Annual Report Template
Naval Station Everett
Municipal Separate Storm Sewer System (MS4)
Permit WAS026620

Reporting Period

- ☐ Year 1 Reporting Period: effective date of the permit – January 31, 2022
- ☐ Year 2 Reporting Period: February 1, 2022 – January 31, 2023
- ☐ Year 3 Reporting Period: February 1, 2023 – January 31, 2024
- ☒ Year 4 Reporting Period: February 1, 2024 – January 31, 2025
- ☐ Year 5 Reporting Period: February 1, 2025 – January 31, 2026
- ☐ Other _____

General Information

Contact Person Name and Title: Kaytee Villafranca

Phone Number: 425-304-3277 E-mail: kaytee.s.villafranca.civ@us.navy.mil

Stormwater Website URL: https://cnrnw.cnic.navy.mil/Installations/NS-Everett/Operations-and-Management/Environmental-Support-and-Compliance/

Signature and Certification

Certification: *"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I have no personal knowledge that the information submitted is other than true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."*

Signature: _____ Date: March 25, 2025

Printed Name: STACY M. WUTHIER

Signatory Title: Commanding Officer

Section I. Permittee Responsibility (Part 1):
If you answer "NO" to any of these questions, please explain in the Comments section.

Year 1 Annual Report		
1.	YES ☐ NO ☒	Has the Permittee submitted to EPA for consideration any documents, plans, programs or program summaries that the Permittee believes to be equivalent to a required control measure or control measure? *If the answer is "YES", use the Comments section to briefly list the one or more documents, plans or programs you have requested be considered as an Equivalent Document, Plan or Program. Cite the relevant Permit provision for each.* (Part 1.5)
All Reporting Years		
2.	YES ☐ NO ☒	Do you, the Permittee, share Permit implementation responsibility with one or more Outside Entity for compliance with the Permit? *If yes, please explain in the Comments section*. (Part 1.4.1))
3.	YES ☐ NO ☒	If yes, is the agreement with Outside Entity(s) formalized in a written and binding agreement between parties? (Part 1.4.1)
4.	YES ☐ NO ☒	If yes, is the agreement with Outside Entity(s) described/cited in the Stormwater Management Program (SWMP) Document? (Part 1.4.1)
5.	YES ☒ NO ☐	Have you established and maintained relevant enforceable mechanisms, to control pollutant discharges into and from the MS4 and to meet the requirements of this Permit? (Part 1.4.2)
6.	YES ☒ NO ☐	Are you maintaining system(s) to track SWMP data and information? (Part 1.4.4)

Permittee Responsibility and Equivalent Documents, Plans or Programs Comments:

2. – 4. NAVSTA Everett does not share permit implementation responsibility with one or more outside entities for compliance with the permit.

Section II. Stormwater Management Program (SWMP) Control Measures (Part 2)
Please answer all questions.

Education and Outreach on Stormwater Impacts (Part 2.1)
If you answer "NO" to any of these questions, please explain in the Comments section.

7.	YES ☒ NO ☐	Have you listed and publicized means for the public and Permittee personnel to report spills and other illicit discharges? (Part 2.1.1.1)
8.	YES ☒ NO ☐	Have you informed target audiences of the environmental impacts associated with illegal discharges and improper disposal of waste and how to report them? (Part 2.1.1.2)
9.	YES ☒ NO ☐	Have you selected specific education and outreach topics to build general awareness and effect behavior change? *Please list these topics in the Comments section.* (Part 2.1.1.3)
10.	Narrative	*In the Comments section,* p*lease summarize your activities and accomplishments as part of the Southern Resident Killer Whale Outreach and Education efforts.* (Part 2.1.2)
11.	YES ☒ NO ☐	Have you assessed, or participated in efforts to assess, the understanding and adoption of intended behaviors by the target audiences for at least one of the topics? *In the Comments section,* p*lease summarize your efforts to assess the education and outreach activities conducted during the reporting period, and how this information is being utilized to improve the public education and outreach program efforts.* (Part 2.1.3) *Please also include one or more example of successful education/outreach.* (Part 2.1.3)

Education and Outreach Comments:
7. In October 2023, NAVSTA Everett posted a sign of facility permit coverage under the Multi-Sector General Permit (MSGP) at the two base entrances for the general public to view its NPDES ID number and to contact NAVSTA Everett Environmental to report observed indicators of stormwater pollution, which is part of its MSGP requirement. During a spot-check of the posted MSGP sign in December 2024, it was observed the MSGP Permit sign by the Main Gate was not secured and the MSGP Permit sign was not posted by the North Gate. The MSGP Permit signs by the North Gate is posted and by the Main Gate is secured.

9. The specific education and outreach topics focused on in 2024 included stormwater awareness for our Environmental Work Center Coordinators (EWCCs), and spill response and clean up. EWCCs oversee their command's adherence to environmental compliance and attend environmental awareness refresher annually. The training covers hazardous waste disposal, SPCC, wastewater, and stormwater permit requirements including BMPs. For 2024, much of the training focused on stormwater awareness, MSGP and MS4 permit compliance, and a broader description and discussion on how we impact stormwater quality. For dewatering vaults, training was given to those who oversee contractor work in the vaults and a process was put in place to ensure analytical analysis is conducted and results submitted prior to permission to pump to the MS4 system. Further education has been provided to NAVSTA Everett and Smokey Point personnel via the Quarterly Environmental Newsletter which started January 2020 in anticipation of the MS4 permit. The newsletter is sent to all EWCCs and their leadership which equates to over 100 NAVSTA Everett and Smokey Point personnel. The latest Environmental Newsletter is in Appendix A. Since the MS4 permit was the impetus for creating the newsletter, the first page always addresses MS4 concerns. Topics covered thus far include general awareness of the Navy's Environmental Mission, stormwater permit requirements, leading causes of stormwater pollution and poor water quality, education on infiltration rates into the natural environment, the urban water cycle, illicit discharge, stormwater impacts on fish and Southern Resident Killer Whales, and BMPs. Information regarding the MSGP is also covered as well as information on the Spill, Air, Hazardous Waste, Natural

Resources, and Recycling Programs. The previous editions of the newsletter can be found at:

https://cnrnw.cnic.navy.mil/Installations/NS-Everett/Operations-and-Management/Environmental-Support-and-Compliance/

10. The Southern Resident Killer Whale (SRKW) topic was included in the first quarterly environmental newsletter of 2024. The SRKW topic will be discussed in the next quarterly environmental newsletter. The newsletter covered bioaccumulation of chemicals, and the decline of Chinook and Coho salmon due to poor stormwater quality. Also, presentation materials going over deterrence methods to minimize exposure to oil spills for SRKW was distributed to the installation stormwater managers in July 2024.

11. Four examples to demonstrate improved understanding and adoption of intended behaviors include increasing EWCCs environmental involvement and oversight, spill response and recycling.

a. Discussions regarding commitment to BMPs and a shared responsibility towards stormwater compliance has resulted in improved storage and covering of material, reduction of trash in the storm trench drain and overall cleanliness of the piers. Additional online trainings from ECATTs were assigned to EWCCs, key personnel and contractors. A listing of trainings can be found in Appendix A.

b. The Environmental Newsletter's recycling section has provided base personnel with explicit information on what is recyclable and what is not in an effort to reduce time wasted separating out non-recyclable materials. Recycling has also taken it a step further and provided information on how to turn in items to DLA. This has helped reduce the outdoor storage of unwanted items from deteriorating in the elements and impacting stormwater quality.

c. Spill response was emphasized in 2024. A regional worst case discharge table-top exercise was held last year. This exercise played out across several naval bases including Manchester, Whidbey Island, Everett, Bangor, and Bremerton. Emergency Operations Center, Port Operations, Environmental, and other stakeholders were involved in the planning, coordination, and execution of the drill. Several Environmental staff, Port Ops personnel also attend Hazardous Substance Incident Response Management (HSIRM) class each year which covers spill response, spill management, and reporting. A detailed description can be found in Appendix A.

d. From February 27, 2024 through February 28, 2024 at the public meeting for the draft EA for Homeporting Constellation-class Frigates, an outreach table was set-up. This effort aimed to further education personnel on pet waste management, to promote stormwater quality awareness, and create a way to properly dispose of pet waste.

Public Involvement/Participation (Part 2.2)
If you answer "NO" to any of these questions, please explain in the Comments section.

12.	YES ☐ NO ☐ NA ☒	Have you complied with applicable federal notice requirements, as relevant? (Part 2.2.1)
13.	YES ☒ NO ☐	Have you conducted one or more meetings to coordinate among appropriate staff, managers and others who play a role in Permit implementation? *Briefly describe meeting(s), participants and topics in the Comments section.* (Part 2.2.2)
14.	Narrative	*In the Comments section, please describe any engagement with affected entities in setting priorities for the storm water program*. (Part 2.2.2)
15.	YES ☒ NO ☐	Have you sponsored at least twice during the Permit term volunteer activities designed to actively engage residents and/or employees to better understand stormwater pollution? *Please describe these events and activities in the Comments section.* (Part 2.2.4)

Public Involvement/Participation Comments:

13. Monthly stormwater meeting are held with key stormwater personnel at Naval Station Everett, Naval Air Station Whidbey Island, and Naval Base Kitsap. Consistent monthly meetings were started in February 2020 and have continued since. These monthly meetings are used to discuss any topic related to stormwater including the MS4 permit, MSGP, and CGP. The meetings provide a collaborative approach to stormwater management at the NW installations. Below is a summary of meetings held since February 2024:

Year	Month	Short Summary of Meeting Topics
2024	February	SWPPP and SWMP updates, annual reports, 6PPD, SWMMWW, Downspout Evaluation updates, stormwater mapping, upcoming construction projects, funding, upcoming NeT MS4 training, and MS4 education and outreach.
	March	Education and outreach campaign, stormwater mapping, funding, SWPPP for heavy equipment maintenance, firefighter training, and annual reports.
	April	Downspout Evaluation updates, SWMP and SWPPP updates, SIIPs, EAP, MCM# 1 discussion, educational and outreach materials, upcoming SWMMWW training, ongoing and upcoming construction projects, dewatering and monitoring plans for construction projects, and funding.
	May	Education outreach discussion.
	June	Funding, Downspout Evaluations, draft Ecology ISGP discussion, sampling discussion, MSGP signs, and construction projects.
	July	Contract awarding, SIIP, funding for permit renewal, Ecology MS4 permit discussion, 6PPD, PCBs, PFAS, SWPPP and maps, construction project updates, and education and outreach items.
	August	Meeting with EPA to discuss the MS4 permit and SAM program.
	September	Installation websites, upcoming SWMMWW training, vessel incidental discharge national standards, UNDS, EAPs, educational material items, stormwater mapping, and upcoming draft MSGP.

	October	2024 SWMMWW training presented by Ecology.
	November	Installation websites, SWMMWW recap, Ecology draft 2022 WQA, PFAS standards, educational materials, stormwater mapping, supplies, and funding.
	December	No meeting held due to holiday/scheduling conflicts.
2025	January	Educational material items and resources, IDDE, 2026 MSGP, contracting, annual reports, sampling for PFAs, AIMs Levels and documentation, source study, and draft proposed mod to CGP.

Beyond the stormwater program manager monthly meetings and EPA quarterly meetings, NAVSTA Everett environmental also engages often with the maintenance partners on the base, specifically the contractor's government oversight to ensure stormwater compliance.

14. During Year 4 of the MS4 permit, EWCCs training occurred three times and covers all aspects of environmental compliance, including stormwater permit requirements, installation best management practices, and minimizing impacts to water quality. The SWMP also lays out required training for targeted personnel. The Quarterly Environmental Newsletter is sent to all NAVSTA Everett and Naval Support Complex Smokey Point EWCCs and their leadership for stormwater awareness.

15. April 2024, two Earth Day events took place along the shores at NAVSTA Everett – one occurred base-wide and another one along the shores. The NAVSTA Everett shoreline cleanup resulted in 75 pounds of refuse, 15 pounds of recycling, and 230 pounds of metal collected, which is a 75.8% overall recycle rate. Another event is planned for Earth Day 2024 to meet the Permit requirement of two events during the Permit term. Sailor volunteers also did a base-wide cleanup event around NAVSTA Everett in February 2024.

Illicit Discharge Detection and Elimination (Part 2.3)

If you answer "NO" to any of these questions, please explain in the Comments section.

16.	YES ☐ NO ☐ NA ☒	Have you developed updated maps of the MS4 within the Permit Area that include all of the features listed in Part 2.3.1 of the Permit? *For Annual Reporting Years 1 through 4, you may check NA if these maps have not yet been completed.* (Part 2.3.1)
17.	YES ☒ NO ☐ NA ☐	Do you effectively prohibit non-storm water discharges into the MS4 (except those authorized in Part 1.3.4 of this Permit) through effectively robust policies and procedures? *For Annual Reporting Years 1 and 2, you may check NA if you have not yet implemented effective policies and procedures.* (Part 2.3.2)
18.	YES ☐ NO ☐ NA ☒	For any discharges of potable water, have you dechlorinated to a total residual chlorine concentration of 0.1 ppm or less, pH-adjusted, and volumetrically and velocity controlled to prevent resuspension of sediments in the MS4? (Part 2.3.2.2.1)
19.	YES ☒ NO ☐ NA ☐	Have discharges from lawn watering and other irrigation runoff been minimized through public education and water conservation efforts? Part 2.3.2.2.2)
20.	YES ☐ NO ☐ NA ☒	For any discharges of swimming pool, spa and hot tub waters, have you dechlorinated to a total residual chlorine concentration of 0.1 ppm or less, pH-adjusted and re-oxygenized if necessary, volumetrically and velocity controlled to prevent resuspension of sediments in the MS4, thermally controlled to prevent an increase in temperature of the receiving waters, and prohibited the discharge of pool cleaning wastewater and filter backwash? (Part 2.3.2.2.3)

21.	YES ☒ NO □ NA □	Have discharges from street and sidewalk wash water, water used to control dust, and routine external building wash down that does not use detergents been minimized through public education and water conservation efforts? (Part 2.3.2.2.4)
22.	YES ☒ NO □ NA □	For any discharges of accumulated stormwater from utility vaults, have you conducted sampling to verify that no pollutants cause or contribute to water quality impairments, AND visually verified prior to any discharge, that there are no visible sheens or solids in the discharge? (Part 2.3.2.2.5)
23.	YES ☒ NO ☐	For any discharges from secondary containment structures, have you conducted sampling to verify that no pollutants cause or contribute to water quality impairments, AND visually verified prior to any discharge, that there are no visible sheens or solids in the discharge?? (Part 2.3.2.2.6)
24.	YES ☒ NO □	Does the program described in the SWMP document include procedures for locating priority areas likely to have illicit discharges, including areas where complaints have been recorded and areas with storage of large quantities of materials that could result in spills and areas where storage, usage, releases or contamination of any pollutant in Table 2.4.4 is or has occurred? (Part 2.3.3.1)
25.	YES ☒ NO ☐ NA ☐	Do you conduct a dry weather analytical and field screening monitoring program to identify non-stormwater flows from stormwater outfalls? *For Annual Reporting Years 1 and 2, you may check NA if you have not yet begun dry weather field screenings. (Part 2.3.3.2.1)*
26.	YES □ NO □ NA ☒	For Annual Reporting Year 5 only, have you completed field screening of at least 75% of all MS4 outfalls located within the Permit Area? *For Annual Reporting Years 1 through, you may check NA unless you have completed screening of 75% of the MS4 outfalls in the Permit Area.* (Part 2.3.3.2.2)
27.	YES ☒ NO □	Are your screening methods/protocols consistent with *Illicit Discharge Detection and Elimination: A Guidance Manual for Program Development and Technical Assessments*, Center for Watershed Protection, October 2004, or another methodology of comparable effectiveness? (Part 2.3.3.2.3)
28.	YES ☒ NO □	Do you have and implement procedures for characterizing the nature of, and potential public or environmental threat posed by, any illicit discharges which are found by or reported to the Permittee? (Part 2.3.3.3)
29.	YES ☒ NO □	Do these procedures include the evaluation of whether the discharge must be immediately contained and the steps to be taken for containment of the discharge per the stipulations in Part 2.3.3.3? (Part 2.3.3.3)
30.	Narrative	*In the Comments section, please summarize all illicit discharge responses, including responses to spills and recurring discharges. Also summarize any investigations and referrals as detailed in Part 2.3.3.3.2.* (Parts 2.3.3.3.1, 2.3.3.3.2 and 2.3.3.3.3)
31.	YES ☒ NO □	Do you have and implement procedures for notification of affected parties, including immediate notification of the spills and illicit discharges and ongoing updates about abatement measures and possible impacts? (Part 2.3.3.4)
32.	Narrative	*In the Comments section, please summarize all notifications to downstream operators of MS4s, shellfish beds/fisheries,*

		agricultural/livestock operations, drinking water systems (public or private) or other affected entity of spills or other non-stormwater discharges that may impact those systems. (Part 2.3.3.4.1) *Please include in the description all outreach, discussions and/or information exchanges regarding the impacts of discharges and the status of illicit discharge elimination activities.* (Part 2.3.3.4.2)
33.	YES ☒ NO ☐	Do you have and implement procedures for tracing sources of illicit discharges, including visual inspections, opening manholes, using mobile cameras, collecting and analyzing water samples, and other procedures, as appropriate? (Part 2.3.3.5)
34.	YES ☒ NO ☐	Do you have procedures for eliminating illicit discharges, including scheduling and implementing remedial measures and other safeguards to ensure the discharge does not recur? (Part 2.3.3.6)
35.	YES ☒ NO ☐	Do these procedures include initiation of an investigation within 21 days of a report or discovery of an illicit connection to determine the source, nature and volume, and responsible party? (Part 2.3.3.6.1)
36.	YES ☒ NO ☐	Do these procedures include initiation of action to eliminate the illicit connection within 45 days of confirming the connection? (Part 2.3.3.6.1)
37.	YES ☒ NO ☐	Have all staff responsible for investigating, identifying and eliminating illicit discharges, spills, and illicit connections into the MS4 received program-specific training? (Part 2.3.4)
38.	Narrative	*In the Comments section, please describe any training provided during this reporting period, including new employee training and follow-up training*. (Part 2.3.4)
39.	Narrative	*In the Comments section, please include a general summary of the results of dry weather screening program activities conducted over the preceding reporting period, including number and type of illicit connections identified, dry weather screening efforts, and location and efforts to correct identified illicit discharges.* (Part 2.3.5)

Illicit Discharge Detection and Elimination Comments:

23. Stormwater accumulation in secondary containment structures that are caused by rainfall are visibly inspected prior to release to the MS4. If an oil sheen is present, pads are used to absorb the sheen prior to releasing the water to the sewer. If an incident were to occur where there was a large amount of oily water, the water would be pumped and sent to the Oily Water Separator Facility (OWSF) on base for treatment prior to being sent to the City of Everett's wastewater treatment facility.

30. NAVSTA Everett did not experience any illicit discharges that made it into the MS4 system in 2024. NAVSTA Everett responded to a few small oil/gas spills that were cleaned up prior to reaching the MS4. This includes a spill at the NSC Smokey Point gas station and a transformer exploded at the South Wharf which were cleaned up with absorbent pads and properly disposed to Hazardous Waste. There was also a response to oil pans and improperly stored oils in one of the parking lots, which were removed for proper disposal to Hazardous Waste and PIG socks were placed around three catch basins to minimize oil from flowing into the storm drains. Please see Appendix B for the Illicit Discharge Reporting Form. All storm water catch basins on base discharge stormwater to one of four outfalls. All outfalls have an oil interceptor which traps the oil and prevents it from reaching the outlet side of the outfall which discharges to the Snohomish River. Visual inspections of the inlet side of the outfalls occurs quarterly, and if the inspections shows the presence of oil, the outfall is pumped or pads are used to absorb the oil. NAVSTA Everett receives stormwater off-base from the Port of Everett and from Marine Drive. Past investigations and dye testing revealed grease from restaurants located in the Port of Everett was entering NAVSTA Everett's MS4 through stormwater catch basins. Measures were put in place for the proper disposal of

cooking grease which solved the illicit discharge.

32. NAVSTA Everett does not have any downstream operators of MS4s, shellfish beds/fisheries, agricultural/livestock operations, drinking water systems, or other affected entity of spills or other non-stormwater discharges that may impact those systems. As a receiver of stormwater from the Port of Everett, outreach, discussion, and changes were made to eliminate the discharge of cooking grease into our MS4 system.

38. EWCC training occurs annually and covers all aspects of environmental compliance. The SWMP also lays out required training for targeted personnel. The trainings are online through the ECATTs website and a chart of required training by position is included in the SWMP. Some examples are listed below.

a. Stormwater – Basic Information: Washington
b. Stormwater Pollution Prevention for MS4 Video Training
c. Sediment and Stormwater Construction Training
d. Water Quality: Washington
e. General Environmental Compliance
f. NAVFAC Construction Contractor Prime – Stormwater

39. Dry weather screenings at Smokey Point were conducted during the summer of 2021 and no illicit discharge was noted. A facility inspection at NAVSTA Everett is required each quarter under the MSGP. Sediment from the outfalls are pumped out annually and disposed. Further education on car maintenance is discussed on quarterly environmental newsletters and helpful reminders such as “No Car Maintenance on Base” magnets are available upon request. No other observations beyond known groundwater penetration was noted. It is believed stormwater from Marine Drive off base has stormwater catch basins that flow into the base’s stormwater system. The contractor hired to update the stormwater maps will also verify and include in the updated stormwater maps.

New Development, Redevelopment, and Construction Site Runoff Control (Part 2.4)
If you answer "NO" to any of these questions, please explain in the Comments section.

40.	YES ☒ NO ☐	Does the SWMP document describe, and are you implementing, a program to reduce pollutants in stormwater runoff to the MS4 from all construction, new development and redevelopment project site activities in the Permit Area, including roads? (Part 2.4)
41.	YES ☐ NO ☐ NA ☒	During this reporting year have you provided adequate oversight to "regulated construction activities" and "regulated industrial activities" to ensure that all regulated activities obtained coverage under the appropriate stormwater permits? *Only choose NA if there were none of these activities in the Permit Area during this reporting year.* (Part 2.4.1)
42.	YES ☒ NO ☐	Have you implemented an enforceable mechanism to address runoff from new development, redevelopment and construction site projects to include the minimum requirements, thresholds and definitions? (Part 2.4.2.1)
43.	YES ☒ NO ☐	Does the enforceable mechanism include all of the criteria listed in Part 2.4.2.2 of the Permit? (Part 2.4.2.2)
44.	YES ☐ NO ☒	Have you had any equivalent criteria approved by EPA for use in stormwater controls from new development, redevelopment, and construction site runoff? *If so, in the Comments section please describe how these have been utilized during this reporting year.* (Part 2.4.2.4)
45.	YES ☒ NO ☐	Have you implemented policies and procedures, including contract mechanisms, to ensure review of all stormwater site plans for proposed development activities? (Part 2.4.3.1)
46.	YES ☐ NO ☐ NA ☒	Do you inspect, prior to clearing and construction, all development sites that have a high potential for sediment transport as determined through plan reviews based on definitions and requirements of Appendix C of the Permit? *Only choose NA if there were none of these activities in the Permit Area during this reporting year.* (Part 2.4.3.2)
47.	YES ☐ NO ☐ NA ☒	Do you inspect all development sites during construction to verify proper installation and maintenance of required erosion and sediment controls? *Only choose NA if there were none of these activities in the Permit Area during this reporting year.* (Part 2.4.3.3)
48.	YES ☐ NO ☐ NA ☒	During this reporting year, did you take the necessary enforcement actions, as relevant, based on the results of these inspections? *If yes, please describe in the Comments section. Only choose NA if there were no construction activities in the Permit Area or you did not identify any failures to properly install or maintain the required controls.* (Part 2.4.3.3)
49.	Narrative	*In the Comments section please document what percentage of all permanent stormwater treatment and flow control BMPs/facilities and catch basins in new developments were inspected every six months prior to 90% of the common plan of development being constructed during this reporting year?* (Part 2.4.3.4)
50.	YES ☐ NO ☐ NA ☒	Do you inspect all development sites upon completion of construction and prior to final approval or occupancy to ensure proper installation of permanent stormwater facilities? *Only choose NA if there were none of these activities in the Permit Area during*

		this reporting year. (Part 2.4.3.5)
51.	YES □ NO ☒	Are all maintenance requirements assigned/entered into the electronic tracking system for stormwater treatment and flow control BMPs/facilities? (Part 2.4.3.5)
52.	YES □ NO ☒	Do you keep adequate records to document that all the requirements of Part 2.4.3 of the Permit have been fully implemented? (Part 2.4.3.6)
53.	YES □ NO ☒	Were at least 80% of scheduled inspections completed during this reporting year? (Part 2.4.3.6)
54.	YES ☒ NO □	Have you established and implemented an internal tracking system to respond to issues of non-compliance? (Part 2.4.3.7)
55.	Narrative	*Annual Reporting Year 1: In the Comments section, please describe the Early Action Projects (EAPs) you plan to implement during this permit term. Please also provide a summary of all EAP planning and implementation actions taken to date.* (Part 2.4.4)
56.	Narrative	*Annual Reporting Year 2-5: In the Comments section, please provide any updates to your Early Action Projects (EAPs) plan. Please also provide a summary of all EAP planning and implementation actions taken in this reporting year.* (Part 2.4.4)
57.	YES ☒ NO □ NA ☐	*Annual Reporting Year 4:* Have you submitted a written Stormwater Infrastructure Investment Plan to EPA that documents future investments and upgrades in Naval Station Everett's stormwater infrastructure designed to improve MS4 discharge quality, AND that meets all of the requirements of Part 2.4.4? (Part 2.4.4)
58.	Narrative	*In the Comments section, please describe any training provided during this reporting period, including new employee training and follow-up training*. (Part 2.4.5)
59.	Narrative	*In the Comments section, please include a general summary any corrective actions taken at construction sites, number of site plans reviewed, site inspections, and one or more example of follow-up actions.* (Part 2.4.6)

New Development, Redevelopment, and Construction Site Runoff Control Comments:

44. No equivalent criteria has been submitted or approved by the EPA for use.

49. NAVSTA Everett and Smokey Point did not have any new development.

51. Maintenance items are entered into the electronic tracking system, but not all get addressed due to lack of funds, manpower or due to non-concurrence.

52. Only a "no" because there was no construction, new development, or redevelopment project site activities.

53. "No" is checked because there was no construction, new development or redevelopment projects to inspect.

56. Below is a summary of EAP planning and implementation actions taken in this reporting year.

EAP	**Summary**	**Status**
Construction project process	Stormwater managers are included in the early design phase and continued efforts are	Ongoing

	underway to define the roles and responsibilities with various stakeholders.	
Mapping Contract	The review of maps is currently underway.	Ongoing
Street Sweeping	Reviewed the street sweeping plan in 2024.	Complete-Ongoing
Enhancing pet waste management at Smokey Point	Installed additional pet waste bag station and signage. The pet waste bag stations are checked and filled with pet waste bags as needed.	Complete-Ongoing
Trench Drains	Trench drains were cleaned in 2024. Catch basins are being continuously evaluated.	Complete-Ongoing
Smokey Point pond maintenance study	The final report for dye testing and additional monitoring was completed in 2023.	Complete
Maintenance staff training and utility vault sampling	Staff were trained in 2021 and 2022 and sampling was completed in 2021-2022.	Complete
Copper and Zinc at NAVSTA Everett	Oyster shells were installed in the trench drains of Pier Bravo and South Wharf. Further evaluation of potential copper and zinc sources is ongoing.	Complete-Ongoing

57. Please see the Stormwater Infrastructure Investment Plan in Appendix C.

58. Trainings were conducted in 2024. The training topics presented included stormwater awareness, the SWMP, MS4 permit requirements, the Stormwater Management Manual for Western Washington, a refresher information about the Construction General Permit, and construction BMPs.

59. No corrective actions were needed to be performed because there were no construction, new development, or redevelopment projects at NAVSTA Everett or Smokey Point in Year 4.

Pollution Prevention and Good Housekeeping for Municipal Operations and Maintenance (Part 2.5)

If you answer "NO" to any of these questions, please explain in the Comments section.

60.	YES ☒ NO ☐	Have you established maintenance standards that are protective of facility function for all permanent stormwater facilities used for onsite management, flow control and treatment? (Part 2.5.1.1)
61.	YES ☒ NO ☐	Were all required maintenance activities, as relevant, undertaken per the schedules in Part 2.5.1.2? (Part 2.5.1.2)
62.	YES ☒ NO ☐	Does your operation and maintenance program include an enforceable mechanism that clearly identifies the party/parties responsible for maintenance? (Part 2.5.1.3)
63.	YES ☒ NO ☐	During this reporting year have you conducted inspections of all stormwater treatment and flow control BMPS/facilities that discharge to the MS4 at least annually or per an alternative schedule as established in the SWMP based on maintenance records or other documented information? (Part 2.5.2)
64.	Narrative	*In the Comments section, please specify the number of inspections of permanent stormwater facilities conducted pursuant to Parts 2.5.2. Please also indicate what percentage of the overall number of permanent stormwater facilities these numbers represent.* (Part 2.5.2)
65.	YES ☒ NO ☐	During this reporting year, have you conducted spot checks of all permanent stormwater facilities, per the requirements of Part 2.5.3 after all major storm events? (Part 2.5.3)
66.	Narrative	*In the Comments section, please specify the number of catch basins and inlets that were inspected during this reporting year. Please also indicate what percentage of the overall number of catch basins and inlets, this represents.* (Part 2.5.4)
67.	Narrative	*In the Comments section, please specify the number of catch basins cleaned during this reporting year.* (Part 2.5.4)
68.	YES ☐ NO ☒	During this reporting year, did you undertake and complete all the necessary maintenance, as required by Part 2.5.6 of the Permit, and as described in the SWMP document? (Part 2.5.6) *Please briefly describe in the Comments section.*
69.	Narrative	*In the Comments section, please briefly describe the enhanced street sweeping measures undertaken in all areas draining to Naval Station Everett Outfalls A, B, C, and D, during this reporting year.* (Part 2.5.7)
70.	Narrative	*In the Comments section, please describe any training provided during this reporting period, including new employee training and follow-up training*. (Part 2.5.8)
71.	YES ☒ NO ☐ NA ☐	Have you developed and implemented SWPPPs for all heavy equipment maintenance and storage yards and all material storage facilities within the MS4 area that are not already regulated under the MSGP? *Only choose NA if there were none of these facilities in the Permit Area OR if this is the Annual Report for Year 1.* (Part 2.5.9)
72.	YES ☒ NO ☐	During this reporting year, have you kept records of all inspections, findings of inspections, follow up actions to correct problems, and all maintenance? (Part 2.5.10)

Pollution Prevention and Good Housekeeping for Municipal Operations and Maintenance Comments:

61. A contractor is updating all stormwater maps at NAVSTA Everett and Smokey Point. Maintenance for sediment disposal of trench drains that run along Piers A and B and the South Wharf were cleaned out semi-annually in 2024 as the current maintenance plan indicates. Also, 75 catch basins were cleaned out at NAVSTA Everett during Year 4.

62. The SWMP includes an enforceable mechanism that clearly identifies the party/parties responsible for maintenance.

64. During Year 4 of the MS4 permit, two stormwater inspections were conducted at Smokey Point. The inspections included a site visit with PPV Housing/Hunt to discuss the redevelopment project areas and a spot-check of the permanent stormwater facilities in which 100% of the stormwater system, which is a series of ponds, were inspected. The Snohomish Conservation District finalized their maintenance recommendations for stormwater infrastructures at Smokey Point in January 2024. The Smokey Point stormwater maintenance recommendations were discussed in February 2024. At NAVSTA Everett, the location of the street sweeping pile was discussed due to its proximity to a storm water catch basin. Requirements were put in place to manage it such as additional analytical monitoring and relocation for the street sweeping pile. The additional analytical monitoring started in 2024 and the street sweeping pile relocation has been complete. Also at NAVSTA Everett, all four outfalls were inspected and sediment was removed from the inlet side of the outfall per the normal maintenance plan. Discussions on cleaning out the trench drains that run along the piers have been complete. Additional oil in Outfall C will be addressed. The cleaning out of the trench drains that run along the piers and wharf has been completed per the current maintenance plan in 2024.

66. With the exception of the large trench drain that run the length of the piers and wharf, 68 catch basins have been inspected at Smokey Point and 75 catch basins at NAVSTA Everett. Some of the catch basins at Smokey Point have deficiencies and also couldn't be opened with proper tools. Methods are being investigated to open the grates safely. As the MS4 program continues to ramp up, more emphasis on funding and equipment is occurring in order to comply. The plan is to complete 38% of catch basin inspections at Smokey Point over the next year and 77% of the catch basin inspections at NAVSTA Everett over the next year.

67. Sediment from all four outfalls and 75 catch basins at Everett were removed this past year.

68. Due to similar MSGP requirements, a majority of the activities listed in 2.5.6 of the MS4 permit are already in compliance. Existing Navy or installation requirements and established BMPs provide written guidance. Some of the activities do not apply because they do not occur on the base. For the few activities that need to be addressed, we are currently evaluating policies and procedures for the maintenance activities to make sure they are in compliance with the MS4 permit and pollution prevention practices. A new policy was signed by the CO in 2024 committed to continual environmental improvement and pollution prevention and distributed to the EWCC's in the environmental newsletter for environmental awareness. This helps educate and ensure stormwater compliance.

69. The street sweeping and disposal plan was reviewed by Environmental, Integrated Solid Waste Management, Production, Facilities and Maintenance, and Utilities in June 2024. Street sweeping is not being conducted according to the current maintenance plan on NAVSTA Everett. The street sweeping plan is scheduled biweekly on Piers Alpha and Bravo, and the South Wharfs. The North Wharf and parking lots current maintenance plan are scheduled to be swept one to two times per year. NAVSTA Everett had a base-wide clean-up volunteer event in February 2024 for volunteers' stormwater quality awareness.

70. Please see Appendix A which lists required and follow-up training by key personnel such as EWCCs,

Environmental staff, Port Operations personnel and other identified key personnel.

71. Due to similar MSGP requirements, the NAVSTA Everett developed SWPPPs for heavy equipment maintenance and material storage yards under the SWPPP Table 5-1.

Part III. Monitoring, Recordkeeping and Reporting Requirements (Part 3)
If you answer "NO" to any of these questions, please explain in the Comments section.

73.	Narrative	*In the Comments section, please provide an evaluation of your compliance with the Permit conditions and progress towards achieving the control measures, during this reporting year.* (Part 3.1)
74.	☐ Option 1 ☒ Option 2	For Annual Reporting Year 1: Did you select monitoring Option 1 (Monitoring/Assessment Plan) or monitoring Option 2 (participation in the Stormwater Action Monitoring Program)? *For all reporting years: If you selected Option 1, please answer questions 75, 76 and 77. If you selected Option 2, please answer question 78.*
75.	Narrative	*In the Comments section, please summarize the results of all monitoring and evaluation undertaken during this reporting year. Discuss results of all types of assessments per the monitoring plan approved by EPA pursuant to Parts 3.3.1 through 3.3.10 of the Permit. Provide your interpretation of these data and how you are using them to inform your stormwater management program.* (Part 3.3)
76.	YES ☐ NO ☐	During this reporting year, was all sample collection, preservation and analysis conducted according to test procedures approved under 40 CFR Part 136, or another method approved by EPA? (Part 3.3.4)
77.	YES ☐ NO ☐	During this reporting year, have you complied with all elements of your Quality Assurance Program Plan (QAPP) developed pursuant to the requirements of part 3.3.9 of the Permit? (Part 3.3.9)
78.	Narrative	*In the Comments section, please summarize your activities as a participant with the Stormwater Action Monitoring Program.*
79.	YES ☒ NO ☐	Are you complying with the record-keeping requirements of Part 3.6 of the Permit? (Part 3.6)
80.	YES ☒ NO ☐	During this reporting year have you ensured that an updated SWMP and all SWMP records are available to the public? (Part 3.7.2.2) *In the Comments section please discuss what records are available on your website, any requests you have received for records and your responses.*
81.	YES ☐ NO ☒	During this reporting year, have any boundary changes to your facilities resulted in either an increase or a decrease in the Permit Area? *If yes, please describe in the Comments section.* (Part 3.7.2.2.4)
82.	Narrative	*In the Comments section please provide an annotated list of any attachments to this Annual Report.* (Part 3.7.2.2.1)
83.	YES ☒ NO ☐	Are all monitoring data collected during this reporting year, as applicable, attached to this Annual Report? (Part 3.7.3)

Monitoring, Recordkeeping and Reporting Comments:

73. Compliance with the MS4 permit began before the official MS4 permit became effective February 1, 2021. Efforts included drafting construction requirements, updating maps with stormwater structures, preparation for IDDE dry weather surveys, and development of maintenance standards. After the effective permit date, the efforts to meet compliance intensified. Significant changes and new requirements such as the requirement to test utility vaults prior to pumping to the MS4 was addressed with contractors and base personnel in an effort to ensure the new requirement was adhered to.

MCM #1 – Training and outreach efforts were established to meet permit compliance in and continued into 2024. Existing EWCC training was updated to include MS4 permit requirements and the training was conducted in person in small groups. In 2020 in anticipation of the MS4 permit, an environmental newsletter was established to help education all personnel on base regarding all the environmental programs, especially stormwater. It is sent out quarterly to approximately 100 base personnel.

MCM #2 – NAVSTA Everett held two Earth Day events in April 2024, which focused on the removal of trash and recycling throughout the base and along the riprap of the base. Another clean-up effort is planned to take place on the base in April 2025.

MCM #3 – Procedures in accordance with the MS4 permit were developed and incorporated within the SWMP plan. Materials to aid in dry weather surveys and investigations, including a portable spectrophotometer, turbidity meter, and testing supplies, were purchased in 2022.

MCM #4/5 – Procedures and responsibilities were developed in accordance with the MS4 and incorporated within the SWMP plan. Multiple trainings were held during the first and second year of the program to communicate the permit requirements.

MCM #6 - In order to become compliant with permit conditions, several jobs were put in the database to bring to light and discuss mitigation tactics to achieve compliance. Jobs were put in the system to improve the street sweeping program, stormwater catch basin inspections and subsequent clean out, checking the stormwater catch basin filter and subsequent replacement, and adhering to the planned maintenance of cleaning out the trench drains semi-annually.

78. Through negotiations with the Stormwater Action Monitoring (SAM) Network, the Navy is considered an active participant through annual payments. The Navy’s participation in SAM is outlined in the Cover Letter provided by the Washington Department of Ecology SAM Program, which is available upon request.

80. The SWMP and SWMP records are available on the NAVSTA website.

82. Annotated List of Attachments

Appendix A, Education and Training Courses
Appendix B, Illicit Discharge Reporting Form
Appendix C, Stormwater Infrastructure Investment Plan
Appendix D, Everett and Smokey Point Downspout Evaluation

Part IV. Required Response to Exceedances of Water Quality Standards (Part 4)

84.	YES ☐ NO ☒	During this reporting year were any exceedances of water quality standards identified, per the terms of Part 4 of the Permit? (Part 4)
85.	Narrative	*If yes, please describe in the Comments section all measures that were taken to mitigate the water quality standards exceedance, including notifications, adaptive management measures undertaken, schedules for implementation, and a status of current conditions. Include details per the provisions in Part 4 of the Permit.*

Required Reponses to Violations of Water Quality Standards Comments:

Appendix B
MS4 Annual Report
Year 3

Outreach Summary					
Date	**Outreach Item**	**Topics Covered**	**Audience(s)**	**Distribution Method and # of personnel**	**Additional Information**
Quarterly	Enviormental Insights Newsletter	MS4/MSGP general awareness, BMPs, and stormwarter concerns; Recycling; Hazardous Waste; Spill Response; Air; and Natural Resource Program	EWCCs and their leadership	Distributed electronically to 100 base personnel	

Training Summary					
Date	**Training**	**Topics Covered**	**Audience(s)**	**Training Method and # of personnel**	**Additional Information**
Held Quarterly, Required Annually	EWCC Training	Stormwater awareness, regulatory and permit background, potential ecological impacts of stormwater runoff, proper BMPs usage and maintenance, allowable and prohibited discharges, key elements of the industrial stormwater program, common sources of stormwater pollution, and spill response. Also covers updates to the Air, Hazardous Waste, Spill, AST/UST, SPCC, and Natural Resource Programs	Civilian and Military workers	In person training, approximently 50 personnel per year	This has been a requirement under EMS for a number of years. It is a well established and tracked program
Annually	Hazardous Substance Incident Response Management (HSIRM)	Knowledge and skills necessary to respond safely and effectively to releases of, or substancial threats of releasesof, hazardous substances, in compliance with applicable federal, state, and UNS environmental regulations and instructions.	Environmental personnel, Operations personnel and some EWCCs	Contractor from HAZTRAIN provides training in person	Fullfils training requirement established by regulations delineated in 29 CFR 1910.120(q) and 29 CFR 1910.120(p)(7)(I)
Assigned to key personnel in 2023	MS4 Video	General Stormwater Eductation as it pertains to the MS4		Virtual ECATTS	
Assigned to key personnel in 2023	Sediment and Stormwater Construction Training	Introduction to laws and regulations, environmental impacts of soil erosion, principals of erosion and sedimentation, vegetative stabilization, principals of stormwater runoff, construction site pollution prevention, sediment and stormwater plans.	Civilian and Military workers associated with construction, and construction contractors	Virtual ECATTS	
Assigned to key personnel in 2023	Stormwater--Comprehensive Overview: Washington	General stormwater awareness, sources of pollution, laws and regulations, MS4 permits, environmental impacts of stormwater, controlling sediments and erosion control on construction sites, point and non-point source pollution sources, BMPs, LID, managing stormwater in industrial areas, and cross connections.	Civilian, Military and Contractors	Virtual ECATTS	
Assigned to key personnel in 2023	Stormwater--Basic Information: Washington	General stormwater awareness, sources of pollution, laws and regulations, environmental impacts of stormwater, controlling sediments, point and non-point source pollution sources, BMPs, managing stormwater in industrial areas, and cross connections.	Civilian, Military and Contractors	Virtual ECATTS	
Jun-23	Impacts of Stormwater on Southern Resident Killer Whales	The training covered SRKW monitoring and mitigation strategies, their status under the Endangered Species Act, habitat, prey, chemical threats such as PCP, PCB, DDT, PBDEs, persistent organic pollutants, bioaccumulation of chemicals, and the decline of chinook and Coho salmon due to poor stormwater quality.	MS4 program managers, other personnel that influence the quality of stormwater discharges	Virtual training hosted by regional natural resources environmental team	
Apr-23	Washington State Municipal Stormwater Conference	The conference covered street sweeping for pollutant reductions and chemical properties and treatment of 6PPD-Quinone.	MS4 program managers	Virtual training hosted by Washington Stormwater Center	
Jan-24	Climate Change Impacts on Southern Resident Killer Whales	The training covered SRKW, habitat, prey, chemical threats such as PCP, PCB, DDT, PBDEs, persistent organic pollutants, disturbance from vessels and sound, and the decline of chinook and Coho salmon due to poor stormwater quality.	Stormwater media managers	Virtual training hosted by regional climate resiliency environmental team	

Illicit Discharge Reporting Form

Version 2.0 July 2021

This form is to be completed for a) yearly dry weather surveys for the Outfall Reconnaissance Inventory and b) characterization of illicit discharges reported by other means. This form should be completed by stormwater personnel and placed in the folder located here: W:\Region_Env\Everett\Stormwater\MS4\SWMP . Please ensure the Date listed in Section 1 covers all dates that were required for completing this form and any investigations.

Section 1: Background Data

Date	Time
Drainage Basin	Outfall ID (if applicable)
Form Completed By (name, phone #)	
Ambient Temp (F)	Last Rainfall
Location	GPS Coordinates
Notes (hotline reporting?)	

Section 2: Outfall Description & Indicators

General description:

Submerged in Water? ☐ No ☐ Partially ☐ Fully

Under Sediment? ☐ No ☐ Partially ☐ Fully

Outfall Damage: ☐ Cracking, Chipping ☐ Corrosion
☐ Other _____

Vegetation ☐ Slight overgrowth ☐ Moderate overgrowth ☐ Excessive overgrowth
☐ Other: _____

Flow Present? If no flow present, then No Further Action. Skip to Section 5.
☐ Yes ☐ No If flow is present, continue to Section 3.

Section 3: Flow Characterization

(continues to pg. 2)

Flow Description: Estimated Volume (L/s): Method of Flow Estimation:	Deposits/Stains ☐ None ☐ Oil ☐ Sewage fuzz ☐ Other: _____
pH & Temp (F)	Phosphate (ppm)
Ammonia(ppm)	Chlorine (total/free ppm)
Hardness (CaCO3 ppm)	Alkalinity (CaC03 ppm)
Nitrate/Nitrite (ppm)	

Were samples collected for lab? Sample Notes:
☐ Yes ☐ No

Section 3: Flow Characterization (continued)

Odor - Description ☐ Sewage ☐ Rancid/Sour ☐ Petroleum/Gas ☐ Sulfer ☐ None ☐ Other _____	Odor - Severity ☐ Faint ☐ Easily Detectable ☐ Noticeable from a distance ☐ N/A
Color - Description ☐ Clear, no color ☐ Other _____	Color - Severity ☐ Faint ☐ Clearly visible in sample container ☐ Clearly visible in outfall ☐ N/A
Flotables - Description ☐ Sewage (toilet paper) ☐ Petroleum (oil sheen) ☐ Suds ☐ Other _____	Flotables- Severity ☐ Slight ☐ Some ☐ Heavy ☐ N/A
Overall Characterization ☐ Discharge not harmful (skip to Section 5) ☐ Discharge potentially harmful ☐ Discharge harmful to human health and/or environment	

Section 4: Response

Nature of Discharge (see Indicator Sampling Flow Chart) ☐ Residential ☐ Industrial/ Commercial ☐ Industrial/ Process Water ☐ Sanitary Wastewater ☐ Human/Animal Waste ☐ Tap Water ☐ Groundwater ☐ Other _____ ☐ Unknown/Further Investigation Req
Source of Discharge
Action Taken (downstream facilities/personnel notified? etc)

Section 5: Next Steps

☐ No Further Action ☐ Open For Further Investigation	Notes:

1. Background

Part 2.2.4 of the Naval Station Everett (NSE) MS4 Permit (WAS026620) states that the permittee "shall identify Early Action Projects (EAPs) that meet the objectives of this section" by identifying pollutants of concern and prioritizing reduction and elimination of these pollutants if they are identified in discharges. Pollutants for which TMDLs have been established have also been prioritized. NSE has prepared the following Stormwater Infrastructure Investment Plan (SIIP) to document future investments and upgrades in its stormwater infrastructure, designed to improve MS4 discharge quality in these and other areas. This plan also evaluates any monitoring data collected and takes into consideration any other relevant monitoring data available from the Washington Department of Ecology, Snohomish County, or other neighboring jurisdictions. The NPDES further specifies the required content of SIIP, which will be detailed in the sections below.

This SIIP evaluates potential projects and project locations to mitigate water quality impacts identified therein based on the following considerations:

- Monitoring data and watershed/basin plans;
- Effectiveness in improving water quality in the receiving water including support of beneficial uses;
- Feasibility;
- Cost effectiveness;
- Pollutant removal effectiveness; and
- Long term maintenance requirements.

2. Characterization of MS4 Discharges

2.1 Pollutants of Concern

The NPDES permit requires this plan to prioritize reduction and elimination of pollutants of concern, if those pollutants have been identified in discharges from NSE. NSE's MS4 covers two installations that discharge into different waterbodies. Pollutants of concern identified in discharges from Naval Station Everett that adversely impact water quality include the following:

Table 2-1: Pollutants of Concern

Installation	Identified Pollutant	Receiving Waterbody
NSE	Copper	Snohomish River/Port Gardner and Possession Sound
	Zinc	
	Fecal Coliform	
	Nitrate	
Naval Support Complex Smokey Point	Zinc	Hayho Creek/Quilceda Creek/Possession Sound
	Copper	
	Fecal Coliform	

2.2 Total Maximum Daily Loads (TMDLs)

The NPDES permit requires the Permittee must also prioritize pollutants for which relevant total maximum daily loads (TMDLs) have been established. Receiving waterbodies with published TMDLs are listed in Table 2-2 below. Other than the pollutants already listed in Table 2-1 above, no discharges from NSE with adverse impact to water quality according to the listed TMDL pollutants have been identified.

Table 2-2: Waterbodies and TMDLs

Installation	Affected Waterbodies	Published TMDL
NSE	Snohomish River/Port Gardner and Possession Sound	None
Naval Support Complex Smokey Point	Hayho Creek/Quilceda Creek/Possession Sound	Fecal Coliform

3. Current and Completed Projects to Mitigate Water Quality Impact

3.1 Early Action Project Plan

The NPDES permit requires the Permittee to identify early action projects during Year 1 of the first year of the effective date of the permit. A finalized EAP plan was prepared in 2022 and submitted with the Year 1 Annual Report. This EAP plan included extensive sampling and analysis data to evaluate pollutants of concern at all installations and provided a list of operational, maintenance, and structural projects to be completed during the permit term to reduce pollutants of concern and TMDL pollutants. In particular, the structural EAP projects are part of NSE's overall SIIP. Table 3-1 summarizes these EAP projects.

Table 3-1: Early Action Project Status

Installation	Project	Pollutant of Concern Addressed	Status
NSE	Oyster shells installed at South Wharf and Pier Bravo and the conveyance system in Outfall B drainage area in 2024 for aid in metals removal. Additionally, the cleaning frequency of the trench drains on Pier Alpha, Pier Bravo, and the South Wharf has been increased to semi-annual to help address high copper levels.	Copper, Zinc	Completed-Continuous

Smokey Point	Pond maintenance study in partnership with Snohomish Conservation District to evaluate current status of stormwater ponds and provide maintenance recommendations for changes to improve water quality.	Copper, Zinc	Completed

3.1. Pollutants of Concern

The EAP also prioritized areas of concern for specific pollutants. Over the course of the permit period, NSE monitored several MS4 outfalls at different installations where potential pollutants might be expected. The pollutants which, after testing, showed levels of concern are summed in Table 3-2 and provide the focus for future infrastructure projects.

Table 3-2 – Pollutants of Concern

Installation	Pollutant of Concern	Receiving Waterbody
NSE	Cu, Zn, Nitrate, Fecal Coliform	Snohomish River/Port Gardner and Possession Sound
Smokey Point	Cu, Fecal Coliform	Hayho Creek

3.2 Downspout Evaluation Survey

In 2023, a Downspout Evaluation investigation was conducted to evaluate the feasibility of using low impact development techniques and other controls that infiltrate, evapotranspire, harvest, and re-use stormwater runoff, or which otherwise eliminate stormwater pollutant loadings. The final report was provided to NSE in April 2024. The report evaluated existing building locations where the disconnection of existing flows from rooftop downspouts into the MS4 would be feasible and will contribute to water quality improvement.

The downspout evaluation survey evaluated downspouts from buildings at NSE and Smokey Point. The survey is at Attachment D. Twenty-seven (27) buildings at NSE were considered feasible areas for potential modifications, incorporating bioretention swales, bioretention plantar boxes, or splash blocks. Table 3-3 shows the breakdown of recommended best management practices for NSE. Buildings at Smokey Point were also evaluated, but stormwater runoff from all buildings at Smokey Point is already conveyed through multiple regional water quality facilities that provide equal or enhanced benefits compared with BMPs installed at individual downspouts.

Table 3-3 – Feasible Buildings for Retrofits

Installation	Building Total	Splash Block	Bioretention Swale	Bioretention Plantar Box
Everett	27	3	19	5

4. NSE Stormwater Projects

For the MS4 permit period (February 2022-current), the following stormwater projects have occurred or are planned to take place:

4.1 Completed Projects

4.1.1 Oyster shells Installed in Outfall A and Outfall B Drainage area - NSE

Under NSE's MSGP (WAR05F001), quarterly sector-specific benchmark sampling and indicator monitoring is required at four outfalls. Under Part 2.4.4.9, corrective action projects were initiated to comply with NSE's MSGP AIMs levels for copper at Outfall A and zinc at Outfall B. Oyster shells, which are a treatment control, were installed in the trench drain on Pier Bravo and the South Wharf to help address high copper levels at Outfall A and also in four locations in the conveyance system at Outfall B drainage area. The project was completed in 2024.

Investigative sampling is planned in Year 5 of the MS4 permit to identify potential metal sources to obtain appropriate funding to implement and/or install effective pollutant controls at Outfall A, Outfall B, and Outfall D drainage area.

4.1.2 Outfall and Oil/Water Separator Repairs and Improvements - NSE

This project will repair the baffle and ladders in outfall D, also install a monitoring base and conduit for a data logger. Project also installs a duckbill valve on outfalls A. Outfall A and Outfall D are two of the four outfalls where stormwater samples are collected as part of the installations' MSGP. The baffle wall and ladder at Outfall D needs to be repaired to intercept pollutants from entering the Snohomish River. The duckbill valve is missing from Outfall A and a new duckbill valve needs to be installed to prevent pollutants from entering the stormwater system during high tides. Project was completed in 2024.

4.2 Current Projects

4.2.1 Wetland Enhancement at Smokey Point

Enhancement of wetlands at NSC Smokey Point to sustain and improve threatened and endangered species habitats.

4.3 Future Stormwater/Capital Improvement Projects

4.3.1 Housing Redevelopment at Smokey Point

Parts of Smokey Point will be redeveloped as housing areas. The redevelopment project will incorporate Washington Department of Ecology's stormwater design requirements in the 2024 Stormwater Management Manual for Western Washington (SWMMWW) to include on-site stormwater management, runoff treatment, flow control, and wetlands protection.

As part of this redevelopment, upgrades to the stormwater system, including possible resizing of stormwater ponds, low impact development (LID) features, and General Use Level Designation (GULD) technologies or bioretention cells will be installed to reduce many pollutants in stormwater including oils, hydrocarbons, metals, and 6PPD-quinone in runoff.

The objective of on-site stormwater management is to use practices distributed across a development that reduce the amount of disruption of the natural hydrologic characteristics of the site.

The objective of runoff treatment is to reduce pollutant loads and concentrations in stormwater run-off using physical, biological, and chemical removal mechanisms so that beneficial uses of receiving waters are maintained and, where applicable, restored. When site conditions are appropriate, infiltration can be an effective BMP for runoff treatment.

The objective of flow control is to prevent increases in the stream channel erosion rates that are characteristic of natural conditions (i.e. prior to disturbance). The Flow Control Performance Standard intends to maintain the total amount of time that a receiving stream exceeds an erosion-causing threshold based upon historic rainfall and natural land cover conditions, in order to protect fish habitat and production.

Wetlands protection standards ensure that wetlands receive the same level of protection as any other water of the state. Wetlands are extremely important natural resources that provide multiple functions and values, including ground water recharge, flood control, and stream channel erosion protection. Careful planning and management are conducted to avoid impact by urban development through pollutants in the runoff or disruption of the natural hydrologic pattern of the wetland.

4.3.2 Riparian Restoration at Smokey Point

Restoration of riparian buffer at NSC Smokey Point to sustain and improve threatened and endangered species habitats. A cooperative agreement is currently underway with the Tulalip Tribes to develop a conceptual design for restoration of the Hayho Creek channel.

5. Potential Projects to Mitigate Water Quality Impact

The NPDES permit requires where the available data and information indicate that the Permittee's MS4 discharges adversely impact water quality, including beneficial uses, and where non-structural BMPs are inadequate to sufficiently avoid such impacts, the Permittee must analyze potential locations for structural stormwater control measures designed to further reduce pollutant loadings. For each potential location, the written plan must evaluate the feasibility of using low impact development techniques, and/or other controls that eliminate that eliminate stormwater pollutant loadings, from existing surfaces draining into Puget Sounds.

NSE conducted sampling and analysis under the EAP for pollutants of concern and TMDL pollutants. Those pollutants determined to adversely affect water quality are listed in Table 5-1.

Table 5-1: Pollutants of Concern

Installation	Identified Pollutant	Discharge Locations
NSE	Copper	Outfall A, Outfall B, Outfall C, Outfall D
	Zinc	Outfall A, Outfall B
	Fecal Coliform	Outfall A, Outfall B, Outfall C, Outfall D
	Nitrate	Outfall A, Outfall B
Naval Support Complex Smokey Point	Zinc	Large pond, small pond
	Copper	Small pond
	Fecal Coliform	SP Bridge, small pond

5.1. Non-Structural BMPs

NSE prioritizes the use of non-structural operations and maintenance BMPs to eliminate stormwater pollutants at the source before they can be captured by stormwater.

At NSE, the street sweeping effort has been ongoing. The street sweeping pile location until it is hauled offsite has been cause for concern. The location where the debris is stored has been relocated to Oily Waste Treatment Facility and is covered by a tarp. Additionally, monitoring of any stormwater flow is planned to evaluate potential pollutants from the pile. This operational change is being completed by the Naval Station Everett Public Works department. Monitoring efforts will be evaluated and if necessary, a structural solution may be required to address any potential pollution runoff. In additional, ten catch basin filters have been installed in Outfall B and Outfall D's conveyance system and PM's have been created to check the filters quarterly and changed as needed.

At Smokey Point, pet waste management is being operationally enhanced. Pet waste signages and waste stations have already been placed on-site to encourage pet owners to be more responsible in cleaning up after their pets. NSE Environmental is working with PPV to implement additional pet waste signage and waste stations during the PPV housing project at Smokey Point.

Naval Facilities Engineering Systems Command

Final
JUNE 2024

MS4 Downspout Evaluation Report

Naval Station Everett
Snohomish County, Washington

United States Department of the Navy
Naval Facilities Engineering Systems Command Northwest
1101 Tautog Circle
Silverdale, WA 98315-1101

Naval Facilities Engineering Systems Command Northwest
Silverdale, WA

Final

MS4 Downspout Evaluation Report

Naval Station Everett, Snohomish County, Washington

June 2024

DCN: LBJV-5006-4255-0003

Prepared for:

United States Department of the Navy
Naval Facilities Engineering Systems Command Northwest
1101 Tautog Circle
Silverdale, WA 98315

Prepared by:

Liberty Joint Venture
15862 SW 72nd Avenue, Suite 150
Portland, Oregon 97224
503-639-3400

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FINAL
MS4 DOWNSPOUT EVALUATION REPORT
NAVAL STATION EVERETT, SNOHOMISH COUNTY, WASHINGTON

June 2024

Prepared for
United States Department of the Navy
Naval Facilities Engineering Systems Command Northwest
Silverdale, WA 98315

REVIEW AND APPROVAL

Task Order Manager:  June 13, 2024

Daniel Schall, PE
Liberty JV

Date

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List of Appendices

List of Tables

Acronyms and Abbreviations

bgs ..... below ground surface
BMP ..... best management practice

CWA ..... Clean Water Act

DLA ..... Defense Logistics Agency

Ecology ..... Washington Department of Ecology
EPA ..... United States Environmental Protection Agency

ft ..... foot (feet)

ID ..... identifier
INRMP ..... Integrated Natural Resources Management Plan

MS4 ..... municipal separate storm sewer system

NAVD88 ..... North American Vertical Datum of 1988
NAVFAC ..... Naval Facility Engineering Systems Command Northwest
NAVFAC NW ..... Naval Facility Engineering Systems Command Northwest
Navy ..... United States Department of the Navy
NPDES ..... National Pollutant Discharge Elimination System
NSC ..... Naval Support Complex
NSE ..... Naval Station Everett

O&M ..... operation and maintenance

PAHs ..... polycyclic aromatic hydrocarbons

ROM ..... rough order of magnitude

SIIP ..... Stormwater Infrastructure Investment Plan
SWMMWW ..... Stormwater Management Manual for Western Washington

TSS ..... total suspended solids

UIC ..... underground injection control
WAC ..... Washington Administrative Code

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1.0 Introduction

This Municipal Separate Storm Sewer System (MS4) Downspout Evaluation Report describes the evaluation of existing building locations at Naval Station Everett (NSE) and Naval Support Complex (NSC) Smokey Point where disconnection of existing flows from rooftop downspouts into the MS4 and/or to Puget Sound could be suitable for and contribute to water quality improvement, including support of beneficial uses. This report was prepared by Liberty JV for Naval Facilities Engineering Systems Command Northwest (NAVFAC NW) under Contract No. N44255-20-D-5006, Task Order No. N4425523F4255.

1.1 MS4 Permit

The United States Environmental Protection Agency (EPA) issued an MS4 permit (Permit Number WAS026620) for NSE, which went into effect on February 1, 2021. The MS4 permit (EPA, 2020) encompasses both NSE and NSC Smokey Point under a single regulatory framework and allows for stormwater discharge from non-industrial areas for activities that could potentially pollute waters of the United States under the National Pollutant Discharge Elimination System (NPDES) permit program in accordance with the Clean Water Act (CWA). The NSE MS4 permit is based on EPA's Phase II regulations for MS4 discharges, which apply to urbanized areas with populations fewer than 100,000.

Naval installations are Federal jurisdictions and therefore are regulated by EPA. Although NSE is located in the state of Washington, municipal stormwater permits administered by the Washington Department of Ecology (Ecology) are not applicable. The EPA does refer to Ecology documents for reference and guidance, but ultimately all regulatory requirements are based on EPA standards.

1.1.1 Downspout Disconnection Evaluation Requirements

As described in Section 2.4.4 of the MS4 permit for NSE, a Stormwater Infrastructure Investment Plan (SIIP) is required with the Fourth Year Annual Report. The SIIP is a written plan submitted to EPA to document feasible and effective future investments and upgrades to stormwater infrastructure at the installations that are designed to improve the water quality of MS4 discharges. These improvements can be both operational and structural in nature and must be designed to prioritize the reduction and elimination of the pollutants of concern listed in Table 2.4.4 of the MS4 permit. Overall, the SIIP must evaluate and recommend potential projects that improve water quality based on effectiveness, feasibility, cost effectiveness, pollutant removal effectiveness, and long-term maintenance requirements.

One portion of the SIIP is an evaluation of rooftop downspouts of existing buildings. Section 2.4.4.7 of the MS4 permit requires an "evaluation of existing building locations where the disconnection of existing flows from rooftop downspouts into the MS4 and/or to the Puget Sound could be feasible and could contribute to water quality improvement, including support of beneficial uses" (EPA, 2020). Beneficial uses, sometimes called designated uses, for the Puget Sound include aquatic wildlife habitat, fish and shellfish harvesting, commerce and navigation, boating, and aesthetics (Washington Administrative Code [WAC] 173-201A-210). Water quality parameters that influence these beneficial uses include temperature, dissolved oxygen, turbidity or total suspended solids (TSS), pH, metals, toxic substances, and bacteria (enterococci or fecal coliform).

The MS4 permit requires that water quality best management practices (BMPs) described in Ecology's Stormwater Management Manual for Western Washington (SWMMWW) be considered (Ecology, 2019). The SWMMWW includes multiple BMPs for stormwater and water quality management, but some are not relevant or may not be reasonable to implement in conjunction with the disconnection of downspouts. BMPs that were considered appropriate or suitable for installation for the downspout disconnection evaluation are described in Section 2.1. This report documents the rooftop downspout disconnection evaluation required for the SIIP.

Runoff from rooftops can contain pollutants that negatively affect the beneficial uses for the Puget Sound. On metal roofs, stormwater can react with the roof's surface and adsorb dissolved metals, while roofs with wooden or asphalt shingles can release pollutants such as polycyclic aromatic hydrocarbons (PAHs) and other inorganic compounds into the contacting stormwater. However, rooftops are typically not the most significant source of pollution in stormwater runoff. In general, most pollutant loading in stormwater runoff from non-industrial areas stem from the ground surface, particularly roadways. Other BMPs, such as regional water quality facilities that capture runoff from both roofs and catch basins located in the street, may provide much more water quality benefit while potentially being more cost-effective for the amount of area and pollutant loading treated.

1.2 Installation Description

The NSE MS4 permit covers both NSE and NSC Smokey Point. General descriptions of the two naval installations are provided in this section.

1.2.1 Naval Station Everett

NSE is a 117-acre property located along the industrial waterfront of Port Gardner in Everett, Washington. NSE is the homeport for five guided missile destroyers and

two United States Coast Guard vessels. Operations at the installation include administration, Chief of Naval Operations maintenance availabilities, selected restricted availabilities and emergent work on guided missile destroyers, light industry, and housing. Additionally, the Navy has several facilities on the west side of the site including the Exchange store, gas station, convenience store, car wash, recruiting office, and three aboveground storage tanks owned by the Defense Logistics Agency (DLA).

The Snohomish River flows along the western shoreline of NSE before discharging into Possession Sound, which is part of the Puget Sound. Most of the stormwater runoff from NSE drains to the Snohomish River, immediately upstream of the junction with Possession Sound, but a portion of the site does drain directly into the Sound. There are four stormwater outfalls from the installation as well as a few locations where sheet flow discharges directly off-site. The drainage areas and the installation's stormwater infrastructure are further described in NSE's Phase II Stormwater Management Program Plan (NAVFAC, 2022b).

1.2.2 NSC Smokey Point

NSC Smokey Point is a 52-acre site located north of Marysville, Washington, approximately 12 miles northeast of NSE. The Navy Exchange and Commissary, Navy Lodge, Education Center, a gas station, large personal vehicle storage, Navy Campus, and other support services are all located at NSC Smokey Point. No industrial areas are covered by an industrial stormwater general permit at this installation.

A wetland, oriented east-west, is located in the northern portion of the site between the facility buildings and the large vehicle storage area (NAVFAC, 2022a). A 25-foot-wide landscaped buffer extends on either side of the wetland. A 30-foot-wide drainage and landscape easement extends along the northern and eastern property boundaries. In addition to the vegetated swale along the northern and eastern edges of the properties, two stormwater ponds are located immediately north of the wetland, and two larger stormwater ponds are located along the eastern property boundary. Hayho Creek flows south along the western property boundary of NSC Smokey Point and is surrounded by a 50-foot-wide native planting buffer.

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2.0 Stormwater Management

2.1 Potential BMPs

The MS4 permit recommends consideration of BMPs described in the SWMMWW that are feasible and could contribute to water quality improvement of existing downspout flows. The BMPs listed in the SWMMWW were evaluated by Liberty JV for their suitability commensurate with the disconnection of downspouts, with input from the United States Department of the Navy (Navy). This initial screening removed BMPs from consideration if they were intended to treat runoff from ground surfaces or required considerable removal of the pavement around the downspout discharge location, installation of above-ground infrastructure that would impede typical site operations, and/or alteration of existing stormwater infrastructure other than the downspouts or simple connections to existing storm conveyance piping. Based on the MS4 permit language, implementation of BMPs that are more extensive or intrusive for the existing site conditions would likely be considered in alternative sections in the SIIP, as described in Sections 2.4.4.4 through 2.4.4.6 of the MS4 permit. BMPs that are more regional in nature and capture runoff from ground surfaces and runoff collected in catch basins in addition to rooftop runoff, exceed the reasonably feasible threshold for disconnection of existing flows from rooftop downspouts. Table 2-1 lists the BMPs from the SWMMWW that were considered potentially suitable for downspout disconnection.

Table 2-1: Potentially Suitable BMPs for Downspout Disconnection

BMP General Name	BMP Classification in SWMMWW	BMP Short ID	BMP Description Report Section	BMP Detail Sheet in Appendix A	Water Quality Improvements
Infiltration Trench	BMP T5.10A	I	2.1.1.1	V-4.1 and V-4.2	Reduction of TSS, metals, bacteria, and quantity of stormwater runoff ultimately reaching the Puget Sound.
Drywell	BMP T5.10A	W	2.1.1.2	V-4.3	
Dispersion Trench	BMP T5.10B	D	2.1.2.1	V-4.4 and V-4.5	
Splashblock	BMP T5.10B	K	2.1.2.2	V-4.6	
Perforated Stub-out Connection	BMP T5.10C	C	2.1.3	V-4.7	
Infiltration Pond/Basin	BMP T7.10	B	2.1.4	V-5.4	
Bioretention (Swale or Planter Box)	BMP T7.30	P or S	2.1.5	Swale: V-5.12 – V-5.14 Planter: V-5.15	
Rain Garden	BMP T5.14	R	2.1.6	N/A	

Abbreviations/Acronyms:
BMP = best management practice
ID = identifier
N/A = not applicable
SWMMWW = Stormwater Management Manual for Western Washington
TSS = total suspended solids

In general, the SWMMWW BMPs not considered suitable include site design, dispersion, filtration, biofiltration, wetpool, pretreatment, manufactured treatment devices as BMPs, detention, and oil and water separators (Volumes V-2, V-3, V-6, V-7, V-8, V-9, V-10, V-12, and V-13 of the SWMMWW, respectively).

From the remaining categories of BMPs in the SWMMWW, the following sections detail the potentially suitable BMPs for this downspout disconnection evaluation.

2.1.1 BMP T5.10A – Downspout Full Infiltration

Downspout full infiltration systems are designed to infiltrate runoff from roof downspouts and are typically trench or drywell designs. Infiltration systems require testing to demonstrate adequate infiltration rates in the native soil beneath the proposed BMP and adequate vertical separation between the expected bottom elevation of the infiltration feature and the seasonal high ground water table.

Setbacks may be required for sites with slopes over 40 percent, landslide areas, open water features, springs, wells, and septic tank drain fields. For example, infiltration systems may be required to be set back at least 10 feet from any structure, property line, or sensitive area or at least 50 feet from the top of any slope over 40 percent or must be downgradient of a septic drainfield.

2.1.1.1 Pipe or Sheet Flow to Infiltration Trench

Figures V-4.1 and V-4.2 in Appendix A provide typical details of downspout infiltration trenches. Downspout infiltration trenches are generally at least 2 feet wide, 1.5 feet deep, and filled with clean (washed) coarse rock. Stormwater is able to flow through the voids of the aggregate fill temporarily and infiltrate into the underlying soil. A perforated pipe can be used to distribute the water within the trench; however underground injection control (UIC) requirements apply if a perforated pipe is used (EPA, 2023), as described in Section 2.1.1.3.

Filter fabric must be placed over the drain rock prior to backfilling. Because of low saturated hydraulic conductivity, silt- and clay-type soils do not provide adequate infiltration and are thus unsuitable for downspout infiltration trenches.

Infiltration trenches must not be built on slopes greater than 25 percent. A geotechnical analysis may be required on slopes over 15 percent if the proposed infiltration trench is located in a landslide hazard area or within 200 feet of the top of a 40 percent or steeper slope.

The Ecology SWMMWW outlines general O&M procedures for infiltration trenches, which are included in Table V-A.2 in Appendix D. The inlet to the trenches may

accumulate sediment and therefore the sediment must be periodically removed from the area to ensure the sediment doesn't impact the infiltration rate of the feature.

2.1.1.2 Drywell

Infiltration drywells (see Figure V-4.3 in Appendix A) are often precast concrete structures. They typically are at least 48 inches in diameter and are installed 5 to 10 feet deep or deeper. Drywells must be spaced a minimum of 10 feet apart and must be installed where the bottom elevation of the drywell is a minimum of 5 feet above the seasonal high ground water level or impermeable soil layer. Filter fabric must be placed above the drain rock and on drywell sides prior to backfilling. Similar to infiltration trenches, drywells may not be built on slopes greater than 25 percent or be placed in a landslide hazard area or on slopes greater than 15 percent without evaluation by a licensed geotechnical expert, geologist, or engineer, or without jurisdiction approval.

The Ecology SWMMWW describes general O&M procedures for drywells. The maintenance activities for drywells are conducted to ensure adequate infiltration by the drywells. The drywells should be opened and cleaned of debris and sediment periodically, or as needed, to maintain adequate infiltration.

2.1.1.3 Underground Injection Control Requirements

Installation of infiltration trenches or drywells must consider UIC requirements. A drywell is considered a Class V UIC structure because it is a subsurface fluid distribution system for which the depth is greater than the largest surface dimension, as defined in the UIC regulations (Title 40 of the Code of Federal Regulations, Section 144.3). Additionally, infiltration trenches that include a perforated pipe are also considered Class V UIC structures (Ecology, 2019). Inventory information on Class V UICs must be sent to EPA and potentially registered with Ecology as well. Regulations to prevent contamination of underground sources of drinking water exist at both the federal and state level, which will likely require evaluation of any contamination risks, BMP design, and operation and maintenance (O&M) requirements for any new drywells installed on-site.

2.1.2 BMP T5.10B – Downspout Dispersion Systems

Downspout dispersion systems, most commonly splashblocks or gravel filled trenches, are designed to spread roof runoff over vegetated or pervious areas. Dispersion slows the runoff, which provides some filtration by allowing the larger particles to settle out before entering the conveyance system. Runoff is conveyed to the vegetated flow path, which must be a well-established lawn or pasture or native vegetation or landscaping

with well-established groundcover. The groundcover should be dense enough to disperse and infiltrate flows and prevent erosion and flooding of downstream properties.

To maintain separation of flows, the vegetated flowpaths for multiple splashblocks or dispersion trenches must not overlap with other flowpaths. If the vegetated flow path is less than 25 feet in length, erosion or flooding may occur because of the downspout dispersion and a perforated stub-out connection may be used instead. Splashblocks or dispersion trenches on slopes greater than 15 percent or in erosion hazard areas must be evaluated by a licensed engineer or geologist.

Although downspout dispersion systems are simple to install, consideration should be given to ensure that runoff from a downspout dispersion system does not damage an adjacent, down-gradient property. Residential areas can be at risk for stormwater damage and intrusion through a foundation or basement because of the short separation distance and gradient between houses. Additionally, dispersion and over-saturation of lawns at multifamily units or single-family homes with small lots can render the outdoor recreation space unusable for those occupants and their children. Consideration for use of the dispersion area and the potential ramifications of introducing additional stormwater should be considered before disconnecting any downspouts.

2.1.2.1 Downspout Dispersion Trench

Dispersion trenches (see Figures V-4.4 and V-4.5 in Appendix A) must have a vegetated flow path of at least 25 feet in length, unless at any slope steeper than 15 percent, which must be at least 50 feet in length. A setback of at least 5 feet must be maintained between any edge of the trench and structures or property lines. Trenches may be 10 feet long by 2 feet wide to serve up to 700 square feet of roof area. For roof areas with areas larger than 700 square feet, a notched grade board dispersion trench may be used. The total trench length may not exceed 50 feet and must provide at least 10 feet of trench length per 700 square feet of roof runoff area. The length can vary based on contribution area, as described above, but dispersion trenches are typically 2 feet wide and 3 feet deep.

Ecology does not include O&M guidelines for downspout dispersion trenches. If catch basins are installed ahead of a dispersion trench, the O&M activities associated with catch basins (as outlined in the SWMMWW and included in Table V-A.5 in Appendix D) should be completed.

2.1.2.2 Splashblock

Typically, splashblocks (see Figure V-4.6 in Appendix A) can be implemented if the ground is sloped away from the foundation, and adequate vegetation and area are

available to disperse storm runoff. Flexible downspout extension pipes can also be used instead of a splashblock to direct the downspout discharge farther away from a structure, particularly if the structure has a basement or the ground is fairly level. Splashblocks or flexible piping may be used to disperse runoff from downspouts discharging to a vegetated flow path that is at least 50 feet in length.

Ecology does not have O&M guidelines for splashblocks.

2.1.3 BMP T5.10C – Perforated Stub-out Connections

A perforated stub-out connection (see Figure V-4.7 in Appendix A) is a length of perforated pipe in a drain rock-filled trench that can be placed between roof downspouts and the local drainage system to provide infiltration and/or flow control.

Perforated stub-out connections consist of at least 10 feet of perforated pipe per 5,000 square feet of roof area, laid in a level, 2-foot-wide, 1.5-foot-deep trench backfilled with washed drain rock. The drain rock should be extended to at least 8 inches below the bottom of the pipe and must cover the pipe. The pipe should be level, and the rock trench should be covered with filter fabric and 6 inches of soil fill. Similar to infiltration trenches, perforated stub-out connections are considered Class V UIC structures and must follow UIC requirements, as described in Section 2.1.1.3 of the MS4 permit.

Ecology does not include O&M guidelines for perforated stub-out connections.

2.1.4 BMP T7.10 – Infiltration Basins and Ponds

Infiltration basins and ponds (see Figure V-5.4 in Appendix A) are shallow impoundments used for collection, temporary storage, and infiltration of stormwater runoff. Typically, an infiltration basin or pond is used to convey stormwater runoff from new development or redevelopment areas to the ground while filtration, adsorption, and biological properties of native soils and vegetation are used to remove pollutants as stormwater soaks into the ground.

A site is not suitable for an infiltration basin or pond if implementation will cause a violation of Ecology's Ground Water Quality Standards to protect ground water quality (Ecology, 2019). A geotechnical and hydrogeologic report must be prepared by a licensed engineer to determine site selection and design decisions. Infiltration methods used for treatment must meet a soil infiltration rate of 9 inches per hour or less, and the base of the infiltration basin must be higher than 5 feet above the seasonal high groundwater elevation. It is important that vegetation within and near the basin or pond is maintained to provide optimal water quality benefits.

The Ecology SWMMWW outlines general O&M procedures for infiltration basins and ponds, which are included in Table V-A.2 in Appendix D. These maintenance activities ensure adequate infiltration for stormwater and beneficial vegetative cover. The vegetation in the basin or pond should be maintained below a maximum height of 18 inches. To minimize vegetation maintenance the infiltration basin or pond should be seeded with slow-growing stoloniferous grasses, which will allow for mowing only twice per year on average.

2.1.5 BMP T7.30 – Bioretention

Bioretention areas (see Figures V-5.12 through V-5.15 in Appendix A) are shallow landscaped areas that receive stormwater from impervious surfaces such as roofs, driveways, sidewalks, and parking lots. Bioretention can vary in design and is used to describe various features used to collect stormwater and remove pollutants using a designed soil and plant mix as a treatment medium.

Bioretention designs may include swales or planters. Bioretention swales are shallow trenches with a designed planting soil mix and a variety of vegetation used to treat stormwater runoff. Planters and planter boxes are vertical-walled structures containing bioretention soil mixes and are often used in urban settings. Planters are typically more expensive to construct and maintain than a swale that treats the same quantity of runoff, and therefore are typically installed only where space is limited and a swale will not fit (i.e., between a building and a sidewalk). Each method of bioretention provides pollutant removal mechanisms through filtration, adsorption, and biological action.

For purposes of the ROM cost analysis, it was assumed that bioretention swales would be 8 feet wide, have a ponding and freeboard depth of 1.5 feet, and include a 2-foot-thick layer of organic media and a 1-foot-deep underdrain at the base of the swale. Planter boxes were assumed to be 4 feet wide, have a ponding depth of 1 foot, and include a 1.5-foot-thick layer of organic media.

The Ecology SWMMWW outlines general O&M procedures for bioretention features to maintain optimum infiltration, storage, and pollutant removal capabilities, which are included in Table V-A.21 in Appendix D. Vegetation utilized for bioretention features should be drought tolerant and mature to allow watering to be completed through natural storm events. The features should be weeded manually without herbicides semiannually and coincide with typical growth cycles. Mulch on top of the soil should be replaced annually if known to receive significant heavy metals pollutant contributions from stormwater or replaced every 5 years otherwise. The features should be inspected regularly to identify sediment accumulation, erosion areas, and failing vegetation.

2.1.6 BMP T5.14 – Rain Gardens

Rain gardens are non-engineered, shallow, landscaped depressions composed of composted soils and plants that temporarily store stormwater runoff from adjacent areas. Stormwater passes through the amended soil layer and into the native soil beneath, thereby reducing stormwater pollutants and surface runoff. The *Rain Garden Handbook for Western Washington: A Guide for Design, Installation, and Maintenance* (Hinman et al., 2013) provides rain garden specifications, construction guidance, and routine maintenance recommendations. A summary of O&M procedures for rain gardens has been included in Table 6 in Appendix E. For purposes of the ROM cost analysis, it was assumed that rain gardens have a ponding and freeboard depth of 1.5 feet and include a 2-foot-thick layer of organic media.

2.2 Water Quality Benefits of BMPs

As described in the MS4 permit, the purpose of the potentially suitable BMPs identified in Section 2.1 is to improve the water quality of stormwater runoff conveyed in downspouts that ultimately drains to the Puget Sound. Water quality parameters of stormwater runoff that influence the beneficial uses of the Puget Sound include temperature, dissolved oxygen, turbidity or TSS, pH, metals, toxic substances, and bacteria (enterococci or fecal coliform).

In general, all the identified BMPs promote infiltration, which reduces the quantity of stormwater runoff that leaves a site and ultimately discharges to the Puget Sound. Soil, whether placed as part of the BMP construction or consisting of the native underlying material, can filter out pollutants in stormwater runoff as it infiltrates to the groundwater table. Runoff that infiltrates into the ground is no longer a source of pollutants that can degrade the water quality of the Puget Sound. By promoting infiltration of rooftop runoff, the contribution of pollutants such as TSS, metals, toxic substances (if roofing materials leach these substances), and even bacteria discharging from a site can be reduced or eliminated. Additionally, infiltration can reduce the extent of downstream flooding during heavy rain events.

Vegetated BMPs (i.e., dispersion across lawns, bioretention swales, and rain gardens) can also reduce pollutants in stormwater that does not infiltrate into the underlying soil. Vegetation can filter out pollutants as runoff flows through a BMP, and the roots can adsorb pollutants within the plant structure, which reduces the concentrations that discharge from a site. Dispersion across lawns, however, can potentially degrade water quality if pet droppings or excess fertilizers are present that are mobilized to a downstream water source. Proper maintenance of lawns and increased flow distances across lawns can reduce the potential source of water quality degradation.

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3.0 Suitability Evaluation

The field investigation at NSE, conducted on 25 July 2023 by Liberty JV personnel, included evaluation of all facilities documented on base maps provided by the Navy. The investigation crew observed whether certain conditions may be met for downspout disconnection to be considered reasonably suitable. This section describes the conditions for suitability.

As described in Section 2.4, NSC Smokey Point appears to already convey stormwater runoff through multiple regional water quality facilities that provide equal or enhanced benefits compared with BMPs installed at individual downspouts. As such, Table B-1 in Appendix B and Table C-1 in Appendix C (described in following subsections) do not include any facility located at NSC Smokey Point.

3.1 Suitable BMP Options

The Liberty JV field evaluation team observed each facility on site and determined which, if any, of the initially screened stormwater BMPs could be reasonably implemented at each location. The findings do not account for any additional analyses that may be needed for implementation of the BMPs (e.g., geotechnical analysis, utility surveys, engineering design, permitting, etc.). Table B-1 in Appendix B shows the structures for which downspout disconnection was considered suitable at NSE; multiple BMPs may be deemed suitable for a single feature.

A BMP was deemed to be suitable at a structure if it could be installed and receive runoff contributions from one or more downspouts located around the perimeter of the structure. In many cases, only a portion of a structure would be able to disconnect downspouts for the benefit of the MS4 program, typically due to existing landscaping, pavement, and utility constraints.

3.2 Unsuitable Downspout Disconnection Rationale

This section describes common conditions of unsuitability based on general site characteristics and observations made during the field investigation. Table C-1 in Appendix C lists the structures for which downspout disconnection was considered unsuitable at NSE and the reasons for removal from consideration.

3.2.1 Land Use Considerations

NSE includes areas of housing and services for families that limit options for suitably implementable BMPs for stormwater management. Residential areas, as well as buildings where children are expected to frequent (i.e., daycares and schools), were

noted during the evaluation process. The first limitation stems from ensuring child safety by eliminating from consideration the installation of stormwater features that include exposed gravel (e.g., dispersion trenches, bioretention planters, infiltration trenches without soil/vegetative cover). Such features pose a safety risk to children playing in or around the area. Note that bachelor enlisted quarters do not have the same restrictions for child-safe BMPs because only adults are expected to use these housing units, and children will not be present.

Through discussions of the ramifications, the Navy and Liberty JV determined that the installation of drywells at residential properties is not a suitable BMP option for downspout disconnection. In theory, a drywell can be installed in almost any area with a 6-foot-diameter clear space, including almost every residential lawn. Given the expected utility conflicts, drywells would likely be able serve only a single residential property. It was concluded by the Navy and Liberty JV that the cost and effort associated with geotechnical investigations, design, UIC documentation/inventory requirements, construction, and disturbance of the occupants are unacceptable for installation of drywells at each individual residential property. Therefore, drywells were considered suitable only for non-residential properties.

Although not a uniform exclusion policy, use of downspout disconnection features at residential areas must ensure that the stormwater management does not result in potential stormwater intrusion into a building's foundation or basement and that the dwelling's outside space remains suitable for the occupants' use and children's recreation.

Rain gardens were not considered appropriate for installation at industrial/commercial buildings. Rain gardens, in accordance with the SWMMWW, are non-engineered facilities that are typically installed at a residential property as part of that property's landscaping. The drainage area and resultant quantity of stormwater runoff are much less than at a typical industrial/commercial building, which makes a rain garden most suitable for residential applications. Industrial/commercial buildings should use an engineered BMP for downspout disconnection options, except for a splashblock directing runoff directly to a vegetated area; therefore, rain gardens were not considered a suitable BMP for any non-residential buildings.

Regional water quality facilities, such as infiltration basins, ponds, or swales that would collect stormwater from multiple buildings for treatment, were determined to be not suitable BMPs for the purposes of this downspout disconnection evaluation. While these facilities can provide great benefit, they typically require substantial modifications to the subsurface conveyance system and site grading to accommodate the various inflow sources than the disconnection of downspouts from a single building. Additionally, these facilities typically treat runoff from streets and catch basins in addition to building

downspouts. While regional water quality facilities are considered under alternative sections of the SIIP, they have been deemed to be outside the scope of a downspout disconnection program and therefore are not considered in this evaluation.

3.2.2 Existing Treatment Facilities at NSC Smokey Point

Most of the stormwater runoff from NSC Smokey Point is collected in catch basins and conveyed to the four engineered stormwater ponds located on-site. Runoff also flows across the ground surface as sheet flow to the vegetated conveyance ditches that border the property. As described in the Integrated Natural Resources Management Plan (INRMP) regarding NSC Smokey Point (NAVFAC, 2022a), stormwater that flows into the stormwater ponds is detained and allowed to infiltrate into the underlying soils. The ponds are vegetated to provide water quality benefits, and infiltration reduces the total quantity of stormwater discharging to the MS4 system. If a storm event produces runoff in excess of the detention capacity of the ponds along with their respective infiltration rates, the ponds have outfall structures to safely discharge stormwater. Discharges from the stormwater ponds are directed to the vegetated conveyance ditches along the perimeter of the property or to the linear wetland south of the large vehicle parking lot. Similar to the ponds, both the wetland and vegetated conveyance ditches allow for additional infiltration and water quality benefits before runoff is ultimately discharged to Hayho Creek.

Based on site observations and information provided in the INRMP, it appears that the NSC Smokey Point installation was constructed in accordance with the goals of the SIIP. Stormwater runoff from impervious areas, including building rooftops, is conveyed to stormwater detention ponds, vegetated conveyance ditches, and a wetland, which all provide water quality benefits and promote infiltration of runoff into the underlying soils. The detention ponds and vegetated conveyance ditches can be considered regional water quality facilities and likely provide similar, if not enhanced, benefits compared with BMPs installed at individual downspouts.

Given the site's stormwater infrastructure and regional water quality features, disconnection of downspouts and construction of localized BMPs would not be cost effective or provide benefit beyond existing conditions to meet the intent of the SIIP. As such, this report does not describe any downspout disconnection BMPs at NSC Smokey Point.

3.2.3 Common Reasons for Unsuitability of BMPs

Certain infrastructure conditions prevent downspout disconnection from being suitable and reasonably implementable. Existing downspout outlet locations that are surrounded by paved surfaces and catch basins prevent the ability to redirect the stormwater flow to

an area where a stormwater BMP could be constructed and are therefore unsuitable for this evaluation. Removal of paved surfaces and catch basins and regrading of the existing site were deemed to be beyond the scope of a downspout disconnection program.

Downspouts that are located inside the structures are not considered to be suitable for disconnection. The flow from a disconnected downspout needs to be routed to an area where it is possible to install stormwater BMPs. Rerouting downspouts that are internal to a structure was deemed to be beyond the scope of this program because of the challenges of locating all the internal downspouts and the necessary disturbances to the building structure. Additionally, areas that did not have sufficient setback from pavement or structures (as outlined in the SWMMWW) for installation of any of the potential BMPs were also considered unsuitable.

In cases in which downspouts were already disconnected and runoff drains onto vegetation, then the intent of the MS4 downspout disconnection strategy had already been met. Installing additional BMPs in these instances was considered unnecessary. Similarly, some structures did not have gutters, and runoff from the structure's roof drains directly to vegetation. In these cases, disconnection of downspouts and installation of BMPs was also deemed unnecessary.

Numerous facilities that are not buildings have been identified on the base maps. In these cases, there is no roof to produce runoff, and the downspout disconnection program does not apply. The facilities that are not buildings have been identified in Table C-1 in Appendix C.

At NSE, multiple piers extend into Possession Sound or the Snohomish River. Structures on these piers drain stormwater almost directly into Possession Sound or the Snohomish River, and there is no feasible method to treat the stormwater with a potentially suitable BMP before discharge into the sound. All of the potentially suitable BMPs listed in the SWMMWW require vegetation and/or soil for water quality treatment, which is not feasible on a pier. Therefore, any structures located on piers were deemed unsuitable for downspout disconnection and are noted as such in Table C-1 in Appendix C. An aboveground, portable biofilter could potentially be installed at the base of downspouts for structures on the pier, but this is not standard BMP listed in the SWMMWW.

3.2.4 Groundwater Depth in Area

Stormwater BMPs that involve infiltration must be installed in areas where the presence of groundwater will not interfere with the infiltration rate, and a sufficient thickness of soil is present to filter pollutants before runoff enters the groundwater to ensure proper

performance. Volume V-5.6 of the SWMMWW requires that a minimum 5-foot vertical separation be maintained between the bottom of most infiltration features and the top of the seasonal high groundwater table. A separation of 3 feet between the bottom of the infiltration BMP and the seasonal high groundwater table may be allowed following site-specific hydrogeological investigations. This evaluation does not account for such investigations; therefore, the full vertical separation criteria will be used. The minimum groundwater vertical separation criteria described in the SWMMWW for each considered BMP is provided in Table 3-2.

Nearby well drilling records, available through the Ecology Monitoring Program database, and publicly available reports were used to determine whether potential sites at NSE sufficiently satisfy these vertical separation criteria. Table 3-1 presents depth to groundwater data for select wells near NSE. The elevations presented in Table 3-1 are not necessarily the seasonal high groundwater elevations, depending on the timing of the measurements.

Table 3-1: Summary of Groundwater Depths in Wells Near NSE

Well ID	Ground Elevation at Well [ft NAVD88]	Average Groundwater Depth [ft bgs]	Average Groundwater Elevation [ft NAVD88]	Distance of Well from NSE Boundary [miles]
AODE5271RI-MW4	13.00	4.57	8.43	0.25
AODE527RI_MW7	12.50	2.74	9.76	0.27
DE8979-MW1	18.08	5.65	12.43	1.07

Note: Ground surface elevation at NSE is 12–13 feet NAVD88, based on Google Earth.

Abbreviations/Acronyms:
bgs = below ground surface
ft – feet
ID = identifier
NAVD88 = North American Vertical Datum of 1988
NSE = Naval Station Everett

Additionally, NSE is bordered to the north and south by environmental cleanup sites at which extensive groundwater monitoring has been conducted within the past 10 years. The *Phase I Environmental Site Assessment* report for the cleanup site to the south identified that groundwater is at a depth ranging from 1.0 foot to 5.0 feet below ground surface (bgs) (AECOM, 2011). A soil and groundwater management plan for the cleanup site to the south states that the “depth to groundwater at the Site ranges from about 1 to 4 feet bgs in the eastern portion of the Site, and 6 to12 feet bgs in the western portion of the Site; groundwater elevations near the western shoreline are tidally influenced” (Landau, 2021). For the cleanup site to the north, a remedial investigation/feasibility study from 2011 states that “the depth to [groundwater] ranged from 3.0 to 7.5 feet bgs” (Landau, 2011).

Based on the groundwater characteristics documented in the area immediately surrounding the site, the potential BMPs are limited because of inadequate groundwater separation for infiltration facilities. Table 3-2 lists each initially screened BMP, the required groundwater separation based on guidance from the SWMMWW, and the suitability of the BMP for the site based on the corresponding separation requirement. Based on the information available, the seasonal high groundwater elevation may be as shallow as 1 foot bgs. Hydrogeological investigations, such as test pits and borings, should be conducted prior to future BMP implementations. This requirement does not apply to the BMPs that use an impermeable liner at the base of the feature because of the disconnection to the groundwater table.

Table 3-2: BMP Suitability Due to Minimum Groundwater Separation Requirements

BMP General Name	BMP Classification in SWMMWW	BMP Short ID	Minimum Groundwater Separation[A] [feet]	Suitability For Site Based on Groundwater Separation Requirement
Infiltration Trench	BMP T5.10A	I	5	No
Dry Well	BMP T5.10A	W	5	No
Dispersion Trench	BMP T5.10B	D	N/A	Yes
Splash Block	BMP T5.10B	K	N/A	Yes
Perforated Stub-out Connection	BMP T5.10C	C	1[B]	No
Infiltration Basin/Pond	BMP T7.10	B	5	No
Bioretention (Swale or Planter)	BMP T7.30	P or S	3	Yes[C]
Rain Garden	BMP T5.14	R	1	Yes

Notes:

[A] Groundwater separation depth may be able to be reduced with hydrogeological studies including on-site borings or test pits.
[B] Minimum separation based on seasonal groundwater table. Available groundwater depth data do not provide enough detail to differentiate between high and seasonal groundwater depths. Seasonal high groundwater depth may be as shallow as 1 foot bgs.
[C] Bioretention BMP possible if base is impermeable (see Figure V-5.14 of Appendix A for an example).

Abbreviations/Acronyms:

BMP = best management practice
ID = identifier
SWMMWW = Stormwater Management Manual for Western Washington

3.3 Cost Estimates

Rough order of magnitude (ROM) costs were developed for each of the structures for which downspout disconnection was determined to be suitable. The capital costs for construction or installation of the recommended BMPs, as well as 10-year O&M costs, are included in Table B-1 in Appendix B. Capital costs for each type of BMP were developed on an incremental cost basis where a single dimension or count is utilized to scale the cost of the BMP construction. The cost and quantity for each suitable BMP at each feature is shown in Table B-1 in Appendix B as well. For features where multiple BMPs were deemed suitable for installation the ROM cost estimate was developed for each suitable BMP.

The costs presented are to be considered ROM cost estimates for planning purposes and should be verified and refined during the design process. Prior to the construction of any BMPs onsite, additional evaluation and design effort is required, including geotechnical investigations, utility locating, engineering design, potential hydrologic/hydraulic modeling, determination of any permit requirements, and a detailed cost estimate.

3.4 Considerations Prior to Implementation of Suitable BMPs

The BMPs considered suitable and presented in Appendix B are based on information gathered during a visual inspection of the site as part of a feasibility screening level assessment by Liberty JV. Prior to the construction of any BMPs onsite, additional evaluation and design effort are required, including geotechnical investigations, utility locating, engineering design, potential hydrologic/hydraulic modeling, determination of any permit requirements, and a detailed cost estimate. Some of the BMPs may be determined infeasible based on the presence of utilities or results from geotechnical investigations that were not evident during the visual inspection.

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4.0 Future Development

Any future development should consider incorporating design guidance from the SWMMWW to address runoff quantity and quality as part of the Navy's design and permitting requirements for all new structures. Although the Navy is not required to follow Ecology's guidance because the installations are on federal property and regulated by EPA, the existing MS4 permit does reference the SWMMWW for guidance in improving stormwater quality. Inclusion of BMPs during the construction phase of new development is more cost effective than retrofits and can be more effective for improving stormwater quality. The conveyance system design and siting of low-impact designs, regional facilities, and other stormwater quality BMPs can be optimized if included in the initial design of a property.

Additionally, incorporating stormwater treatment requirements during the design phase of a project will most likely allow for runoff from both rooftops and ground surfaces to be captured and treated, maximizing water quality ultimately discharged to the Puget Sound.

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5.0 Conclusions

A total of 121 structures were evaluated at NSE as part of this MS4 downspout disconnection feasibility assessment. Of the evaluated structures at NSE, 27 buildings (a total of 22% of the assessed structures) were determined to have downspouts that could feasibly be disconnected to meet the requirements of Section 2.4.4.7 of the MS4 permit.

Although runoff from rooftops can include pollutants (such as dissolved metals, PAHs, and other inorganic compounds), rooftops are typically not a major pollutant source. In general, most pollutant loading in stormwater runoff from non-industrial areas comes from the ground surface, particularly roadways. The downspout disconnection options described in this report meet the requirements in Section 2.4.4.7 of the MS4 permit. However, permittees must evaluate and recommend potential projects that improve water quality based on the effectiveness, feasibility, cost effectiveness, pollutant removal effectiveness, and long-term maintenance requirements in the SIIP. It is worth noting that other BMPs not included in this evaluation may accomplish the goals of the SIIP more efficiently than downspout disconnection. These BMPs include regional water quality facilities that capture runoff from both roofs and catch basins located in the street, which can provide much more water quality benefits while potentially being more cost-effective for the amount of runoff area and pollutant loading treated. However, downspout disconnection BMPs do provide low-cost solutions for water quality improvements that are typically easy to implement.

All of the recommendations presented in this report are based on information gathered during a non-intrusive visual inspection of the site as part of a feasibility screening level assessment, and the costs presented are to be considered ROM cost estimates for planning purposes. Prior to the construction of any BMPs on-site, additional evaluation and design effort are required, including geotechnical investigations, utility locating, engineering design, potential hydrologic/hydraulic modeling, determination of any permit requirements, and a detailed cost estimate.

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6.0 References

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Washington Administrative Code WAC 173-201A-210. <https://apps.leg.wa.gov/WAC/default.aspx?cite=173-201A-210>.

Appendix A:
BMP Standard Details,
Figures excerpted from *2019 Stormwater Management Manual for Western Washington*, Volume V - Chapter 5, revised July 2019

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Figure V-4.1: Typical Downspout Infiltration Trench

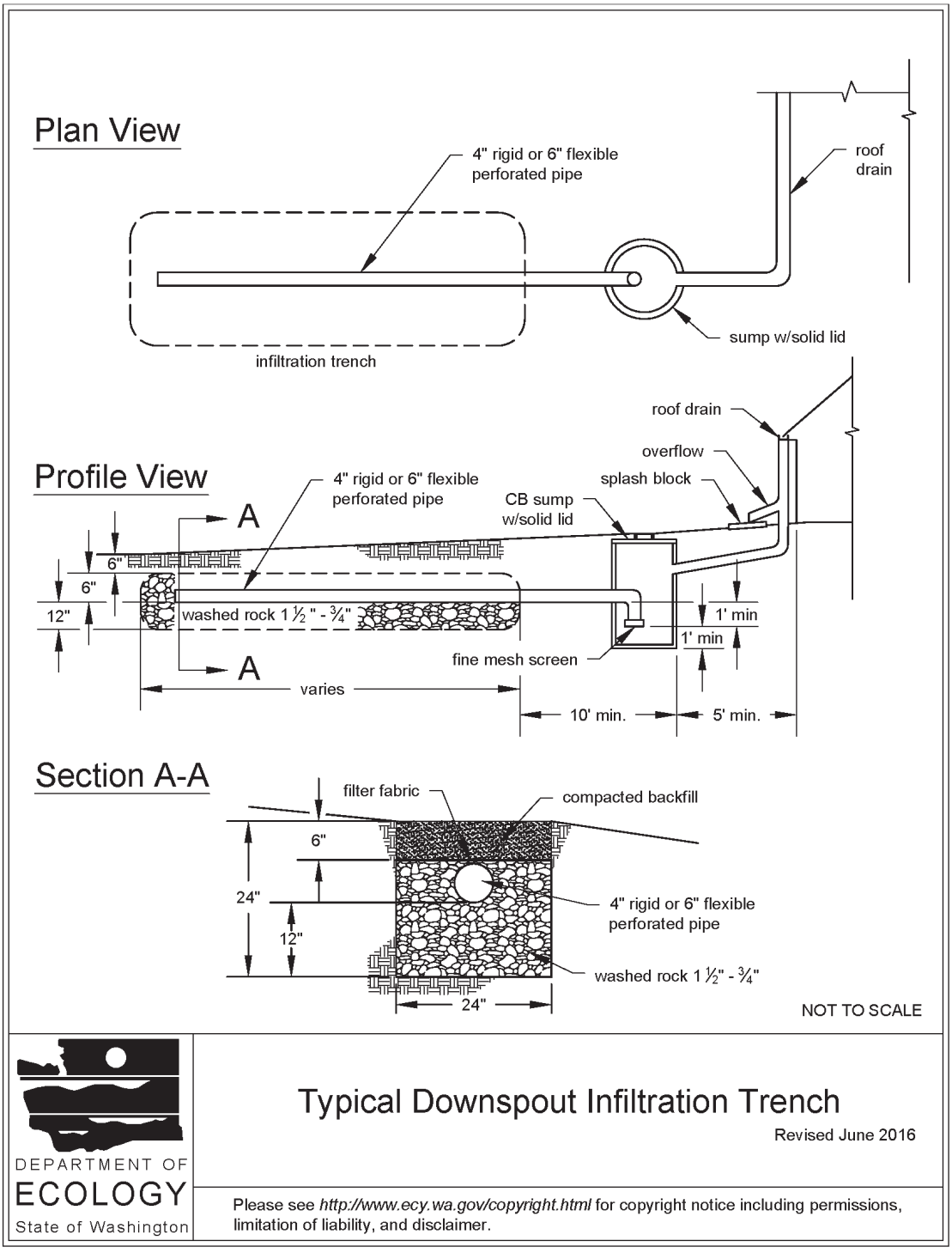


Figure V-4.2: Alternative Downspout Infiltration Trench System for Coarse Sand and Gravel

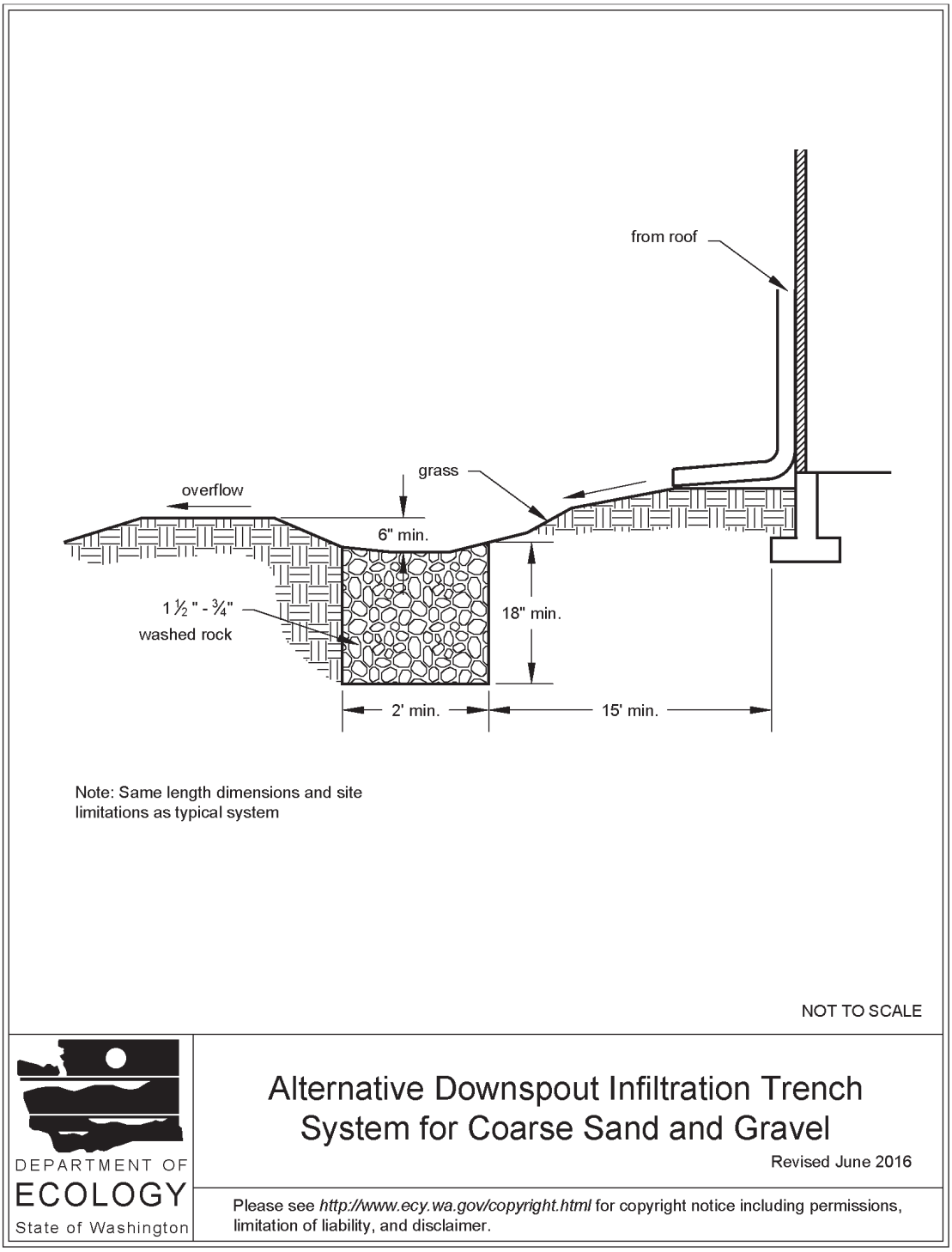


Figure V-4.3: Typical Downspout Infiltration Drywell

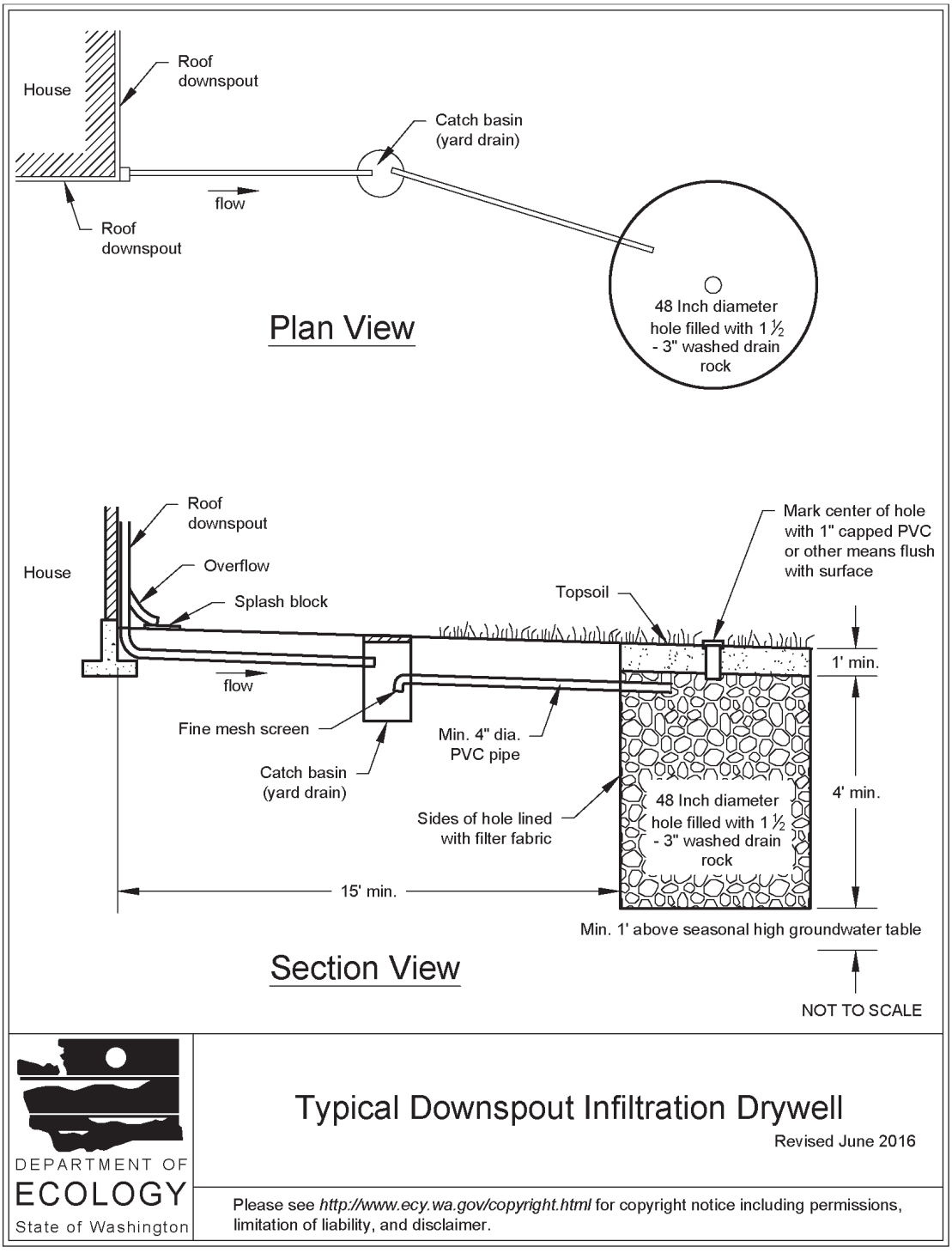


Figure V-4.4: Typical Downspout Dispersion Trench

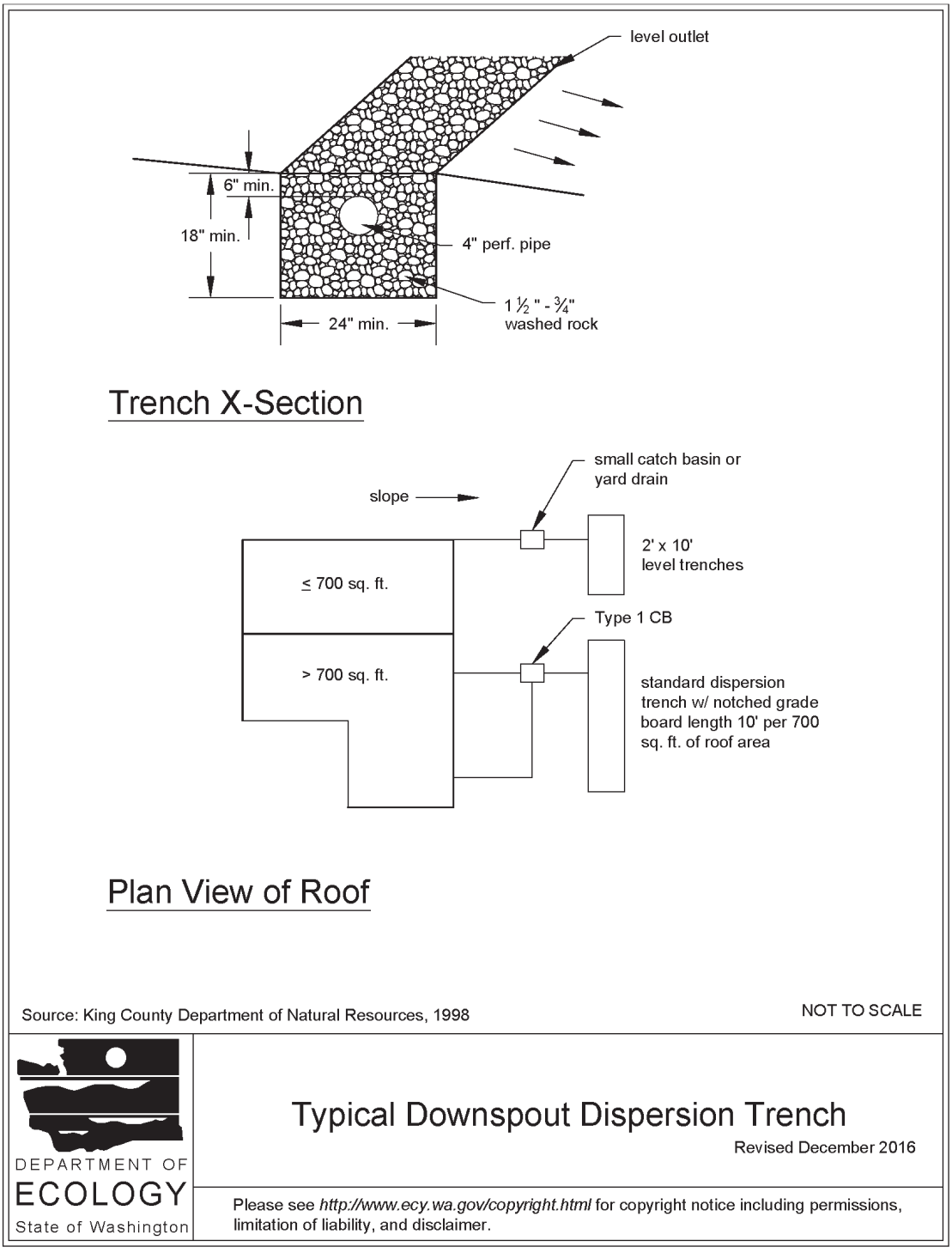


Figure V-4.5: Standard Dispersion Trench with Notched Grade Board

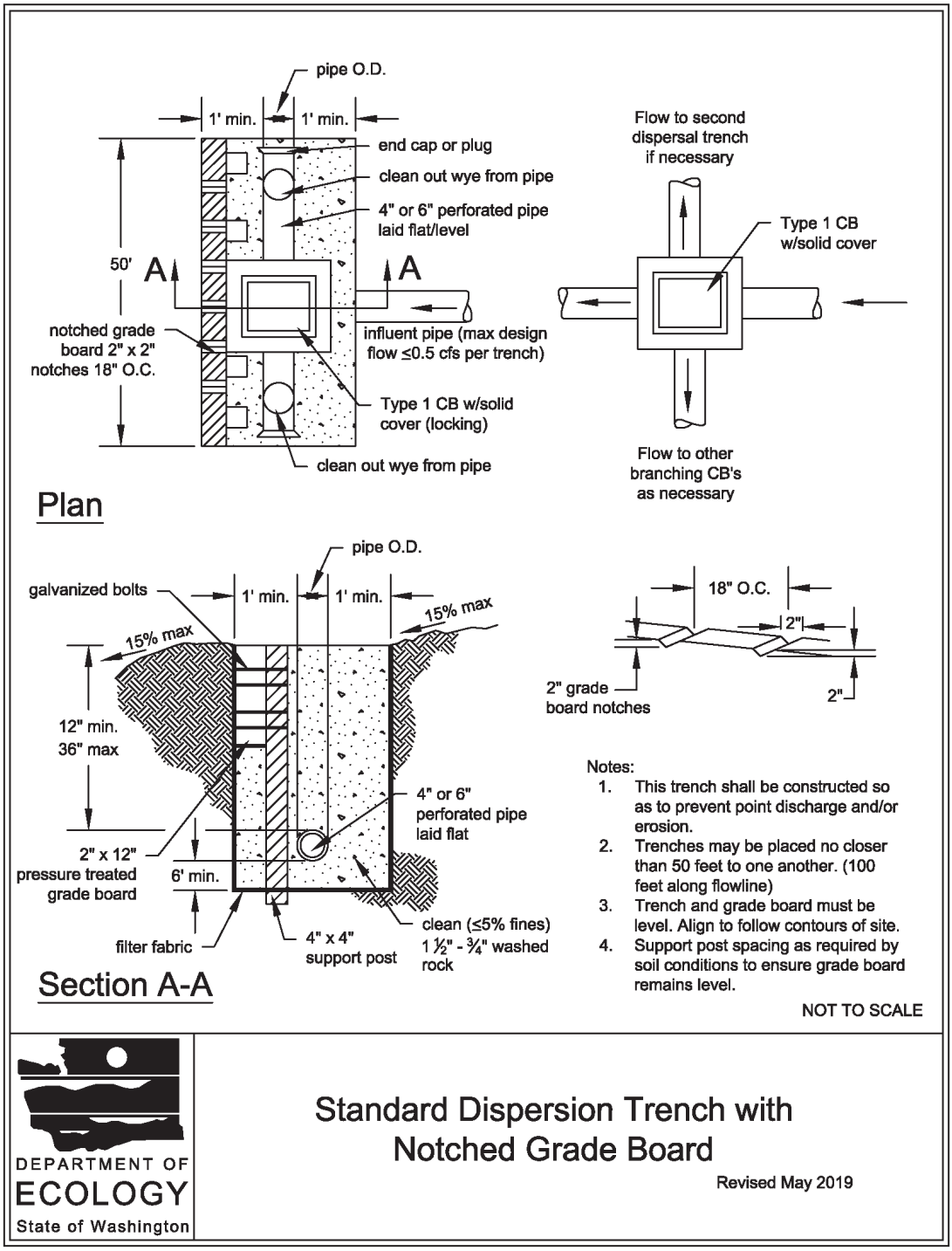


Figure V-4.6: Typical Downspout Splashblock Dispersion

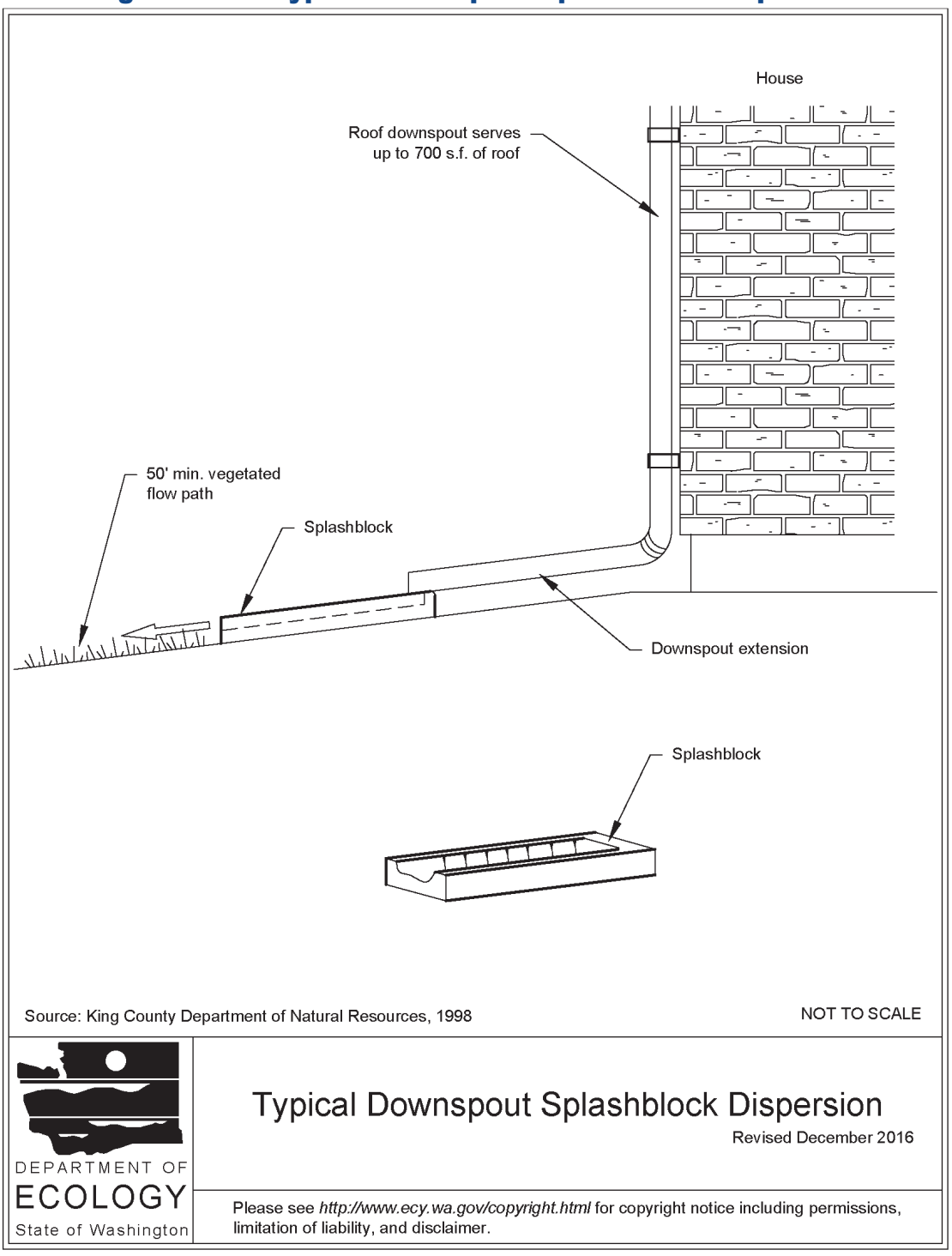


Figure V-4.7: Perforated Stub-Out Connection

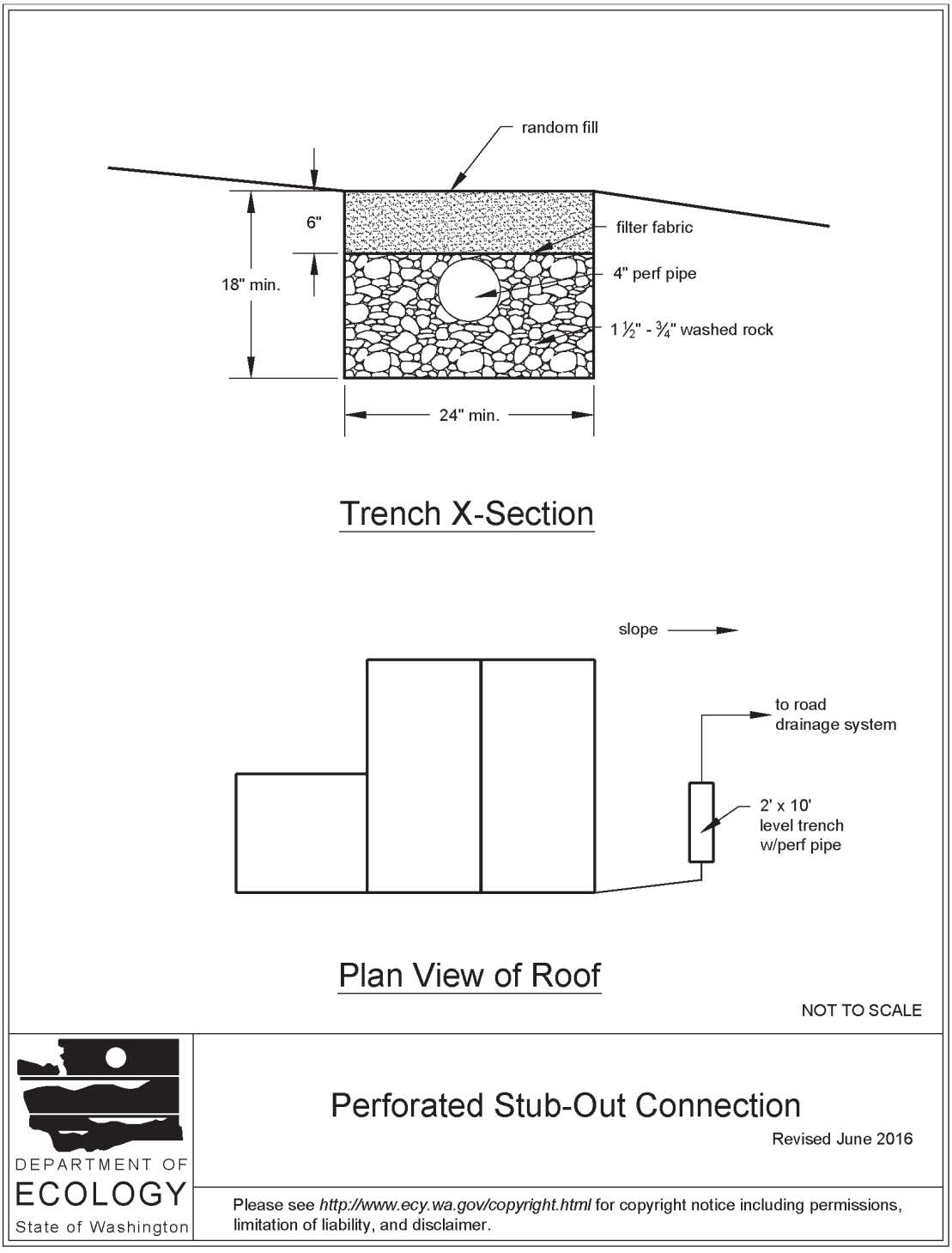


Figure V-5.4: Typical Infiltration Pond/Basin

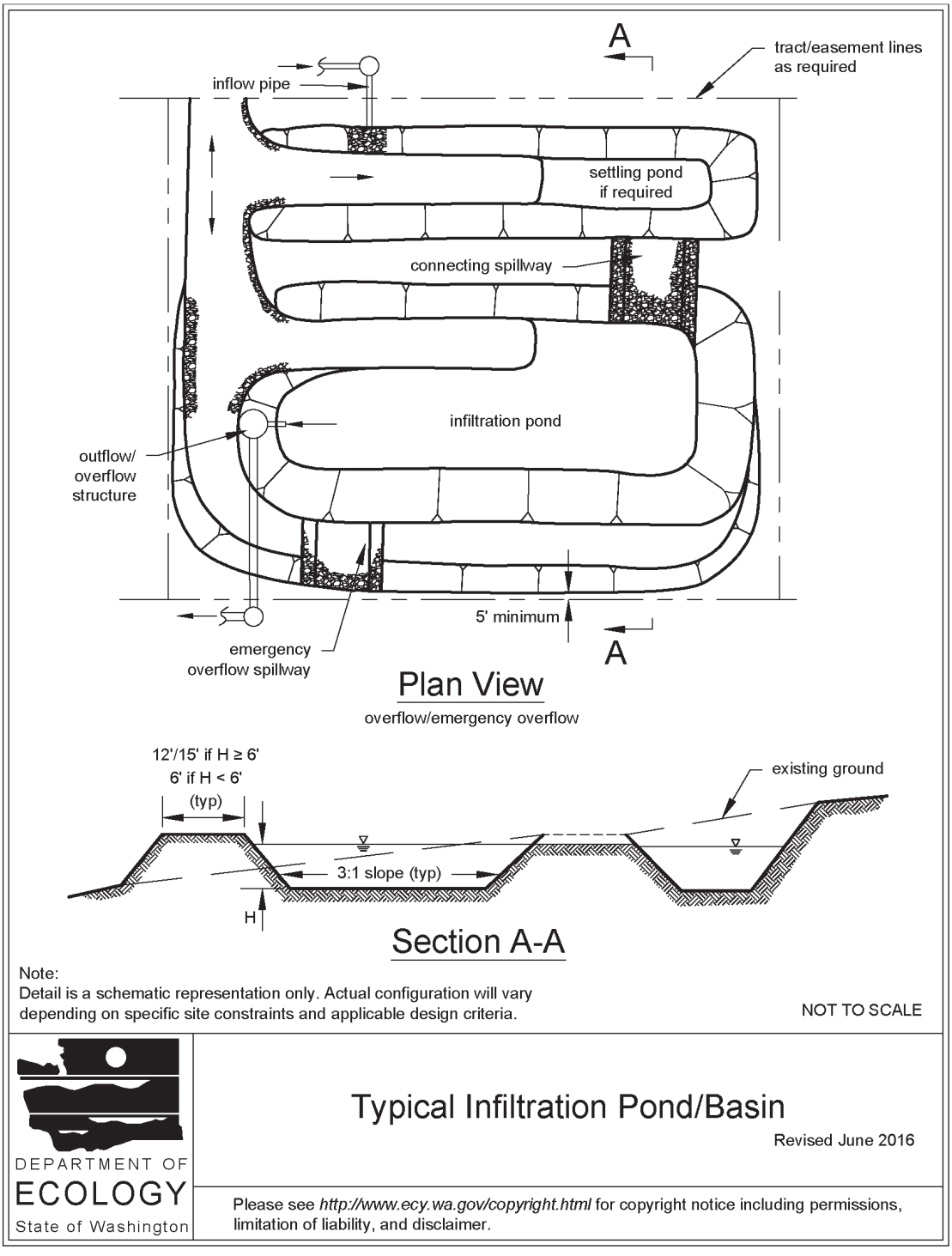


Figure V-5.12: Typical Bioretention

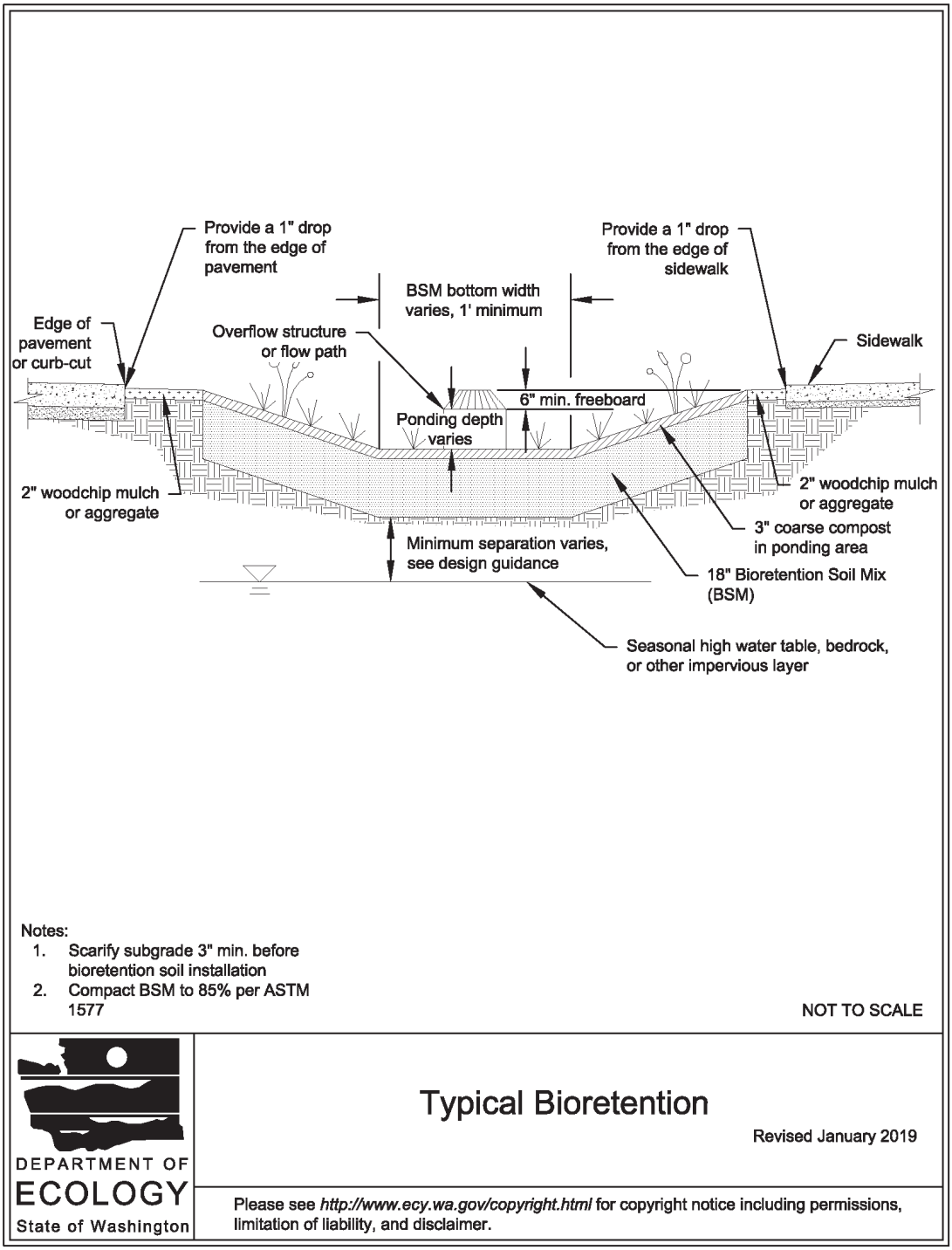
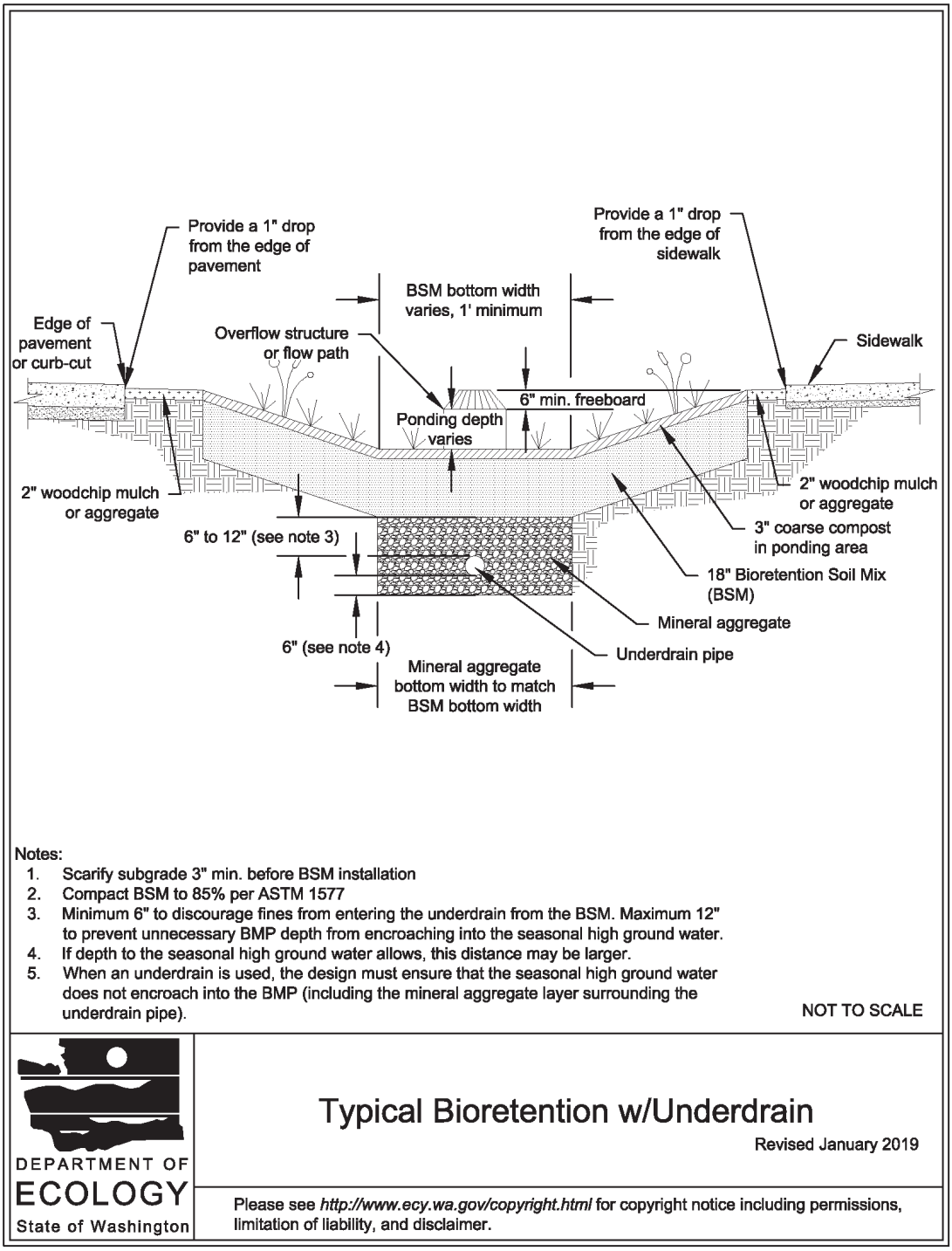


Figure V-5.13: Typical Bioretention w/Underdrain



Notes:
1. Scarify subgrade 3" min. before BSM installation
2. Compact BSM to 85% per ASTM 1577
3. Minimum 6" to discourage fines from entering the underdrain from the BSM. Maximum 12" to prevent unnecessary BMP depth from encroaching into the seasonal high ground water.
4. If depth to the seasonal high ground water allows, this distance may be larger.
5. When an underdrain is used, the design must ensure that the seasonal high ground water does not encroach into the BMP (including the mineral aggregate layer surrounding the underdrain pipe).

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State of Washington

Typical Bioretention w/Underdrain

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Figure V-5.14: Typical Bioretention w/Liner (Not LID)

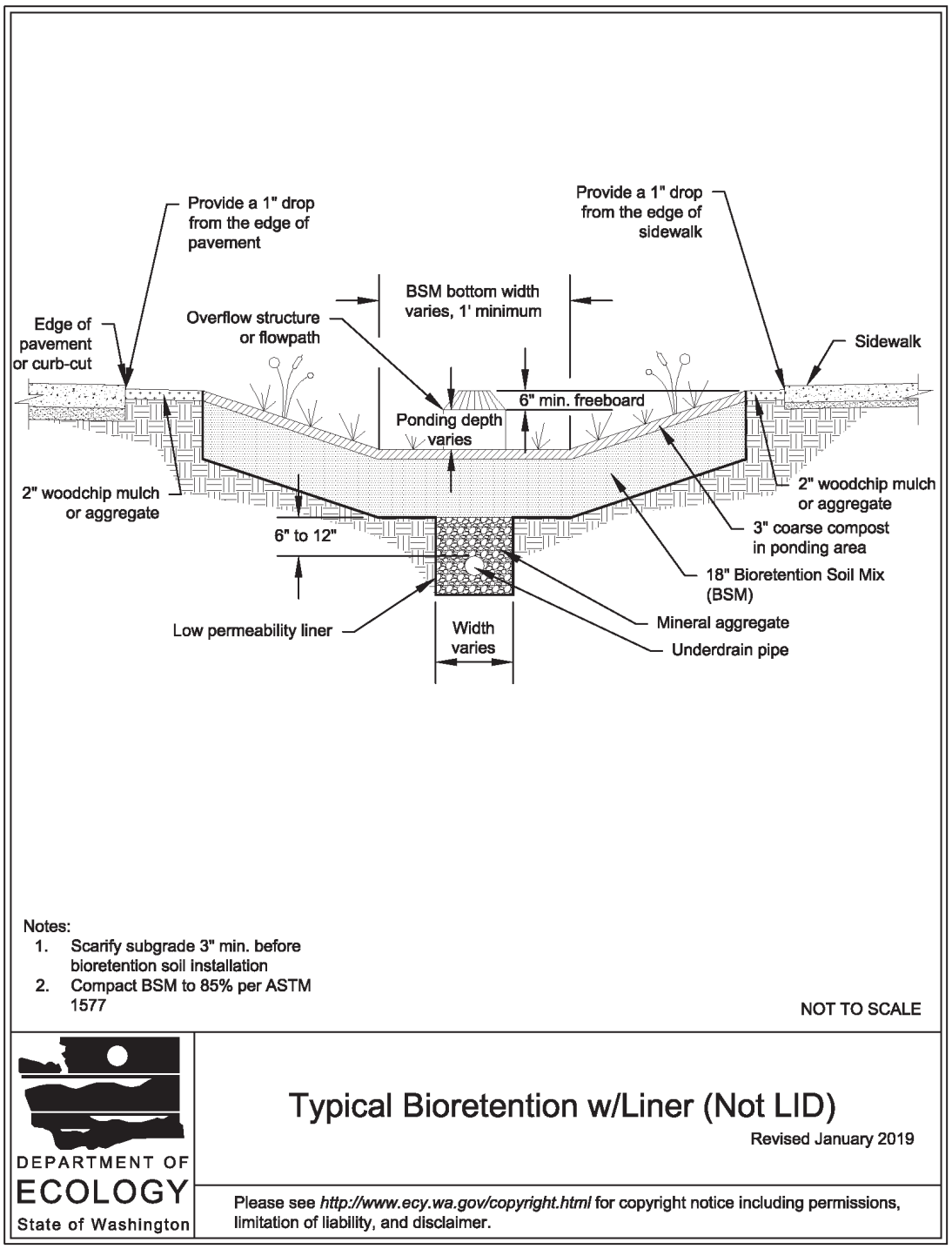
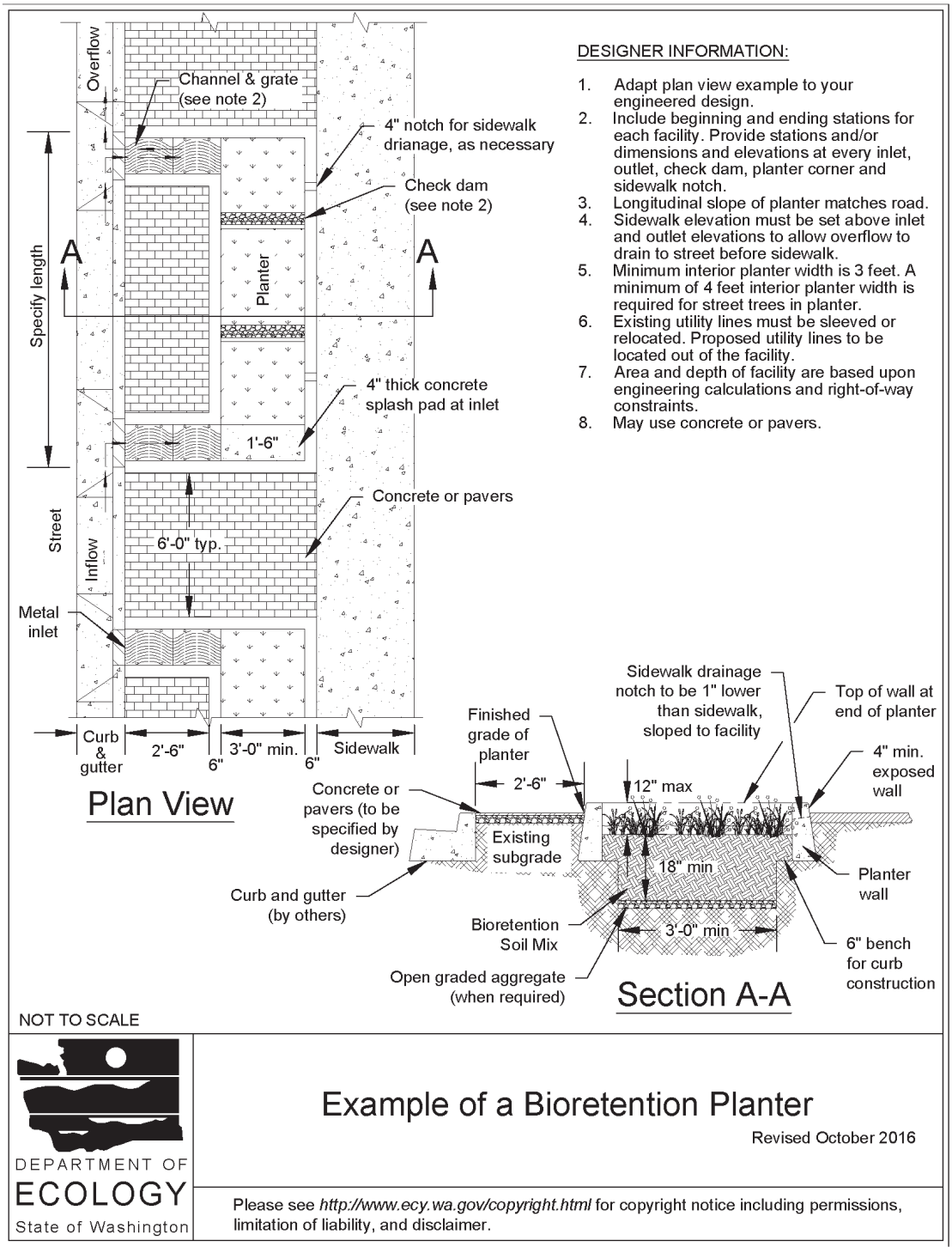


Figure V-5.15: Example of a Bioretention Planter



Appendix B:
Suitable Downspout Disconnection Locations, Recommended BMPs, and ROM Cost Estimates

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Appendix C:
Locations Unsuitable for Downspout Disconnection

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Appendix D:
BMP Maintenance Recommendations Tables,
Tables excerpted from *2019 Stormwater Management Manual for Western Washington*, Volume V – Appendix A, revised July 2019

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Appendix V-A: BMP Maintenance Tables

Ecology intends the facility-specific maintenance standards contained in this section to be conditions for determining if maintenance actions are required as identified through inspection. Recognizing that Permittees have limited maintenance funds and time, Ecology does not require that a Permittee perform all these maintenance activities on all their stormwater BMPs. We leave the determination of importance of each maintenance activity and its priority within the stormwater program to the Permittee. We do expect, however, that sufficient maintenance will occur to ensure that the BMPs continue to operate as designed to protect ground and surface waters. Ecology doesn't intend that these measures identify the facility's required condition at all times between inspections. In other words, exceedance of these conditions at any time between inspections and/or maintenance does not automatically constitute a violation of these standards. However, based upon inspection observations, the Permittee shall adjust inspection and maintenance schedules to minimize the length of time that a facility is in a condition that requires a maintenance action.

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	Any trash and debris which exceed 1 cubic feet per 1,000 square feet. 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.	Trash and debris cleared from site.
	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 by State or local regulations. (Apply requirements of adopted IPM policies for the use of herbicides).	No danger of poisonous vegetation where maintenance personnel or the public might normally be. (Coordinate with local health department). Complete eradication of noxious weeds may not be possible. Compliance with State or local eradication policies required.
	Contaminants and Pollution	Any evidence of oil, gasoline, contaminants or other pollutants(Coordinate removal/cleanup with local water quality response agency).	No contaminants or pollutants present.
	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.)
	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	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.
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. Liner repaired or replaced. Liner is fully covered.
Storage Areas	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 potential for erosion to continue. (Recommend a Geotechnical engineer be called in to inspect and evaluate condition and recommend repair of condition.	Piping eliminated. Erosion potential resolved.
Emergency Overflow/ Spillway and Berms over 4 feet in height	Tree Growth	Tree growth on emergency spillways creates blockage problems and may cause failure of the berm due to uncontrolled overtopping. Tree growth on berms over 4 feet in height may lead to piping through the berm which could lead to failure of the berm.	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.
	Piping	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.	Piping eliminated. Erosion potential resolved.
Emergency Over- flow/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 flow path of spillway. (Rip-rap on inside slopes need not be replaced.)	Rocks and pad depth are restored to design standards.
	Erosion	See "Side Slopes of Pond"	See "Side Slopes of Pond"

Table V-A.2: Maintenance Standards - Infiltration

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed
General	Trash & Debris	Any trash and debris which exceed 1 cubic feet per 1,000 square feet. 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.	Trash and debris cleared from site.
	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 by State or local regulations. (Apply requirements of adopted IPM policies for the use of herbicides).	No danger of poisonous vegetation where maintenance personnel or the public might normally be. (Coordinate with local health department). Complete eradication of noxious weeds may not be possible. Compliance with State or local eradication policies required.
	Contaminants and Pollution	Any evidence of oil, gasoline, contaminants or other pollutants (Coordinate removal/cleanup with local water quality response agency).	No contaminants or pollutants present.
	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.)
Storage Area	Sediment	Water ponding in infiltration pond after rainfall ceases and appropriate time allowed for infiltration. Treatment basins should infiltrate Water Quality Design Storm Volume within 48 hours, and empty within 24 hours after cessation of most rain events. (A percolation test pit or test of facility indicates facility is only working at 90% of its designed capabilities. Test every 2 to 5 years. If two inches of more of sediment is present, remove).	Sediment is removed and/or facility is cleaned so that infiltration system works according to design.
Filter Bags (if applicable)	Filled with Sediment and Debris	Sediment and debris fill bag more than 1/2 full.	Filter bag is replaced or system is redesigned.
Rock Filters	Sediment and debris	By visual inspection, little or no water flows through filter during heavy rain storms.	Gravel in rock filter is replaced.
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. Liner repaired or replaced. Liner is fully covered.
Emergency Overflow/ Spillway and Berms over 4 feet in height	Tree Growth	Tree growth on emergency spillways creates blockage problems and may cause failure of the berm due to uncontrolled overtopping. Tree growth on berms over 4 feet in height may lead to piping through the berm which could lead to failure of the berm.	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.
	Piping	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.	Piping eliminated. Erosion potential resolved.
Emergency Over- flow/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 flow path of spillway. (Rip-rap on inside slopes need not be replaced.)	Rocks and pad depth are restored to design standards.
	Erosion	See "Side Slopes of Pond"	See "Side Slopes of Pond"
Pre-settling Ponds and Vaults	Facility or sump filled with Sediment and/or debris	6" or designed sediment trap depth of sediment.	Sediment is removed.

Table V-A.5: Maintenance Standards - Catch Basins

Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed
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%. 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 1/3 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 or on grate opening. No trash or debris in the catch basin. Inlet and outlet pipes free of trash or debris. 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
	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.
	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 regrouted and secure at basin wall.
	Settlement/Misalignment	If failure of basin has created a safety, function, or design problem.	Basin replaced or repaired to design standards.
	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.
	Containment and Pollution	Any evidence of oil, gasoline, contaminants or other pollutants (Coordinate removal/cleanup with local water quality response agency).	No contaminants or pollutants present.
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
	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.
	Cover Difficult to Remove	One maintenance person cannot remove lid after applying normal lifting pressure. (Intent is keep cover from sealing off access to maintenance.)	Mechanism opens with proper tools.
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.
Metal Grates (If Applicable)	Grate opening Unsafe	Grate with opening wider than 7/8 inch.	Grate opening meets design standards.
	Trash and Debris	Trash and debris that is blocking more than 20% of grate surface inletting capacity.	Grate free of trash and debris.
	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.

Table V-A.7: Maintenance Standards - Energy Dissipators

Maintenance Component	Defect or Problem	Condition When Maintenance is Needed	Recommended Maintenance to Correct Problem
External:			
Rock Pad/Splash Block	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.
	Erosion	Soil erosion in or adjacent to rock pad.	Rock pad replaced to design standards.
Dispersion Trench	Pipe Plugged with Sediment	Accumulated sediment that exceeds 20% of the design depth.	Pipe cleaned/flushed so that it matches design.
	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.
	Perforations Plugged	Over 1/2 of perforations in pipe are plugged with debris and sediment.	Perforated pipe cleaned or replaced.
	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.
	Receiving Area Over-Saturated	Water in receiving area is causing or has potential of causing landslide problems.	No danger of landslides.
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.
	Other Defects	See Table V-A.5: Maintenance Standards - Catch Basins	See Table V-A.5: Maintenance Standards - Catch Basins

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 underdrains or convert to a wet bioretention 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 Base- flow	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 clip-
	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 Accumulation	Trash and debris accumulated in the bio-swale.	Remove trash and debris from 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.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 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.
	Trash & Debris	Any trash and debris which exceed 1 cubic feet per 1,000 square feet. 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.	Trash and debris cleared 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 Juncus effusus (soft rush) in wet areas or snowberry (Symphoricarpos albus) in dryer areas.

Table V-A.11: Maintenance Standards - Wetponds

Maintenance Component	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
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 turbulence of the incoming flow and reduce sediment resuspension.
	Trash and Debris	Accumulation that exceeds 1 CF per 1000-SF of pond area.	Trash and debris removed from pond.
	Inlet/Outlet Pipe	Inlet/Outlet pipe clogged with sediment and/or debris material.	No clogging or blockage in the inlet and outlet piping.
	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 the pond bottom.
	Oil Sheen on Water	exceeds 6-inches, or where continued erosion is prevalent.	Oil removed from the water using oil-absorbent pads or vactor truck. Source of oil located and corrected. If chronic low levels of oil persist, plant wetland plants such as Juncus effusus (soft rush) which can uptake small concentrations of oil.
	Erosion	exceeds 6-inches, or where continued erosion is prevalent.	Slopes stabilized using proper erosion control measures and repair methods.
	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.
	Internal Berm	Berm dividing cells should be level.	Berm surface is leveled so that water flows evenly over entire length of berm.
	Overflow Spillway	Rock is missing and soil is exposed at top of spillway or outside slope.	Rocks replaced to specifications.

Table V-A.21: Maintenance Standards - Bioretention Facilities (Swale, Planter Box)

Maintenance Component	Recommended Frequency (See Notes)		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
Facility Footprint				
Earthen side slopes and berms	B, S		Erosion (gullies/rills) greater than 2 inches deep around inlets, outlet, and alongside slopes.	• Eliminate cause of erosion and stabilize damaged area (regrade, rock, vegetation, erosion control matting). • 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. • 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.
	A		Erosion of sides causes slope to become a hazard	Take actions to eliminate the hazard and stabilize slopes
	A, S		Settlement greater than 3 inches (relative to undisturbed sections of berm).	Restore to design height
	A, S		Downstream face of berm wet, seeps or leaks evident.	Plug any holes and compact berm (may require consultation with engineer, particularly for larger berms)
	A		Any evidence of rodent holes or water piping in berm.	• Eradicate rodents (see "Pest control"). • Fill holes and compact (may require consultation with engineer, particularly for larger berms).
Concrete sidewalls	A		Cracks of failure of concrete sidewalls	• Repair/ seal cracks. • Replace if repair is insufficient.
Rockery sidewalls	A		Rockery side walls are insecure	Stabilize rockery sidewalls (may require consultation with engineer, particularly for walls 4 feet or greater in height)
Facility area		All maintenance visits (at least biannually)	Trash and debris present	Clean out trash and debris
Facility bottom area	A, S		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 resettlement or installing berms to create a forebay at the inlet
		During/after fall leaf drop	Accumulated leaves in facility	Remove leaves if there is a risk to clogging outlet structure or water flow is impeded
Low permeability check dams and weirs	A, S		Sediment, vegetation, or debris accumulated at or blocking (or having the potential to block) check dam, flow control weir or orifice.	Clear the blockage
	A, S		Erosion and/or undercutting present	Repair and take preventative measures to prevent future erosion and/or undercutting
	A		Grade board or top of weir damaged or not level	Restore to level position

Table V-A.21: Maintenance Standards - Bioretention Facilities (Swale, Planter Box)

Maintenance Component	Recommended Frequency (See Notes)		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
Ponded water	B, S		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	Determine cause and resolve in the following order: 1. Confirm leaf or debris buildup in the bottom of the facility is not impeding infiltration. If necessary, remove leaf litter/debris. 2. Ensure that underdrain (if present) is not clogged. If necessary, clear underdrain. 3. Check for other water inputs (e.g., groundwater, illicit connections). 4. 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.
Bioretention soil mix	As needed		Bioretention soil mix protection is needed when per- forming 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.
Inlets/Outlets/Pipes				
Splash block inlet	A		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
Curb cut inlet/outlet	M during the wet season and before severe storm is fore-casted	Weekly during fall leaf drop	Accumulated leaves at curb cuts	Clear leaves (particularly important for key inlets and low points along long, linear facilities)
Pipe inlet/outlet	A		Pipe is damaged	Repair/ replace
	W		Pipe is clogged	Remove roots or debris
	A, S		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.
		Weekly during fall leaf drop	Accumulated leaves at inlets/outlets	Clear leaves (particularly important for key inlets and low points along long, linear facilities)
		A	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.

Table V-A.21: Maintenance Standards - Bioretention Facilities (Swale, Planter Box)

Maintenance Component	Recommended Frequency (See Notes)		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
Erosion control at inlet	A		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)
Trash Rack	S		Trash or other debris present on trash rack	Remove/dispose
	A		Bar screen damaged or missing	Repair/replace
Overflow	A, S		Capacity reduced by sediment or debris	Remove sediment or debris/dispose
Underdrain pipe	Clean pipe as needed	Clean orifice at least biannually (may need more frequent cleaning during wet season)	• 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.
Vegetation				
Facility bottom area and upland slope vegetation	Fall and Spring		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
Vegetation (general)	As needed		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 Ocamb, 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".

Table V-A.21: Maintenance Standards - Bioretention Facilities (Swale, Planter Box)

Maintenance Component	Recommended Frequency (See Notes)		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
Trees and shrubs		All pruning seasons (timing varies by species)	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
	A		Large trees and shrubs interfere with operation of the facility or access for maintenance	• Prune trees and shrubs using most current ANSI A300 standards and ISA BMPs. • Remove trees and shrubs, if necessary.
	Fall and Spring		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		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		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.
Trees and shrubs adjacent to vehicle travel areas (or areas where visibility needs to be maintained)	A		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
Flowering plants		A	Dead or spent flowers present	Remove spent flowers (deadhead)
Perennials		Fall	Spent plants	Cut back dying or dead and fallen foliage and stems
Emergent vegetation		Spring	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).

Table V-A.21: Maintenance Standards - Bioretention Facilities (Swale, Planter Box)

Maintenance Component	Recommended Frequency (See Notes)		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
Ornamental grasses (perennial)		Winter and Spring	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.
Ornamental grasses (evergreen)		Fall and Spring	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
Noxious weeds		M (March - October, preceding seed dispersal)		• By law, class A & 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 • Herbicides and pesticides may be prohibited in some jurisdictions • Apply mulch after weed removal (see "Mulch"); herbicides not to be used in order to protect water quality
Weeds		M (March - October, preceding seed dispersal)	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)
Excessive vegetation		Once in early to mid-May and once in early to mid-September	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
	As needed		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
Mulch				
Mulch		Following weeding	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

Table V-A.21: Maintenance Standards - Bioretention Facilities (Swale, Planter Box)

Maintenance Component	Recommended Frequency (See Notes)		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
Watering				
Irrigation system (if any)		Based on manufacturer's instructions	Irrigation system present	Follow manufacturer's instructions for O&M
	A		Sprinklers or drip irrigation not directed/ located to properly water plants	Redirect sprinklers or move drip irrigation to desired areas
Summer watering (first year)		Once every 1-2 weeks or as needed during prolonged dry periods	Trees, shrubs and groundcovers in first year of establishment period	• 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 • 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
Summer watering (second and third years)		Once every 2-4 weeks or as needed during prolonged dry periods	Trees, shrubs and groundcovers in second or third year of establishment period	• 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
Summer watering (after establishment)		As needed	Established vegetation (after 3 years)	• 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 • 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 • Water during drought conditions or more often if necessary to maintain plant cover

Table V-A.21: Maintenance Standards - Bioretention Facilities (Swale, Planter Box)

Maintenance Component	Recommended Frequency (See Notes)		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
Pest Control				
Mosquitoes	B, S		Standing water remains for more than 3 days after the end of storm	• Identify the cause of the standing water and take appropriate actions to address the problem (see "Ponded water") • 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. • Use of pesticides or Bacillus thuringiensis israelensis (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.
Nuisance animals	As needed		Nuisance animals causing erosion, damaging plants, or depositing large volumes of feces	• Reduce site conditions that attract nuisance species where possible (e.g., plant shrubs and tall grasses to reduce open areas for geese, etc.) • Place predator decoys • Follow IPM protocols for specific nuisance animal issues (see "Additional Maintenance Resources" section for more information on IPM protocols) • Remove pet waste regularly • For public and right-of-way sites consider adding garbage cans with dog bags for picking up pet waste.
Insect pests	Every site visit vegetation management		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 protocols).

Note that the inspection and routine maintenance frequencies listed above are recommended by Ecology. They do not supersede or replace the municipal stormwater permit requirements for inspection frequency required of municipal stormwater permittees for "stormwater treatment and flow control BMPs/facilities".

Recommended Frequency Notes: A = Annually; B = Biannually (twice per year); M = Monthly; W = At least one visit should occur during the wet season (for debris/clog related maintenance, this inspection/maintenance visit should occur in the early fall, after deciduous trees have lost their leaves); S = Perform inspections after major storm events (24-hour storm event with a 10-year or greater recurrence interval).

IPM - Integrated Pest Management

ISA - International Society of Arboriculture

Appendix E:
Maintenance Standards for Rain Gardens,
Table excerpted from *Guidance Document: Western Washington Low Impact Development (LID) Operation and Maintenance (O&M)*,
revised July 2013

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Table 6: Maintenance Standards and Procedures for Rain Gardens

Maintenance Component	Recommended Frequency (See Notes)		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
Rain Garden Footprint				
Earthen side slopes	B		Persistent soil erosion on slopes	If erosion persists, water may be flowing into the garden too rapidly. In this case, the slope of the pipe or swale directing water to the garden, or the amount of water may need to be reduced (see "Erosion control at inlet")
Rockery sidewalls	A		Rockery side walls are insecure	Stabilize rockery sidewalls (may require consultation with engineer, particularly for walls 4 feet or greater in height)
Rain Garden Footprint		B	Trash and debris present	Clean out trash and debris
Rain garden bottom area	A		Visible sediment deposition in the rain garden that reduces drawdown time of water in the rain garden	• Remove sediment accumulation • If sediment is deposited from water entering rain garden, determine the source and stabilize area
		During/after fall leaf drop	Accumulated leaves in garden (may reduce infiltration capacity of rain garden or clog overflow)	Remove leaves
Ponded water	B, S		Excessive ponding water: Ponded water remains in the basin more than 3 days after the end of a storm	Confirm leaf, debris or sediment buildup in the bottom of the rain garden is not impeding infiltration. If necessary, remove leaf litter/debris/sediment. If this does not solve the problem, consultation with a professional with rain garden expertise is recommended to evaluate the following: • Check for other water inputs (e.g., groundwater, illicit connections). • Verify that the facility is sized appropriately for the contributing area. Confirm that the contributing area has not increased. • Determine if the soil is clogged by sediment accumulation at the surface or if the soil has become overly compacted
Inlets/Outlets/Pipes				
Splash block inlet	A		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
Pipe inlet/outlet	A		Pipe capacity is reduced by sediment or debris (can cause backups and flooding)	Clear pipes of sediment and debris
	A		Damaged/cracked drain pipes	• Repair/seal cracks • Replace when repair is insufficient
Erosion control at inlet	A		Rock or cobble is removed or missing and concentrated flows are contacting soil	Maintain a cover of rock or cobbles to protect the ground where concentrated water flows into the rain garden from a pipe or swale
Vegetation				
Vegetation (general)		As needed	Dying, dead, or unhealthy plants	• Maintain a healthy cover of plants • Remove any diseased plants or plant parts and dispose of in commercial landfill to avoid risk of spreading the disease to other plants • Disinfect gardening tools after pruning to prevent the spread of disease • Re-stake trees if they need more support, but plan to remove stakes and ties after the first year • Cars can damage roots – protect root areas of trees and plants from vehicle traffic
		As needed	Vegetation inhibits sight distances and sidewalks	Keep sidewalks and sight distances on roadways clear
		As needed	Broken, dead, or sucker vegetation is present	Remove broken or dead branches and suckers
		As needed	Vegetation is crowding inlets and outlets	Keep water inlets and outlets in the rain garden clear of vegetation
	One time March through June		• Yellowing: possible Nitrogen (N) deficiency • Poor growth: possible Phosphorous (P) deficiency • Poor flowering, spotting or curled leaves, or weak roots or stems: possible Potassium (K) deficiency	• Test soil to identify specific nutrient deficiencies • Consult with a professional knowledgeable in the area of natural amendments or refer to Natural Lawn and Garden Care resources and avoid synthetic fertilizers • Consider selecting different plants for soil conditions

Table 6: Maintenance Standards and Procedures for Rain Gardens

Maintenance Component	Recommended Frequency (See Notes)		Condition when Maintenance is Needed (Standards)	Action Needed (Procedures)
	Inspection	Routine Maintenance		
Weeds		As needed, preceding seed dispersal	Problem weeds are present	• Remove weeds by hand, especially in spring when the soil is moist and the weeds are small • Dig or pull weeds out by the roots before they go to seed • Apply mulch after weeding (see "Mulch")
Mulch				
Mulch		Following weeding	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 • Use coarse compost in the bottom of the rain garden and arborist wood chips on side slopes and rim (above typical water levels) • Keep all mulch away from woody stems
Watering				
Summer watering (first year)		Once every 1-2 weeks or as needed during prolonged dry periods	Trees, shrubs and groundcovers in first year of establishment period	• 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 • 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
Summer watering (second and third years)		Once every 2-4 weeks or as needed during prolonged dry periods	Trees, shrubs and groundcovers in second or third year of establishment period	• 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
Summer watering (after establishment)		As needed	Established vegetation (after 3 years)	• 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 • Water during drought conditions or more often if necessary to maintain plant cover
Pest Control				
Mosquitoes	B, S		Standing water remains for more than 3 days after the end of storm	• Identify the cause of the standing water and take appropriate actions to address the problem (see "Ponded water") • 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. • Use of pesticides or Bacillus thuringiensis israelensis (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.

Note that the inspection and routine maintenance frequencies listed above are recommended by Ecology. They do not supersede or replace the municipal stormwater permit requirements for inspection frequency required of municipal stormwater permittees for "stormwater treatment and flow control BMPs/facilities".

Recommended Frequency Notes: A = Annually; B = Biannually (twice per year); S = Perform inspections after major storm events (24-hour storm event with a 10-year or greater recurrence interval).

IPM - Integrated Pest Management

ISA - International Society of Arboriculture