inches, or where continued erosion is prevalent.	Slopes stabilized using proper erosion control measures and repair methods.	Annually (preferably Sept.)
	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 (preferably Sept.)
	Internal Berm	Berm dividing cells should be level.	Berm surface is leveled so that water flows evenly over entire length of berm.	Annually (preferably Sept.)
	Overflow Spillway	Rock is missing and soil is exposed at top of spillway or outside slope.	Rocks replaced to specifications.	Annually (preferably Sept.)
	Insects	When insects such as wasps and hornets interfere with maintenance activities.	Insects destroyed or removed from site. Apply insecticides in compliance with adopted integrated pest management policies.	Annually (preferably Sept.)

## Maintenance Standards – Wetvaults

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed	Inspection Frequency
General	Damaged Pipes	Inlet/outlet piping damaged or broken and in need of repair.	Pipe repaired and/or replaced.	Annually (preferably Sept.)
	Trash and Debris Accumulation	Trash and debris accumulated in vault, pipe or inlet/outlet (includes floatables and non-floatables).	Trash and debris removed from vault.	Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)
	Insects	When insects such as wasps and hornets interfere with maintenance activities.	Insects destroyed or removed from site. Apply insecticides in compliance with adopted integrated pest management policies.	Annually (preferably Sept.)
	Ventilation	Ventilation area blocked or plugged.	Blocking material removed or cleared from ventilation area. A specified percentage of the vault surface area must provide ventilation to the vault interior (see design specifications).	Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)
	Sediment Accumulation in Vault	Sediment accumulation in vault bottom exceeds the depth of the sediment zone plus 6 inches.	Remove sediment from vault. (If sediment contamination is a potential problem, sediment should be tested regularly to determine leaching potential prior to disposal.)	Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)
	Access Cover Damaged/ Not Working	Cover cannot be opened or removed, especially by one person.	Pipe repaired or replaced to proper working specifications.	Annually (preferably Sept.)

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed	Inspection Frequency
Vault Structure	Damage – Includes cracks in walls/bottom, 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.	Annually (preferably Sept.)
	Damage – Includes cracks in walls/bottom, frame and/or top slab	Cracks wider than one-half-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 one-fourth inch at the joint of the inlet/outlet pipe.	Annually (preferably Sept.)
	Baffles	Baffles corroding, cracking, warping and/or showing signs of failure as determined by maintenance/inspection staff.	Baffles repaired or replaced to specifications.	Annually (preferably Sept.)
Access Ladder	Damage	Ladder is corroded or deteriorated, not functioning properly, not attached to structure wall, missing rungs, has cracks, and/or is 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.	Annually (preferably Sept.)

## Maintenance Standards – Sand Filters (aboveground/open)

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed	Inspection Frequency
Aboveground (open sand filter)	Sediment Accumulation on top layer	Sediment depth exceeds one-half inch.	No sediment deposit on grass layer of sand filter that would impede permeability of the filter section.	Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)
	Trash and Debris Accumulation	Trash and debris accumulated on sand filter bed.	Trash and debris removed from sand filter bed.	Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)
	Sediment/ Debris in Clean-outs	When the clean-outs become full or partially plugged with sediment and/or debris.	Sediment removed from clean-outs.	Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)
	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.	Top several inches of sand are scraped. 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). Other options include removal of thatch, aerating the filter surface, tilling the filter surface, replacing the top 4 inches of filter media, and inspecting geotextiles for clogging.	Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)
	Prolonged Flows	Sand is saturated for prolonged periods of time (several weeks) and does not dry out between storms due to continuous base flow or prolonged flows from detention facilities. (Consider 4-8 hour drawdown tests)	Low, continuous flows are limited to a small portion of the facility by using a low wooden divider or slightly depressed sand surface.	Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed	Inspection Frequency
	Short Circuiting	Drawdown greater than 12 inches per hour. When flows become concentrated over one section of the sand filter rather than dispersed. (Consider 4-8 hour drawdown tests)	Flow and percolation of water through sand filter is uniform and dispersed across the entire filter area. Inspect periphery and cleanouts for leakage.	Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)
	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.	Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)
	Rock Pad Missing or Out of Place	Soil beneath the rock is visible.	Rock pad replaced or rebuilt to design specifications.	Annually (preferably Sept.)
	Flow Spreader	Flow spreader uneven or clogged so that flows are not uniformly distributed across sand filter. Rills and gullies on the surface of the filter can indicate improper function of the inlet flow spreader.	Spreader leveled and cleaned so that flows are spread evenly over sand filter. Refill rills and gullies with sand.	Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)
	Damaged Pipes	Any part of the piping that is crushed or deformed more than 20 percent or any other failure to the piping.	Pipe repaired or replaced.	Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)
	Insects	When insects such as wasps and hornets interfere with maintenance activities.	Insects destroyed or removed from site. Apply insecticides in compliance with adopted integrated pest management policies.	Annually (preferably Sept.)
	Drawdown	N/A	Every two years conduct a drawdown test by filling the filter with water and measuring the decline in water level over a 4-8 hour period.	Every other year

## Maintenance Standards – Sand Filters (below ground/enclosed)

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed	Inspection Frequency
Below Ground Vault	Sediment Accumulation on Sand Media Section	Sediment depth exceeds one-half inch.	No sediment deposit on grass layer of sand filter that would impede permeability of the filter section.	Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)
	Sediment Accumulation in Presettling Portion of Vault	Sediment accumulation in vault bottom exceeds the depth of the sediment zone plus 6 inches.	No sediment deposits in first chamber of vault.	Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)
	Trash and 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.	Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)
	Sediment/Debris in Drain Pipes/Cleanouts	When the drain pipes, clean-outs become full with sediment and/or debris.	Sediment removed from clean-outs.	Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)
	Clogged 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. (Consider 4-8 hour drawdown tests.)	Top several inches of sand are scraped. 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). Other options include removal of thatch, aerating the filter surface, tilling the filter surface, replacing the top 4 inches of filter media.	Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed	Inspection Frequency
	Short Circuiting	Drawdown greater than 12 inches per hour. When flows become concentrated over one section of the sand filter rather than dispersed. (Consider 4-8 hour drawdown tests)	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.	Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)
	Flow Spreader	Flow spreader uneven or clogged so that flows are not uniformly distributed across sand filter. Rills and gullies on the surface of the filter can indicate improper function of the inlet flow spreader.	Spreader leveled and cleaned so that flows are spread evenly over sand filter. Refill rills and gullies with sand.	Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)
	Damaged Pipes	Any part of the piping that is crushed or deformed more than 20 percent or any other failure to the piping.	Pipe repaired or replaced.	Annually (preferably Sept.)
	Ventilation	Ventilation area blocked or plugged.	Blocking material removed or cleared from ventilation area. A specified percentage of the vault surface area must provide ventilation to the vault interior (see design specifications).	Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)
	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.	Annually (preferably Sept.)
	Vault Structure Damaged; Includes Cracks in Walls, Bottom, Frame and/or Top Slab	Cracks wider than one-half 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 (preferably Sept.)

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed	Inspection Frequency
	Vault Structure Damaged; Includes Cracks in Walls, Bottom, Frame and/or Top Slab	Cracks wider than one-half 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 one-fourth inch at the joint of the inlet/outlet pipe.	Annually (preferably Sept.)
	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.	Annually (preferably Sept.)
	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.	Annually (preferably Sept.)
General	Insects	When insects such as wasps and hornets interfere with maintenance activities.	Insects destroyed or removed from site. Apply insecticides in compliance with adopted integrated pest management policies.	Annually (preferably Sept.)

## Maintenance Standards – Baffle Oil/Water Separator

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed	Inspection Frequency
Monitoring	Inspection of discharge water for obvious signs of poor water quality	Sheen, obvious oil present in discharge.	Effluent discharge from vault should be clear without visible sheen.	Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)
	Sediment Accumulation	Sediment depth in bottom of vault exceeds 6 inches.	No sediment deposits on vault bottom that would impede flow through the vault and reduce separation efficiency.	Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)
	Trash and 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.	Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)
	Oil Accumulation	Oil accumulation that exceeds 1 inch, at the surface of the water or 6 inches of sludge in the sump.	Extract oil/sludge from vault by vacating. Dispose of in accordance with state and local rules and regulations. Clean separators by October 15 to remove material accumulated during the dry season. Clean separators after spills. Replace wash water with clean water before returning to service.	Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)
	Damaged Pipes	Inlet or outlet piping that is damaged or broken and in need of repair.	Pipe repaired or replaced.	Annually (preferably Sept.)
	Access Cover Damaged/ Not Working	Cover cannot be opened, corrosion/ deformation of cover.	Cover repaired to proper working specifications or replaced.	Annually (preferably Sept.)

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed	Inspection Frequency
	Vault Structure Damaged; Includes Cracks in Walls, Bottom, Frame and/or Top Slab	Maintenance person judges that structure is unsound.	Vault replaced or repairs made so that vault meets design specifications and is structurally sound.	Annually (preferably Sept.)
	Vault Structure Damaged; Includes Cracks in Walls, Bottom, Frame and/or Top Slab	Cracks wider than one-half 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 one-fourth inch at the joint of the inlet/outlet pipe.	Annually (preferably Sept.)
	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.	Annually (preferably Sept.)
	Access Ladder Damaged	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.	Annually (preferably Sept.)
General	Insects	When insects such as wasps and hornets interfere with maintenance activities.	Insects destroyed or removed from site. Apply insecticides in compliance with adopted integrated pest management policies.	Annually (preferably Sept.)

### Maintenance Standards – Coalescing Plate Oil/Water Separator

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed	Inspection Frequency
General	Inspection of discharge water for obvious signs of poor water quality	Sheen, obvious oil present in discharge.	Effluent discharge from vault should be clear without visible sheen.	Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)
	Sediment Accumulation	Sediment depth in bottom of vault exceeds 6 inches and/or there are visible signs of sediment on plates.	No sediment deposits on vault bottom and plate media that would impede flow through the vault and reduce separation efficiency.	Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)
	Trash and 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.	Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)
	Oil Accumulation	Oil accumulation that exceeds 1 inch at the water surface.	Extract oil/sludge from vault by vac-toring. Dispose of in accordance with state and local rules and regulations. Coalescing plates are cleaned by thoroughly rinsing and flushing. Direct wash-down effluent to the sanitary sewer system where permitted. Should be no visible oil depth on water. Clean separators by October 15 to remove material accumulated during the dry season. Clean separators after spills. Replace wash water with clean water before returning to service.	Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)
	Damaged Coalescing Plates	Plate media broken, deformed, cracked and/or showing signs of failure.	A portion of the media pack or the entire plate pack is replaced depending on severity of failure.	Annually (preferably Sept.)

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed	Inspection Frequency
	Damaged Pipes	Inlet or outlet piping that is damaged or broken and in need of repair.	Pipe repaired or replaced.	Annually (preferably Sept.)
	Baffles	Baffles or walls corroding, cracking, warping and/or showing signs of failure as determined by maintenance/inspection person.	Baffles repaired or replaced to specifications.	Annually (preferably Sept.)
	Vault Structure Damaged; Includes Cracks in Walls, Bottom, Frame and/or Top Slab	Cracks wider than one-half 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 (preferably Sept.)
	Vault Structure Damaged; Includes Cracks in Walls, Bottom, Frame and/or Top Slab	Cracks wider than one-half 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 one-fourth inch at the joint of the inlet/outlet pipe.	Annually (preferably Sept.)
	Access Ladder Damaged	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.	Annually (preferably Sept.)
General	Insects	When insects such as wasps and hornets interfere with maintenance activities.	Insects destroyed or removed from site. Apply insecticides in compliance with adopted integrated pest management policies.	Annually (preferably Sept.)

## Maintenance Standards – Bioretention Facilities

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed	Inspection Frequency
Earthen Side Slopes and Berms	Failure in earthen reservoir	Erosion (gullies/rills) greater than 2 inches deep around inlets, outlet and alongside slopes.	<p>Eliminate cause of erosion and stabilize damaged area (regrade, rock, vegetation, erosion control matting).</p> <p>For deep channels or cuts (over 3 inches in ponding depth), temporary erosion control measures should be put in place until permanent repairs can be made.</p> <p>Properly designed, constructed and established facilities with appropriate flow velocities should not have erosion problems except perhaps in extreme events. If erosion problems persist, the following should be reassessed: (1) flow volumes from contributing areas and bioretention facility sizing; (2) flow velocities and gradients within the facility; and (3) flow dissipation and erosion protection strategies at the facility inlet.</p>	Biannually and after major storm event (1" in 24 hours)
	Erosion of sides causes slope to become a hazard		Take actions to eliminate the hazard and stabilize slopes.	Annually
	Settlement greater than 3 inches (relative to undisturbed sections of berm)		Restore to design height.	Annually and after any major storm event (1" in 24 hours)
	Downstream face of berm wet, seeps or leaks evident		Plug any holes and compact berm (may require consultation with engineer, particularly for larger berms).	Annually and after any major storm event (1" in 24 hours)
	Any evidence of rodent holes or water piping in berm		<p>Eradicate rodents (see "Pest control").</p> <p>Fill holes and compact (may require consultation with engineer, particularly for larger berms).</p>	Annually

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed	Inspection Frequency
Concrete Sidewalls	Cracks or Failure of Concrete Sidewalls	Cracks or failure of concrete sidewalls	Repair/seal cracks. Replace if repair is insufficient.	Annually
Rockery Sidewalls	Rockery Sidewalls are Insecure	Rockery side walls are insecure	Stabilize rockery sidewalls (may require consultation with engineer, particularly for walls 4 feet or greater in height)	Annually
Facility Area	Trash and Debris	Trash and debris present	Clean out trash and debris	All maintenance visits; at least biannually
Facility Bottom Area	Sediment or Debris Accumulation	Accumulated sediment to extent that infiltration rate is reduced (see "Ponded water") or surface storage capacity significantly impacted	Remove excess sediment. Replace any vegetation damaged or destroyed by sediment accumulation and removal. Mulch newly planted vegetation. Identify and control the sediment source (if feasible). If accumulated sediment is recurrent, consider adding presettlement or installing berms to create a forebay at the inlet.	Annually and after any major storm event (1" in 24 hours)
		Accumulated leaves in facility.	Remove leaves if there is a risk to clogging outlet structure or water flow is impeded.	As needed, during and after fall leaf drop
Low Permeability Check Dams and Weirs	Sediment or Debris Accumulation	Sediment, vegetation, or debris accumulated at or blocking (or having the potential to block) check dam, flow control weir or orifice	Clear the blockage.	Annually and after any major storm event (1" in 24 hours)
		Failure of Check Dams and Weirs	Repair and take preventative measures to prevent future erosion and/or undercutting.	Annually and after any major storm event (1" in 24 hours)
		Grade board or top of weir damaged or not level	Restore to level position.	Annually

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed	Inspection Frequency
Ponded Water	Water remains in bioretention facility after storm event.	Excessive ponding water: Water overflows during storms smaller than the design event or ponded water remains in the basin 48 hours or longer after the end of a storm.	<p>Determine cause and resolve in the following order:</p> <ol style="list-style-type: none"> <li>1. Confirm leaf or debris buildup in the bottom of the facility is not impeding infiltration. If necessary, remove leaf litter/debris.</li> <li>2. Ensure that underdrain (if present) is not clogged. If necessary, clear underdrain.</li> <li>3. Check for other water inputs (e.g., groundwater, illicit connections).</li> <li>4. Check that the facility is sized appropriately for the contributing area. Confirm that the contributing area has not increased.</li> </ol> <p>Verify that the facility is sized appropriately for the contributing area. Confirm that the contributing area has not increased. If steps #1-4 do not solve the problem, the bioretention soil is likely clogged by sediment accumulation at the surface or has become overly compacted. Dig a small hole to observe soil profile and identify compaction depth or clogging front to help determine the soil depth to be removed or otherwise rehabilitated (e.g., tilled). Consultation with an engineer is recommended.</p>	Biannually and after any major storm event (1" in 24 hours)
Bioretention Soil Media	N/A	Bioretention soil mix protection is needed when performing maintenance requiring entrance into the facility footprint	Minimize all loading in the facility footprint (foot traffic and other loads) to the degree feasible in order to prevent compaction of bioretention soils. Never drive equipment or apply heavy loads in facility footprint. Because the risk of compaction is higher during saturated soil conditions, any type of loading in the cell (including foot traffic) should be minimized during wet conditions. Consider measures to distribute loading if heavy foot traffic is required or equipment must be placed in facility. As an example, boards may be placed across soil to distribute loads and minimize compaction. If compaction occurs, soil must be loosened or otherwise rehabilitated to original design state.	As needed.

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed	Inspection Frequency
Splash Block Inlet	Inlet Failure	Water is not being directed properly to the facility and away from the inlet structure.	Reconfigure/repair blocks to direct water to facility and away from structure.	Annually
Curb Cut Inlet/Outlet	Inlet Clogged	Accumulated leaves at curb cuts	Clear leaves (particularly important for key inlet and low points along long, linear facilities).	Monthly during the wet season and before severe storm is forecasted.
Pipe Inlet/Outlet	Inlet Pipe Structure Failure	Pipe is damaged	Repair/replace.	Annually
	Inlet Pipe Clogged	Pipe is clogged	Remove roots or debris.	Annually during the wet season.
	Inlet Pipe Clogged	Sediment, debris, trash or mulch reducing capacity of inlet/outlet.	Clear the blockage. Identify the source of the blockage and take actions to prevent future blockages.	Annually and after any major storm event (1" in 24 hours)
	Inlet Clogged	Accumulated leaves at inlets/outlets	Clear leaves (particularly important for key inlets and low points along long, linear facilities)	Weekly During Fall Leaf Drop
	Inlet Blocked	Maintain access for inspections	Clear vegetation (transplant vegetation when possible) within 1 foot of inlets and outlets, maintain access pathways. Consultation with a landscape architect is recommended for removal, transplant, or substitution of plants.	Annually
	Erosion/Scouring	Concentrated flows are causing erosion	Maintain a cover of rock or cobbles or other erosion protection measure (e.g., matting) to protect the ground where concentrated water enters the facility (e.g., a pipe, curb cut or swale).	Annually
Trash Rack	Trash Rack Clogged	Trash or other debris present on trash rack	Remove/dispose	After major storm event (1" in 24 hours)

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed	Inspection Frequency
	Trash Rack Damaged	Bar screen damaged or missing	Repair/replace	Annually
Overflow	Sediment or Debris Accumulation	Capacity reduced by sediment or debris	Remove sediment or debris/dispose	Annually and after any major storm event (1" in 24 hours)
Underdrain Pipe	Sediment or Debris Accumulation	Plant roots, sediment or debris reducing capacity of underdrain. Prolonged surface ponding (see "Ponded water")	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.	As needed; at least biannually (may need more frequent cleaning during wet season)
Facility Bottom Area and Upland Slope Vegetation	Low Survival Rate	Vegetation survival rate falls below 75% within first two years of establishment (unless project O&M manual or record drawing stipulates more or less than 75% survival rate)	Determine cause of poor vegetation growth and correct condition. Replant as necessary to obtain 75% survival rate or greater. Refer to original planting plan, or approved jurisdictional species list for appropriate plant replacements (See Appendix 3 - Bioretention Plant List, in the LID Technical Guidance Manual for Puget Sound, (Hinman and Wulkan, 2012)). Confirm that plant selection is appropriate for site growing conditions. Consultation with a landscape architect is recommended for removal, transplant, or substitution of plants.	Fall and Spring
Vegetation	Poor plant growth	Presence of diseased plants and plant material	Remove any diseased plants or plant parts and dispose of in an approved location (e.g., commercial landfill) to avoid risk of spreading the disease to other plants. Disinfect gardening tools after pruning to prevent the spread of disease.  See the Pacific Northwest Plant Disease Management Handbook (Pscheidt and Ocam, 2016) for information on disease recognition and for additional resources. Replant as necessary according to recommendations provided for "facility bottom area and upland slope vegetation".	As needed

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed	Inspection Frequency
Trees and Shrubs	Oversized trees and shrubs	Pruning as needed.	Prune trees and shrubs in a manner appropriate for each species. Pruning should be performed by landscape professionals familiar with proper pruning techniques. All pruning of mature trees should be performed by or under the direct guidance of an ISA certified arborist.	All pruning seasons.
		Large trees and shrubs interfere with operations of facility or maintenance access.	Prune trees and shrubs using most current ANSI A300 standards and ISA BMPs. Remove trees and shrubs, if necessary.	Annually
	Dead trees or shrubs	Standing dead vegetation is present.	Remove standing dead vegetation. Replace dead vegetation within 30 days of reported dead and dying plants (as practical depending on weather/planting season). If vegetation replacement is not feasible within 30 days, and absence of vegetation may result in erosion problems, temporary erosion control measures should be put in place immediately.  Determine cause of dead vegetation and address issue, if possible. If specific plants have a high mortality rate, assess the cause and replace with appropriate species. Consultation with a landscape architect is recommended.	Fall and spring
	Tree support	Planting beneath mature trees	When working around and below mature trees, follow the most current ANSI A300 standards and ISA BMPs to the extent practicable (e.g., take care to minimize any damage to tree roots and avoid compaction of soil).  Planting of small shrubs or groundcovers beneath mature trees may be desirable in some cases; such plantings should use mainly plants that come as bulbs, bare root or in 4-inch pots; plants should be in no larger than 1-gallon containers.	Fall and spring

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed	Inspection Frequency
	Tree support	Presence of or need for stakes and guys (tree growth, maturation, and support needs)	Verify location of facility liners and underdrain (if any) prior to stake installation in order to prevent liner puncture or pipe damage  Monitor tree support systems: Repair and adjust as needed to provide support and prevent damage to tree. Remove tree supports (stakes, guys, etc.) after one growing season or maximum of 1 year. Backfill stake holes after removal.	Fall and spring
Trees and shrubs adjacent to vehicle travel areas (or areas where visibility needs to be maintained)	Line of sight	Vegetation causes some visibility (line of sight) or driver safety issues.	Maintain appropriate height for sight clearance  When continued, regular pruning (more than one time/ growing season) is required to maintain visual sight lines for safety or clearance along a walk or drive, consider relocating the plant to a more appropriate location.  Remove or transplant if continual safety hazard. Consultation with a landscape architect is recommended for removal, transplant, or substitution of plants.  Consultation with a landscape architect is recommended for removal, transplant, or substitution of plants.	Annually
Flowering Plants	Dead flowers	Dead or spent flowers present	Remove spent flowers (deadhead).	Annually
Perennials	Dead plants	Spent plants	Cut back dying or dead and fallen foliage and stems.	Fall
Emergent Vegetation	Slow moving or ponded water	Vegetation compromises conveyance	Hand rake sedges and rushes with a small rake or fingers to remove dead foliage before new growth emerges in spring or earlier only if the foliage is blocking water flow (sedges and rushes do not respond well to pruning).	Spring
Ornamental Grasses (Perennial)	Dead grasses	Dead material from previous year's growing cycle or dead collapsed foliage	Leave dry foliage for winter interest. Hand rake with a small rake or fingers to remove dead foliage back to within several inches from the soil before new growth emerges in spring or earlier if the foliage collapses and is blocking water flow.	Winter and Spring

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed	Inspection Frequency
Ornamental Grasses (Evergreen)	Dead grasses	Dead growth present in spring	Hand rake with a small rake or fingers to remove dead growth before new growth emerges in spring. Clean, rake, and comb grasses when they become too tall. Cut back to ground or thin every 2-3 years as needed.	Fall and Spring
Noxious Weeds	Presence of noxious weeds	Listed noxious vegetation is present (refer to current county noxious weed list)	<p>By law, class A &amp; B noxious weeds must be removed, bagged and disposed as garbage immediately Reasonable attempts must be made to remove and dispose of class C noxious weeds.</p> <p>It is strongly encouraged that herbicides and pesticides are not used in order to protect water quality; use of herbicides and pesticides may be prohibited in some jurisdictions.</p> <p>Apply mulch after weed removal (see "Mulch").</p>	March – October preceding seed dispersal
Weeds	Presence of weeds	Weeds are present	Remove weeds with their roots manually with pincer-type weeding tools, flame weeders, or hot water weeders as appropriate. Follow IPM protocols for weed management (see "Additional Maintenance Resources" section for more information on IPM protocols).	March – October preceding seed dispersal
Vegetation	Excessive Vegetation	Low-lying vegetation growing beyond facility edge onto sidewalks, paths, or street edge poses pedestrian safety hazard or may clog adjacent permeable pavement surfaces due to associated leaf litter, mulch, and soil	Edge or trim groundcovers and shrubs at facility edge. Avoid mechanical blade-type edger and do not use edger or trimmer within 2 feet of tree trunks. While some clippings can be left in the facility to replenish organic material in the soil, excessive leaf litter can cause surface soil clogging.	Once in early mid-May and once in early to mid-September

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed	Inspection Frequency
Vegetation		Excessive vegetation density inhibits stormwater flow beyond design ponding or becomes a hazard for pedestrian and vehicular circulation and safety	Determine whether pruning or other routine maintenance is adequate to maintain proper plant density and aesthetics.  Determine if planting type should be replaced to avoid ongoing maintenance issues (an aggressive grower under perfect growing conditions should be transplanted to a location where it will not impact flow).  Remove plants that are weak, broken or not true to form; replace in-kind. Thin grass or plants impacting facility function without leaving visual holes or bare soil areas. Consultation with a landscape architect is recommended for removal, transplant, or substitution of plants.	As needed
		Vegetation blocking curb cuts, causing excessive sediment buildup and flow bypass	Remove vegetation and sediment buildup.	As needed
	Mulch	Bare spots (without mulch cover) are present or mulch depth less than 2 inches.	Supplement mulch with hand tools to a depth of 2 to 3 inches.  Replenish mulch per O&M manual. Often coarse compost is used in the bottom of the facility and arborist wood chips are used on side slopes and rim (above typical water levels). Keep all mulch away from woody stems.	Following weeding
Irrigation System	Plant watering	Irrigation system present	Follow manufacturer's instructions for O&M.	Based on manufacturer's instructions
		Sprinklers or drip irrigation not directed/located to properly water plants	Redirect sprinklers or move drip irrigation to desired areas.	Annually

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed	Inspection Frequency
Summer Watering (first year)	Plant watering	Trees, shrubs, and ground cover in the first year of establishment period.	<p>10 to 15 gallons per tree 3 to 5 gallons per shrub 2 gallons water per square foot for groundcover areas Water deeply, but infrequently, so that the top 6 to 12 inches of the root zone is moist Use soaker hoses or spot water with a shower type wand when irrigation system is not present Pulse water to enhance soil absorption, when feasible Pre-moisten soil to break surface tension of dry or hydrophobic soils/mulch, followed by several more passes. With this method, each pass increases soil absorption and allows more water to infiltrate prior to runoff.</p> <p>Add a tree bag or slow-release watering device (e.g., bucket with a perforated bottom) for watering newly installed trees when irrigation system is not present.</p>	Once every 1-2 weeks or as needed during prolonged dry periods
Summer Watering (second and third years)	Plant watering	Trees, shrubs and groundcovers in second or third year of establishment period	<p>10 to 15 gallons per tree 3 to 5 gallons per shrub 2 gallons water per square foot for groundcover areas Water deeply, but infrequently, so that the top 6 to 12 inches of the root zone is moist Use soaker hoses or spot water with a shower type wand when irrigation system is not present</p> <ul style="list-style-type: none"> <li>◦ Pulse water to enhance soil absorption, when feasible</li> </ul> <p>Pre-moisten soil to break surface tension of dry or hydrophobic soils/mulch, followed by several more passes. With this method, each pass increases soil absorption and allows more water to infiltrate prior to runoff.</p>	Once every 2-4 weeks or as needed during prolonged dry periods

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed	Inspection Frequency
Summer Watering (after establishment)		Established vegetation (after 3 years)	<p>Plants are typically selected to be drought tolerant and not require regular watering after establishment; however, trees may take up to 5 years of watering to become fully established.</p> <p>Identify trigger mechanisms for drought-stress (e.g., leaf wilt, leaf senescence, etc.) of different species and water immediately after initial signs of stress appear.</p> <p>Water during drought conditions or more often if necessary to maintain plant cover.</p>	As needed
Pest Control	Mosquitoes	Standing water remains for more than 3 days after the end of a storm	<p>Identify the cause of the standing water and take appropriate actions to address the problem (see "Ponded water").</p> <p>To facilitate maintenance, manually remove standing water and direct to the storm drainage system (if runoff is from non-pollution-generating surfaces) or sanitary sewer system (if runoff is from pollution-generating surfaces) after getting approval from sanitary sewer authority.</p> <p>Use of pesticides or <i>Bacillus thuringiensis israelensis</i> (Bti) may be considered only as a temporary measure while addressing the standing water cause. If overflow to a surface water will occur within 2 weeks after pesticide use, apply for coverage under the Aquatic Mosquito Control NPDES General Permit.</p>	Biannually and after major storm events (1" in 24 hours)
	Nuisance Animals	Nuisance animals causing erosion, damaging plants, or depositing large volumes of feces	<p>Reduce site conditions that attract nuisance species where possible (e.g., plant shrubs and tall grasses to reduce open areas for geese, etc.)</p> <p>Place predator decoys</p> <p>Follow IPM protocols for specific nuisance animal issues (see "Additional Maintenance Resources" section for more information on IPM protocols)</p> <p>Remove pet waste regularly</p> <p>For public and right-of-way sites consider adding garbage cans with dog bags for picking up pet waste.</p>	As needed

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed	Inspection Frequency
	Insect Pests	Signs of pests, such as wilting leaves, chewed leaves and bark, spotting or other indicators	Reduce hiding places for pests by removing diseased and dead plants. For infestations, follow IPM protocols (see "Additional Maintenance Resources" section for more information on IPM.)	Every site visit associated with vegetation management

## Maintenance Standards – Concerns for Stormwater Facilities

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed	Inspection Frequency
Irrigation	Irrigation system (if any)	Irrigation system present.	Follow manufacturer's instructions for O&M.	Based on manufacturer's instructions.
	Plant watering	Plant establishment period (1-3 years).	Water weekly during periods of no rain to ensure plant establishment	Weekly (May - September)
		Longer term period (3+ years)	Water during drought conditions or more often if necessary to maintain plant cover.	As Needed
Spill Prevention and Response	Spill Prevention	Storage or use of potential contaminants in the vicinity of facility	Exercise spill prevention measures whenever handling or storing potential contaminants.	Ongoing
	Spill Response	Release of pollutants. Call to report any spill to City of Tacoma Source Control 253.502.2222.	Cleanup spills as soon as possible to prevent contamination of stormwater.	As Needed
Training and documentation	Training / written guidance	Training / written guidance is required for proper O&M.	Provide property owners and tenants with proper training and a copy of the O&M manual.	At startup
Safety	Safety (slopes)	Erosion of side causes slope to exceed 1:4 or otherwise becomes a hazard.	Restore to design slope.	Annually (preferably Sept.)
	Safety (hydraulic structures)	Hydraulic structures (pipes, culverts, vaults, etc.) become a hazard to children playing in and around the facility.	Take actions to eliminate the hazard (such as covering and securing any openings).	Annually (preferably Sept.)
	Line of Sight	Vegetation causes some visibility (line of sight) or driver safety issues.	Prune or replace plants as necessary.	Annually (preferably Sept.)

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed	Inspection Frequency
Aesthetics	Aesthetics	Damage/vandalism/debris accumulation.	Clean, repair, and restore facility to original aesthetic conditions.	Annually (preferably Sept.)
		Grass/vegetation	Less than 75% of planted vegetation is healthy with a generally good appearance.	Take appropriate maintenance actions. (e.g., remove/replace plants, amend soil, etc.).
	Edging	Grass is starting to encroach on facility.	Repair edging. Remove encroaching grass. Install additional measures to prevent encroachment.	Annually (preferably Sept.)
General	Poisonous Vegetation and noxious weeds	Any poisonous or nuisance vegetation may constitute a hazard to maintenance personnel or to the public. Any evidence of noxious weeds as defined by the State or local regulations. The Washington State Noxious Weed Control Board has a list of common noxious weeds at <a href="http://www.nwcb.wa.gov">www.nwcb.wa.gov</a> .	No danger of poisonous vegetation. Compliance with state or local eradication policies is required. Apply requirements of adopted integrated pest management plan as necessary.	Annually (Preferably Sept.)

## Maintenance Standards – Media Filter Drain

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed	Inspection Frequency
General	Trash & Debris Accumulation	Trash or debris accumulated on the embankment.	Remove trash and debris from embankment.	Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)
	Sediment Accumulation on Grass Filter Strip	Sediment depth exceeds 2 inches or creates uneven grading that interferes with sheet flow.	Remove sediment deposits on grass treatment area of the embankment. When finished, embankment should be level from side to side and drain freely toward the toe of the embankment slope.  There should be no areas of standing water once inflow has ceased.	Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)
	Vegetation	When the grass becomes excessively tall (greater than 10 inches); when nuisance weeds and other vegetation start to take over.	Mow grass, control nuisance vegetation, such that flow is not impeded. Grass should be mowed to a height of 6 inches.	Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)
	Poor Vegetation Coverage	Grass is sparse or bare, or eroded patches are observed in more than 10% of the grass strip surface area.	Determine why grass growth is poor and correct the offending condition. Reseed into loosened, fertile soil or compost; or, replant with plugs of grass from the upper slope.	Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)
	Flow Spreader	Flow spread uneven or clogged so that flows are not uniformly distributed through the entire filter width.	Level the spreader and clean so that flows are spread evenly over entire embankment.	Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)
	Excessive Shading	Grass growth is poor because sunlight does not reach embankment.	If possible, trim back overhanging limbs and remove brushy vegetation on adjacent slopes.	Annually (preferably Sept.)

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed	Inspection Frequency
	Media Filter Drain Mix Replacement	Water is seen on the surface of the media filter drain mix long after the storms have ceased. Typically, the 6- month, 24-hour precipitation event should drain within 48 hours. More common storms should drain within 24 hours. Maintenance also needed on a 10-year cycle and during a preservation project.	Excavate and replace all of the media filter drain mix contained within the media filter drain.	Annually (preferably Sept.)
	Flooding of Media Filter Drain	When media filter drain is inundated by flood water.	Evaluate media filter drain material for acceptable infiltration rate and replace if media filter drain does not meet long-term infiltration rate standards.	Annually (preferably Sept.)

## Maintenance Standards – Manufactured Media Filters

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed	Inspection Frequency
Below Ground Vault	Sediment Accumulation on Media	Sediment depth exceeds one-quarter inch.	No sediment deposits that would impede permeability of the compost media.	Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)
	Sediment Accumulation in Vault	Sediment depth exceeds 6 inches in the first chamber.	No sediment deposits in first chamber of vault.	Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)
	Trash and Debris Accumulation	Trash and debris accumulated on compost filter bed.	Trash and debris removed from the compost filter bed.	Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)
	Sediment/Debris in Drain Pipes/ Cleanouts	When the drain pipes, clean-outs become full with sediment and/or debris.	Sediment and debris removed.	Monthly from Oct. – Apr. and after any major storm event (1" in 24 hours)
	Damaged Pipes	Any part of the piping that is crushed or damaged due to corrosion and/or settlement.	Pipe repaired or replaced.	Annually (preferably Sept.)
	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.	Annually (preferably Sept.)
	Vault Structure Damaged; Includes Cracks in Walls, Bottom, Frame and/or Top Slab	Cracks wider than one-half 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 (preferably Sept.)

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed	Inspection Frequency
Above Ground	Vault Structure Damaged; Includes Cracks in Walls, Bottom, Frame and/or Top Slab	Cracks wider than one-half 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 one-fourth inch at the joint of the inlet/outlet pipe.	Annually (preferably Sept.)
	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.	Annually (preferably Sept.)
	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.	Annually (preferably Sept.)
Below Ground	Cartridge Type Media	Drawdown of water through the media takes longer than 1 hour, and/or overflow occurs frequently.	Media cartridges replaced.	Annually (preferably Sept.)
	Short Circuiting	Flows do not properly enter filter cartridges.	Filter cartridges replaced.	Annually (preferably Sept.)

# APPENDIX B:

## Water Quality Monitoring and Protection Plan for the Port of Tacoma Stormwater Infrastructure Maintenance Program

### (NWS-2017-0032-WRD, WQC #15819)

# **Water Quality Monitoring and Protection Plan (WQMPP)**

Port of Tacoma Stormwater Infrastructure Maintenance Program  
(NWS-2017-0032-WRD, WQC #15819)

*Prepared by*

Jenn Stebbings  
Biologist – Port of Tacoma

March 25, 2020



## **PURPOSE**

This Water Quality Monitoring and Protection Plan (WQMPP) is to comply with the Water Quality Certification (WQC) issued by the Washington Department of Ecology (Ecology) on May 18, 2018. The WQMPP will be used to identify and track the performance of Best Management Practices (BMPs) used during maintenance activities under the Port of Tacoma's (Port) Stormwater Infrastructure Maintenance project. This Ecology-approved WQMPP is the minimum standard for Port Maintenance Staff and/or the Contractor to follow during the proposed activities.

Water Quality Condition B.2. under the above-reference WQC requires the following:

2. *The Applicant shall submit a Water Quality Monitoring and Protection Plan (WQMPP) to Ecology's Federal Permit Manager (per Condition A2, above) for review and approval at least 30 days prior to any work within ditches with surface water present or designated as yellow per the Port of Tacoma memo dated May 4, 2018. Ditches that have been designated as red will require further coordination with Ecology and a separate WQMPP. Work is not authorized to begin until written approval of the WQMPP is received. The WQMPP shall include at a minimum, the following information:*
  - a. *The name(s) and contact information of the person or firm responsible for on-site monitoring and reporting;*
  - b. *The Best Management Practices (BMPs) and procedures to be used to protect water quality during the specific segments of work activities;*
  - c. *A water sampling plan for turbidity that includes the sampling method and frequency; and,*
  - d. *A contingency plan that includes the steps to be taken if monitoring results indicate that an exceedance has occurred.*

The Port has identified three stormwater features proposed for maintenance in 2020 that were designated as yellow in the May 4, 2018 memo. JARPA IDs 1, 2 and 16. JARPA ID 28 is also proposed to be maintained in 2020. This particular ditch was designated as green in the May 4, 2018 memo; however, surface water may be present during the proposed activities. See Figures 1-4 for specific project locations.

## **OBJECTIVES**

This WQMPP will:

- Document the relevant Water Quality Standards for conducting work in stormwater features that discharge to surface waters.
- Identify Port contact(s) responsible for on-site monitoring and reporting.
- Identify appropriate BMPs for use while performing work under this WQC.
- Document the performance of BMPs through water quality monitoring and turbidity sampling.
- Identify turbidity sampling method and frequency based on site conditions.
- Identify and implement (if needed) a contingency plan if turbidity monitoring indicates a Water Quality exceedance has occurred.

**Any changes to monitoring must be approved by Ecology prior to making the changes.**

## **PROJECT DESCRIPTION FOR EACH PROJECT LOCATION**

A Stormwater Pollution Prevention Plan (SWPPP) has been created for this year's stormwater infrastructure maintenance activities and is attached to this WQMPP (Attachment C). The following is a brief description of the proposed work at each site. Please refer to the SWPPP for additional project details and proposed BMPs for each site.

### **BIOFILTRATION TRENCH AND DETENTION POND (JARPA IDs 1 and 2)**

The biofiltration trench (JARPA ID 1) is located immediately downstream of the small detention pond (JARPA ID 2) on Port Parcel 103, also known as Steamplant. Both stormwater features were designated as yellow in the May 4, 2018 memo. Both stormwater features are not meeting maintenance standards due to excessive vegetation growth. This is creating flooding and ponding in the surrounding upland areas. Work proposed to be completed in 2020 includes the following:

- Remove excess vegetation;
- Remove abundance of leaf litter and other debris;
- Eliminate invasive and/or noxious weeds;
- Remove excess sediment that has built up at the inlets and outlets of both structures.

### **LINCOLN LOOP ROAD BIOSWALE (JARPA ID 16)**

The Lincoln Loop Road Bioswale (JARPA ID 16) is located along Lincoln Loop Road and intersects with Milwaukee Way. This stormwater feature was designated as yellow in the May 4, 2018 memo. This stormwater feature is not meeting maintenance standards due to excessive vegetation growth. It is creating flooding on the adjacent public road (Lincoln Loop) during and immediately after rain events. Work proposed to be completed in 2020 includes the following:

- Remove excess vegetation;
- Remove and replace impacted quarry spalls;
- Remove excess sediment at flow dissipators in front of inlet;
- Clean and jet underdrain and associated overflow catch basin.

### **FABULICH CENTER DITCH (JARPA ID 28)**

The Fabulich Center Ditch (JARPA ID 28) is located south and west of the Fabulich Center on Port of Tacoma Road, near Pacific Highway. This stormwater feature was designated as green in the May 4, 2018 memo; however, due to its highly impacted nature, surface water may be present at any time during the year, regardless of weather patterns. This stormwater feature is not meeting performance standards due to excessive vegetation growth. It is causing erosion of asphalt pavement in surrounding upland areas and creating flooding during rain events. Work proposed to be completed in 2020 includes the following:

- Remove excess vegetation;
- Remove abundance of leaf litter and other debris;
- Eliminate invasive and/or noxious weeds.

## **WATER QUALITY STANDARDS FOR SURFACE WATERS**

This project is located at the Port of Tacoma, located in WRIA 10, doing work in stormwater features that eventually discharge into the Blair and Hylebos Waterways. While the majority of the maintenance

work is anticipated to occur only when no surface water is present, the following Water Quality Standards apply to this project.

The Water Quality Standards considered to be applicable to JARPA IDs 16 and 28 under Washington Administrative Code (WAC) 173-201A-200(1)(e) (Freshwater designated uses and criteria) are as follows:

- Turbidity shall not exceed
  - 10 NTUs over background when the background is 50 NTUs or less; or
  - A 20-percent increase in turbidity when the background is more than 50 NTUs.

Due to the stormwater features not directly discharging salmon-bearing aquatic resources, the following criteria should also apply:

- The turbidity water quality standard for waters up to 10 cfs flow includes an allowed 100-foot mixing zone that extends downstream from the point of the in-water activity (WAC 173-201A-200(1)(e)(i)(A)).

The Water Quality Standards considered to be applicable to JARPA IDs 1 and 2 under WAC 173-201A-210(1)(e) (Marine water designated uses and criteria) are as follows:

- Turbidity will not exceed
  - 10 NTUs over background when the background is 50 NTUs or less; or
  - A 20-percent increase in turbidity when the background is more than 50 NTUs.
  - The water quality standard for turbidity will need to be met at the compliance boundary at the edge of the authorized mixing zone for construction activities. The turbidity water quality standard for marine waters and estuaries includes an allowed 150-foot mixing zone that extends out from the point of the in-water activity (WAC 173-201A-210(1)(e)(i)).
- Oil and Grease- No Visible Sheen

## ON-SITE MONITORING AND REPORTING PERSONNEL

The following table identifies Port personnel that will be responsible for the on-site water quality monitoring and reporting for each project proposed in 2020. Additional contacts may be added if a contractor performs the work. Ecology will be notified prior to the start of work if additional contacts are needed.

NAME	TITLE	PHONE	EMAIL	RESPONSIBILITY
Anita Fichthorn	WQ Project Manager II	253-830-5379	<a href="mailto:afichthorn@nwseaportalliance.com">afichthorn@nwseaportalliance.com</a>	Project oversight; permit compliance; primary on-site water quality monitoring & sampling
Rob Zinkevich	WQ Analyst II	253-383-9451	<a href="mailto:rzinkevich@nwseaportalliance.com">rzinkevich@nwseaportalliance.com</a>	Primary on-site water quality monitoring & sampling
Jenn Stebbings	Biologist	253-592-6793	<a href="mailto:jstebbings@portoftacoma.com">jstebbings@portoftacoma.com</a>	Reporting; backup for on-site water quality monitoring & sampling

## **BMPs FOR IN-WATER ACTIVITIES AND EROSION SEDIMENT CONTROL**

The Port will implement BMPs in accordance with the most current version of Ecology's Stormwater Management Manual for Western Washington, Volumes II and IV. BMPs for all Port stormwater infrastructure proposed for maintenance in 2020 include, but are not limited to:

- S411 – Landscaping and Lawn/Vegetation Management
- C120 – Temporary and Permanent Seeding
- C140 – Dust Control
- C150 – Materials on Hand
- C209 – Outlet Protection

In addition to the erosion and sediment control (ESC) BMPs listed above, the following BMPs will also be implemented for the following:

- JARPA IDs 1 and 2 (yellow)
  - S417 – Maintenance of Stormwater Drainage and Treatment Systems
  - C220 – Inlet Protection
  - C235 – Wattles
  - Obtain a WDA from TPCHD if sediment is removed from the stormwater features.
  - If surface water is present, monitor for turbidity 150 feet downstream of maintenance footprint or at the ditch outlet, whichever is closer. Turbidity will not exceed established water quality standards (see Water Quality Standards for Surface Waters section).
- JARPA ID 16 (yellow)
  - S416 – Maintenance of Roadside Ditches
  - C220 – Inlet Protection
  - Table V 7.3 – Grass Seed Mixes Suitable for Biofiltration Swale Treatment Areas
  - Table V 7.4 – Groundcovers and Grasses Suitable for the Upper Side Slopes of Biofiltration Swale in Western Washington
  - Obtain a WDA from TPCHD if sediment is removed from the stormwater feature.
  - If surface water is present, monitor for turbidity 150 feet downstream of maintenance footprint or at the ditch outlet, whichever is closer. Turbidity will not exceed established water quality standards (see Water Quality Standards for Surface Waters section).
- JARPA ID 28 (green)
  - S417 – Maintenance of Stormwater Drainage and Treatment Systems
  - C235 – Wattles

## **SAMPLING PROTOCOL**

### **Sampling Locations**

Turbidity will be measured only if surface water is present during the period in which the maintenance activity occurs. Turbidity monitoring locations will be measured directly from the point of the maintenance activity. Each site will have a point of compliance, an early detection point, and a background point identified; the exact monitoring locations will be identified in the field. Monitoring will be conducted at the following locations:

- Background monitoring location (at least 150 feet upstream of the maintenance activity or at the inlet of the stormwater feature, whichever is farther away)
- Early detection monitoring location (75 feet downstream of the point of the maintenance activity or halfway between maintenance activity and stormwater feature outlet, if stormwater feature is less than 150 feet)
  - If turbidity is elevated at the early detection location, additional/different BMPs will be implemented to prevent actual exceedance.
- Compliance monitoring location (150 feet downstream of the point of maintenance activity or at stormwater feature outlet, whichever is closer).
  - Turbidity that is observed as greater than background turbidity at or beyond the 150-foot point of compliance from the area of construction activity is considered an exceedance of water quality standards.

In addition to these locations, visual monitoring will be performed at the point of the active operation to monitor the effectiveness of the BMPs and for visible sheen and/or construction debris.

### **Sampling Procedures**

If surface water is present during maintenance activities, it will be observed for the appropriate parameters, per the Monitoring Schedule below, following the equipment and sampling guidelines:

- Turbidity will be monitored visually at all sites.
  - The first compliance sample for turbidity will be taken approximately one (1) hour after the in-water activity starts, unless there is a visual plume at the point of compliance prior to 1 hour.
- JARPA IDs 1, 2, and 16 (designated yellow features) will be physically monitored with a turbidity meter.
  - The first compliance sample for turbidity will be taken approximately one (1) hour after the in-water activity starts. A minimum of two samples will be recorded during the in-water work activities.
- Oil and Grease is a continuous visual for a visible sheen on the water's surface.
- If turbidity appears to exceed the water quality criteria using visual methods, a turbidity meter will be employed no later than one (1) hour after the observation. A background sample will be taken upstream and prior to the downstream samples.

### **Monitoring Contacts**

Jenn Stebbings or other designated Port personnel will be responsible for providing Ecology with the necessary notifications and results of the monitoring per the frequency specified in the WQC.

The Contractor or Rob Zinkevich, Anita Fichthorn or other designated Port personnel may be responsible for conducting the water quality monitoring; however, the Port will oversee water quality monitoring to ensure compliance with the WQC. The phone number to reach the Port office is 253-383-5841.

### **Monitoring Schedule**

The following monitoring parameters will be observed during in-water work activities:

- Visual turbidity monitoring at all sites
- Physical turbidity monitoring using a turbidity meter at stormwater features designated as yellow in the May 4, 2018 memo (JARPA IDs 1, 2 and 16 for 2020)
- Sheen
- Construction debris in the water
- Operation and effectiveness of BMPs

### **Monitoring Duration (Physical)**

If surface water is present in stormwater features designated as yellow in the May 4, 2018 memo during maintenance activities, the Contractor or Port personnel will conduct physical turbidity monitoring with an approved turbidity meter. Physical turbidity monitoring will be conducted before in-water work begins, one hour after in-water work begins, and a minimum of twice a day during in-water work activities.

### **Monitoring Duration (Visual)**

If surface water is present in stormwater features designated as green in the May 4, 2018 memo during maintenance activities, the Contractor or Port personnel will conduct visual turbidity monitoring. Visual turbidity monitoring will occur continuously and will be documented a minimum of twice a day during in-water work activities. Visual monitoring will occur for as long as the construction activity that has triggered monitoring is taking place.

## **CONTINGENCY PLAN**

JARPA IDs 1, 2 and 16: If a water quality exceedance is documented at the point of compliance, field personnel will stop work. The source of the exceedance or impact will be identified and assessed. Additional ESC BMPs identified in the May 4, 2018 memo will be evaluated and implemented as necessary. Notification of the exceedance will be reported to the Ecology Federal Permit Manager/Coordinator within the time specified by the WQC. Field personnel will implement operation modifications and/or additional/different BMPs to bring water quality back into compliance with the criteria. Physical turbidity sampling will occur until it is confirmed water quality is back in compliance with the criteria.

All Sites: If an exceedance of a water quality standard appears to occur during visual monitoring, a turbidity meter will be used to verify the results. The background turbidity level, the early detection location and the point of compliance location will all be sampled to verify the exceedance. If the exceedance is confirmed using the turbidity meter, field personnel will stop work. The source of the exceedance or impact will be identified and assessed. Additional ESC BMPs identified in the May 4, 2018 memo will be evaluated and implemented as necessary. Notification of the exceedance will be report to the Ecology Federal Permit Manager/Coordinator within the time specified by the WQC. Field personnel will implement operation modifications and/or additional/different BMPs to bring water quality back into compliance with the criteria.

Once the control measures have been deemed effective, monitoring will continue every 4 hours using the turbidity meter during working hours until the water quality exceedances have been brought into compliance. Once compliance with water quality standards is achieved, the project shall return to its standard sampling schedule.

## **Non-Compliance**

If either visual and/or physical monitoring indicates that water quality standards have been exceeded, the required reporting will be initiated.

## **REPORTING**

All water quality monitoring results (visual and physical) will be recorded on the monitoring form attached (Attachment A).

All sample results will be submitted to the Ecology Federal Permit Manager/Coordinator weekly, or per the frequency specified in the WQC.

If visual or physical turbidity monitoring indicates an exceedance of water quality standards, notification shall be made to Ecology's Federal Permit Manager/Coordinator.

## **ATTACHMENTS**

Attachment A – Sample Monitoring Results Reporting Form

Attachment B – Figures

Attachment C – SWPPP

Attachment D – May 4, 2018 Memo

## **Attachment A – Sample Monitoring Results Reporting Form**



**Port of Tacoma Daily Turbidity Monitoring**  
**In-Water Construction for Stormwater Infrastructure Maintenance**  
USACE: NWS-2017-032-WRD    ECY WQC Order #: 15819

Date: \_\_\_\_\_

Observer: \_\_\_\_\_

Start of in-water work: \_\_\_\_\_

Ditch Designation:


Green  
Yellow  
Red

End of in-water work: \_\_\_\_\_

**Before Start Work**

Time:	Turbidity visible 150 feet downstream of in-water work?	NTUs (Yellow and Red Ditches Only)	Notes (work modifications, monitoring point, additional observations, etc.)
	<input type="checkbox"/> Yes	Background:	
	<input type="checkbox"/> No	Early Detection: Compliance Point:	

**During Work Observation 1**

Time:	Turbidity visible 150 feet downstream of in-water work?	NTUs (Yellow and Red Ditches Only)	Notes (work modifications, monitoring point, additional observations, etc.)
	<input type="checkbox"/> Yes	Background:	
	<input type="checkbox"/> No	Early Detection: Compliance Point:	

**During Work Observation 2**

Time:	Turbidity visible 150 feet downstream of in-water work?	NTUs (Yellow and Red Ditches Only)	Notes (work modifications, monitoring point, additional observations, etc.)
	<input type="checkbox"/> Yes	Background:	
	<input type="checkbox"/> No	Early Detection: Compliance Point:	

**Additional Observations**

Time:	Turbidity visible 150 feet downstream of in-water work?	NTUs (Yellow and Red Ditches Only)	Notes (work modifications, monitoring point, additional observations, etc.)
	<input type="checkbox"/> Yes	Background:	
	<input type="checkbox"/> No	Early Detection: Compliance Point:	

**General description of weather, ditch conditions, circumstances affecting background turbidity, and work affecting turbidity throughout the day.**

**Water Quality Monitoring during In-Water Work Activities**

Turbidity should NOT be visible more than 150 feet downstream at any time during in-water work activities. If turbidity is visible, stop work and contact the Engineering Project Manager.

A minimum of two (2) observations must be recorded during active in-water work activity.

Recorded observations should be a minimum of 2 hours apart unless in-water work ceases before 2 hours have passed. If in-water work activity ends before 2 hours, record second observation at the end of the in-water work activity.

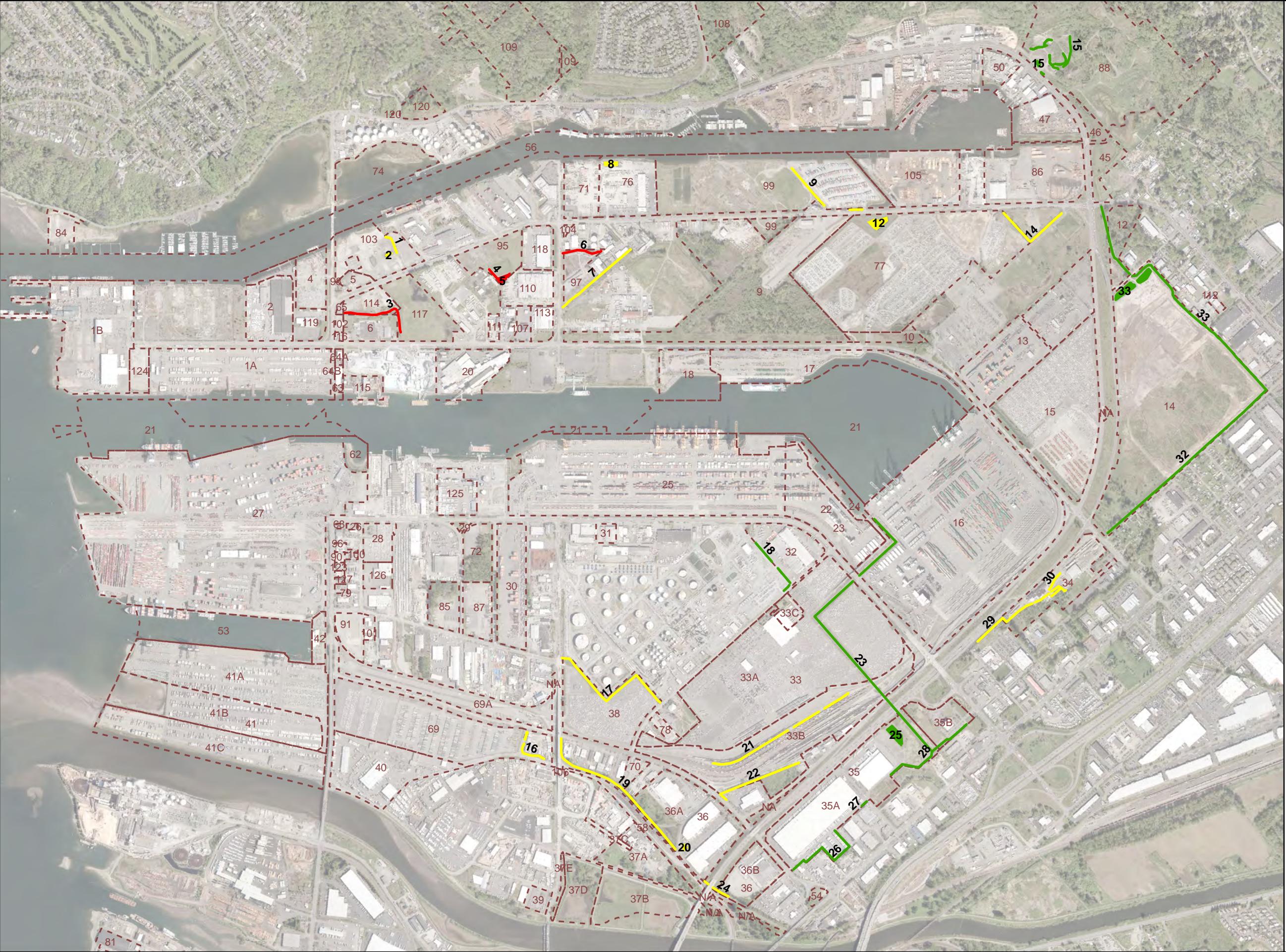
**(For yellow and red ditches only)** In addition to visual observations of turbidity and requirements listed above, water quality measurements must be taken with an approved turbidimeter.

## **Attachment B – Figures**

# Port of Tacoma

## Stormwater Infrastructure Maintenance Program

Document Path: \\apps.portoftacoma.com\GIS\User Projects\Environmental\SHSMisc\Prog Permit Ditches\Prog Permit Ditches.mxd Date Revised: 5/4/2018 by ssasser



# Ditches and Ponds

## Classification



# PortParcels



**(24) Jarpa ID number**



0 2,500

Feet

Data Source: Port of Tacoma

REFERENCE NUMBER: NWS-2017-0032-WRD  
APPLICANT NAME: PORT OF TACOMA  
PROPOSED PROJECT: DITCH MAINTENANCE  
LOCATION: TACOMA, WA



**DISCLAIMER:** The information included on this map has been compiled by Port of Tacoma staff from a variety of sources and is subject to change without notice. These data are intended for informational purposes and should not be considered authoritative for engineering, navigational, legal and other site-specific uses. The Port of Tacoma makes no representations or warranties, express or implied, as to accuracy, completeness, timeliness, or rights to the use of such information.



# Port of Tacoma

Stormwater Infrastructure  
Maintenance Program

## Ditches and Ponds

### Classification



## Port Parcels

42

(24) JARPA ID number



0 150  
Feet

Data Source: Port of Tacoma

WQC NO. 15819  
REFERENCE NO: NWS-2017-0032-WRD  
APPLICANT: PORT OF TACOMA  
PROJECT: DITCH MAINTENANCE  
LOCATION: TACOMA, WA



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# Port of Tacoma

Stormwater Infrastructure  
Maintenance Program

## Ditches and Ponds

### Classification



### PortParcels

42

(24) JARPA ID number



0 150  
Feet

Data Source: Port of Tacoma

WQC NO. 15819  
REFERENCE NO: NWS-2017-0032-WRD  
APPLICANT: PORT OF TACOMA  
PROJECT: DITCH MAINTENANCE  
LOCATION: TACOMA, WA





# Port of Tacoma

Stormwater Infrastructure  
Maintenance Program

## Ditches and Ponds

### Classification



### Port Parcels



42

(24) JARPA ID number



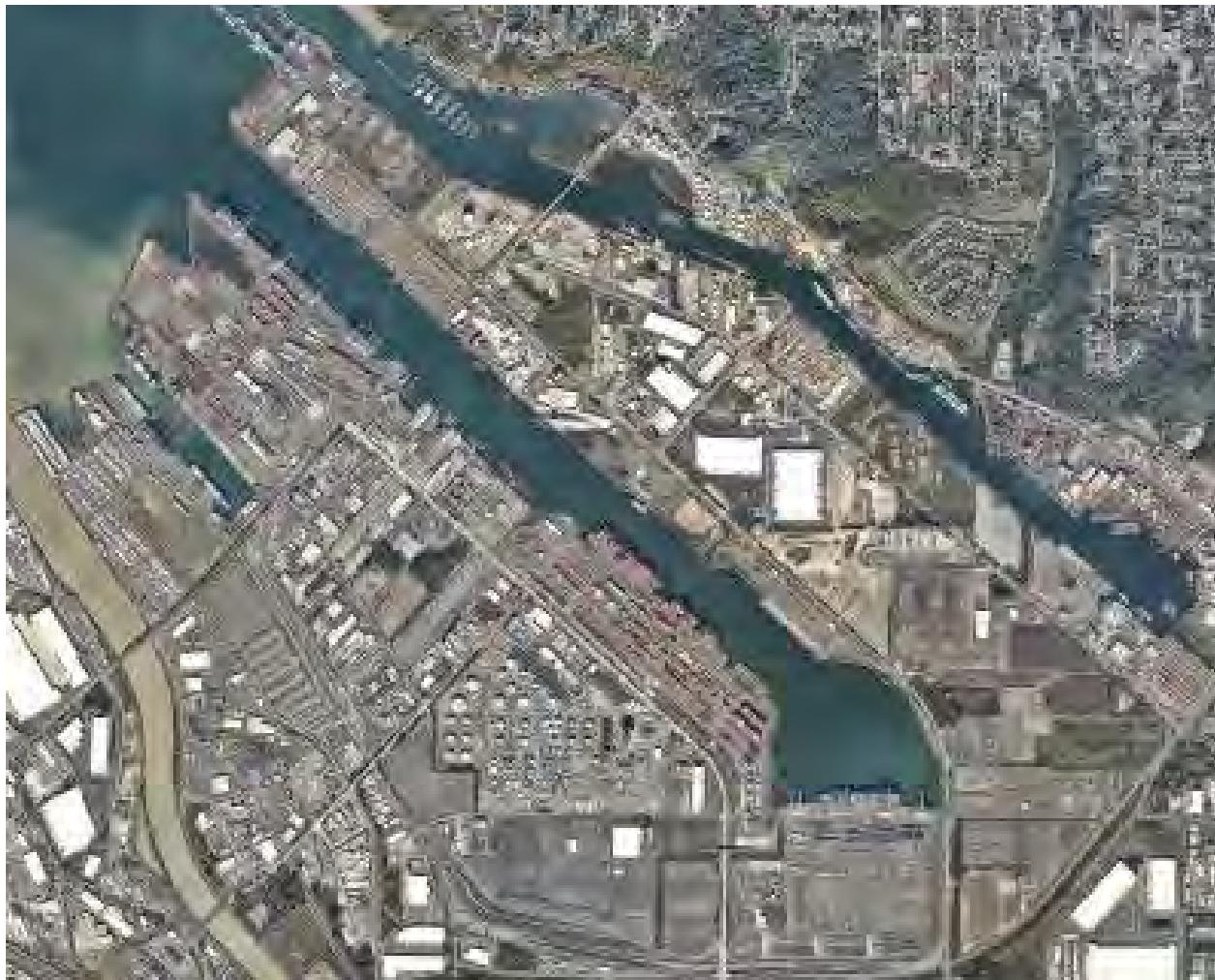
0 150  
Feet

Data Source: Port of Tacoma

WQC NO. 15819  
REFERENCE NO: NWS-2017-0032-WRD  
APPLICANT: PORT OF TACOMA  
PROJECT: DITCH MAINTENANCE  
LOCATION: TACOMA, WA



## **Attachment C – SWPPP**



**Port of  
Tacoma**

2020 Ditch Maintenance  
Stormwater Pollution Prevention  
Plan

March 23, 2020

# **DITCH MAINTENANCE STORMWATER POLLUTION PREVENTION PLAN**

Department of Ecology Water Quality Certification Order No. 15819

## **Introduction**

The Port of Tacoma (Port) is required to conduct routine maintenance on all stormwater infrastructure owned and operated by the Port, per the Phase I Municipal Stormwater Permit, Special Condition S6.E.6. Operations and Maintenance Program.

A Water Quality Certification (WQC) from the Washington Department of Ecology (Ecology) is required in order for the Port to conduct maintenance of open conveyance (e.g., ditches, ponds, etc.) and Low Impact Development (LID) stormwater features due to potential risk of disturbing areas of contamination. Per Condition D.2. of the WQC referenced above, a Work Plan which includes Stormwater Pollution Prevention Plans (SWPPPs) and maps of the proposed monitoring locations are required to be submitted by no later than March 31, prior to conducting any maintenance activities identified in permit.

This SWPPP is for the calendar year 2020. The current schedule of activities is unknown; however, work will happen the dry season to the greatest extent practicable.

## **SWPPP Layout**

Each site proposed for stormwater conveyance maintenance work in 2020 will be addressed separately using the JARPA ID, description, assessment status, work required and the minimum best management practices to be implemented during the work. Ecology has developed Maintenance Standards for each type of stormwater facility. The Maintenance Standards were used to assess the status of each stormwater facility. The specific standard can currently be found in the 2019 Stormwater Management Manual for Western Washington, Volumes IV and V, Department of Ecology, which can be found following the following link or in Appendix B of this document or at this [link](#).

Each JARPA location will have site-specific best management practices (BMPs) associated with the type of maintenance being planned. As with all SWPPPs, this is a living document, and changes may be made in-field, as necessary, to protect water quality. Details of the BMPs can be found in Appendix B

Excess sediments that must be disposed of will be characterized and properly disposed of per WAC 173-303 and the Tacoma-Pierce County Health Department (TPCHD) Waste Disposal Authorization.

## Project Locations and Best Management Practices

**Project Location:** JARPA IDs 1 and 2 on Port Parcel 103



**Description of Stormwater Feature:** Biofiltration trench (JARPA ID 1) downstream from a small detention pond (JARPA ID 2)

**Maintenance Status:** Stormwater facilities are not meeting maintenance standards due to excessive vegetation growth causing flooding and ponding upstream of the facilities.

**Work to be Performed:** Remove excess vegetation, remove abundance of leaf litter and other debris, eliminate weeds. Remove excess sediment build-up at the inlet and outlets.

**Schedule:** Work will be performed in dry weather (July-September) when no surface water is present

### **Best Management Practices:**

**S411 – Landscaping and Lawn/Vegetation Management**

**S417 – Maintenance of Stormwater Drainage and Treatment Systems**

**C120 – Temporary and Permanent Seeding**

**C140 – Dust Control**

**C150 – Materials on Hand**

**C209 – Outlet protection**

**C220 – Inlet protection**

**C235 – Wattles**

**Project Location:** JARPA ID 16 Port Parcel 69



**Description of Stormwater Feature:** Biofiltration swale with underdrain

**Maintenance Status:** Stormwater facility is not meeting maintenance standards due to excessive vegetation growth causing flooding on the adjacent public road.

**Work to be Performed:** Remove excess vegetation and weeds; remove and replace impacted quarry spalls; remove excess sediment at flow dissipater locations in front of inlets; and clean and jet underdrain and associated overflow catch basin.

**Schedule:** Work will be performed in dry weather (July-September) when no surface water is present.

**Best Management Practices:**

**S411 – Landscaping and Lawn/Vegetation Management**

**S416 – Maintenance of Roadside Ditches**

**C120 – Temporary and Permanent Seeding**

**C140 – Dust Control**

**C150 – Materials on Hand**

**C209 – Outlet protection**

**C220 – Inlet protection**

**Table V 7.3 Grass Seed Mixes Suitable for Biofiltration Swale Treatment Areas**

**Table V 7.4 Groundcovers and Grasses Suitable for the Upper Side Slopes of Biofiltration Swale in WW**

**Project Location:** JARPA ID 28 Fabulich Center Ditch



**Description of Stormwater Feature:** Open conveyance ditch which eventually discharges via a lift station into the Blair Waterway

**Maintenance Status:** Stormwater facility is not meeting maintenance standards due to excessive vegetation growth causing flooding and erosion of pavement upstream.

**Work to be Performed:** Remove excess vegetation, remove abundance of leaf litter and other debris, eliminate weeds.

**Schedule:** Work will be performed in dry weather (July-September) when no surface water is present.

**Best Management Practices:**

**S411 – Landscaping and Lawn/Vegetation Management**

**S417 – Maintenance of Stormwater Drainage and Treatment Systems**

**C120 – Temporary and Permanent Seeding**

**C140 – Dust Control**

**C150 – Materials on Hand**

**C209 – Outlet protection**

**C235 – Wattles**

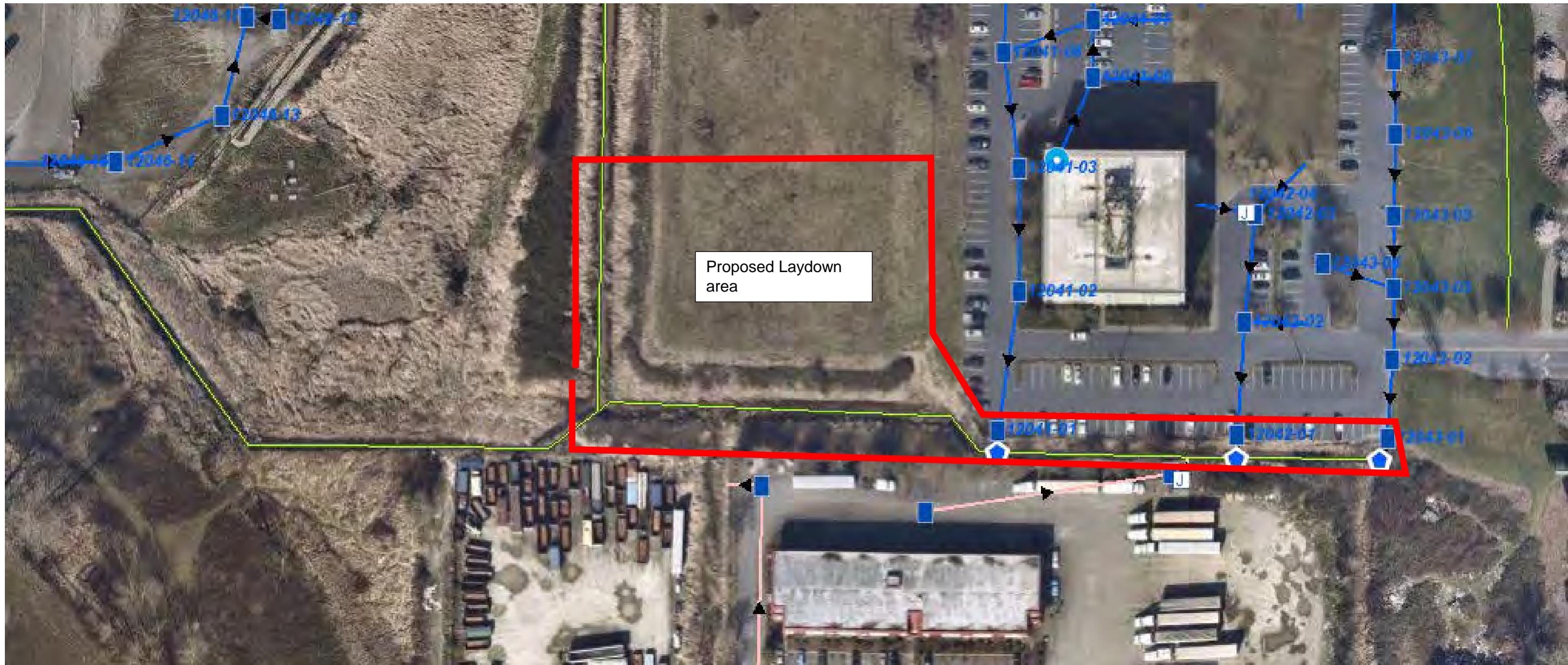
## References

Ecology, Department of. 2019. *Stormwater Management Manual for Western Washington, Vol IV*. Olympia.

—. 2019. *Stormwater Management Manual for Western Washington. Vol V*. Olympia.

## **Appendix A: Figures for Proposed Water Quality (Turbidity) Sampling Locations**

Port of Tacoma  
2020 Ditch Maintenance SWPPP – Fabulich Ditch Site Map



*Drawing not to scale*

Blue indicates stormwater infrastructure

Green indicates boundaries of the Fabulich Ditch

Red indicate proposed maintenance areas and laydown

# Port of Tacoma 2020 Ditch Maintenance SWPPP – Fabulich Ditch Site Map



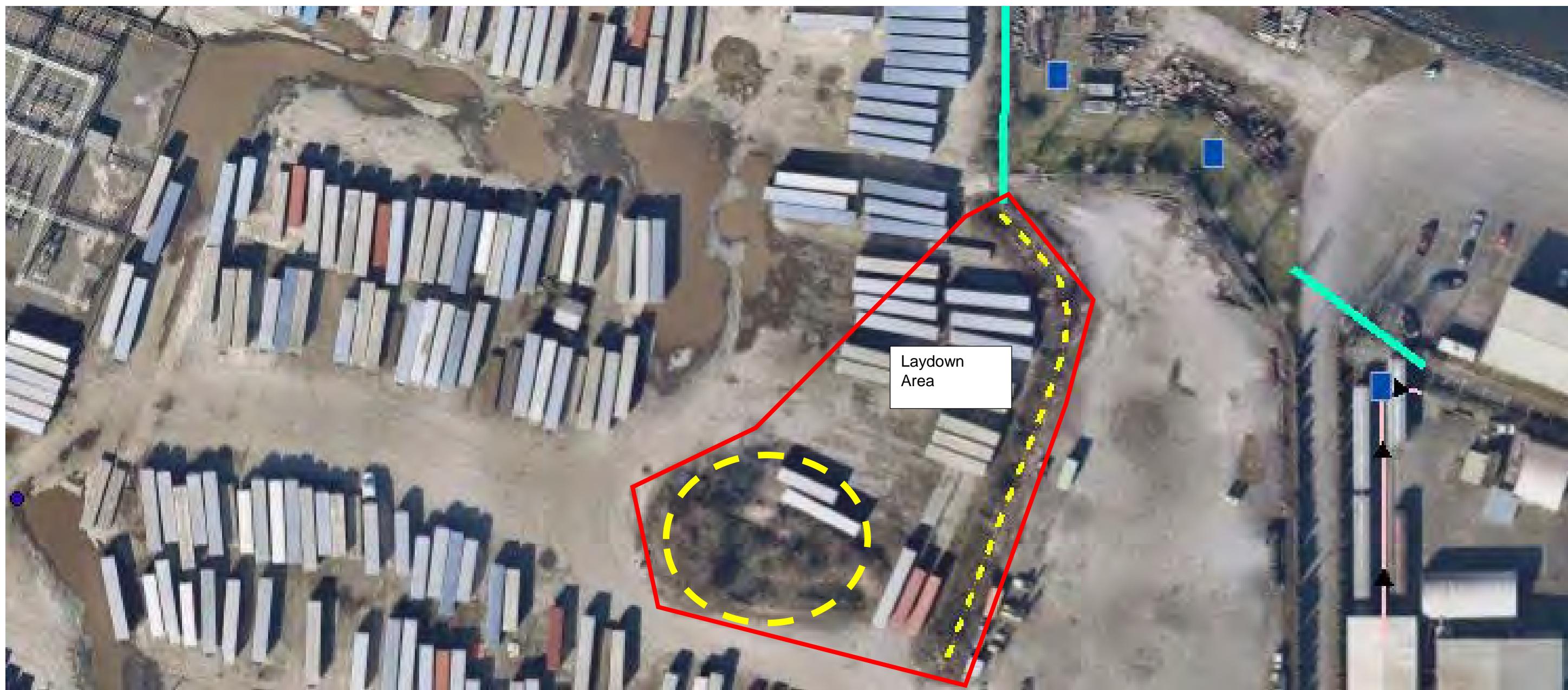
*Figure 1 Drawing not to scale*

Blue indicates stormwater infrastructure

Green indicates boundaries of the Green and dashed yellow indicate ditch line and subsurface drain

Red indicates proposed maintenance areas and laydown

Port of Tacoma  
2020 Ditch Maintenance SWPPP – Fabulich Ditch Site Map



*Drawing not to scale*

Blue indicates stormwater infrastructure

Yellow dashed line indicates boundaries of the Parcel 103 Settling Pond and Ditch

Red indicate proposed maintenance areas and laydown

## **Appendix B: Maintenance Standards**

## Maintenance Criteria

- Inspect biofiltration swales at least once every 6 months, preferably during storm events, and also after storm events of > 0.5 inch rainfall/24 hours. Maintain adequate grass growth and eliminate bare spots.
- Mow grasses, if needed for good growth (typically maintain at 4 – 9 inches and not below design flow level ([King County Department of Natural Resources, 1998](#))).
- Remove sediment as needed at the head of the biofiltration swale if grass growth is inhibited in greater than 10 percent of the swale, or if the sediment is blocking the distribution and entry of the water ([King County Department of Natural Resources, 1998](#)).
- Remove leaves, litter, and oily materials, and re-seed or resod, and regrade, as needed. Clean curb cuts and level spreaders as needed.
- Prevent scouring and soil erosion in the biofiltration swale. If flow channeling occurs, regrade and reseed the biofiltration swale, as necessary.
- Maintain access to the biofiltration swale inlet, outlet, and to mowing (see [Figure V-7.10: Biofiltration Swale Access Features](#)).
- If a biofiltration swale is equipped with underdrains, vehicular traffic on the swale bottom (other than grass mowing equipment) should be avoided to prevent damage to the underdrain.

Table V-A.8: Maintenance Standards - Typical Biofiltration Swale

Maintenance Component	Defect or Problem	Condition When Maintenance is Needed	Recommended Maintenance to Correct Problem
General	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.
	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

Table V-A.8: Maintenance Standards - Typical Biofiltration Swale

Maintenance Component	Defect or Problem	Condition When Maintenance is Needed	Recommended Maintenance to Correct Problem
			underdrains or convert to a wet biofiltration swale.
	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.
	Constant Baseflow	When 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 baseflow around the swale.
	Poor Vegetation Coverage	When 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.
	Vegetation	When the grass becomes excessively tall (greater than 10-inches); when nuisance weeds and other vegetation starts 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.
	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.
	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.
	Trash and Debris	Trash and debris accumulated in the bio-	Remove trash and debris from

Table V-A.8: Maintenance Standards - Typical Biofiltration Swale

Maintenance Component	Defect or Problem	Condition When Maintenance is Needed	Recommended Maintenance to Correct Problem
	Accumulation	swale.	bioswale.
	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, overseed when bare spots are evident, or take plugs of grass from the upper slope and plant in the swale bottom at 8-inch intervals.

Table V-A.1: Maintenance Standards - Detention Ponds

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed
General	Trash & Debris	<p>Any trash and debris which exceed 1 cubic feet per 1,000 square feet. In general, there should be no visual evidence of dumping.</p> <p>If less than threshold all trash and debris will be removed as part of next scheduled maintenance.</p>	Trash and debris cleared from site
	Poisonous Vegetation and noxious weeds	<p>Any poisonous or nuisance vegetation which may constitute a hazard to maintenance personnel or the public.</p> <p>Any evidence of noxious weeds as defined by State or local regulations.</p> <p>(Apply requirements of adopted IPM policies for the use of herbicides).</p>	<p>No danger of poisonous vegetation where maintenance personnel or the public might normally be. (Coordinate with local health department)</p> <p>Complete eradication of noxious weeds may not be possible. Compliance with State or local eradication policies required</p>
	Contaminants and Pollution	<p>Any evidence of oil, gasoline, contaminants or other pollutants</p> <p>(Coordinate removal/cleanup with local water quality response agency).</p>	No contaminants or pollutants present.
	Rodent Holes	<p>Any evidence of rodent holes if facility is acting as a dam or berm, or any evidence of water piping through dam or berm via rodent holes.</p>	Rodents destroyed and dam or berm repaired. (Coordinate with local health department; coordinate with Ecology Dam Safety Office if pond

Table V-A.1: Maintenance Standards - Detention Ponds

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed
			exceeds 10 acre-feet.)
	Beaver Dams	Dam results in change or function of the facility.	Facility is returned to design function. (Coordinate trapping of beavers and removal of dams with appropriate permitting agencies)
	Insects	When insects such as wasps and hornets interfere with maintenance activities.	Insects destroyed or removed from site. Apply insecticides in compliance with adopted IPM policies
	Tree Growth and Hazard Trees	<p>Tree growth does not allow maintenance and inspection access or interferes with maintenance activity (i.e., slope mowing, silt removal, vacating, or equipment movements). If trees are not interfering with access or maintenance, do not remove</p> <p>If dead, diseased, or dying trees are identified</p> <p>(Use a certified Arborist to determine health of tree or removal requirements)</p>	<p>Trees do not hinder maintenance activities. Harvested trees should be recycled into mulch or other beneficial uses (e.g., alders for firewood).</p> <p>Remove hazard Trees</p>
Side Slopes of Pond	Erosion	Eroded damage over 2 inches deep where cause of damage is still present or where there is potential for continued erosion.	Slopes should be stabilized using appropriate erosion control measure(s); e.g., rock reinforcement, planting of grass,

Table V-A.1: Maintenance Standards - Detention Ponds

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed
		Any erosion observed on a compacted berm embankment.	compaction. If erosion is occurring on compacted berms a licensed engineer in the state of Washington should be consulted to resolve source of erosion.
Storage Area	Sediment	Accumulated sediment that exceeds 10% of the designed pond depth unless otherwise specified or affects inletting or outletting condition of the facility.	Sediment cleaned out to designed pond shape and depth; pond reseeded if necessary to control erosion.
	Liner (if Applicable)	Liner is visible and has more than three 1/4-inch holes in it.	Liner repaired or replaced. Liner is fully covered.
Ponds Berms (Dikes)	Settlements	Any part of berm which has settled 4 inches lower than the design elevation  If settlement is apparent, measure berm to determine amount of settlement  Settling can be an indication of more severe problems with the berm or outlet works. A licensed engineer in the state of Washington should be consulted to determine the source of the settlement.	Dike is built back to the design elevation.
	Piping	Discernable water flow through pond berm. Ongoing erosion with	Piping eliminated. Erosion potential resolved.

Table V-A.1: Maintenance Standards - Detention Ponds

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed
		<p>potential for erosion to continue.</p> <p>(Recommend a Geotechnical engineer be called in to inspect and evaluate condition and recommend repair of condition.)</p>	
Emergency Overflow/ Spillway and Berms over 4 feet in height	Tree Growth	<p>Tree growth on emergency spillways creates blockage problems and may cause failure of the berm due to uncontrolled overtopping.</p> <p>Tree growth on berms over 4 feet in height may lead to piping through the berm which could lead to failure of the berm.</p>	<p>Trees should be removed. If root system is small (base less than 4 inches) the root system may be left in place. Otherwise the roots should be removed and the berm restored. A licensed engineer in the state of Washington should be consulted for proper berm/spillway restoration.</p>
	Piping	<p>Discernable water flow through pond berm.</p> <p>Ongoing erosion with potential for erosion to continue.</p> <p>(Recommend a Geotechnical engineer be called in to inspect and evaluate condition and recommend repair of condition.)</p>	<p>Piping eliminated. Erosion potential resolved.</p>
Emergency Overflow/Spillway	Emergency Overflow/Spillway	Only one layer of rock exists above native soil in area five square feet or larger, or any exposure of native soil at the top of out	Rocks and pad depth are restored to design standards.

Table V-A.1: Maintenance Standards - Detention Ponds

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed
		flow path of spillway. (Rip-rap on inside slopes need not be replaced.)	
	Erosion	See "Side Slopes of Pond"	

## Maintenance Criteria

- Maintain the infiltration basin floor and side slopes to promote dense turf with extensive root growth. This enhances infiltration, prevents erosion and consequent sedimentation of the basin floor, and prevents invasive weed growth. Immediately stabilize and revegetate bare spots.
- Do not allow vegetation growth to exceed 18 inches in height. Mow the slopes periodically and check for clogging and erosion.
- Use the same seed mixtures as those recommended in [Table V-12.3: Stormwater Tract "Low Grow" Seed Mix](#). The use of slow-growing, stoloniferous grasses will permit long intervals between mowing. Mowing twice a year is generally satisfactory. Apply fertilizers only as necessary and in limited amounts to avoid contributing to ground water pollution. Consult the local agricultural or gardening resources such as Washington State University Extension for appropriate fertilizer type, including slow release fertilizers, and application rates.

Table V-A.9: Maintenance Standards - Wet Biofiltration Swale

Maintenance Component	Defect or Problem	Condition When Maintenance is Needed	Recommended Maintenance to Correct Problem
General	Sediment Accumulation	Sediment depth exceeds 2-inches in 10% of the swale treatment area.	Remove sediment deposits in treatment area.
	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.
	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.
	Inlet/Outlet	Inlet/outlet area clogged with sediment and/or debris.	Remove clogging or blockage in the inlet and outlet areas.

Table V-A.9: Maintenance Standards - Wet Biofiltration Swale

Maintenance Component	Defect or Problem	Condition When Maintenance is Needed	Recommended Maintenance to Correct Problem
	Trash and Debris Accumulation	See <a href="#">Table V-A.1: Maintenance Standards - Detention Ponds</a>	Remove trash and debris from wet swale.
	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 or enlarge swale. Replant eroded areas with fibrous-rooted plants such as <i>Juncus effusus</i> (soft rush) in wet areas or snowberry ( <i>Symphoricarpos albus</i> ) in dryer areas.

## **Appendix C: Best Management Practices**

# BMP C120: Temporary and Permanent Seeding

## **Purpose**

Seeding reduces erosion by stabilizing exposed soils. A well-established vegetative cover is one of the most effective methods of reducing erosion.

## **Conditions of Use**

Use seeding throughout the project on disturbed areas that have reached final grade or that will remain unworked for more than 30 days.

The optimum seeding windows for western Washington are April 1 through June 30 and September 1 through October 1.

Between July 1 and August 30 seeding requires irrigation until 75 percent grass cover is established.

Between October 1 and March 30 seeding requires a cover of mulch or an erosion control blanket until 75 percent grass cover is established.

Review all disturbed areas in late August to early September and complete all seeding by the end of September. Otherwise, vegetation will not establish itself enough to provide more than average protection.

Mulch is required at all times for seeding because it protects seeds from heat, moisture loss, and transport due to runoff. Mulch can be applied on top of the seed or simultaneously by hydroseeding. See [BMP C121: Mulching](#) for specifications.

Seed and mulch all disturbed areas not otherwise vegetated at final site stabilization. Final stabilization means the completion of all soil disturbing activities at the site and the establishment of a permanent vegetative cover, or equivalent permanent stabilization measures (such as pavement, riprap, gabions, or geotextiles) which will prevent erosion. See [BMP T5.13: Post-Construction Soil Quality and Depth](#).

## **Design and Installation Specifications**

### **General**

- Install channels intended for vegetation before starting major earthwork and hydroseed with a Bonded Fiber Matrix. For vegetated channels that will have high flows, install erosion control blankets over the top of hydroseed. Before allowing water to flow in vegetated channels, establish 75 percent vegetation cover. If vegetated channels cannot be established by seed

before water flow; install sod in the channel bottom — over top of hydromulch and erosion control blankets.

- Confirm the installation of all required surface water control measures to prevent seed from washing away.
- Hydroseed applications shall include a minimum of 1,500 pounds per acre of mulch with 3 percent tackifier. See [BMP C121: Mulching](#) for specifications.
- Areas that will have seeding only and not landscaping may need compost or meal-based mulch included in the hydroseed in order to establish vegetation. Re-install native topsoil on the disturbed soil surface before application. See [BMP T5.13: Post-Construction Soil Quality and Depth](#).
- When installing seed via hydroseeding operations, only about 1/3 of the seed actually ends up in contact with the soil surface. This reduces the ability to establish a good stand of grass quickly. To overcome this, consider increasing seed quantities by up to 50 percent.
- Enhance vegetation establishment by dividing the hydromulch operation into two phases:
  - Phase 1- Install all seed and fertilizer with 25-30 percent mulch and tackifier onto soil in the first lift.
  - Phase 2- Install the rest of the mulch and tackifier over the first lift.

Or, enhance vegetation by:

- Installing the mulch, seed, fertilizer, and tackifier in one lift.
- Spread or blow straw over the top of the hydromulch at a rate of 800-1000 pounds per acre.
- Hold straw in place with a standard tackifier.

Both of these approaches will increase cost moderately but will greatly improve and enhance vegetative establishment. The increased cost may be offset by the reduced need for:

- Irrigation.
- Reapplication of mulch.
- Repair of failed slope surfaces.

This technique works with standard hydromulch (1,500 pounds per acre minimum) and Bonded Fiber Matrix/ Mechanically Bonded Fiber Matrix (BFM/MBFMs) (3,000 pounds per acre minimum).

- Seed may be installed by hand if:
  - Temporary and covered by straw, mulch, or topsoil.
  - Permanent in small areas (usually less than 1 acre) and covered with mulch, topsoil, or erosion blankets.
- The seed mixes listed in [Table II-3.4: Temporary and Permanent Seed Mixes](#) include

recommended mixes for both temporary and permanent seeding.

- Apply these mixes, with the exception of the wet area seed mix, at a rate of 120 pounds per acre. This rate can be reduced if soil amendments or slow-release fertilizers are used. Apply the wet area seed mix at a rate of 60 pounds per acre.
- Consult the local suppliers or the local conservation district for their recommendations. The appropriate mix depends on a variety of factors, including location, exposure, soil type, slope, and expected foot traffic. Alternative seed mixes approved by the local authority may be used, depending on the soil type and hydrology of the area.

**Table II-3.4: Temporary and Permanent Seed Mixes**

Common Name	Latin Name	% Weight	% Purity	% Germination
<b>Temporary Erosion Control Seed Mix</b>				
A standard mix for areas requiring a temporary vegetative cover.				
Chewings or annual blue grass	<i>Festuca rubra</i> var. <i>commutata</i> or <i>Poa anna</i>	40	98	90
Perennial rye	<i>Lolium perenne</i>	50	98	90
Redtop or colonial bentgrass	<i>Agrostis alba</i> or <i>Agrostis tenuis</i>	5	92	85
White dutch clover	<i>Trifolium repens</i>	5	98	90
<b>Landscaping Seed Mix</b>				
A recommended mix for landscaping seed.				
Perennial rye blend	<i>Lolium perenne</i>	70	98	90
Chewings and red fescue blend	<i>Festuca rubra</i> var. <i>commutata</i> or <i>Festuca rubra</i>	30	98	90
<b>Low-Growing Turf Seed Mix</b>				
A turf seed mix for dry situations where there is no need for watering. This mix requires very little maintenance.				
Dwarf tall fescue (several varieties)	<i>Festuca arundinacea</i> var.	45	98	90
Dwarf perennial rye (Barclay)	<i>Lolium perenne</i> var. <i>barclay</i>	30	98	90
Red fescue	<i>Festuca rubra</i>	20	98	90
Colonial bentgrass	<i>Agrostis tenuis</i>	5	98	90
<b>Bioswale Seed Mix</b>				
A seed mix for bioswales and other intermittently wet areas.				
Tall or meadow fes-	<i>Festuca arundin-</i>	75-80	98	90

Table II-3.4: Temporary and Permanent Seed Mixes (continued)

Common Name	Latin Name	% Weight	% Purity	% Germination
cue	<i>acea</i> or <i>Festuca elatior</i>			
Seaside/Creeping bentgrass	<i>Agrostis palustris</i>	10-15	92	85
Redtop bentgrass	<i>Agrostis alba</i> or <i>Agrostis gigantea</i>	5-10	90	80
<b>Wet Area Seed Mix</b>				
A low-growing, relatively non-invasive seed mix appropriate for very wet areas that are not regulated wetlands. Consult Hydraulic Permit Authority (HPA) for seed mixes if applicable.				
Tall or meadow fescue	<i>Festuca arundinacea</i> or <i>Festuca elatior</i>	60-70	98	90
Seaside/Creeping bentgrass	<i>Agrostis palustris</i>	10-15	98	85
Meadow foxtail	<i>Alepocturus pratensis</i>	10-15	90	80
Alsike clover	<i>Trifolium hybridum</i>	1-6	98	90
Redtop bentgrass	<i>Agrostis alba</i>	1-6	92	85
<b>Meadow Seed Mix</b>				
A recommended meadow seed mix for infrequently maintained areas or non-maintained areas where colonization by native plants is desirable. Likely applications include rural road and utility right-of-way. Seeding should take place in September or very early October in order to obtain adequate establishment prior to the winter months. Consider the appropriateness of clover, a fairly invasive species, in the mix. Amending the soil can reduce the need for clover.				
Redtop or Oregon bentgrass	<i>Agrostis alba</i> or <i>Agrostis oregonensis</i>	20	92	85
Red fescue	<i>Festuca rubra</i>	70	98	90
White dutch clover	<i>Trifolium repens</i>	10	98	90

### **Roughening and Rototilling**

- The seedbed should be firm and rough. Roughen all soil no matter what the slope. Track walk slopes before seeding if engineering purposes require compaction. Backblading or smoothing of slopes greater than 4H:1V is not allowed if they are to be seeded.
- Restoration-based landscape practices require deeper incorporation than that provided by a simple single-pass rototilling treatment. Wherever practical, initially rip the subgrade to improve long-term permeability, infiltration, and water inflow qualities. At a minimum,

permanent areas shall use soil amendments to achieve organic matter and permeability performance defined in engineered soil/landscape systems. For systems that are deeper than 8 inches complete the rototilling process in multiple lifts, or prepare the engineered soil system per specifications and place to achieve the specified depth.

## **Fertilizers**

- Conducting soil tests to determine the exact type and quantity of fertilizer is recommended. This will prevent the over-application of fertilizer.
- Organic matter is the most appropriate form of fertilizer because it provides nutrients (including nitrogen, phosphorus, and potassium) in the least water-soluble form.
- In general, use 10-4-6 N-P-K (nitrogen-phosphorus-potassium) fertilizer at a rate of 90 pounds per acre. Always use slow-release fertilizers because they are more efficient and have fewer environmental impacts. Do not add fertilizer to the hydromulch machine, or agitate, more than 20 minutes before use. Too much agitation destroys the slow-release coating.
- There are numerous products available that take the place of chemical fertilizers. These include several with seaweed extracts that are beneficial to soil microbes and organisms. If 100 percent cottonseed meal is used as the mulch in hydroseed, chemical fertilizer may not be necessary. Cottonseed meal provides a good source of long-term, slow-release, available nitrogen.

## **Bonded Fiber Matrix and Mechanically Bonded Fiber Matrix**

- On steep slopes use Bonded Fiber Matrix (BFM) or Mechanically Bonded Fiber Matrix (MBFM) products. Apply BFM/MBFM products at a minimum rate of 3,000 pounds per acre with approximately 10 percent tackifier. Achieve a minimum of 95 percent soil coverage during application. Numerous products are available commercially. Most products require 24-36 hours to cure before rainfall and cannot be installed on wet or saturated soils. Generally, products come in 40-50 pound bags and include all necessary ingredients except for seed and fertilizer.
- Install products per manufacturer's instructions.
- BFM and MBFM provide good alternatives to blankets in most areas requiring vegetation establishment. Advantages over blankets include:
  - BFM and MBFM do not require surface preparation.
  - Helicopters can assist in installing BFM and MBFM in remote areas.
  - On slopes steeper than 2.5H:1V, blanket installers may require ropes and harnesses for safety.
  - Installing BFM and MBFM can save at least \$1,000 per acre compared to blankets.

## ***Maintenance Standards***

Reseed any seeded areas that fail to establish at least 75 percent cover (100 percent cover for areas that receive sheet or concentrated flows). If reseeding is ineffective, use an alternate method such as sodding, mulching, nets, or blankets.

- Reseed and protect by mulch any areas that experience erosion after achieving adequate cover. Reseed and protect by mulch any eroded area.
- Supply seeded areas with adequate moisture, but do not water to the extent that it causes run-off.

## ***Approved as Functionally Equivalent***

Ecology has approved products as able to meet the requirements of this BMP. The products did not pass through the Technology Assessment Protocol – Ecology (TAPE) process. Local jurisdictions may choose not to accept these products, or may require additional testing prior to consideration for local use. Products that Ecology has approved as functionally equivalent are available for review on Ecology's website at:

<https://ecology.wa.gov/Regulations-Permits/Guidance-technical-assistance/Stormwater-permittee-guidance-resources/Emerging-stormwater-treatment-technologies>

# BMP C140: Dust Control

## ***Purpose***

Dust control prevents wind transport of dust from disturbed soil surfaces onto roadways, drainage ways, and surface waters.

## ***Conditions of Use***

Use dust control in areas (including roadways) subject to surface and air movement of dust where on-site or off-site impacts to roadways, drainage ways, or surface waters are likely.

## ***Design and Installation Specifications***

- Vegetate or mulch areas that will not receive vehicle traffic. In areas where planting, mulching, or paving is impractical, apply gravel or landscaping rock.
- Limit dust generation by clearing only those areas where immediate activity will take place, leaving the remaining area(s) in the original condition. Maintain the original ground cover as long as practical.
- Construct natural or artificial windbreaks or windscreens. These may be designed as enclosures for small dust sources.
- Sprinkle the site with water until the surface is wet. Repeat as needed. To prevent carryout of mud onto the street, refer to [BMP C105: Stabilized Construction Access](#) and [BMP C106: Wheel Wash](#).
- Irrigation water can be used for dust control. Irrigation systems should be installed as a first step on sites where dust control is a concern.
- Spray exposed soil areas with a dust palliative, following the manufacturer's instructions and cautions regarding handling and application. Used oil is prohibited from use as a dust suppressant. Local governments may approve other dust palliativess such as calcium chloride or PAM.
- PAM ([BMP C126: Polyacrylamide \(PAM\) for Soil Erosion Protection](#)) added to water at a rate of 0.5 pounds per 1,000 gallons of water per acre and applied from a water truck is more effective than water alone. This is due to increased infiltration of water into the soil and reduced evaporation. In addition, small soil particles are bonded together and are not as easily transported by wind. Adding PAM may reduce the quantity of water needed for dust control. Note that the application rate specified here applies to this BMP, and is not the same application rate that is specified in [BMP C126: Polyacrylamide \(PAM\) for Soil Erosion Protection](#), but the downstream protections still apply.  
Refer to [BMP C126: Polyacrylamide \(PAM\) for Soil Erosion Protection](#) for conditions of use. PAM shall not be directly applied to water or allowed to enter a water body.
- Contact your local Air Pollution Control Authority for guidance and training on other dust control measures. Compliance with the local Air Pollution Control Authority constitutes

compliance with this BMP.

- | Use vacuum street sweepers.
- | Remove mud and other dirt promptly so it does not dry and then turn into dust.
- | Techniques that can be used for unpaved roads and lots include:
  - o Lower speed limits. High vehicle speed increases the amount of dust stirred up from unpaved roads and lots.
  - o Upgrade the road surface strength by improving particle size, shape, and mineral types that make up the surface and base materials.
  - o Add surface gravel to reduce the source of dust emission. Limit the amount of fine particles (those smaller than .075 mm) to 10 to 20 percent.
  - o Use geotextile fabrics to increase the strength of new roads or roads undergoing reconstruction.
  - o Encourage the use of alternate, paved routes, if available.
  - o Apply chemical dust suppressants using the admix method, blending the product with the top few inches of surface material. Suppressants may also be applied as surface treatments.
  - o Limit dust-causing work on windy days.
  - o Pave unpaved permanent roads and other trafficked areas.

## ***Maintenance Standards***

Respray area as necessary to keep dust to a minimum.

## BMP C150: Materials on Hand

### ***Purpose***

Keep quantities of erosion prevention and sediment control materials on the project site at all times to be used for regular maintenance and emergency situations such as unexpected heavy rains. Having these materials on-site reduces the time needed to replace existing or implement new BMPs when inspections indicate that existing BMPs are not meeting the Construction SWPPP requirements. In addition, contractors can save money by buying some materials in bulk and storing them at their office or yard.

### ***Conditions of Use***

- Construction projects of any size or type can benefit from having materials on hand. A small commercial development project could have a roll of plastic and some gravel available for immediate protection of bare soil and temporary berm construction. A large earthwork project, such as highway construction, might have several tons of straw, several rolls of plastic, flexible pipe, sandbags, geotextile fabric and steel "T" posts.
- Materials should be stockpiled and readily available before any site clearing, grubbing, or earthwork begins. A large contractor or project proponent could keep a stockpile of materials that are available for use on several projects.
- If storage space at the project site is at a premium, the contractor could maintain the materials at their office or yard. The office or yard must be less than an hour from the project site.

### ***Design and Installation Specifications***

Depending on project type, size, complexity, and length, materials and quantities will vary. A good minimum list of items that will cover numerous situations includes:

- Clear Plastic, 6 mil
- Drainpipe, 6 or 8 inch diameter
- Sandbags, filled
- Straw Bales for mulching
- Quarry Spalls
- Washed Gravel
- Geotextile Fabric
- Catch Basin Inserts
- Steel "T" Posts
- Silt fence material
- Straw Wattles

## ***Maintenance Standards***

- | All materials with the exception of the quarry spalls, steel "T" posts, and gravel should be kept covered and out of both sun and rain.
- | Re-stock materials as needed.

## BMP C209: Outlet Protection

### ***Purpose***

Outlet protection prevents scour at conveyance outlets and minimizes the potential for downstream erosion by reducing the velocity of concentrated stormwater flows.

### ***Conditions of Use***

Use outlet protection at the outlets of all ponds, pipes, ditches, or other conveyances that discharge to a natural or manmade drainage feature such as a stream, wetland, lake, or ditch.

### ***Design and Installation Specifications***

The receiving channel at the outlet of a pipe shall be protected from erosion by lining a minimum of 6 feet downstream and extending up the channel sides a minimum of 1 foot above the maximum tailwater elevation, or 1-foot above the crown, whichever is higher.

For pipes larger than 18 inches in diameter, the outlet protection lining of the channel shall be four times the diameter of the outlet pipe.

- Standard wingwalls, tapered outlets, and paved channels should also be considered when appropriate for permanent culvert outlet protection ([WSDOT, 2015](#)).
- [BMP C122: Nets and Blankets](#) or [BMP C202: Riprap Channel Lining](#) provide suitable options for lining materials.
- With low flows, [BMP C201: Grass-Lined Channels](#) can be an effective alternative for lining material.

The following guidelines shall be used for outlet protection with riprap:

- If the discharge velocity at the outlet is less than 5 fps, use 2-inch to 8-inch riprap. Minimum thickness is 1-foot.
- For 5 to 10 fps discharge velocity at the outlet, use 24-inch to 48-inch riprap. Minimum thickness is 2 feet.
- For outlets at the base of steep slope pipes (pipe slope greater than 10 percent), use an engineered energy dissipator.
- Filter fabric or erosion control blankets should always be used under riprap to prevent scour and channel erosion. See [BMP C122: Nets and Blankets](#).

I Bank stabilization, bioengineering, and habitat features may be required for disturbed areas.

This work may require a Hydraulic Project Approval (HPA) from the Washington State Department of Fish and Wildlife. See [I-2.11 Hydraulic Project Approvals](#).

### ***Maintenance Standards***

- Inspect and repair as needed.
- Add rock as needed to maintain the intended function.
- Clean energy dissipator if sediment builds up.

## **BMP C220: Inlet Protection**

### ***Purpose***

Inlet protection prevents coarse sediment from entering drainage systems prior to permanent stabilization of the disturbed area.

### ***Conditions of Use***

Use inlet protection at inlets that are operational before permanent stabilization of the disturbed areas that contribute runoff to the inlet. Provide protection for all storm drain inlets downslope and within 500 feet of a disturbed or construction area, unless those inlets are preceded by a sediment trapping BMP.

Also consider inlet protection for lawn and yard drains on new home construction. These small and numerous drains coupled with lack of gutters can add significant amounts of sediment into the roof drain system. If possible, delay installing lawn and yard drains until just before landscaping or cap these drains to prevent sediment from entering the system until completion of landscaping. Provide 18-inches of sod around each finished lawn and yard drain.

[Table II-3.10: Storm Drain Inlet Protection](#) lists several options for inlet protection. All of the methods for inlet protection tend to plug and require a high frequency of maintenance. Limit contributing drain- age areas for an individual inlet to one acre or less. If possible, provide emergency overflows with additional end-of-pipe treatment where stormwater ponding would cause a hazard.

Table II-3.10: Storm Drain Inlet Protection

Type of Inlet Protection	Emergency Overflow	Applicable for Paved/ Earthen Sur-faces	Conditions of Use
<b>Drop Inlet Protection</b>			
Excavated drop inlet protection	Yes, temporary flooding may	Earthen	Applicable for heavy flows. Easy to maintain. Large area requirement: 30'x30'/acre
Block and gravel drop inlet pro-	Yes	Paved or Earthen	Applicable for heavy concentrated flows. Will not pond.
Gravel and wire drop inlet pro-	No	Paved or Earthen	Applicable for heavy concentrated flows. Will pond. Can withstand
Catch basin	Yes	Paved or Earthen	Frequent maintenance required.
<b>Curb Inlet Protection</b>			
Curb inlet pro-tection with	Small capacity overflow	Paved	Used for sturdy, more compact install- ation.
Block and gravel curb inlet pro-	Yes	Paved	Sturdy, but limited filtration.
<b>Culvert Inlet Protection</b>			
Culvert inlet sed- iment trap	N/A	N/A	18 month expected life.

### ***Design and Installation Specifications***

#### **Excavated Drop Inlet Protection**

Excavated drop inlet protection consists of an excavated impoundment around the storm drain inlet. Sediment settles out of the stormwater prior to entering the storm drain. Design and installation specifications for excavated drop inlet protection include:

- Provide a depth of 1-2 ft as measured from the crest of the inlet structure.
- Slope sides of excavation should be no steeper than 2H:1V.
- Minimum volume of excavation is 35 cubic yards.
- Shape the excavation to fit the site, with the longest dimension oriented toward the longest inflow area.
- Install provisions for draining to prevent standing water.
- Clear the area of all debris.

- Grade the approach to the inlet uniformly.
- Drill weep holes into the side of the inlet.
- Protect weep holes with screen wire and washed aggregate.
- Seal weep holes when removing structure and stabilizing area.
- Build a temporary dike, if necessary, to the down slope side of the structure to prevent bypass flow.

### Block and Gravel Filter

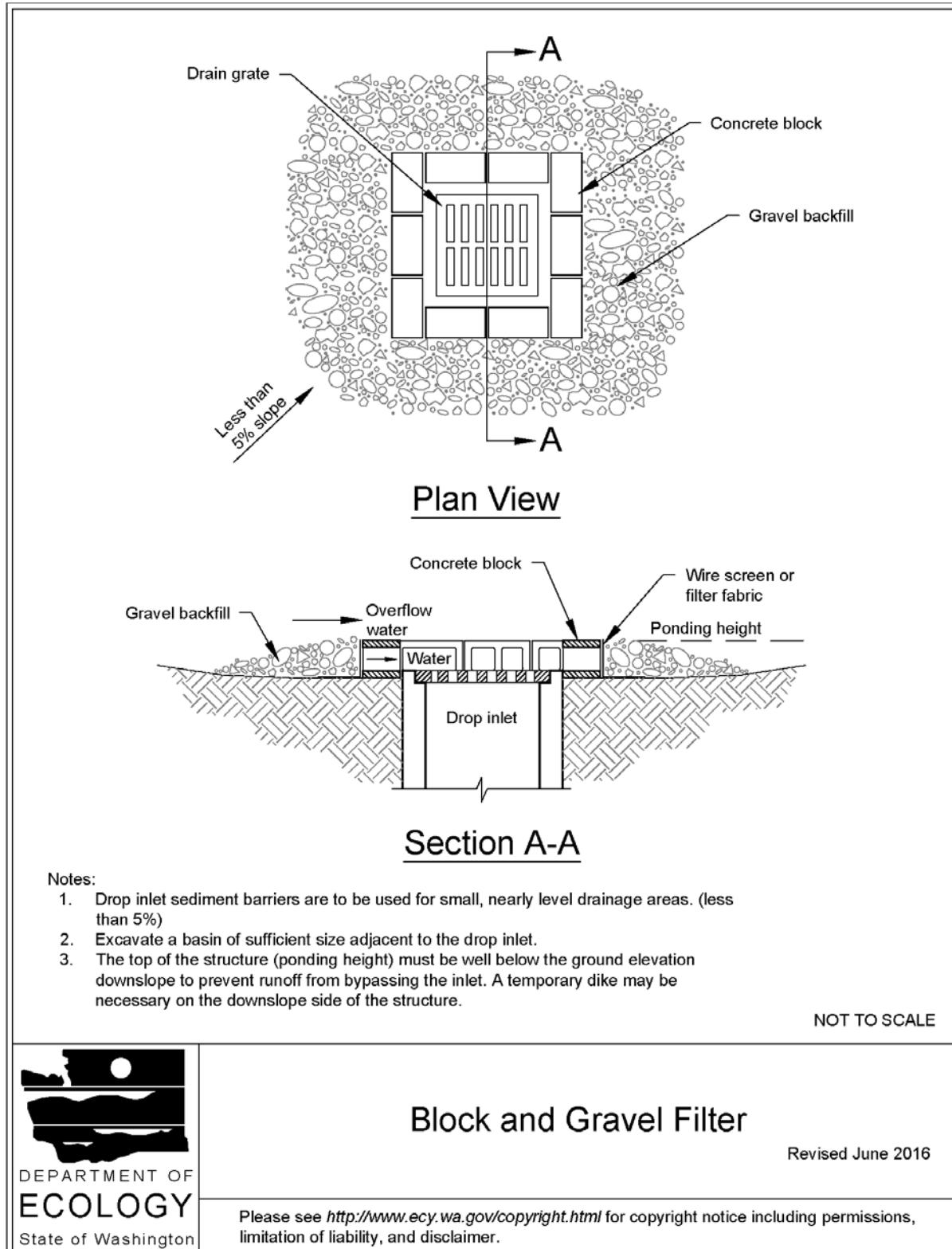
A block and gravel filter is a barrier formed around the inlet with standard concrete blocks and gravel. See [Figure II-3.17: Block and Gravel Filter](#). Design and installation specifications for block gravel filters include:

- Provide a height of 1 to 2 feet above the inlet.
- Recess the first row of blocks 2-inches into the ground for stability.
- Support subsequent courses by placing a pressure treated wood 2x4 through the block opening.
- Do not use mortar.
- Lay some blocks in the bottom row on their side to allow for dewatering the pool.
- Place hardware cloth or comparable wire mesh with  $\frac{1}{2}$ -inch openings over all block openings.
- Place gravel to just below the top of blocks on slopes of 2H:1V or flatter.

An alternative design is a gravel berm surrounding the inlet, as follows:

- Provide a slope of 3H:1V on the upstream side of the berm.
- Provide a slope of 2H:1V on the downstream side of the berm.
- Provide a 1-foot wide level stone area between the gravel berm and the inlet.
- Use stones 3 inches in diameter or larger on the upstream slope of the berm.
- Use gravel  $\frac{1}{2}$ - to  $\frac{3}{4}$ -inch at a minimum thickness of 1-foot on the downstream slope of the berm.

Figure II-3.17: Block and Gravel Filter



### Gravel and Wire Mesh Filter

Gravel and wire mesh filters are gravel barriers placed over the top of the inlet. This method does not provide an overflow. Design and installation specifications for gravel and wire mesh filters include:

- Use a hardware cloth or comparable wire mesh with  $\frac{1}{2}$ -inch openings.
  - Place wire mesh over the drop inlet so that the wire extends a minimum of 1-foot beyond each side of the inlet structure.
  - Overlap the strips if more than one strip of mesh is necessary.
- Place coarse aggregate over the wire mesh.
  - Provide at least a 12-inch depth of aggregate over the entire inlet opening and extend at least 18-inches on all sides.

### Catch Basin Filters

Catch basin filters are designed by manufacturers for construction sites. The limited sediment storage capacity increases the amount of inspection and maintenance required, which may be daily for heavy sediment loads. To reduce maintenance requirements, combine a catch basin filter with another type of inlet protection. This type of inlet protection provides flow bypass without overflow and therefore may be a better method for inlets located along active rights-of-way. Design and installation specifications for catch basin filters include:

- Provides 5 cubic feet of storage.
- Requires dewatering provisions.
- Provides a high-flow bypass that will not clog under normal use at a construction site.
- Insert the catch basin filter in the catch basin just below the grating.

### Curb Inlet Protection with Wooden Weir

Curb inlet protection with wooden weir is an option that consists of a barrier formed around a curb inlet with a wooden frame and gravel. Design and installation specifications for curb inlet protection with wooden weirs include:

- Use wire mesh with  $\frac{1}{2}$ -inch openings.
- Use extra strength filter cloth.
- Construct a frame.
- Attach the wire and filter fabric to the frame.

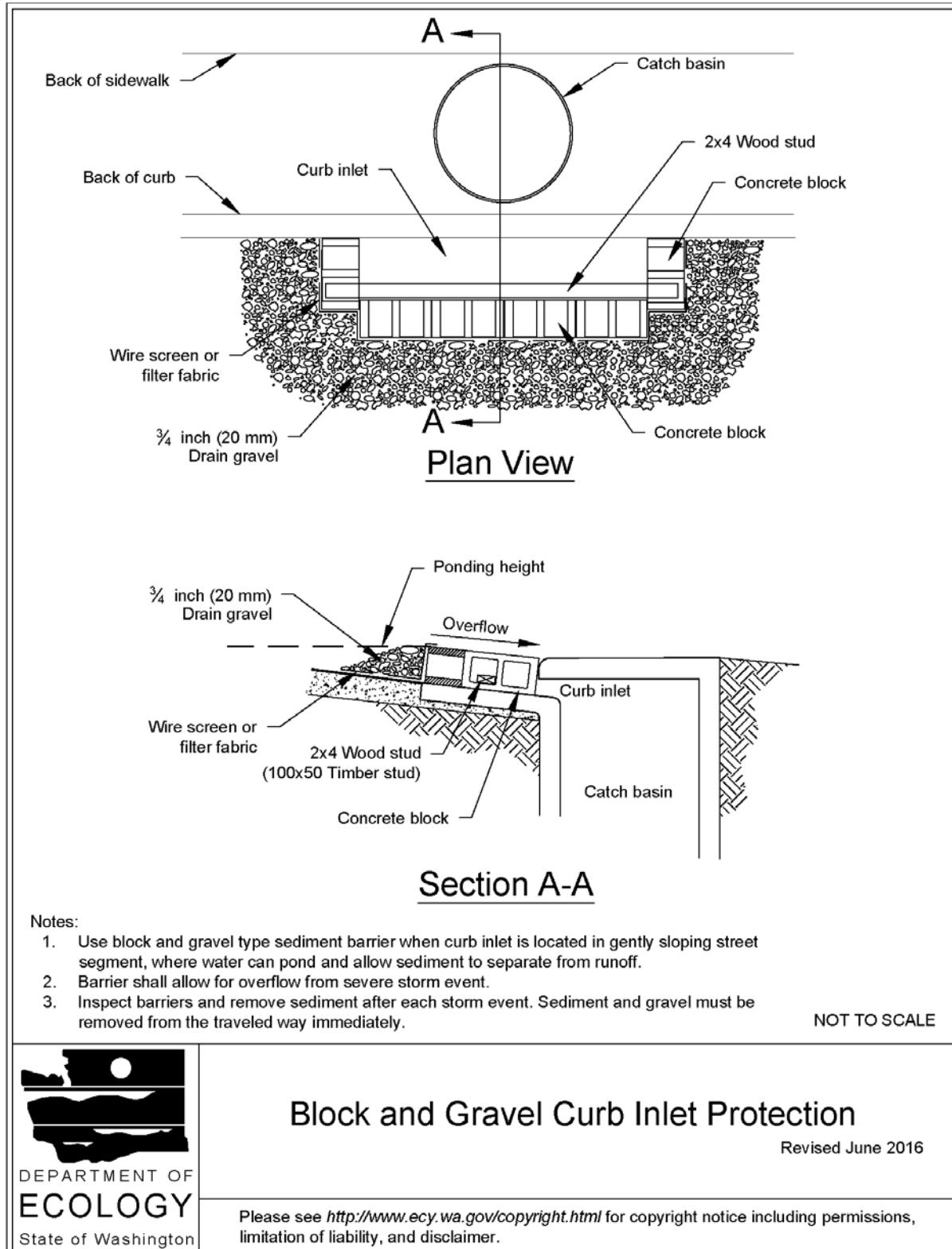
- Pile coarse washed aggregate against the wire and fabric.
- Place weight on the frame anchors.

#### Block and Gravel Curb Inlet Protection

Block and gravel curb inlet protection is a barrier formed around a curb inlet with concrete blocks and gravel. See [Figure II-3.18: Block and Gravel Curb Inlet Protection](#). Design and installation specifications for block and gravel curb inlet protection include:

- | Use wire mesh with  $\frac{1}{2}$ -inch openings.
- | Place two concrete blocks on their sides abutting the curb at either side of the inlet opening.  
These are spacer blocks.
- | Place a 2x4 stud through the outer holes of each spacer block to align the front blocks.
- | Place blocks on their sides across the front of the inlet and abutting the spacer blocks.
- | Place wire mesh over the outside vertical face.
- | Pile coarse aggregate against the wire to the top of the barrier.

Figure II-3.18: Block and Gravel Curb Inlet Protection

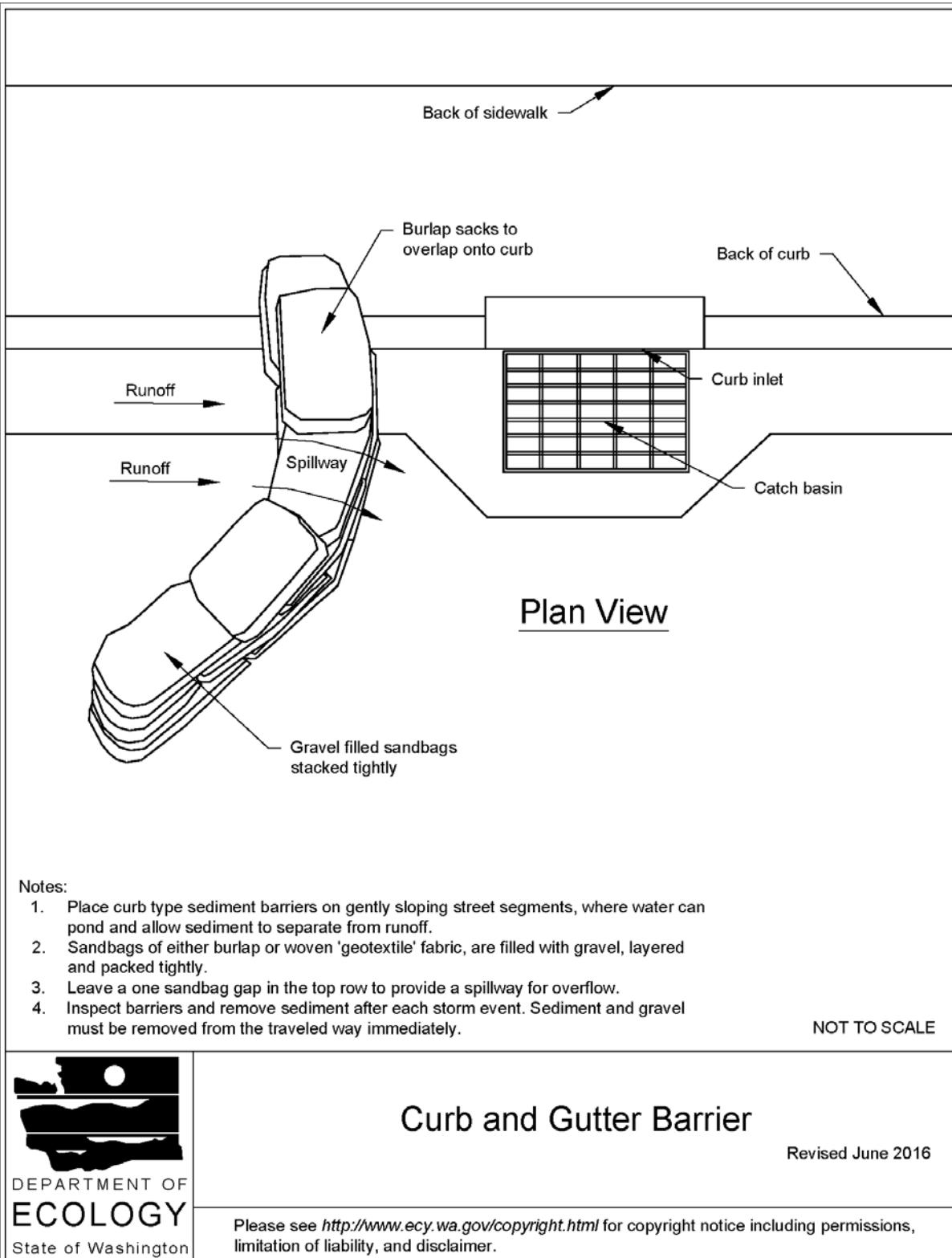


### Curb and Gutter Sediment Barrier

Curb and gutter sediment barrier is a sandbag or rock berm (riprap and aggregate) 3 feet high and 3 feet wide in a horseshoe shape. See [Figure II-3.19: Curb and Gutter Barrier](#). Design and installation specifications for curb and gutter sediment barrier include:

- I Construct a horseshoe shaped berm, faced with coarse aggregate if using riprap, 3 feet high and 3 feet wide, at least 2 feet from the inlet.
- I Construct a horseshoe shaped sedimentation trap on the upstream side of the berm. Size the trap to sediment trap standards for protecting a culvert inlet.

Figure II-3.19: Curb and Gutter Barrier



## ***Maintenance Standards***

- Inspect all forms of inlet protection frequently, especially after storm events. Clean and replace clogged catch basin filters. For rock and gravel filters, pull away the rocks from the inlet and clean or replace. An alternative approach would be to use the clogged rock as fill and put fresh rock around the inlet.
- Do not wash sediment into storm drains while cleaning. Spread all excavated material evenly over the surrounding land area or stockpile and stabilize as appropriate.

## ***Approved as Functionally Equivalent***

Ecology has approved products as able to meet the requirements of this BMP. The products did not pass through the Technology Assessment Protocol – Ecology (TAPE) process. Local jurisdictions may choose not to accept these products, or may require additional testing prior to consideration for local use. Products that Ecology has approved as functionally equivalent are available for review on Ecology's website at:

<https://ecology.wa.gov/Regulations-Permits/Guidance-technical-assistance/Stormwater-permittee-guidance-resources/Emerging-stormwater-treatment-technologies>

## BMP C233: Silt Fence

### ***Purpose***

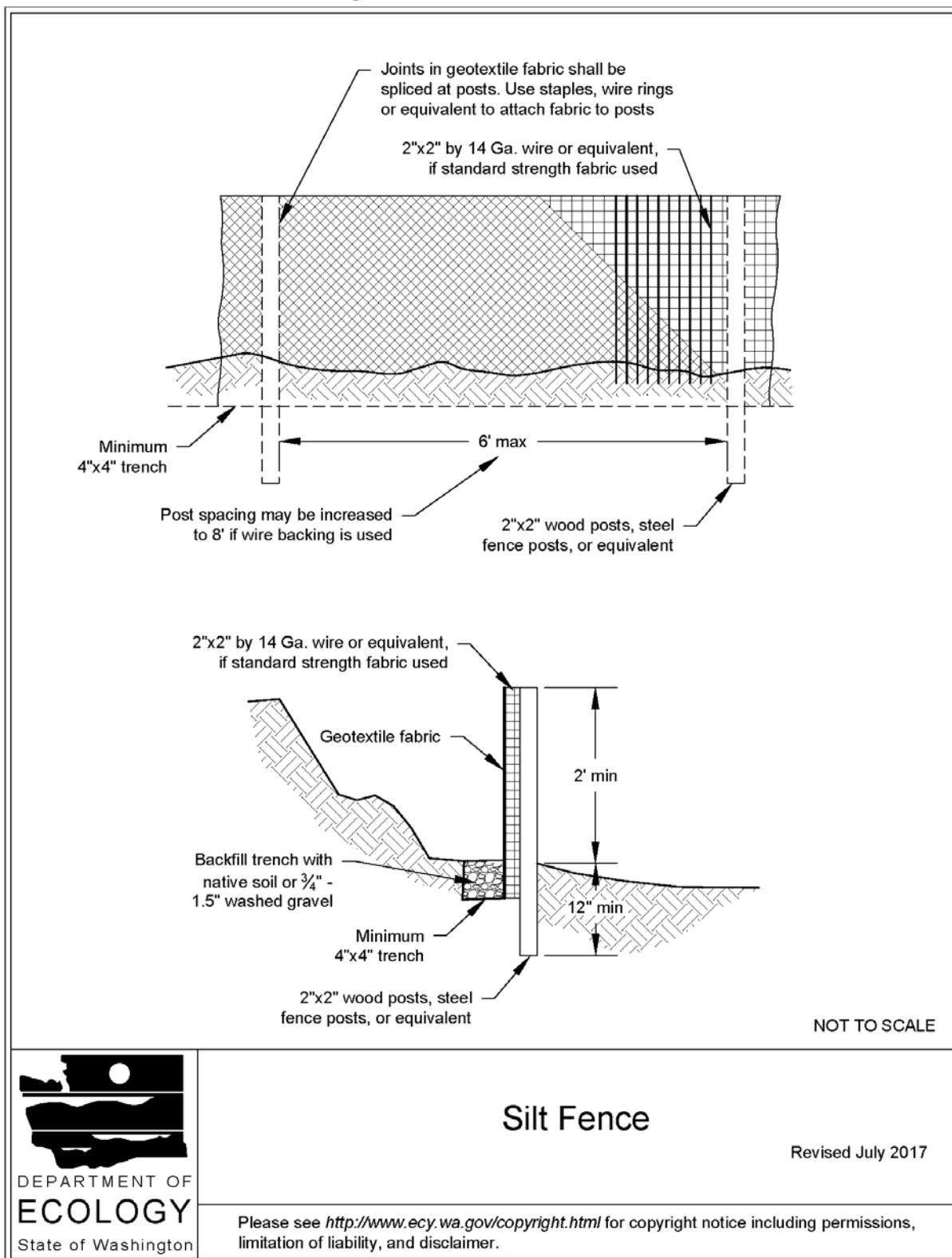
Silt fence reduces the transport of coarse sediment from a construction site by providing a temporary physical barrier to sediment and reducing the runoff velocities of overland flow.

### ***Conditions of Use***

Silt fence may be used downslope of all disturbed areas.

- Silt fence shall prevent sediment carried by runoff from going beneath, through, or over the top of the silt fence, but shall allow the water to pass through the fence.
- Silt fence is not intended to treat concentrated flows, nor is it intended to treat substantial amounts of overland flow. Convey any concentrated flows through the drainage system to a sediment trapping BMP.
- Do not construct silt fences in streams or use in V-shaped ditches. Silt fences do not provide an adequate method of silt control for anything deeper than sheet or overland flow.

Figure II-3.22: Silt Fence



## Design and Installation Specifications

- Use in combination with other construction stormwater BMPs.
- Maximum slope steepness (perpendicular to the silt fence line) 1H:1V.
- Maximum sheet or overland flow path length to the silt fence of 100 feet.
- Do not allow flows greater than 0.5 cfs.
- Use geotextile fabric that meets the following standards. All geotextile properties listed below are minimum average roll values (i.e., the test result for any sampled roll in a lot shall meet or exceed the values shown in [Table II-3.11: Geotextile Fabric Standards for Silt Fence](#)):

**Table II-3.11: Geotextile Fabric Standards for Silt Fence**

Geotextile Property	Minimum Average Roll Value
Polymeric Mesh AOS (ASTM D4751)	0.60 mm maximum for slit film woven (#30 sieve). 0.30 mm maximum for all other geotextile types (#50 sieve). 0.15 mm minimum for all fabric types (#100 sieve).
Water Permittivity (ASTM D4491)	0.02 sec <sup>-1</sup> minimum
Grab Tensile Strength (ASTM D4632)	180 lbs. Minimum for extra strength fabric. 100 lbs minimum for standard strength fabric.
Grab Tensile Strength (ASTM D4632)	30% maximum
Ultraviolet Resistance (ASTM D4355)	70% minimum

- Support standard strength geotextiles with wire mesh, chicken wire, 2-inch x 2-inch wire, safety fence, or jute mesh to increase the strength of the geotextile. Silt fence materials are available that have synthetic mesh backing attached.
- Silt fence material shall contain ultraviolet ray inhibitors and stabilizers to provide a minimum of six months of expected usable construction life at a temperature range of 0°F to 120°F.
- One-hundred percent biodegradable silt fence is available that is strong, long lasting, and can be left in place after the project is completed, if permitted by the local jurisdiction.
- Refer to [Figure II-3.22: Silt Fence](#) for standard silt fence details. Include the following Standard Notes for silt fence on construction plans and specifications:
  - The Contractor shall install and maintain temporary silt fences at the locations shown in the Plans.
  - Construct silt fences in areas of clearing, grading, or drainage prior to starting those activities.

3. The silt fence shall have a 2-feet min. and a 2½-feet max. height above the original ground surface.
4. The geotextile fabric shall be sewn together at the point of manufacture to form fabric lengths as required. Locate all sewn seams at support posts. Alternatively, two sections of silt fence can be overlapped, provided that the overlap is long enough and that the adjacent silt fence sections are close enough together to prevent silt laden water from escaping through the fence at the overlap.
5. Attach the geotextile fabric on the up-slope side of the posts and secure with staples, wire, or in accordance with the manufacturer's recommendations. Attach the geotextile fabric to the posts in a manner that reduces the potential for tearing.
6. Support the geotextile fabric with wire or plastic mesh, dependent on the properties of the geotextile selected for use. If wire or plastic mesh is used, fasten the mesh securely to the up-slope side of the posts with the geotextile fabric up-slope of the mesh.
7. Mesh support, if used, shall consist of steel wire with a maximum mesh spacing of 2-inches, or a prefabricated polymeric mesh. The strength of the wire or polymeric mesh shall be equivalent to or greater than 180 lbs. grab tensile strength. The polymeric mesh must be as resistant to the same level of ultraviolet radiation as the geotextile fabric it supports.
8. Bury the bottom of the geotextile fabric 4-inches min. below the ground surface. Backfill and tamp soil in place over the buried portion of the geotextile fabric, so that no flow can pass beneath the silt fence and scouring cannot occur. When wire or polymeric back-up support mesh is used, the wire or polymeric mesh shall extend into the ground 3-inches min.
9. Drive or place the silt fence posts into the ground 18-inches min. A 12-inch min. depth is allowed if topsoil or other soft subgrade soil is not present and 18-inches cannot be reached. Increase fence post min. depths by 6 inches if the fence is located on slopes of 3H:1V or steeper and the slope is perpendicular to the fence. If required post depths cannot be obtained, the posts shall be adequately secured by bracing or guying to prevent overturning of the fence due to sediment loading.
10. Use wood, steel or equivalent posts. The spacing of the support posts shall be a maximum of 6-feet. Posts shall consist of either:
  - Wood with minimum dimensions of 2 inches by 2 inches by 3 feet. Wood shall be free of defects such as knots, splits, or gouges.
  - No. 6 steel rebar or larger.
  - ASTM A 120 steel pipe with a minimum diameter of 1-inch.
  - U, T, L, or C shape steel posts with a minimum weight of 1.35 lbs./ft.
  - Other steel posts having equivalent strength and bending resistance to the post sizes listed above.
11. Locate silt fences on contour as much as possible, except at the ends of the fence,

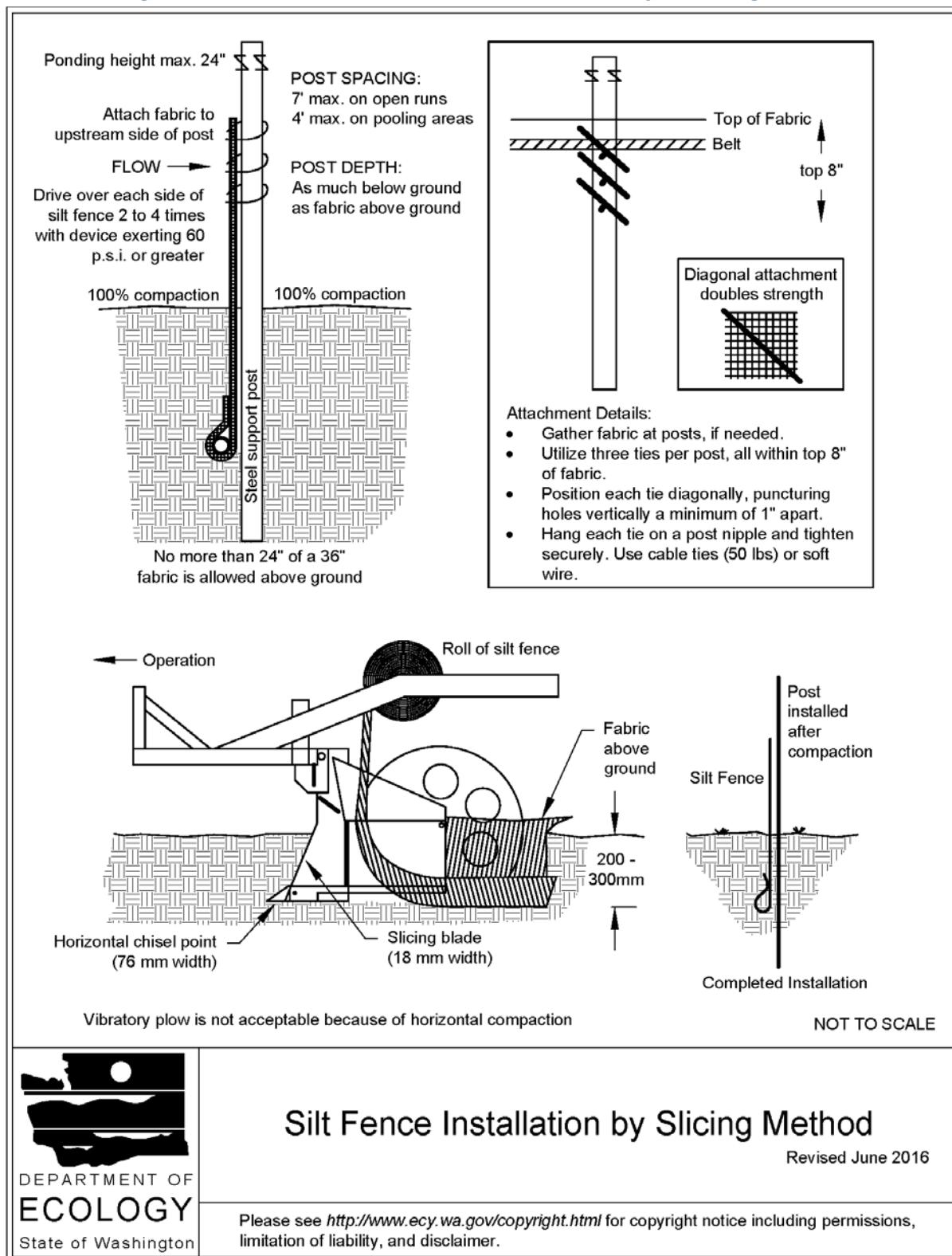
where the fence shall be turned uphill such that the silt fence captures the runoff water and prevents water from flowing around the end of the fence.

12. If the fence must cross contours, with the exception of the ends of the fence, place check dams perpendicular to the back of the fence to minimize concentrated flow and erosion. The slope of the fence line where contours must be crossed shall not be steeper than 3H:1V.
  - Check dams shall be approximately 1-foot deep at the back of the fence. Check dams shall be continued perpendicular to the fence at the same elevation until the top of the check dam intercepts the ground surface behind the fence.
  - Check dams shall consist of crushed surfacing base course, gravel backfill for walls, or shoulder ballast. Check dams shall be located every 10 feet along the fence where the fence must cross contours.

▪ Refer to [Figure II-3.23: Silt Fence Installation by Slicing Method](#) for slicing method details. The following are specifications for silt fence installation using the slicing method:

1. The base of both end posts must be at least 2- to 4-inches above the top of the geotextile fabric on the middle posts for ditch checks to drain properly. Use a hand level or string level, if necessary, to mark base points before installation.
2. Install posts 3- to 4-feet apart in critical retention areas and 6- to 7-feet apart in standard applications.
3. Install posts 24-inches deep on the downstream side of the silt fence, and as close as possible to the geotextile fabric, enabling posts to support the geotextile fabric from upstream water pressure.
4. Install posts with the nipples facing away from the geotextile fabric.
5. Attach the geotextile fabric to each post with three ties, all spaced within the top 8-inches of the fabric. Attach each tie diagonally 45 degrees through the fabric, with each puncture at least 1-inch vertically apart. Each tie should be positioned to hang on a post nipple when tightening to prevent sagging.
6. Wrap approximately 6-inches of the geotextile fabric around the end posts and secure with 3 ties.
7. No more than 24-inches of a 36-inch geotextile fabric is allowed above ground level.
8. Compact the soil immediately next to the geotextile fabric with the front wheel of the tractor, skid steer, or roller exerting at least 60 pounds per square inch. Compact the upstream side first and then each side twice for a total of four trips. Check and correct the silt fence installation for any deviation before compaction. Use a flat-bladed shovel to tuck the fabric deeper into the ground if necessary.

Figure II-3.23: Silt Fence Installation by Slicing Method



## ***Maintenance Standards***

- Repair any damage immediately.
- Intercept and convey all evident concentrated flows uphill of the silt fence to a sediment trapping BMP.
- Check the uphill side of the silt fence for signs of the fence clogging and acting as a barrier to flow and then causing channelization of flows parallel to the fence. If this occurs, replace the fence and remove the trapped sediment.
- Remove sediment deposits when the deposit reaches approximately one-third the height of the silt fence, or install a second silt fence.
- Replace geotextile fabric that has deteriorated due to ultraviolet breakdown.

# BMP C235: Wattles

## **Purpose**

Wattles are temporary erosion and sediment control barriers consisting of straw, compost, or other material that is wrapped in netting made of natural plant fiber or similar encasing material. They reduce the velocity and can spread the flow of rill and sheet runoff, and can capture and retain sediment.

## **Conditions of Use**

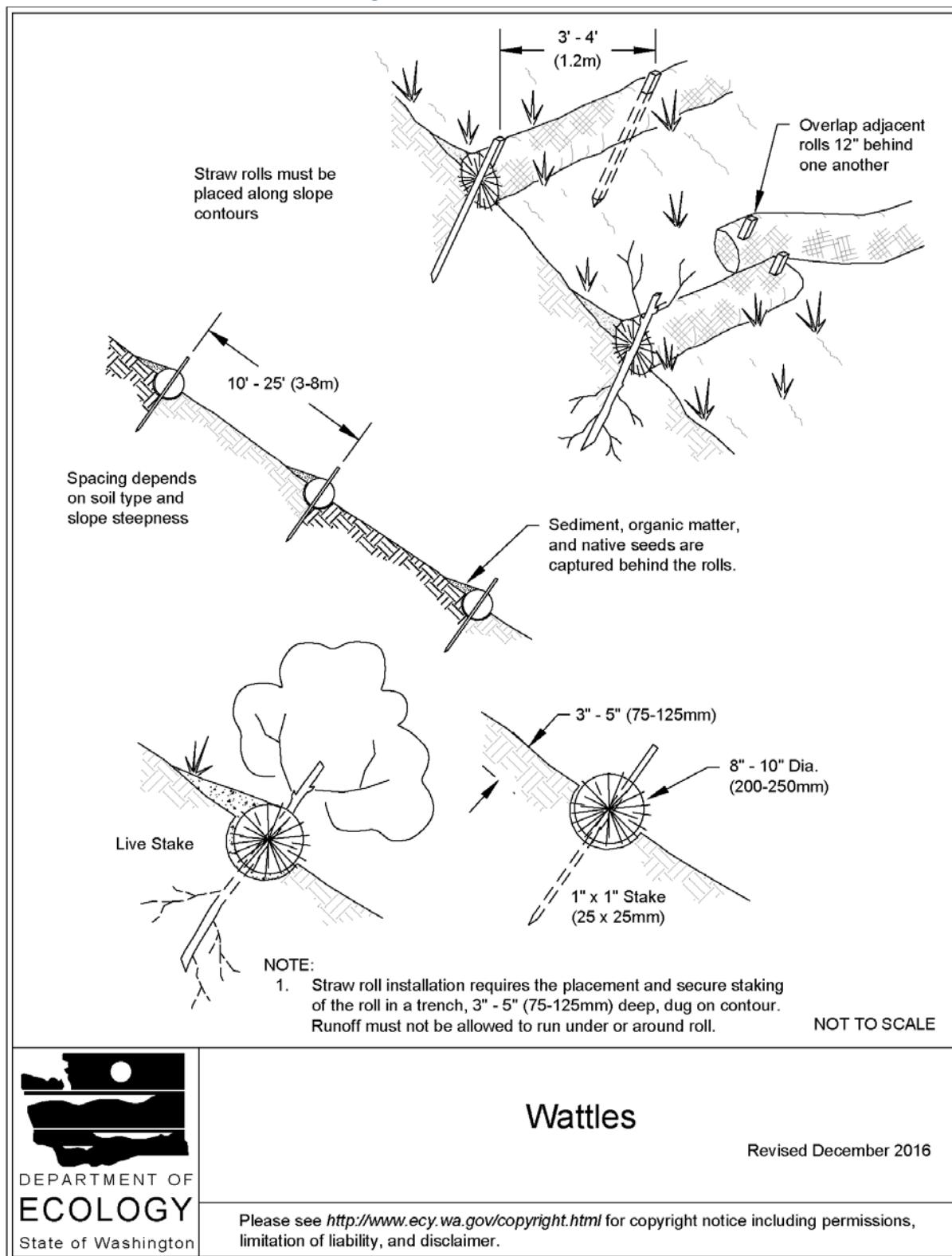
- Wattles shall consist of cylinders of plant material such as weed-free straw, coir, wood chips, excelsior, or wood fiber or shavings encased within netting made of natural plant fibers unaltered by synthetic materials.
- Use wattles:
  - In disturbed areas that require immediate erosion protection.
  - On exposed soils during the period of short construction delays, or over winter months.
  - On slopes requiring stabilization until permanent vegetation can be established.
- The material used dictates the effectiveness period of the wattle. Generally, wattles are effective for one to two seasons.
- Prevent rilling beneath wattles by entrenching and overlapping wattles to prevent water from passing between them.

## **Design Criteria**

- See [Figure II-3.24: Wattles](#) for typical construction details.
- Wattles are typically 8 to 10 inches in diameter and 25 to 30 feet in length.
- Install wattles perpendicular to the flow direction and parallel to the slope contour.
- Place wattles in shallow trenches, staked along the contour of disturbed or newly constructed slopes. Dig narrow trenches across the slope (on contour) to a depth of 3-to-5-inches on clay soils and soils with gradual slopes. On loose soils, steep slopes, and areas with high rainfall, the trenches should be dug to a depth of 5- to 7- inches, or 1/2 to 2/3 of the thickness of the wattle.
- Start building trenches and installing wattles from the base of the slope and work up. Spread excavated material evenly along the uphill slope and compact it using hand tamping or other methods.
- Construct trenches at intervals of 10- to 25-feet depending on the steepness of the slope, soil type, and rainfall. The steeper the slope the closer together the trenches.
- Install the wattles snugly into the trenches and overlap the ends of adjacent wattles 12 inches behind one another.
- Install stakes at each end of the wattle, and at 4-foot centers along entire length of wattle.

- | If required, install pilot holes for the stakes using a straight bar to drive holes through the wattle and into the soil.
- | Wooden stakes should be approximately 0.75x0.75x24 inches min. Willow cuttings or 3/8-inch rebar can also be used for stakes.
- | Stakes should be driven through the middle of the wattle, leaving 2 to 3 inches of the stake protruding above the wattle.

Figure II-3.24: Wattles



## ***Maintenance Standards***

- Wattles may require maintenance to ensure they are in contact with soil and thoroughly entrenched, especially after significant rainfall on steep sandy soils.
- Inspect the slope after significant storms and repair any areas where wattles are not tightly abutted or water has scoured beneath the wattles.

## ***Approved as Functionally Equivalent***

Ecology has approved products as able to meet the requirements of this BMP. The products did not pass through the Technology Assessment Protocol – Ecology (TAPE) process. Local jurisdictions may choose not to accept these products, or may require additional testing prior to consideration for local use. Products that Ecology has approved as functionally equivalent are available for review on Ecology's website at:

<https://ecology.wa.gov/Regulations-Permits/Guidance-technical-assistance/Stormwater-permittee-guidance-resources/Emerging-stormwater-treatment-technologies>

# S411 BMPs for Landscaping and Lawn / Vegetation Management

**Description of Pollutant Sources:** Landscaping can include grading, soil transfer, vegetation planting, and vegetation removal. Examples include weed control on golf course lawns, access roads, and utility corridors and during landscaping; and residential lawn/plant care. Proper management of vegetation can minimize excess nutrients and pesticides.

**Pollutant Control Approach:** Maintain appropriate vegetation to control erosion and the discharge of stormwater pollutants. Prevent debris contamination of stormwater. Where practicable, grow plant species appropriate for the site, or adjust the soil properties of the site to grow desired plant species.

## Applicable BMPs:

- Install engineered soil/landscape systems to improve the infiltration and regulation of stormwater in landscaped areas.
- Select the right plants for the planting location based on proposed use, available maintenance, soil conditions, sun exposure, water availability, height, sight factors, and space available.
- Ensure that plants selected for planting are not on the noxious weed list. For example, butterfly bush often gets planted as an ornamental but is actually on the noxious weed list.

The Washington State Noxious Weed List can be found at the following webpage:

<https://www.nwcb.wa.gov/printable-noxious-weed-list>

- Do not dispose of collected vegetation into waterways or storm sewer systems.
- Do not blow vegetation or other debris into the drainage system.
- Dispose of collected vegetation such as grass clippings, leaves, sticks by composting or recycling.
- Remove, bag, and dispose of class A & B noxious weeds in the garbage immediately.
- Do not compost noxious weeds as it may lead to spreading through seed or fragment if the composting process is not hot enough.
- Use manual and/or mechanical methods of vegetation removal (pincer-type weeding tools, flame weeders, or hot water weeders as appropriate) rather than applying herbicides, where practical.
- Use at least an eight-inch "topsoil" layer with at least 8 percent organic matter to provide a sufficient vegetation-growing medium.
  - Organic matter is the least water-soluble form of nutrients that can be added to the soil. Composted organic matter generally releases only between 2 and 10 percent of its total nitrogen annually, and this release corresponds closely to the plant growth cycle. Return natural plant debris and mulch to the soil, to continue recycling nutrients indefinitely.

- Select the appropriate turfgrass mixture for the climate and soil type.
  - Certain tall fescues and rye grasses resist insect attack because the symbiotic endophytic fungi found naturally in their tissues repel or kill common leaf and stem-eating lawn insects.
    - The fungus causes no known adverse effects to the host plant or to humans.
    - Tall fescues and rye grasses do not repel root-feeding lawn pests such as Crane Fly larvae.
    - Tall fescues and rye grasses are toxic to ruminants such as cattle and sheep
  - Endophytic grasses are commercially available; use them in areas such as parks or golf courses where grazing does not occur.
  - Local agricultural or gardening resources such as Washington State University Extension office can offer advice on which types of grass are best suited to the area and soil type.
- Use the following seeding and planting BMPs, or equivalent BMPs, to obtain information on grass mixtures, temporary and permanent seeding procedures, maintenance of a recently planted area, and fertilizer application rates: [BMP C120: Temporary and Permanent Seeding](#), [BMP C121: Mulching](#), [BMP C123: Plastic Covering](#), and [BMP C124: Sodding](#).
- Adjusting the soil properties of the subject site can assist in selection of desired plant species. Consult a soil restoration specialist for site-specific conditions.

## Recommended Additional BMPs:

- Conduct mulch-mowing whenever practicable.
- Use native plants in landscaping. Native plants do not require extensive fertilizer or pesticide applications. Native plants may also require less watering.
- Use mulch or other erosion control measures on soils exposed for more than one week during the dry season (May 1 to September 30) or two days during the rainy season (October 1 to April 30).
- Till a topsoil mix or composted organic material into the soil to create a well-mixed transition layer that encourages deeper root systems and drought-resistant plants.
- Apply an annual topdressing application of 3/8" compost. Amending existing landscapes and turf systems by increasing the percent organic matter and depth of topsoil can:
  - Substantially improve the permeability of the soil.
  - Increase the disease and drought resistance of the vegetation.
  - Reduces the demand for fertilizers and pesticides.
- Disinfect gardening tools after pruning diseased plants to prevent the spread of disease.
- Prune trees and shrubs in a manner appropriate for each species.
- If specific plants have a high mortality rate, assess the cause and replace with another more appropriate species.

- When working around and below mature trees, follow the most current American National Standards Institute (ANSI) ANSI A300 standards (see [http://www.tcia.org/TCIA/BUSINESS/ANSI\\_A300\\_Standards /TCIA/BUSINESS/A300\\_Standards/A300\\_Standards.aspx?hkey=202ff566-4364-4686-b7c1-2a365af59669](http://www.tcia.org/TCIA/BUSINESS/ANSI_A300_Standards /TCIA/BUSINESS/A300_Standards/A300_Standards.aspx?hkey=202ff566-4364-4686-b7c1-2a365af59669)) and International Society of Arboriculture BMPs to the extent practicable (e.g., take care to minimize any damage to tree roots and avoid compaction of soil).
- Monitor tree support systems (stakes, guys, etc.).
  - Repair and adjust as needed to provide support and prevent tree damage.
  - Remove tree supports after one growing season or maximum of 1 year.
  - Backfill stake holes after removal.
- When continued, regular pruning (more than one time during the growing season) is required to maintain visual sightlines for safety or clearance along a walk or drive, consider relocating the plant to a more appropriate location.
- Make reasonable attempts to remove and dispose of class C noxious weeds.
- Re-seed bare turf areas until the vegetation fully covers the ground surface.
- Watch for and respond to new occurrences of especially aggressive weeds such as Himalayan blackberry, Japanese knotweed, morning glory, English ivy, and reed canary grass to avoid invasions.
- Plant and protect trees per [BMP T5.16: Tree Retention and Tree Planting](#).
- Aerate lawns regularly in areas of heavy use where the soil tends to become compacted. Conduct aeration while the grasses in the lawn are growing most vigorously. Remove layers of thatch greater than  $\frac{3}{4}$ -inch deep.
- Set the mowing height at the highest acceptable level and mow at times and intervals designed to minimize stress on the turf. Generally mowing only 1/3 of the grass blade height will prevent stressing the turf.
  - Mowing is a stress-creating activity for turfgrass.
  - Grass decreases its productivity when mowed too short and there is less growth of roots and rhizomes. The turf becomes less tolerant of environmental stresses, more disease prone and more reliant on outside means such as pesticides, fertilizers, and irrigation to remain healthy.

## Additional BMP Information:

- King County's *Best Management Practices for Golf Course Development and Operation* ([King County, 1993](#)) has additional BMPs for Turfgrass Maintenance and Operation.
- King County, Seattle Public Utilities, and the Saving Water Partnership have created the following natural lawn and garden care resources that include guidance on building healthy soil with compost and mulch, selecting appropriate plants, watering, using alternatives to pesticides, and implementing natural lawn care techniques.

- n *Natural Yard Care - Five steps to make your piece of the planet a healthier place to live* ([King County and SPU, 2008](#))
  - n *The Natural Lawn & Garden Series: Smart Watering* ([Saving Water Partnership, 2006](#))
  - n *Natural Lawn Care for Western Washington* ([Saving Water Partnership, 2007](#))
  - n *The Natural Lawn & Garden Series: Growing Healthy Soil; Choosing the Right Plants; and Natural Pest, Weed and Disease Control* ([Saving Water Partnership, 2012](#))
- l The International Society of Arboriculture (ISA) is a group that promotes the professional practice of arboriculture and fosters a greater worldwide awareness of the benefits of trees through research, technology, and education. ISA standards used for managing trees, shrubs, and other woody plants are the American National Standards Institute (ANSI) A300 standards. The ANSI A300 standards are voluntary industry consensus standards developed by the Tree Care Industry Association (TCIA) and written by the Accredited Standards Committee (ASC). The ANSI standards can be found on the ISA website: [www.isa-arbor.com/education/publications/index.aspx](http://www.isa-arbor.com/education/publications/index.aspx)
- l Washington State University's *Gardening in Washington State* website at <http://gardening.wsu.edu> contains Washington State specific information about vegetation management based on the type of landscape.
- l See the *Pacific Northwest Plant Disease Management Handbook* ([Pscheidt and Ocamb, 2016](#)) for information on disease recognition and for additional resources.

## S416 BMPs for Maintenance of Roadside Ditches

**Description of Pollutant Sources:** Common road debris including eroded soil, oils, vegetative particles, and heavy metals can be sources of stormwater pollutants.

**Pollutant Control Approach:** Maintain roadside ditches to preserve the condition and capacity for which they were originally constructed, and to minimize bare or thinly vegetated ground surfaces. Maintenance practices should provide for erosion and sediment control (see [S411 BMPs for Landscaping and Lawn / Vegetation Management](#)).

**Additional Regulations:** Note that work in wet areas may be regulated by local, state, or federal regulations that impose additional obligations on the responsible party. Check with the appropriate authorities prior to beginning work in those areas.

### Applicable Operational BMPs:

- Inspect roadside ditches regularly to identify sediment accumulations and localized erosion.
- Clean ditches on a regular basis, as needed. Keep ditches free of rubbish and debris.
- Vegetation in ditches often prevent erosion and cleanses runoff waters. Remove vegetation only when flow is blocked or excess sediments have accumulated. Conduct ditch maintenance (seeding, fertilizer application, harvesting) in late spring and/or early fall, where possible. This allows re-establishment of vegetative cover by the next wet season thereby minimizing erosion of the ditch as well as making the ditch effective as a biofilter.
- Do not apply fertilizer unless needed to maintain vegetative growth.
- In the area between the edge of the pavement and the bottom of the ditch, commonly known as the “bare earth zone,” use grass vegetation, wherever possible. Establish vegetation from the edge of the pavement, if possible, or at least from the top of the slope of the ditch.
- Maintain diversion ditches on top of cut slopes constructed to prevent slope erosion by intercepting surface drainage to retain their diversion shape and capability.
- Use temporary erosion and sediment control measures or re-vegetate as necessary to prevent erosion during ditch reshaping.
- Do not leave ditch cleanings on the roadway surfaces. Sweep, collect, and dispose of dirt and debris remaining on the pavement at the completion of ditch cleaning operations as described below:
  - Consider screening roadside ditch cleanings, not contaminated by spills or other releases and not associated with a stormwater treatment system such as a bioswale, to remove litter. Separate screenings into soil and vegetative matter (leaves, grass, needles, branches, etc.) categories. Compost or dispose of the vegetative matter in a municipal waste landfill. Consult with the jurisdictional health department to discuss use or disposal options for the soil portion. For more information, see [Appendix IV-B: Management of Street Waste Solids and Liquids](#).
  - Roadside ditch cleanings contaminated by spills or other releases known or suspected to contain dangerous waste must be handled following the Dangerous Waste Regulations ([Chapter 173-303 WAC](#)). If testing determines materials are

not dangerous waste but contaminants are present, consult with the jurisdictional health department for disposal options.

- Examine culverts on a regular basis for scour or sedimentation at the inlet and outlet, and repair as necessary. Give priority to those culverts conveying perennial and/or salmon-bearing streams and culverts near streams in areas of high sediment load, such as those near subdivisions during construction. Maintain trash racks to avoid damage, blockage, or erosion of culverts.

### **Recommended Treatment BMPs:**

Install biofiltration swales and filter strips (see [V-7 Biofiltration BMPs](#)) to treat roadside runoff wherever practicable and use engineered topsoils wherever necessary to maintain adequate vegetation. These systems can improve infiltration and stormwater pollutant control upstream of roadside ditches.

## S417 BMPs for Maintenance of Stormwater Drainage and Treatment Systems

**Description of Pollutant Sources:** Facilities include roadside catch basins on arterials and within residential areas, conveyance systems, detention facilities such as ponds and vaults, oil/water separators, biofilters, settling basins, infiltration systems, and all other types of stormwater treatment systems presented in [Volume V](#). Oil and grease, hydrocarbons, debris, heavy metals, sediments and contaminated water are found in catch basins, oil and water separators, settling basins, etc.

**Pollutant Control Approach:** Provide maintenance and cleaning of debris, sediments, and other pollutants from stormwater collection, conveyance, and treatment systems to maintain proper operation.

### Applicable Operational BMPs:

Maintain stormwater treatment facilities per the operations and maintenance (O&M) procedures presented in [Appendix V-A: BMP Maintenance Tables](#) in addition to the following BMPs:

- Inspect and clean treatment BMPs, conveyance systems, and catch basins as needed, and determine necessary O&M improvements.
- Promptly repair any deterioration threatening the structural integrity of stormwater facilities. These include replacement of clean-out gates, catch basin lids, and rock in emergency spillways.
- Ensure adequacy of storm sewer capacities and prevent heavy sediment discharge to the sewer system.
- Regularly remove debris and sludge from BMPs used for peak-rate control, treatment, etc. and discharge to a sanitary sewer if approved by the sewer authority, or truck to an appropriate local or state government approved disposal site.
- Clean catch basins when the depth of deposits reaches 60 percent of the sump depth as measured from the bottom of basin to the invert of the lowest pipe into or out of the basin. However, in no case should there be less than six inches clearance from the debris surface to the invert of the lowest pipe. Some catch basins (for example, WSDOT's *Catch Basin Type 1L* ([WSDOT, 2011](#))) may have as little as 12 inches sediment storage below the invert. These catch basins need frequent inspection and cleaning to prevent scouring. Where these catch basins are part of a stormwater collection and treatment system, the system owner/operator may choose to concentrate maintenance efforts on downstream control devices as part of a systems approach.
- Properly dispose of all solids, polluted material, and stagnant water collected through system cleaning. Do not decant water back into the drainage system from eductor trucks or vacuum equipments since there may be residual contaminants in the cleaning equipment. Do not jet material downstream into the public drainage system.
- Clean woody debris in a catch basin as frequently as needed to ensure proper operation of the catch basin.
- Post warning signs; "Dump No Waste - Drains to Ground Water," "Streams," "Lakes," or

emboss on or adjacent to all storm drain inlets where possible.

- Disposal of sediments and liquids from the catch basins must comply with [Appendix IV-B: Management of Street Waste Solids and Liquids](#).

Table V-7.3: Grass Seed Mixes Suitable for Biofiltration Swale Treatment Areas

		<b>Mix 1</b>	<b>Mix 2</b>
75-80 percent	tall or meadow fescue	60-70 percent	tall fescue
		10-15 percent	seaside/ colonial bentgrass
10-15 percent	seaside/colonial bentgrass	10-15 percent	meadow foxtail
		6-10 percent	alsike clover
5-10 percent	Redtop	1-5 percent	marshfield big trefoil
		1-6 percent	Redtop
<p><i>Note: all percentages are by weight.</i></p>			

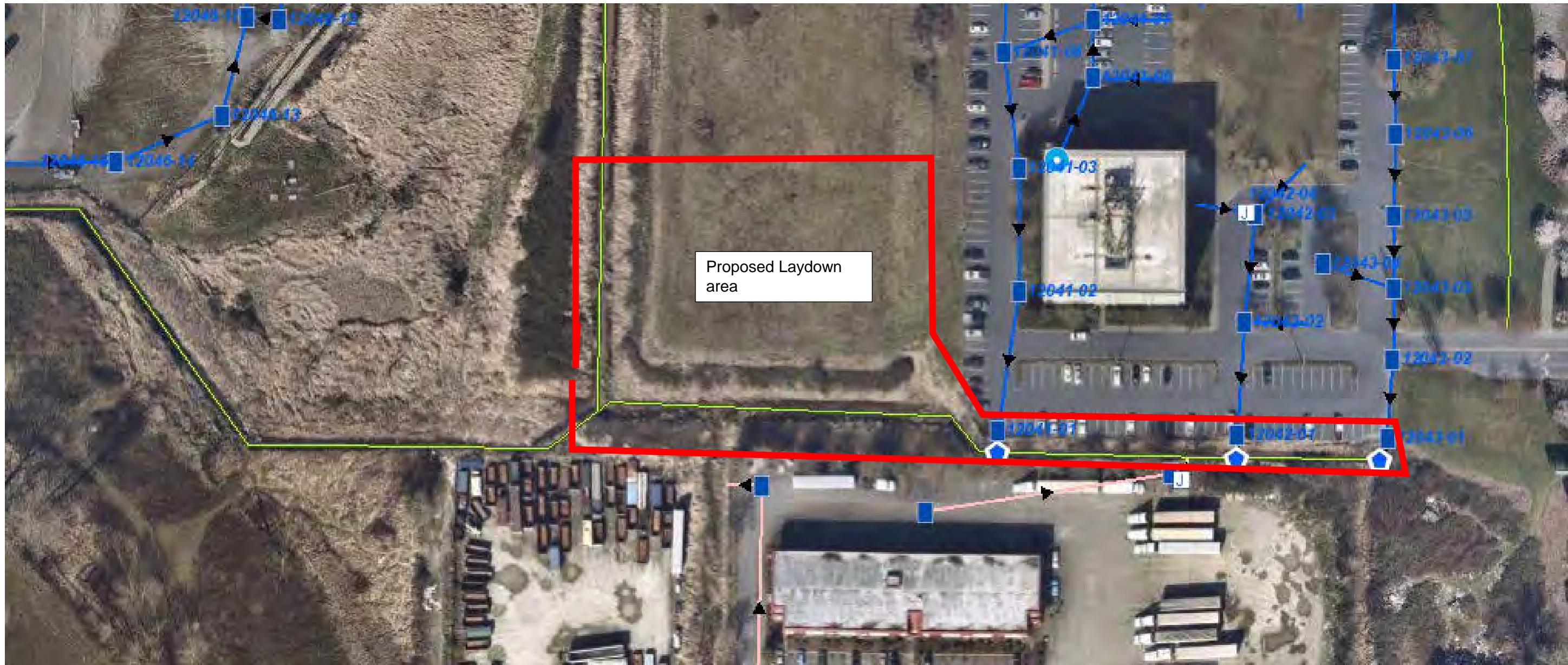
Table V-7.4: Groundcovers and Grasses Suitable for the Upper Side Slopes of a Biofiltration Swale in Western Washington

Groundcovers
kinnikinnick ( <i>Arctostaphylos uva-ursi</i> )
epimedium ( <i>Epimedium grandiflorum</i> )
creeping forget-me-not ( <i>Omphalodes verna</i> )
<i>Euonymus lanceolatus</i>
yellow-root ( <i>Xanthorhiza simplicissima</i> )
<i>Genista</i> (multiple species)
white lawn clover ( <i>Trifolium repens</i> )
crinkle-leaf creeper ( <i>Rubus calycinoides</i> )
strawberry ( <i>Fragaria chiloensis</i> )
broadleaf lupine ( <i>Lupinus latifolius</i> )
<b>Grasses (drought- tolerant, minimum mowing)</b>

Table V-7.4: Groundcovers and Grasses Suitable for the Upper Side Slopes of a Biofiltration Swale in Western Washington

<b>Groundcovers</b>
dwarf tall fescues ( <i>Festuca</i> - multiple species, e.g. Many Mustang, Silverado)
hard fescue ( <i>Festuca ovina duriuscula</i> - e.g., Reliant, Aurora)
tufted fescue ( <i>Festuca amethystine</i> )
buffalo grass ( <i>Buchloe dactyloides</i> )
red fescue ( <i>Festuca rubra</i> )
tall fescue grass ( <i>Festuca arundinacea</i> )
blue oatgrass ( <i>Helictotrichon sempervirens</i> )

Port of Tacoma  
2020 Ditch Maintenance SWPPP – Fabulich Ditch Site Map



*Drawing not to scale*

Blue indicates stormwater infrastructure

Green indicates boundaries of the Fabulich Ditch

Red indicate proposed maintenance areas and laydown

# Port of Tacoma 2020 Ditch Maintenance SWPPP – Fabulich Ditch Site Map



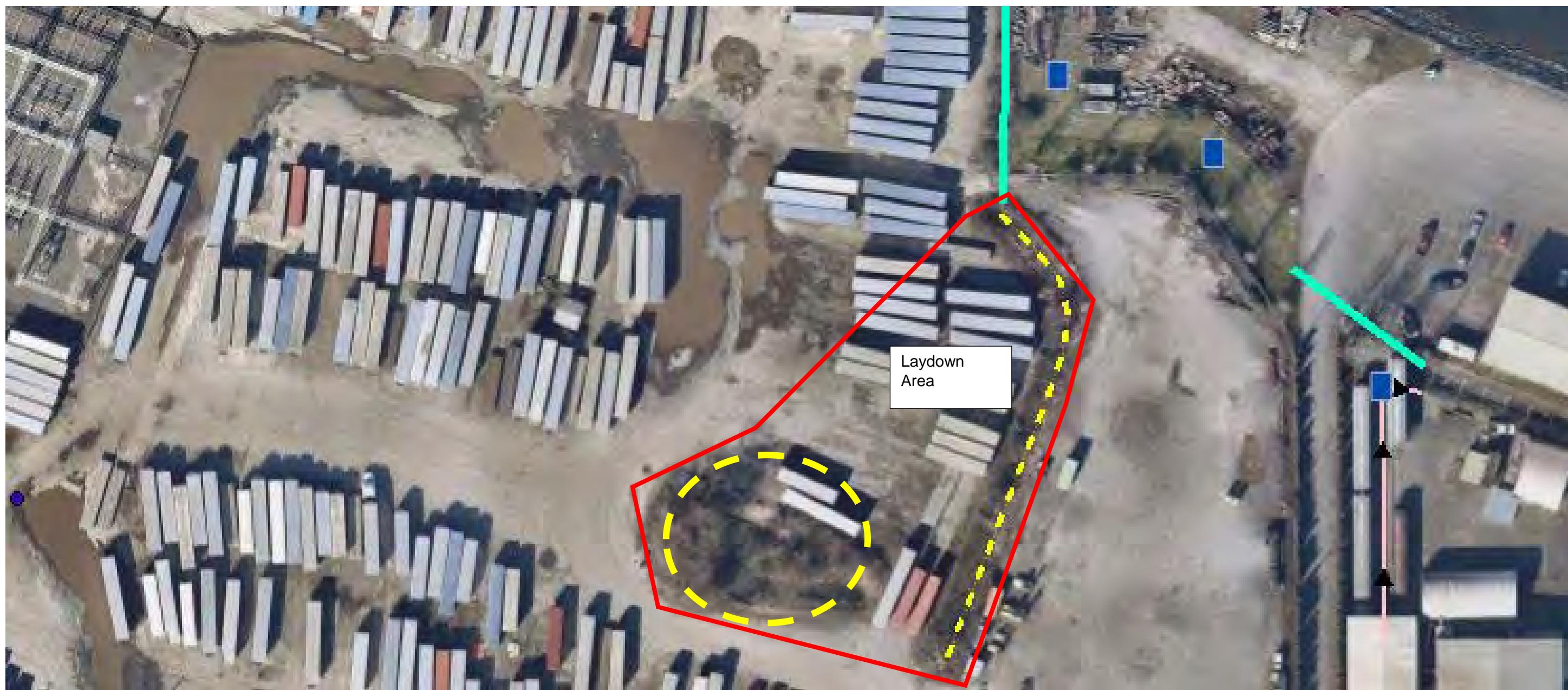
*Figure 1 Drawing not to scale*

Blue indicates stormwater infrastructure

Green indicates boundaries of the Green and dashed yellow indicate ditch line and subsurface drain

Red indicates proposed maintenance areas and laydown

Port of Tacoma  
2020 Ditch Maintenance SWPPP – Fabulich Ditch Site Map



Blue indicates stormwater infrastructure

Yellow dashed line indicates boundaries of the Parcel 103 Settling Pond and Ditch

Red indicate proposed maintenance areas and laydown

## **Attachment D – May 4, 2018 Memo**



## MEMORANDUM

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**DATE:** May 4, 2018

**TO:** Lori Kingsbury, Washington Department of Ecology, Frank Nichols, U.S. Army Corps of Engineers

**FROM:** Jenn Stebbings, Port of Tacoma

**Cc:** Loreé Randall, Washington Department of Ecology; Kristine Koch, U.S. EPA; Justine Barton, U.S. EPA; Tony Warfield, Port of Tacoma; Rob Healy, Port of Tacoma

**SUBJECT:** Port of Tacoma Stormwater Infrastructure Maintenance JARPA Supplemental Information

The following memo provides supplemental JARPA information to address comments provided by the Washington Department of Ecology (Ecology) and the U.S. Environmental Protection Agency (EPA) regarding pollutants potentially located within the Port of Tacoma's (Port) stormwater ditches/ponds proposed for maintenance activities. Specifically, this memo provides a classification system of the stormwater infrastructure to determine Best Management Practices (BMPs) and reporting requirements on maintenance activities that will be conducted; it also describes the Port's reporting system to the regulatory agencies to ensure maintenance activities are conducted according to permit conditions.

### Best Management Practices and Contingency Measures

#### Green Ditches/Ponds

- BMP C120: Temporary and Permanent Seeding
  - Ditches/ponds will be seeded with WSDOT ESC seed mix after sediment removal activity is complete.
- BMP C121: Mulching
  - Mulch may be applied either as part of a hydroseed mix or as weed-free straw. The type and quantity of mulch will depend on the size of the ditch/pond.
- BMP C122: Nets and Blankets (Channel Installation)
  - Nets and blankets may be installed depending on the size and slope of the ditch/pond.
  - This BMP will generally be used for larger ditches (e.g., Erdahl Ditch [JARPA ID 23], Drainage District 23 Ditch and stormwater pond [JARPA ID 33 and 33a]) and as a contingency measure if vegetation is not germinating fast enough to protect slopes.

- BMP C130: Surface Roughening
  - Ditch/pond slopes may be roughened prior to seed application to promote germination.
  - This BMP may be used as a contingency measure as needed.
- BMP C160: CESCL
  - The Port staffs several CESCLs who will be available for inspections/monitoring to ensure proper installation of BMPs before, during, and after maintenance activities.
  - CESCLs will assist contractor/maintenance crews to adaptively manage the site for unforeseen weather events and changing site conditions.
- BMP C162: Scheduling
  - Maintenance activities will be scheduled for the “dry season” when the presence of surface water is less likely.
  - Maintenance activities will be scheduled when no surface water is present, whenever practicable. In certain instances, surface water is present year-round.
  - Maintenance activities in larger ditches will be phased such that the work will occur upstream to downstream to provide additional ESC from vegetation present downstream of the maintenance activity.
- BMP C201: Grass-Lined Channels
  - Larger ditches will be maintained from upstream to downstream to keep downstream vegetation in place to provide additional ESC.
- BMP C202: Channel Lining
  - This BMP will be used as a contingency measure if soils are not stabilized prior to a storm event that generates runoff, creating surface water in the ditch.
- BMP C207: Check Dams
  - Temporary check dams may be installed as a contingency measure to limit the amount of suspended sediment that may mobilize downstream during maintenance activities. Check dams will be removed at the end of the maintenance activity to remain consistent with the ditch’s original design.
- BMP C208: Triangular Silt Dike
  - Triangular silt dikes may be installed depending on the size of the ditch channel and if surface water is present or if a storm event is expected before the maintenance activity is complete to minimize sediment mobilization.
- BMP C235: Wattles
  - Wattles may be installed depending on the size of the ditch channel and if surface water is present or if a storm event is expected before the maintenance activity is complete to minimize sediment mobilization.
- Coordination with the Tacoma-Pierce County Health Department (TPCHD) to obtain a Waste Disposal Authorization (WDA) which will include characterizing the sediment for

constituents of concern identified by TPCHD based on ditch/pond location and current and/or historic land use.

### **Yellow Ditches/Ponds**

- Select BMPs based on size, estimated amount of material to be removed, if surface water is present, etc. (see Green Ditches/Ponds list).
- Coordination with the Tacoma-Pierce County Health Department (TPCHD) to obtain a Waste Disposal Authorization (WDA) which will include characterizing the sediment for constituents of concern identified by TPCHD based on ditch/pond location and current and/or historic land use.
- If surface water is present, monitor for turbidity 150 feet downstream of the maintenance footprint or at the ditch outlet, whichever is closer. Turbidity will not exceed 25 NTUs or 10% of background if background is over 25 NTUs.

### **Red Ditches/Ponds**

- Sediment removal activities will not occur without additional coordination with Ecology, TPCHD, and/or EPA prior to activity.

## **Reporting Requirements**

The Port will provide an annual report to the U.S. Army Corps of Engineers (USACE), Ecology, and any other regulatory agency that requests a copy. This annual report will be submitted by January 31 of the following year and will include the following:

- Details of the stormwater maintenance activities (date, location, approximate activity footprint, approximate amount of material removed, disposal information, photos, etc.).
- Any problems/issues encountered during the work and how they were solved.
- Update stormwater infrastructure matrix based on completed maintenance activities.
- List of ditches/ponds planned to be maintained in the next calendar year.

## **Other Application Updates**

There are two construction stormwater BMPs that were mistakenly identified as ditches in the original permit application. These are JARPA ID 10 and JARPA ID 13. They have been removed from the application and will not be included in the Port's stormwater infrastructure maintenance program.

## **Stormwater Infrastructure Maintenance Matrix**

The following matrix defines the Port's stormwater infrastructure, classification and estimated sediment removal quantities. The classification will determine the Port's approach for implementing BMPs during maintenance activities and water quality monitoring.

May 4, 2018

Port of Tacoma Stormwater Infrastructure Maintenance

Page 4

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**Table 1. Estimated Sediment Removal Quantities and Classification**

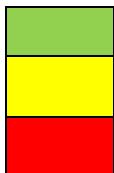
JARPA ID	Stormwater Feature Name	Approximate Area of Stormwater	Estimated Initial Depth of Sediment Removal (inches)	Estimated Maximum Quantity of Initial Sediment Removal (CY)	Estimated Quantity of Maintenance Sediment Removal (CY)**
1	Biofiltration Trench	324	up to 24	24	2
2	Detention Pond	2710	up to 12	100	17
3	TPU Ditch	1135	up to 12	42	7
4	Parcel 95 Ditch	185	up to 12	7	1
5	Prologis Pond	9225	up to 24	683	57
6	Haub Yard Ditch North	590	N/A	N/A	4
7	Haub Yard Ditch South	740	up to 12	27	5
8	Carlile Detention Pond	1705	up to 12	63	11
9	East-West Ditch	1405	N/A	N/A	9
10	Parcel 77 North Ditch	<b>REMOVE FROM PERMIT APPLICATION – NOT A DITCH (REMNANT CONSTRUCTION SW BMP)</b>			
11	Kaiser Ditch	<b>REMOVE FROM PERMIT APPLICATION</b>			
12	Kaiser Pond	5220	N/A	N/A	32
13	Parcel 77 East Ditch	<b>REMOVE FROM PERMIT APPLICATION – NOT A DITCH (REMNANT CONSTRUCTION SW BMP)</b>			
14	Parcel 77 East Ditch	600	up to 30	56	4
15	Parcel 88 North Pond and Ditches	5360	up to 12	199	33
16	Lincoln Loop Road Bioswale	585	N/A	N/A	4
17	Parcel 38 Ditch	2075	up to 24	154	13
18	K-Pak Ditch	650	N/A	N/A	4
19	Bullfrog Ditch	1115	up to 24	83	7
20	Parcel 36A Detention Pond	3350	up to 12	124	21
21	Banana One Ditch	2140	up to 18	119	13
22	Tacoma Rail Ditch	1290	up to 18	72	8
23	Erdahl Ditch	4420	N/A	N/A	27
24	Bullfrog Ditch South	210	up to 12	8	1
25	Versacold Detention Pond	15390	N/A	N/A	95
26	Versacold Ditch	1500	N/A	N/A	9
27	Parcel 35A Ditch	85	N/A	N/A	1
28	Fabulich Center Ditch	1540	up to 12	57	10
29	Parcel 34 Ditch	1020	N/A	N/A	6
30	Parcel 34 Ditch	290	N/A	N/A	2
31	Bioswale	205	N/A	N/A	1
32	Fife Ditch	2570	up to 12	95	16
33	DD23 Ditch	4020	up to 12	149	25
33a	Parcel 14 Stormwater Pond	25650	N/A	N/A	158
	<b>TOTAL</b>	<b>97304</b>		<b>2062</b>	<b>603</b>

May 4, 2018

Port of Tacoma Stormwater Infrastructure Maintenance

Page 5

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Site is not an active cleanup site or adjacent to a cleanup site.

Stormwater infrastructure is on or adjacent to a confirmed or suspected impacted site without active cleanup underway, or a site that has undergone cleanup and is in long-term monitoring. Water quality monitoring will occur if surface water is present.

Known cleanup site is under an AO or CD with Ecology. No remedy yet selected. Maintenance activities unlikely to occur without further coordination with Ecology/EPA.

\*Assumption: Average width of ditch is 12 inches. Actual ditch width varies.

\*\*Ditches/ponds will not have sediment removed every year. This is an estimated annualized average over the 10-year permit life cycle after initial sediment removal (if applicable). The Port estimates approximately 2 inches of sediment will be removed from stormwater infrastructure when maintained. Actual sediment quantities removed to maintain design capacity for each ditch will vary based on deposition rates and budget constraints.

Information regarding maintenance for Proprietary and Non-Proprietary Filtration and Treatment Units are stored as listed below.

- Operations and Maintenance Manuals are stored in the Maintenance Library at the Port.
- Maintenance checklists are stored in NPDES Pro.
- Preventative maintenance job plans are stored in Maximo.

## APPENDIX C:

# Proprietary and Non-proprietary O&M Manuals and Checklists