

**MS4 Permit Renewal Application Package
for
Clackamas County Service District No. 1, the City of Happy
Valley, the Surface Water Management Agency of Clackamas
County, the City of Rivergrove, and Clackamas County**

DEQ Permit #101348/DEQ File #108016

February 2017



City of Rivergrove

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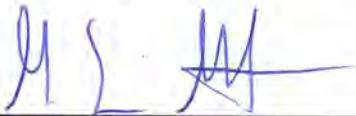
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February 2017

**Clackamas County
Clackamas County Service District No. 1
Surface Water Management Agency of Clackamas County
The City of Happy Valley
The City of Rivergrove**

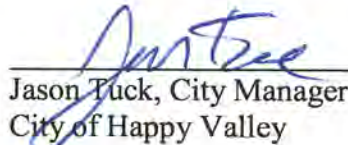
**NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES)
MUNICIPAL SEPARATE STORM SEWER SYSTEM PERMIT
RENEWAL APPLICATION PACKAGE**

We, the undersigned, hereby submit this National Pollutant Discharge Elimination System (NPDES) Municipal Stormwater System Renewal Application Package in accordance with NPDES Permit Number 101348. We certify under penalty of law that this document and all attachments were prepared under our direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on our 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 our knowledge and belief, true, accurate and complete. We are aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.



Gregory L. Geist, Director
Water Environment Services
For CCSD#1 & SWMACC

2/17/17
Date



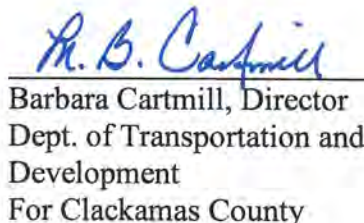
Jason Tuck, City Manager
City of Happy Valley

2-21-17
Date



Leanne Moll,
City Manager/City Recorder
City of Rivergrove

February 15, 2017
Date



Barbara Cartmill, Director
Dept. of Transportation and
Development
For Clackamas County

2-21-2017
Date

SECTION 1 INTRODUCTION AND OVERVIEW

1.1 Introduction

In the early 1990s, the Federal Clean Water Act required municipalities with populations greater than 100,000 to apply for and obtain a National Pollutant Discharge Elimination System (NPDES) permit for their storm sewer systems which discharge to creeks, rivers, and other surface water bodies. In Oregon, this program was, and continues to be, administered by the Oregon Department of Environmental Quality (DEQ) and DEQ directed several cities, counties, and service districts in Oregon and Oregon's Dept. of Transportation to apply for and obtain a NPDES Municipal Separate Storm Sewer System (MS4) Discharge permit.

The Clackamas County Phase I MS4 permit was issued to thirteen separate co-permittees in December 1995. Although none of these thirteen individual communities met the minimum population eligibility threshold on their own in the 1990s, the combined population served by all 13 of the Clackamas County co-permittees at that time did exceed 100,000, and continues to exceed 100,000 in 2017. The MS4 permit was subsequently renewed on several occasions, most recently in March 2012.

The MS4 permit requires the permit holder to implement a comprehensive program which reduces the discharge of pollutants from its MS4 to the Maximum Extent Practicable (MEP).

1.2 MS4 Permit Renewal Application Package

These five MS4 permit co-permittees have implemented a coordinated MS4 permit program since the early 1990s: Clackamas County Service District No. 1 (CCSD#1), the Surface Water Management Agency of Clackamas County (SWMACC) – both of which are Clackamas County Service Districts administered by Clackamas County Water Environment Services (WES) – the Cities of Rivergrove and Happy Valley, and Clackamas County. **This document and its appendices is the MS4 Permit Renewal Application Package for these five co-permittees.**

The current MS4 permit expires on March 1, 2017. Although Schedule B(6) of the MS4 permit says the Permit Renewal Application had originally been expected to be submitted at least 180 days prior to the permit expiration date, on June 17, 2016, the DEQ's Municipal Stormwater Program Coordinator, Mark Riedel-Bash, granted an extension of the due date until February 28, 2017 by invoking authority afforded by MS4 permit Schedule F's section (A)(4).

1.3 Coordinated Participants

These five co-permittees (Clackamas County, CCSD#1, the SWMACC, the Cities of Rivergrove and Happy Valley) are referred to as the Coordinated Participants in this document. A shared MS4 Permit Stormwater Management Plan (hereinafter referred to as the Shared SWMP) which describes a single stormwater management program for these five co-permittees is included in Appendix A of this MS4 Permit Renewal Application Package. Although the existence of a SWMP is a MS4 permit requirement, the Shared SWMP is also an informative guide for staff and a resource for the public to learn about the Coordinated Participants' combined efforts to

reduce pollutants discharged by their storm sewer systems. See Figure 1 in Section 1.5 for a map of the Coordinated Participants' service area.

1.4 Document Organization

This section provides a guide to the organization of this document's elements. Table 1 (below) summarizes the MS4 Permit Renewal Application Package's (Package) requirements and provides the corresponding location within the Package for the items which comply with these requirements.

TABLE 1: Submittal Requirement Location in the Document

Permit Renewal Package's Requirements:	Document Section where the Requirement is met:	MS4 Permit requirement
Signature Page	Page ii	Clean Water Act Req't
Introduction and Overview	Section 1	NA
Existing and Proposed Stormwater Management Programs, including Proposed SWMP Modifications and MEP Evaluations	Section 2	Schedule B(6), B(6)(a), and B(6)(b)
Fiscal Evaluation	Section 3	Schedule B(6)(f)
Shared SWMP	Appendix A	Schedule B(6)(a)
Summary of Proposed Changes to SWMP	Appendix B	Schedule B(6)
Updated Estimate of Total Annual Stormwater Pollutant Loads and Description of Expected Service Area Expansion	Appendix C	Schedule B(6)(c) and B(6)(e)
Land Use Compatibility Statement	Appendix D	NA
Proposed Monitoring Program Objectives Matrix	Appendix E	Schedule B(6)(d)
Proposed Monitoring Plan	Appendix F	Schedule B(6)(d)
Maps	Appendix G	Schedule B(6)(g)
TMDL Pollutant Load Reduction Benchmarks	Appendix H	Schedule B(6)(h)

1.5 Description of MS4 Permit Area

The Clackamas County MS4 permit applies to most of the lands within Clackamas County which are inside the Portland Metro Area urban growth boundary (UGB). The Clackamas County MS4 permit authorizes discharges from the MS4 which is owned by the following thirteen co-permittees: Clackamas County, the cities of Gladstone, Happy Valley, Johnson City, Lake Oswego, Milwaukie, Oregon City, Rivergrove, West Linn and Wilsonville, the Oak Lodge Sanitary District (OLSD), CCSD#1, and the SWMACC. A separate MS4 permit issued to ODOT by DEQ regulates the discharge of pollutants from the portion of ODOT's MS4 which is located in Clackamas County.

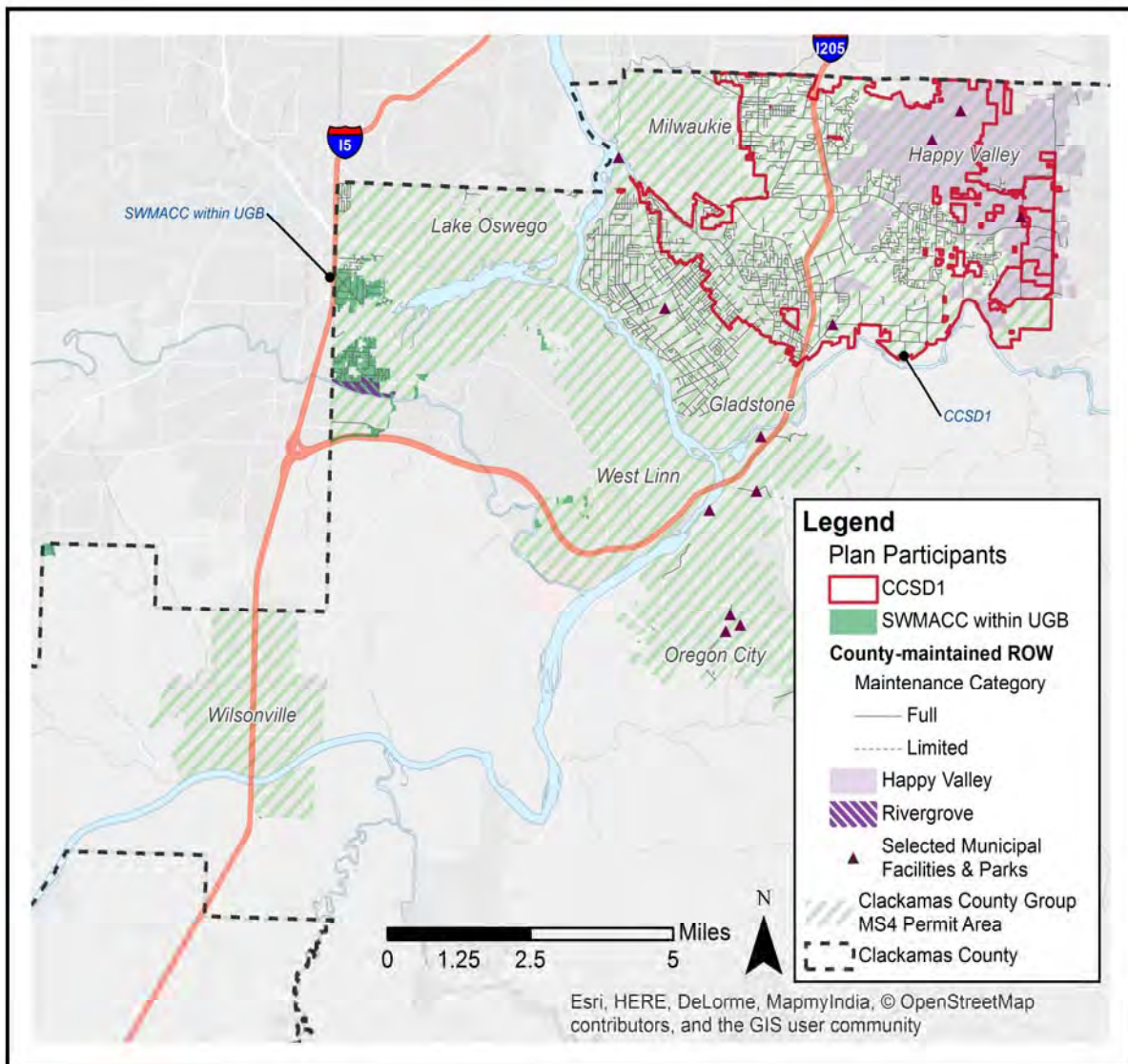
The MS4 permit regulates discharges of pollutants from the co-permittees' storm sewer systems to creeks, rivers and other surface water bodies. The MS4 Permit does not regulate discharges from lands, buildings, facilities, and roads which are drained by:

- Stormwater injection devices (drywells, for example), or

- Storm sewer systems which are owned by others, such as the state of Oregon or a corporation, unless the other storm sewer system eventually discharges into a surface-discharging storm sewer system owned/operated by one of the five Coordinated Participants.

The service boundaries of the five Coordinated Participants (Clackamas County, CCSD#1, the SWMACC, the Cities of Rivergrove and Happy Valley) are shown in Figure 1 below:

Figure 1: Clackamas County MS4 Permit Geographic Coverage Map



Additional information about the five Coordinated Participants is below:

CCSD#1 and the City of Happy Valley

Clackamas County Service District No. 1, which provides sanitary sewer and surface water management services, has the following four non-contiguous subunits in Clackamas County:

- Fischer's Forest Park – Located in the Redland area.
- Hoodland – Located in and near Welches, Wemme, and Rhododendron.
- Boring – Located in the hamlet of Boring.
- Portland metropolitan area – Only the Portland metro area subunit of CCSD#1 is regulated by the MS4 permit, because the other subunits are not within the Portland metro area's urban growth boundary (UGB). The Portland metro area subunit is known as CCSD#1-UGB. A large block of unincorporated, urbanized lands – including the community of Clackamas, OR (97015) – is within CCSD#1-UGB. The urbanized portion of the City of Happy Valley is also within CCSD#1-UGB. Note that an undeveloped, rural section of the City of Happy Valley, known as the East Happy Valley area, is not within CCSD#1-UGB at this time, but it is expected to be annexed into CCSD#1 as these lands are developed over time.

SWMACC and the City of Rivergrove

SWMACC provides surface water management services in a portion of Clackamas County. All of the lands within the SWMACC are in the Tualatin River's watershed. Although the SWMACC includes over 10,000 acres of land, the only portion of the SWMACC which is regulated by the MS4 permit are those lands in the SWMACC which are also within the Portland metro area's UGB. Fewer than 500 of the SWMACC's acres are regulated by the MS4 permit. Most of the City of Rivergrove is within the SWMACC, although a portion of the city is in Washington County. Due to annexations by the Cities of Tualatin, Lake Oswego, and West Linn, the land area within the SWMACC is decreasing gradually over time because no portion of these cities are located in the SWMACC.

Clackamas County

Most of the work which Clackamas County does to comply with the MS4 permit is performed by Clackamas County's Department of Transportation and Development (DTD). DTD is a department of Clackamas County responsible for maintaining and improving the County's road system, jointly operating the County's MS4 within the permitted area, and for planning, zoning, plan review, permitting, and code enforcement. The vast majority of the Clackamas County-owned MS4 is located with the County's road rights-of-way (ROW). These ROW are operated and maintained by DTD. Most of the Clackamas County-owned MS4 is located in CCSD#1-UGB, the SWMACC, the East Happy Valley area in the City of Happy Valley, and in the Oak Lodge Water Services service area (formerly known as the Oak Lodge Sanitary District). However, a few sections of the Clackamas County-owned MS4 are located within other cities in the Clackamas County MS4 permit area (the storm sewer system which serves SE Johnson Creek Blvd in the City of Milwaukie is an example). All Clackamas County-owned ROW within the MS4 permit area are included in the Shared SWMP (see Appendix A).

Note that one or more Coordinated Participants may choose to satisfy some or all their MS4 permit obligations through an agreement with one or more co-permittees. For example, the operation of the Clackamas County-owned MS4 within the Oak Lodge Water Services (OLWS) service area is described in a Memorandum of Understanding (MOU) signed by both parties in July 2013. The OLWS service area is within the geographic area regulated by the MS4 permit and OLWS is a MS4 permit co-permittee. The OLWS operates a district which provides sanitary wastewater collection & treatment and surface water management services for approximately 30,000 people in the Oak Grove and Jennings Lodge areas of unincorporated Clackamas County. Please see the Shared SWMP in Appendix A, the MOU, and/or the Oak Lodge Water Services MS4 Permit Renewal Application package, which is expected to include an updated SWMP, for more information about compliance with the MS4 permit in the Oak Lodge Water Services service area.

Other Clackamas County Departments, such as Business and Community Services – which administers the North Clackamas Parks & Recreation District – and the Facilities Management Department also perform work which assists Clackamas County with MS4 permit compliance. See the Feb. 2017 Shared SWMP in Appendix A for more information.

SECTION 2

EXISTING STORMWATER MANAGEMENT PROGRAM AND PROPOSED PROGRAM MODIFICATIONS: REDUCTION OF POLLUTANTS TO THE MEP

Schedule B(6) of the 2012 MS4 Permit states:

“...the co-permittee must submit a permit renewal application package to support their proposed modifications to the SWMP for the renewed permit...The application package must include an evaluation of the adequacy of the proposed SWMP modifications in reducing pollutants in discharges from the MS4 to the MEP. The application package must contain:

a. Proposed program modifications including the modification, addition or removal of BMPs incorporated into the SWMP, and associated measurable goals.

b. The information and analysis necessary to support the Department’s independent assessment that the co-permittee’s stormwater management program addressed the requirements of the existing permit. Co-permittees must also describe how the proposed management practices, control techniques, and other provisions implemented as part of the stormwater program were evaluated using a co-permittee-defined and standardized set of objective criteria relative to the following MEP general evaluation factors:

- i. Effectiveness – program elements effectively address stormwater pollutants.*
- ii. Local Applicability – program elements are technically feasible considering local soils, geography, and other locale specific factors.*
- iii. Program Resources – program elements are implemented considering availability to resources and the co-permittees stormwater management program priorities.”*

This section of the permit renewal application provides information to support the Oregon DEQ’s assessment that our:

- *Existing* stormwater management program, including the three existing Stormwater Management Plans (SWMP), addressed the requirements of the existing MS4 Permit, and reduced pollutants in discharges from the municipal separate storm sewer system (MS4) to the maximum extent practicable (MEP).
- *Proposed* program, including the Shared SWMP (see Appendix A), also addressed the requirements of the existing MS4 Permit, and will continue to reduce pollutants in discharges from the MS4 to the MEP in the future.

To address this requirement, this section includes three parts:

- Section 2.1: How the *Existing* Stormwater Management Program Addressed Existing Permit (issued March 2012) Requirements.
- Section 2.2: *Proposed* program modifications, including changes made to the Stormwater Management Plan (SWMP).
- Section 2.3: How the *Proposed* Stormwater Management Program meets the MEP Requirement.

2.1 How the *Existing* Stormwater Management Program Addressed the March 2012 MS4 Permit Requirements

Throughout the current MS4 permit term and at the present time, the five Coordinated Participants (Clackamas County, CCSD#1, the SWMACC, the Cities of Rivergrove and Happy Valley) implemented and continue to implement an existing stormwater management program which is comprised of activities described in:

- The three SWMPs (Clackamas County DTD's, The City of Happy Valley/CCSD#1's, and The City of Rivergrove/SWMACC's).
- The Comprehensive Clackamas County NPDES Stormwater Monitoring Plan (CCCSMP).
- Additional assessments, strategies, and submittals (June 2015 Stormwater Retrofit Plan, for example).

Documentation of the implementation of existing SWMPs and the CCCSMP has been – and continues to be – provided to DEQ on an annual basis in annual reports for each July 1st to June 30th year. Required actions described in the additional assessments and submittals have also been taken and implemented. Please see these annual reports, additional assessments, and submittals for more information about the implementation of the relevant portions of our MS4 permit program.

The following portion of section 2.1 summarizes how the existing program and the SWMPs (as subsets of the overall program) were adaptively managed during the current 2012-2017 MS4 permit term, and how the overall stormwater management program addressed existing permit requirements.

One of the most significant management changes during the permit term occurred in 2014 when Water Environment Services' surface water management program was reorganized. As the result of this reorganization, a Division-level management position, the Surface Water Manager, was created to oversee and/or monitor all surface water management program activities conducted by the Cities of Happy and Rivergrove, CCSD#1, and the SWMACC, and to coordinate with other Clackamas County Departments, including the Dept. of Transportation & Development. This position was initially filled by staff on an interim basis and the permanent, full-time position was filled in February 2015. The Surface Water Manager position has overseen a renewed and successful effort by the five Coordinated Participants (Clackamas County, CCSD#1, the SWMACC, the Cities of Rivergrove and Happy Valley) to comply with the requirements in the existing MS4 permit (renewed March 2012).

2.1.1 EPA Audit

The U.S. EPA initiated an MS4 permit program audit of CCSD#1 and the City of Happy Valley in 2014. Their audit was completed in March 2015. The programmatic areas which were audited are:

- Illicit Discharge Detection and Elimination [MS4 Permit Schedule A(1) and A(4)(a)]
- Post-Construction Site Runoff [Schedule A(4)(f)]
- Pollution Prevention for Municipal Operations [Schedule A(4)(g), except for A(4)(g)(ii) and A(4)(g)(vi)]

- Stormwater Management Facilities Operation and Maintenance Activities [Schedule A(4)(h)]

Although CCSD#1's and the City of Happy Valley's overall performance in the audit was good, the EPA issued a Warning Letter to CCSD#1 on March 3, 2016 which included the following three "Areas of Concern":

1. Illicit Discharge Detection and Elimination (IDDE) Procedures:

Some storm sewer system outfalls had been incorrectly categorized, and as a result, the set of mapped outfalls contained inaccuracies. These inaccuracies have been rectified. In addition, one outfall which had recently been discovered, and was receiving dry-weather IDDE inspections, hadn't been added to the official list of "Priority Locations" yet. The outfall was designated as a Priority Location for monitoring on July 17, 2013, which is about nine months *after* the most recent version of the CCSD#1-SWMAACC Priority IDDE Monitoring Locations document had been published on October 25, 2012. This outfall was subsequently added to the list when the official list of Priority Locations was updated.

2. Pollution Prevention for Municipal Operations:

An element of the June 28, 2013 written Strategy for operating CCSD#1's Vector Truck Decant Facility wasn't being followed. The EPA auditors documented that liquid from the trucks was being discharged into a vegetated stormwater management pond at the site, but the written strategy stated that this liquid shall be discharged into CCSD#1's sanitary sewer system. This practice was promptly discontinued.

3. Stormwater Management Facilities Operation and Maintenance Activities:

The concerns expressed in the Warning Letter pertain to some of the privately owned storm sewer systems which discharge into the MS4. For those privately owned storm sewer systems which serve commercial & industrial facilities and properties, churches and other places of worship, and apartment complexes, the auditors documented that CCSD#1 had typically not verified the operational and maintenance status of these storm sewer systems. While the Warning Letter acknowledged the program's significant educational and incentive-based aspects, the auditors noted that a different set of resources (such as inspections) will need to be deployed to ensure that these property owners properly maintain their storm sewer systems. This issue has been addressed; see BMP MAINT-7 in the Shared SWMP in Appendix A for more information.

2.1.2 Annual and Permit Cycle Adaptive Management

The following requirement is outlined in Schedule D.4 of the permit: *"Each co-permittee must follow an adaptive management approach to assess annually and modify, as necessary, any or all existing SWMP components and adopt new or revised SWMP components to achieve reductions in stormwater pollutants to the MEP. The adaptive management approach must include routine assessment of the need to further improve water quality and protection of beneficial uses, review of available technologies and practices, review of monitoring data and analyses required in Schedule B, review of measurable goals and tracking measures, and evaluation of resources available to implement the technologies and practices. The co-permittee*

must submit a description of the process for conducting this adaptive management approach during the permit term by November 1, 2012.”

Using our *Outline for the Adaptive Management Approach* (October 2012), the five Coordinated Participants (Clackamas County, CCSD#1, the SWMACC, the Cities of Rivergrove and Happy Valley) assessed their existing SWMPs on an annual and permit cycle basis. The March 2012 MS4 Permit’s Permit Evaluation Report and Fact Sheet (PER) identifies five operational ‘phases’ to consider when identifying an adaptive management approach. The following five operational phases identified in the PER were considered as the *Outline for the Adaptive Management Approach* was created: 1) implementing a stormwater program, 2) collecting data and information, 3) evaluating the stormwater program, 4) assessing and identifying stormwater program needs, and 5) developing or modifying the existing program.

Throughout the duration of the current MS4 permit cycle, the five coordinated participants implemented the BMPs in their DEQ-approved SWMPs as part of their stormwater management program. Tracking measures in the BMPs were assessed to gauge progress toward achieving the BMPs’ measurable goals. Data collected during program implementation was consistent with documented tracking measures (e.g., miles of streets swept, number of catch basins cleaned, etc.) and allowed for the assessment of measurable goal attainment. Environmental monitoring data collected as part of the environmental monitoring plan (CCCSMP) was reviewed to identify potential data anomalies, trends or water quality standards exceedances. We assessed BMP effectiveness data to evaluate the effectiveness of specific BMPs within our overall stormwater management program. We reviewed available technologies and practices. We reviewed measurable goals and tracking measures in the three DEQ-approved SWMPs. And we evaluated the resources which are available to implement the technologies and practices.

The product of each of these annual assessments was reported to DEQ in each year’s July 1st-June 30th MS4 permit annual report. To illustrate this process, the 2015-2016 annual adaptive management assessment for the Cities of Rivergrove and Happy Valley, the SWMACC and CCSD#1 is provided below as an example:

“Schedule B(5)(c) of the MS4 Permit requires a summary of the current implementation of the adaptive management process to be provided in each annual report. Permit Schedule D(10)(a) defines adaptive management as “A structured, iterative process designed to refine and improve stormwater programs over time by evaluating results and adjusting actions on the basis of what has been learned”. Our October 2012 document titled “Outline for Adaptive Management Approach” was used to guide our 2015-2016 adaptive management process, which was summarized in our November 2016 annual report for the 2015-2016 MS4 Permit year. An analysis of BMP implementation and environmental monitoring data was performed by Clackamas County’s WES on behalf of the SWMACC, CCSD#1, and the Cities of Rivergrove and Happy Valley throughout the 2015-2016 reporting period. The effort to adaptively manage BMP implementation in light of measurable goals in their two SWMPs is on track. At this point no revisions to our two SWMPs (SWMACC-City of Rivergrove and City of Happy Valley-CCSD#1) are deemed necessary, and adjustments to ensure attainment of the measurable goals in the current SWMPs, if needed, will be made. Two potential programmatic changes that are expected to be made in the future were identified. Upon reviewing the SWMP BMPs, we recognized the need to:

- a) Provide additional stormwater services in the following subject area: Permit Schedule A(4)(h)’s “Stormwater Management Facilities Operation and Maintenance Activities”. The portion of our program which pertains to the inspection and maintenance of privately owned storm sewer

systems which serve churches and other places of worship, industrial facilities, apartment complexes, shopping malls, and other commercial areas has relied heavily upon education and technical assistance in the past. We expect to expand some related service categories, such as inspections and enforcement, in the future.

b) Re-categorize the way that MS4-permitted storm sewer system outfalls are organized in our GIS system. Other structures, such as pipes which discharge into man-made stormwater quality ponds, had been categorized together with storm sewer system outfalls, making it difficult to list or map only the storm sewer system outfalls which discharge to Waters of the State. This re-categorization process is underway and we expect to complete it soon."

By providing a summary in each MS4 annual report of progress toward attainment of measurable goals in SWMP BMPs – through data collection and tracking measures – we met the applicable MS4 permit reporting requirements and facilitated a critical step in adaptively managing our stormwater program by assessing our SWMP BMPs.

During the annual adaptive management process, staff weighed resource availability and needs related to our overall stormwater program, including consideration of budget/funding, training needs, and new technology or available equipment. Our annual adaptive management process also includes an assessment of whether the modifications are resulting in the predicted outcomes/efficiencies through an iterative feedback loop. Annual adaptive management, therefore, contributed to the identification of modifications which were ultimately made as the Shared SWMP was developed in 2016 and 2017. The Shared SWMP complies with all of the applicable MS4 permit requirements, including but not limited to those in Schedules A(3), A(4), B(6), and D(5).

The end result of the annual adaptive management process is to reduce pollutants discharged by the MS4 to the MEP.

The *Outline for the Adaptive Management Approach* also includes a Permit Cycle Adaptive Management Process. See section 2.3 for more information.

2.1.3 Recent SWMP Modifications

Over the current March 2012 to March 2017 MS4 permit term, the Rivergrove-SWMAACC SWMP and the Happy Valley-CCSD#1 SWMP were both modified once. The SWMPs were modified on April 27, 2012 in response to additional requirements in the renewed MS4 permit. This modification included the addition of measurable goals into selected BMPs per Schedule D(8) of the permit. An example is the addition of a measurable goal to develop an Integrated Pest Management Plan by December 31, 2012.

2.1.4 Compliance with Requirements in 2012-2017 MS4 Permit:

The five Coordinated Participants (Clackamas County, CCSD#1, the SWMAACC, the Cities of Rivergrove and Happy Valley) have addressed all of the requirements in the existing MS4 permit (renewed March 2012) and are in compliance. To attain compliance, the five Coordinated Participants have:

- Implemented their respective DEQ-approved SWMPs
- Implemented the Monitoring Plan (the CCCSMP)

- Submitted to DEQ and subsequently implemented the required additional assessments and strategies, many of which are summarized in the tables in the permit’s Schedules A(7) and D(9). Examples include the June 2015 Stormwater Retrofit Plan and the June 2013 Updated Strategy for the WES Industrial/Commercial Stormwater Program.
- Submitted their annual reports to DEQ.
- Made programmatic changes in response to the three Areas of Concern in the EPA’s March 3, 2016 Warning Letter.

Please see these documents for detailed information about the specific activities and actions which were proposed and subsequently completed.

2.1.5 Results of the MEP Evaluation for the Existing Program:

Schedule A(2) of the MS4 permit, which is titled “Reduce Pollutants to the Maximum Extent Practicable”, says:

“Each co-permittee must reduce the discharge of pollutants from the MS4 to the maximum extent practicable (MEP). Compliance with this permit and implementation of a stormwater management program, including the Department-approved Stormwater Management Plan (SWMP), establishes this MEP requirement...”.

The three DEQ-approved SWMPs for the five Coordinated Participants have been adaptively managed over the current permit term using our annual adaptive management process. In addition to implementing and adaptively managing the SWMPs, the five Coordinated Participants are in compliance with all of the other requirements in the 2012-2017 MS4 permit. Therefore, the five Coordinated Participants’ existing program has met the MEP requirement.

Section 2.2: Proposed program modifications, including changes made to the Stormwater Management Plan (SWMP)

At the present time, the five Coordinated Participants (Clackamas County, CCSD#1, the SWMACC, the Cities of Rivergrove and Happy Valley) implement their MS4 permit programs through three separate SWMPs. The co-owners/implementers of these three SWMPs are:

- Clackamas County DTD
- The City of Happy Valley and CCSD#1
- The City of Rivergrove and the SWMACC

To improve coordination and overall program effectiveness, the five Coordinated Participants recently chose to create a single, combined, Shared SWMP (Shared SWMP). This proposed Shared SWMP is in Appendix A of this permit renewal application package.

An extensive process was undertaken as the three SWMPs were integrated into one Shared SWMP. This process, which was facilitated and supported by Otak, Inc., included a project kickoff meeting, three separate Workshops, three separate Visioning sessions, and over a dozen

other meetings to receive input and direction which was subsequently used to determine the depth and breadth of the program which is described in the Shared SWMP. Attendees at the Workshops, Visioning sessions, and meetings included numerous staff from Clackamas County's WES, DTD and BCS, the City of Happy Valley and the City of Rivergrove.

Otak, Inc. completed a Gap Analysis in October 2016 which compared the Coordinated Participants' current SWMPs with requirements in the March 2012 MS4 permit to ensure that the February 2017 Shared SWMP fully complies with the MS4 permit.

A substantial number of modifications were made to various BMPs (Best Management Practices) during the process of integrating the three existing SWMPs into the Shared SWMP. The Shared SWMP has thirty-six (36) BMPs, many of which have new, improved measurable goals and tracking measures. A summary of these modifications is provided in Appendix B of this MS4 Permit Renewal Application Package.

A public comment period was provided for the draft Shared SWMP and the TMDL Benchmarks from January 20, 2017 to February 21, 2017. The draft Shared SWMP and a TMDL Benchmarks summary document were posted on WES' website during the public comment period. One set of comments – from the Clackamas River Water Providers (CRWP) – were received. All of the CRWP's comments were about the Shared SWMP. In response to these comments, several changes were made to the Shared SWMP before it was finalized.

See section 2.3 below for the evaluation of the adequacy of the proposed SWMP modifications in reducing pollutants in discharges from the MS4 to the Maximum Extent Practicable (MEP).

2.3 How the *Proposed Stormwater Management Program* Meets the MEP Requirement

The Coordinated Participants' proposed stormwater management program complies with all of the requirements in the existing permit, including the MEP requirement. This section contains our evaluation of the adequacy of the proposed program modifications, including the SWMP modifications described in Section 2.2 and summarized in Appendix B, in reducing pollutants in discharges from the MS4 to the Maximum Extent Practicable (MEP). The following sub-sections provide the elements of this evaluation:

- 2.3.1: Permit Cycle Adaptive Management Process (PCAMP)
- 2.3.2: Program Modifications were Supported by a Collaborative and Thorough Process
- 2.3.3: MEP, including Effectiveness, Local Applicability, and Program Resources
- 2.3.4: Public Comments
- 2.3.5: Conclusion

2.3.1 PCAMP

The Coordinated Participants' *Outline for the Adaptive Management Approach* includes a Permit Cycle Adaptive Management Process (PCAMP). The PCAMP was utilized in 2016 and 2017 as

important MS4 program documents were updated, including the February 2017 Shared SWMP in Appendix A and the December 15, 2016 Comprehensive Clackamas County NPDES MS4 Stormwater Monitoring Plan (CCCSMP) in Appendix E. The proposed program modifications in these documents – which comply with all relevant MS4 permit requirements and are intended to reduce pollution discharged by the MS4 to the MEP – have been submitted as part of this permit renewal package for the upcoming permit term.

2.3.2 Program Modifications were Supported by a Collaborative and Thorough Process:

A collaborative and thorough process was implemented in 2016 and 2017 to review the existing Stormwater Management Programs, including the three SWMPs, and then identify and subsequently make proposed modifications to the Coordinated Participants' stormwater management program, including the Shared SWMP. A substantial amount of resources were invested in this important, successful effort. This collaborative and thorough process included:

- Development of the Shared SWMP through numerous meetings, Workshops, Visioning Sessions, and other conversations.
- Creation of the Gap Analysis to ensure that the Shared SWMP complies with all of the applicable requirements in the March 2012 MS4 permit.

See section 2.2 for more information.

2.3.3 Maximum Extent Practicable (MEP)

Background

The Coordinated Participants initially developed and implemented SWMPs that met the MEP requirement as part of the original 1993 MS4 permit application. Those SWMPs have become the foundation for our program, a foundation that has been continuously evaluated and improved through adaptive management since December 1995 when the Phase I MS4 permit was issued to Clackamas County co-permittees. As a result, the BMPs described in the Coordinated Participants' current SWMPs are the result of the cumulative effect of implementing, continuously evaluating, and making corresponding changes (i.e., adaptive management) to a variety of technically and economically feasible BMPs which ensure that the most appropriate controls are implemented in the most effective manner based on local conditions.

From the development of the first SWMP up until the submittal of this permit renewal application in 2017, the Coordinated Participants have followed our adaptive management process to ensure that our Proposed Stormwater Management Program, including but not limited to the Shared SWMP in Appendix A, meets the MEP standard.

MEP General Evaluation Factors and Objective Criteria

As part of this MEP evaluation and demonstration, nearly all of the jurisdictions in Oregon with Phase I MS4 permits recently coordinated on an approach to define and standardize objective criteria related to the three MEP general evaluation factors: Effectiveness, Local Applicability, and Program Resources. The collaborative process included identification of example objective criteria for consideration by the jurisdictions. Each jurisdiction scored and ranked the example criteria depending on deemed importance and applicability. The highest ranking objective

criteria were deemed universally acceptable by all participating jurisdictions with Phase I MS4 permits in Oregon and are provided below:

Program Effectiveness

- The program includes a range of BMPs that encompass pollution prevention, source control, and treatment approaches.
- The program includes BMPs that are technically feasible, effective, and implementable.
- The program includes BMPs that target applicable 303(d) parameters, help to achieve TMDL pollutant load reduction benchmarks, and make progress toward TMDL Waste Load Allocations.
- The program targets pollutant discharges from existing development, re-development, and new development activities.

Local Applicability

- The program is consistent with local ordinances and current legal authority.
- Stormwater design standards implemented as part of the program reflect local conditions specific to soils, rainfall, infiltration rates, and stream conditions.
- The program encourages and solicits feedback and involvement from stakeholders to ensure consistency with community-wide goals and objectives.

Program Resources

- The program is included in the current budget allocations.
- The program considers implementation costs and practicability within the overall context of permittee priorities and resources
- The program considers cost effectiveness in implementing stormwater management approaches, including public acceptance of program costs and benefits.

Water Environment Services, on behalf of the Coordinated Participants, evaluated the combined stormwater management program, including its Shared SWMP, against this standardized set of objective criteria for the MEP general evaluation factors and concluded that its proposed stormwater management program, including the Shared SWMP, has met all the criteria listed above for Program Effectiveness, Local Applicability, and Program Resources.

2.3.4 Public Comment

A public comment period was provided for the draft Shared SWMP and the TMDL Benchmarks from January 20, 2017 to February 21, 2017. The draft Shared SWMP and a TMDL Benchmarks summary document were posted on WES' website during the public comment period. One set of comments – from the Clackamas River Water Providers (CRWP) – were received. All of the CRWP's comments were about the Shared SWMP. In response to these comments, several changes were made to the Shared SWMP before it was finalized.

2.3.5 Result of MEP Evaluation for Proposed Program

The Coordinated Participants' proposed program, including the proposed Shared SWMP, was evaluated. The evaluation included an assessment of the proposed Shared SWMP with respect to

the standardized MEP criteria identified in Section 2.3.3 and we concluded that the updated program met all the criteria listed for program effectiveness, local applicability, and program resources. The evaluation determined that the proposed stormwater management program, including the proposed Shared SWMP, complies with all of the requirements in the existing permit. Therefore, the conclusion of this evaluation is that implementation of the proposed stormwater management program meets the Maximum Extent Practicable (MEP) requirement.

SECTION 3

FISCAL EVALUATION FOR CURRENT AND PROJECTED EXPENDITURES

Schedule B(6)(f) of the 2012 MS4 Permit states the following shall be provided in this Package: “A fiscal evaluation summarizing program expenditures for the current permit cycle and projected program allocations for the next permit cycle.”

3.1 Funding Sources

Funding sources for the Coordinated Participants (CCSD#1, the SWMACC, the cities of Happy Valley, Rivergrove, and Clackamas County) are different, so they’re addressed separately in the following paragraphs.

Funding sources for Water Environment Services (WES) on behalf of CCSD#1 and SWMACC

The surface water management activities of the WES surface water districts have their own accounting cost centers, budget, and dedicated funding sources. Program resources are provided by three primary funding sources: monthly surface water charges, system development charges (SDCs), and plan review and inspection fees. Charges and fees are adopted by the Board of County Commissioners, acting in their role as the Board of Directors for Clackamas County Service District No. 1 (CCSD#1) and the Surface Water Management Agency of Clackamas County (SWMACC), respectively.

Monthly surface water charges are paid by property owners in CCSD#1 and SWMACC (the Districts). Property owners pay a monthly surface water charge per Equivalent Service Unit (ESU) defined as one single-family residence or 2,500 square feet of impervious surface for nonresidential customers. SWMACC customers also pay a monthly surface water charge per Equivalent Service Unit; however, only a small portion of this revenue is collected within the MS4-permitted area of this district. Business and institutional customers are charged impervious area multiples of the impervious area typical for a single-family residence. New single-family residential customers, since 1998, may also pay a monthly maintenance agreement fee per ESU for maintenance of local subdivision stormwater conveyance, detention, treatment, and infiltration facilities.

SDCs are collected from new development and dedicated to planning, design, and construction of additional stormwater infrastructure capacity needed to accommodate growth.

Plan review and inspection fees for stormwater and erosion control activities are collected with new development applications. Fee revenue is strongly influenced by development activity in the Districts.

Funding sources for Happy Valley, Rivergrove, and Clackamas County

The Cities of Happy Valley and Rivergrove, and Clackamas County do not have dedicated surface water funding sources. The vast majority of the MS4 permitted area within these

jurisdictions is also within CCSD#1 and SWMACC, and surface water services are provided by WES on behalf of the Districts using the funding sources described above.

Plan review and inspection fees for stormwater and erosion control activities are collected with new development applications in Happy Valley and Clackamas County. Rivergrove for the most part relies on Clackamas County to provide development review services. When particular services are not provided by the Districts, or when a copermitee chooses to implement a MS4 permit activity (e.g. construction runoff control in Happy Valley), co-permittees utilize fee-based funding for development review activities.

The City of Happy Valley and Clackamas County also use other funding sources such as General Fund or Road Fund for road maintenance activities and pollution prevention, like ditch cleaning and street sweeping, respectively.

3.2 Program expenditures for the current permit cycle

Program expenditures for the current permit cycle are summarized below. Table 1 below shows WES expenditures in CCSD#1 and SWMACC, including plan review and inspection costs for development projects.

Table 1. WES Surface Water Program Fiscal Summary, 2011/12 – 2016/17

		Fiscal Year					5 Year Total	2016/17 Budget
		2011/12	2012/13	2013/14	2014/15	2015/16		
Program Revenue	CCSD1 SW	\$ 4,133,534	\$ 4,460,953	\$ 4,366,704	\$ 4,900,465	\$ 4,844,282	\$ 22,705,938	\$ 4,768,061
	SWMACC	182,585	188,657	188,409	181,325	192,943	933,919	191,822
	Total Revenue	4,316,119	4,649,610	4,555,113	5,081,790	5,037,225	23,639,857	4,959,883
Program Expenditure s	CCSD1 SW	4,960,701	4,550,607	3,840,946	4,109,208	3,596,165	21,057,627	5,644,836
	SWMACC	220,853	109,855	93,622	87,104	103,599	615,033	202,960
	Total Expenditures	\$ 5,181,554	\$ 4,660,462	\$ 3,934,568	\$ 4,196,312	\$ 3,699,764	\$ 21,672,660	\$ 5,847,796

Source: District Financial Reports, 2016/17 Budget

For the City of Happy Valley, the permit fees for plan review and inspection for development is based on the construction value of the project. In the July 2015/16 fiscal year, the City collected approximately \$442,500 in plan review and inspection fees for storm and erosion control activities. Funds for road maintenance and street sweeping are budgeted from the City of Happy Valley's General Funds. Table 2 below shows an overview of the budget and expense for street sweeping and roadway debris removal, and the yearly budget associated with those efforts.

Table 2. Happy Valley road maintenance budget and expenditures related to MS4 permit activities, 2011/12 – 2015/16

Year:	2011/12	2012/13	2013/14	2014/15	2015/16
Budget:	\$115,300	\$120,000	\$120,000	\$110,000	\$180,000
Expenditures:	\$44,595	\$65,685	\$65,677*	\$40,928	\$74,789.40

*Per Happy Valley Public Works staff the budget report value of \$131,355 for 2013/14 is likely an error, so it is estimated in this table.

For Clackamas County, there is no data available at this time for plan review and inspection revenue or expense. Generally, this activity is funded by fees collected specifically for plan review and inspection activities.

Funds for road maintenance and street sweeping are budgeted from Clackamas County's Road fund. Table 3 below provides an overview of the cost of Dept. of Transportation & Development (DTD) road maintenance activities which pertain to MS4 permit requirements. Funding for stormwater-related road maintenance is not specifically collected but is budgeted from the road fund, so revenue is not shown in this table.

Table 3. DTD road maintenance expenditures related to required permit activities, 2011/12 - 2016/17

		FISCAL YEAR					4 Year Total	2016/17 Budget
		2011/12	2012/13	2013/14	2014/15	2015/16		
Program Expenditures	Culvert/Storm Sewers	N/A	\$280,325	\$346,202	\$213,248	\$167,423	\$1,007,198	\$172,446
	Ditch Maintenance	N/A	\$121,501	\$114,023	\$79,185	\$58,119	\$372,828	\$59,863
	Hydroseeding	N/A	\$0	\$0	\$0	\$750	\$750	\$773
	Street Sweeping	N/A	\$159,354	\$180,646	\$220,128	\$168,648	\$728,776	\$173,707
	Total Expenditures in permit area (UGB):	N/A	\$561,180	\$640,871	\$512,561	\$394,940	\$2,109,552	\$406,789

3.3 Projected Future Program Allocations for the next Permit Cycle:

Projecting the surface water management budget's demands and revenue in the future is challenging because the annual budgeting process considers many factors such as national and local economic factors, overall costs to the public including current fee levels, annual priorities, long-term asset management, and regulatory requirements. Many of these factors, such as future Phase 1 MS4 permit requirements, are not known at this point. Any proposed budget increases are subject to County Board and City Council approvals.

The Districts are the primary surface water management service provider for the vast majority of the area regulated by the MS4 permit, so the Districts' surface water management budget is expected to be the primary source of funding to implement permit-required activities in the future. WES anticipates a reliable and stable funding source for the Districts through monthly surface water management charges, system development charges (SDCs), and plan review and inspection fees.

The annual surface water management budgets for both CCSD#1 and SWMACC may continue to grow in order to meet regulatory requirements, system expansion, and maintenance of existing storm systems. Although revenue forecasts can be based on the number of ESUs served within each district, it is likely that future budgets will increase somewhat independently of the number of ESUs served, and may require rate increases and possibly additional staffing. WES is currently evaluating the surface water management services provided and the current programs for CCSD#1 and SWMACC. The results of this evaluation will provide a better understanding of costs of surface water services, actual revenue requirements, and priorities.

As stated previously the City of Happy Valley and Clackamas County fund a portion of the cost of plan review and inspection activities applicable to the implementation of post-construction and construction runoff BMPs. This funding is fee-supported, and the City and County expect them to continue to be fee-supported over the next permit term, and are expected to have the resources to continue to implement these BMPs. Fee schedules are approved by the applicable governing body: Happy Valley City Council and the Clackamas County Board of Commissioners acting in their capacity as the Board of Directors for the SWMACC and CCSD#1.

Funding for road maintenance and street sweeping will continue to come from general funds or road funds, as they are available and approved by the City Council and County Board of Commissioners.

Overall, funding during the next MS4 permit cycle is expected to be reliable and stable. Collective annual budgets should continue in the \$4-5 million dollar range. Again, factors such as future Phase 1 MS4 permit requirements and the maintenance and repair of stormwater infrastructure could significantly affect this projection.

Appendix A

Shared MS4 Permit Stormwater Management Plan (SWMP)

2017 MS4 Permit Shared Stormwater Management Plan

for

Clackamas County

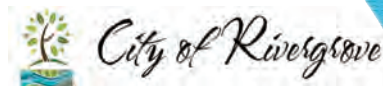
**Clackamas County Service
District No. 1**

**Surface Water Management
Agency of Clackamas County**

City of Happy Valley

City of Rivergrove

**February
2017**



Acknowledgements

2017 MS4 Permit Shared Stormwater Management Plan

Submitted to:

Water Environment Services

Andrew Swanson

Prepared by:

Otak, Inc.

Trista Kobluskie

Stormwater Planner

Cody Kent

Stormwater Planning Assistant

Tim Kraft, PE

Principal, Water Resources

With Assistance from:

Water Environment Services

Andrew Swanson, Water Quality Analyst
Chanin Bays, Resource Recovery Program
Supervisor

Curtis Barton, Source Control Coordinator
Don Kemp, Development Review Supervisor
Gail Shaloom, Environmental Policy Specialist
Gari Johnson, Community Relations Specialist
John Nagy, Surface Water Technician
Leah Johanson, Senior Civil Engineer
Manuel Contreras, Policy Analyst

Matt House, Information
Management/Technical Services Supervisor
Mona LaPierre, Environmental Monitoring
Manager
Ron Wierenga, Watershed Protection Manager
Tim Finley, Technical Services Coordinator
Tim Kay, Sanitary and Storm Technician
Zachary Koellermeier, Sanitary and Storm
Coordinator

Clackamas County Department of Transportation and Development

Cheryl Bell, Deputy Building Codes
Administrator
Devin Patterson, Bridge Scour/Fish-Passage
Coordinator
Ron Buck, Integrated Vegetation Management
Coordinator

Randy Harmon, Transportation Operations
Manager
Shane Abbott, Road Operations Supervisor
Travis Wootan, Road Operations Supervisor

City of Happy Valley

Carol Earle, Engineering Manager
Chris Randall, Public Works Director
Steve Koper, Planning Services Manager

City of Rivergrove

Sheri Richards, City Manager

On the Cover:

An extended dry detention pond manages residential stormwater runoff from the Sunshine Ridge subdivision in Happy Valley. The facility discharges to a tributary of Sieben Creek in the Clackamas River watershed.

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Introduction

The 2017 MS4 Permit Shared Stormwater Management Plan (Shared SWMP) describes the stormwater management program of five of 13 co-permittees of the Clackamas County Group National Pollutant Discharge Elimination System (NPDES) municipal separate storm sewer system permit (MS4 Permit).

The group of five co-permittees that make up the participants of the Shared SWMP includes: Clackamas County, Clackamas County Service District No. 1, Surface Water Management Agency of Clackamas County, the City of Happy Valley, and the City of Rivergrove.

Throughout the Shared SWMP, the five co-permittees participating in the plan are referred to as the “Plan Participants.”

The Shared SWMP acts as a resource for the public to learn about the Plan Participants’ efforts to reduce pollutants discharged by the storm sewer systems, an informative guide for staff, and a compliance measure for the MS4 Permit.

Clackamas County Group MS4 Permit No. 101348

The Clackamas County Group MS4 Permit is issued by Oregon Department of Environmental Quality (DEQ) and covers most of the Portland-Metro urban growth boundary (UGB) within Clackamas County. The most recent version of the MS4 Permit was issued on Mar. 16, 2012. The MS4 Permit regulates discharges from the co-permittees’ storm sewers to waters of the state under the federal Clean Water Act’s NPDES program. The MS4 Permit authorizes discharges from the following 13 co-permittees:

- Clackamas County
- City of Gladstone
- City of Happy Valley (Happy Valley)
- City of Johnson City
- City of Lake Oswego
- City of Milwaukie
- City of Oregon City
- City of Rivergrove (Rivergrove)
- City of West Linn
- City of Wilsonville
- Oak Lodge Sanitary District (now a part of Oak Lodge Water Services District (OLWS))
- Clackamas County Service District No. 1 (CCSD#1)
- Surface Water Management Agency of Clackamas County (SWMACC)

Each co-permittee is required, by MS4 Permit Schedule A.4, Stormwater Management Plan Requirements, to implement a SWMP to reduce the discharge of pollutants from its MS4 to the maximum extent practicable. During the 2012-2017 MS4 Permit term, the Shared SWMP’s Plan Participants published three separate SWMPs.

Permit Expiration and Renewal

The 2012-2017 term of the MS4 Permit expires on Feb. 28, 2017. In anticipation of permit renewal, co-permittees must develop new SWMPs, which will be reviewed by DEQ and incorporated into the upcoming MS4 Permit term. The renewed five-year term is anticipated to begin during or after 2017.

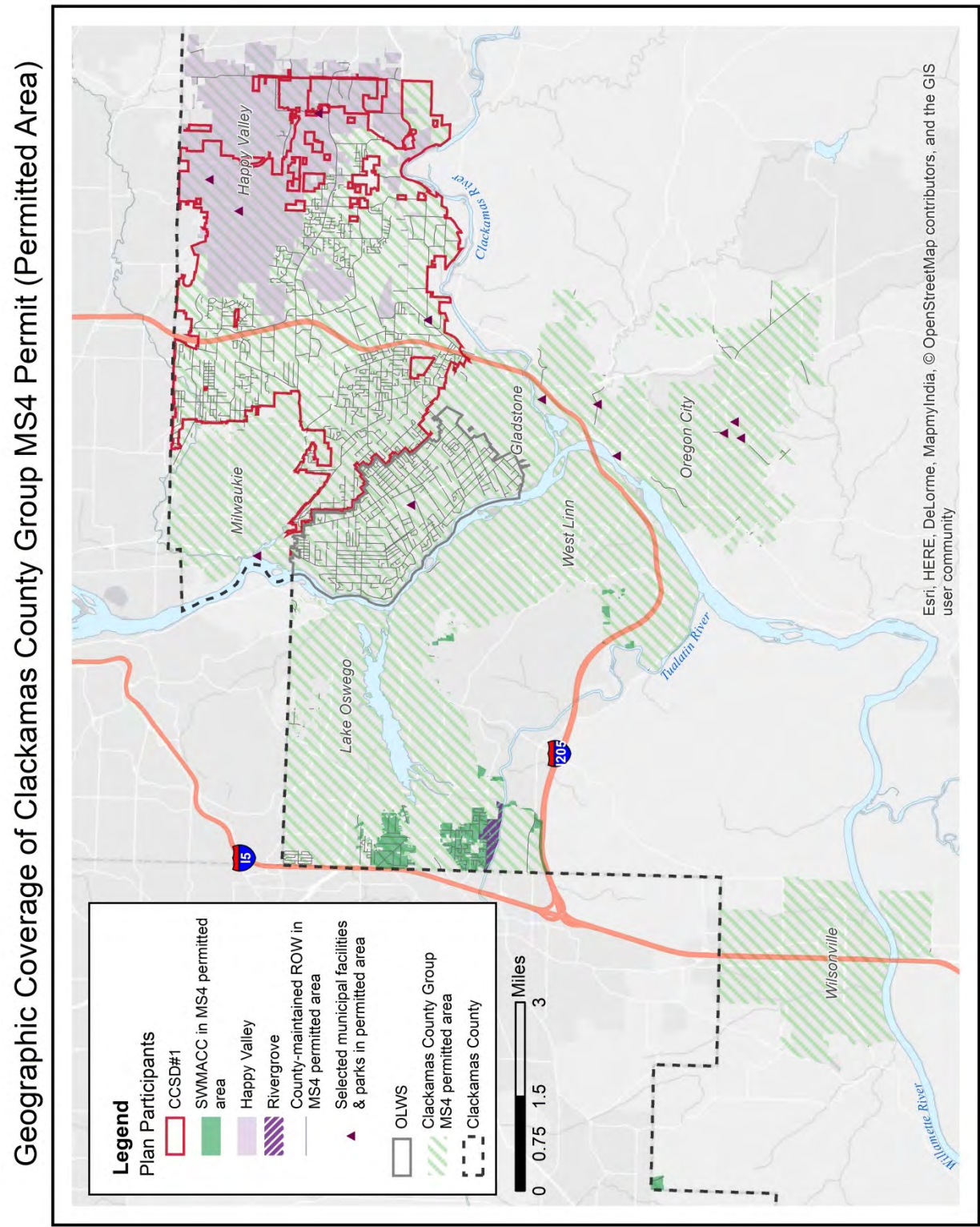
Throughout the Shared SWMP, the phrase “MS4 Permit term” refers to the five-year term anticipated to begin during or after 2017.

Permitted Area Geographic Coverage

The MS4 Permit covers all existing and new discharges of stormwater from MS4s within the service boundaries of the 13 co-permittees. The five Plan Participants’ service boundaries, as well as the entire permitted area, are shown on the map below (Figure 1).

Throughout the Shared SWMP, the term “permitted area” refers to the entire coverage area of the MS4 Permit’s 13 co-permittees.

Figure 1: Map of MS4 Permitted Area and Plan Participants' Geographic Coverage



Plan Participant Geographic Coverage

Service Districts

CLACKAMAS COUNTY SERVICE DISTRICT NO. 1

CCSD#1 provides sanitary sewer and surface water management services in Clackamas County. This district contains several sub-districts. Within the Portland-Metro UGB, CCSD#1 covers approximately 25 square miles of unincorporated county and the urbanized portion of Happy Valley. It serves approximately 75,000 people. This sub-district is known as CCSD#1-UGB.

CCSD#1 is in the Clackamas River watershed.

The geographic coverage of the Shared SWMP includes CCSD#1-UGB. Throughout the Shared SWMP, references to CCSD#1 include only the portion of the district within the UGB.

SURFACE WATER MANAGEMENT AGENCY OF CLACKAMAS COUNTY

SWMACC provides surface water management services to Rivergrove and portions of unincorporated Clackamas County draining to the Tualatin River. Most of the district is rural, but a densely urbanized section of SWMACC is situated in and around Rivergrove. The district is composed of several non-contiguous segments.

The geographic coverage of the Shared SWMP includes the approximately 500 acres of SWMACC within the UGB and the portion of Rivergrove within Clackamas County.

OAK LODGE WATER SERVICES DISTRICT

OLWS operates a large drinking water, sanitary sewer, and surface water service district, which serves about 30,000 people, within unincorporated Clackamas County. OLWS's surface water discharges are covered by the MS4 Permit; however, OLWS is not a Plan Participant in the Shared SWMP.

Clackamas County's service area includes many miles of transportation rights-of-way (ROW) within OLWS. The County's MS4 within OLWS is jointly managed by the County and the district as described in a Memorandum of Understanding between Clackamas County and Oak Lodge Sanitary District (now incorporated into OLWS) signed in July 2013. Therefore, activities of OLWS are indirectly included in the Shared SWMP, but are not described in detail. Readers may see the OLWS's SWMP for more information about MS4 Permit implementation in the district.

Clackamas County Transportation Rights-of-Way

Clackamas County's MS4 is within the transportation ROW of County-maintained roads. Approximately 400 curb miles of County-maintained ROW extend through the entire permitted area. All County-maintained ROW within the permitted area are included in the Shared SWMP, even when they are outside the four other Plan Participants' service areas. The County's obligations as a co-permittee may be met by other co-permittees by agreement.

Throughout the Shared SWMP, references to County-maintained ROW include only those portions within the permitted area.

Cities

RIVERGROVE

Rivergrove is a small city almost entirely contained within the service boundary of SWMACC. A tiny portion of Rivergrove in Washington County is not included in the Shared SWMP.

HAPPY VALLEY

The urbanized portion of Happy Valley is within the service boundary of CCSD#1. The non-urban portion of Happy Valley is outside of the service boundary of CCSD#1. As non-urban areas of Happy Valley develop and require sanitary sewer service or surface water service, the areas annex to CCSD#1. Both the urban and non-urban areas of Happy Valley are included in the Shared SWMP.

Happy Valley's transportation ROW are also covered by the Shared SWMP.

County and Municipal Properties

Any property that is located within the permitted area and is either owned or operated directly by Clackamas County, SWMACC, CCSD#1, Water Environment Services (see below), Rivergrove, or Happy Valley is included in the geographic coverage of the Shared SWMP.

Other Storm Sewer and Storm Disposal Systems Excluded from the Shared SWMP

The Shared SWMP does not apply to lands, buildings, facilities, and roads that are drained by:

- Stormwater injection devices (drywells, for example), or
- Storm sewer systems owned by others, such as the state of Oregon or a corporation, unless the other storm sewer system discharges into a surface-discharging storm sewer system owned or operated by one of the Plan Participants.

Shared SWMP Responsibilities

Plan Participants share responsibility for compliance with MS4 Permit Schedule A.4 as described in the Shared SWMP. Compliance relies on coordination, cooperation, and sharing among the Plan Participants. The Shared SWMP identifies the Plan Participant(s) responsible for implementing each activity by reason of geographic jurisdiction, expertise, or agreement.

Clackamas County Water Environment Services

Water Environment Services (WES) is a department of Clackamas County that provides collection and treatment of wastewater and surface water management for Clackamas County communities. On behalf of CCSD#1 and SWMACC, WES operates the MS4s within the two districts in partnership with the three other Plan Participants.

Throughout the Shared SWMP, when WES is described as a "Plan Participant," WES is acting in that role on behalf of CCSD#1 and SWMACC.

Introduction

Shared SWMP Responsibilities

Broadly, WES is responsible for most compliance activities within CCSD#1 and SWMACC, including in Happy Valley and Rivergrove, and is also responsible for many activities on County ROW in the districts. WES also takes the lead for the types of BMPs that are not easily tied to a geographic area, such as education, outreach, and public involvement.

Clackamas County Department of Transportation and Development

The vast majority of Clackamas County's MS4 is located within the County's ROW and is operated by Clackamas County Department of Transportation and Development (DTD). DTD is a department of Clackamas County responsible for maintaining and improving the County road system; for operating the County's roadway drainage system, both inside and outside the permitted area; and for planning, zoning, plan review, permitting, and code enforcement throughout the County.

DTD is responsible for most compliance activities associated with County ROW in the permitted area. DTD is responsible for maintaining a memorandum of understanding with OLWS to jointly manage the County's MS4 within OLWS.

DTD also operates some of the municipal facilities throughout the permitted area that are subject to requirements of the MS4 Permit.

Happy Valley

Happy Valley has a total area of approximately eight square miles and a population of approximately 18,000.

WES takes responsibility for many compliance activities in Happy Valley, with important contributions from the City. Happy Valley takes responsibility for a few compliance activities within the City limits.

Rivergrove

Rivergrove has a total area of 0.16 square miles and a population of approximately 500. A small portion of the City extends into nearby Washington County. Rivergrove is a contributor in implementing some compliance activities, but most requirements in Rivergrove are met by WES and DTD.

Other Clackamas County Departments

Other Clackamas County departments, such as Facilities Management and Clackamas County Business and Community Services, operate a small number of discrete storm sewer systems serving County properties and parks within the permitted area.

Document Organization

The Shared SWMP follows the organization of the eight Stormwater Management Plan elements laid out in Schedule A.4 of the MS4 Permit – elements A through H. Each plan element includes a regulatory overview and a detailed description of best management practices (BMPs) the Plan Participants will use to comply with the requirements. The organization of plan elements is described below.

Regulatory Overview

Each plan element includes a brief summary of the regulatory requirements and a table that links at least one BMP to each requirement.

Best Management Practices

The MS4 Permit Schedule D.10 defines BMPs as “the schedule of activities, controls, prohibition of practices, maintenance procedures and other management practices designed to prevent or reduce pollution. BMPs also include treatment requirements, operating procedures and practices to control stormwater runoff.”

BMPs describe the specific ways in which Plan Participants propose to comply with the MS4 Permit Schedule A.4.

Each BMP includes the following:

- The BMP’s purpose;
- A checklist showing the geographic area(s) where the BMP is applied;
- A checklist showing which Plan Participant(s) are generally responsible for implementing the BMP;
- A background describing past or current activities;
- A detailed description of the BMP activities;
- A responsibilities matrix with specific roles for each activity; and
- The measurable goals and tracking measures for evaluating the BMP.

Each of these components is described in greater detail below.

BMP Names

BMPs are organized and named by plan element with a unique identifier:

IDDE	Illicit Discharge Detection and Elimination
COMM	Industrial and Commercial Facilities
EPSC	Construction Site Runoff Control
ED	Education and Outreach
PP	Public Participation
POST	Post-Construction Site Runoff
PREV	Pollution Prevention for Municipal Operations
MAINT	Stormwater Management Facilities Operations and Maintenance

BMPs are numbered sequentially within each element.

Geography and General Responsibility

Each BMP uses two checklists to indicate where the BMP takes place and which Plan Participant is involved in implementing it (see Figure 2). A checkmark indicates when a geography or Plan Participant is selected.

Although not a Plan participant, OLWS is included in the general responsibility checklist. When OLWS is marked as responsible, the reader may refer to OLWS's SWMP to find out more.

Figure 2: Example Geography and General Responsibility Checklists

Geography

✓	CCSD#1-UGB, including Happy Valley
✓	SWMACC, including Rivergrove
✓	County-maintained ROW
	Municipal Facilities in permitted area

General Responsibility

✓	WES
	Happy Valley
✓	Clackamas County DTD
	Other Clackamas County department
	Rivergrove
✓	OLWS (see OLWS SWMP)

Background

Each BMP includes a background section that describes past and current activities and provides context when BMPs have been updated.

Detailed Description

This section describes the specific activities the Plan Participants will engage in during the MS4 Permit term. The detailed description may also reference existing or planned documents, which provide authority or give additional program details.

A BMP may describe continuous activities or those that happen once or only occasionally during the MS4 Permit term. Some BMPs are carried out differently in each geographic area. To differentiate these nuances, each BMP is divided into sequentially numbered sub-components.

For example, the BMP to detect illicit discharges is IDDE-3, Dry-weather Inspections. It has three sub-components. 1) IDDE-3.1 for determining pollutant parameter action levels, 2) IDDE-3.2 for maintaining a list of locations for fieldwork, and 3) IDDE-3.3 for the annual inspection fieldwork.

Each sub-component is characterized by type and status as described below.

BMP TYPES

Annual	A time-limited or otherwise discrete activity that happens once a year.
Ongoing	A program or activity that, once started, goes continuously or is carried out frequently due to frequent need.
Periodic	An activity that is revisited intermittently (e.g. update a plan every 2-3 years).
One-time	An activity that will be done once during the MS4 Permit term (e.g. developing a strategy or a plan).

BMP STATUS

Ongoing	The activity began during the 2012-2017 MS4 Permit term and is already underway.
Future	The activity will be initiated in the future relative to the date of the Shared SWMP.
Complete	The activity was completed in the 2012-2017 MS4 Permit term and it produced a resource that is still required in the current Shared SWMP.

Responsibilities Matrices

Each BMP includes a responsibilities matrix, which shows assigned responsibilities for implementing the BMP (see Figure 3).

Each row is a task. Each column is a Plan Participant's department or division responsible for the task. Each cell is populated by a letter indicating the level of responsibility for carrying out the task.

RESPONSIBILITY DESCRIPTIONS

P	Performs Task	Performs the actual work.
C	Consulted	Delivers foundational information and/or decisions needed to perform the work; likely is a significant stakeholder in the work.
S	Supports	Provides direct assistance needed to perform the work (labor, running reports).
I	Informed	Needs to be informed of the progress or results of the work (receives a report, receives a submittal).

Figure 3: Example Responsibilities Matrix

MAINT-2.2 Responsibilities for Developing the Stormwater Mapping Strategy

Responsibilities Matrix	WES Field Ops	WES Dev Review	WES Info Mgmt	DTD Transpo Maint	Happy Valley Planning	Happy Valley Public Works
Define facility types	C	C	P	C	C	C
Define facility ownership criteria	C	C	P	C	C	C
Develop private facility inclusion criteria	C	C	P		C	C
Develop process for updating existing records	I	I	P	I	I	I
Develop database sharing/integration plan	I	I	P	S	I	S

P = Performs Task, C = Consulted, S = Supports, I = Informed

Measurable Goals and Tracking Measures

Each BMP includes a list of measurable goals and each goal's associated tracking measures to evaluate the success of the BMP. Each goal is given a unique sequential ID linked to the BMP name and sub-component. Tracking measures will be reported to DEQ annually with the Plan Participants' MS4 Annual Report.

Introduction
Document Organization

The table below gives example goals and tracking measures and describes how to calculate the tracking measures. These examples represent the various types of goals and measures included in the Shared SWMP.

Figure 4: Example Measurable Goals and Tracking Measures with Calculation Instructions

ID	EXAMPLE MEASURABLE GOALS	EXAMPLE TRACKING MEASURES	CALCULATION INSTRUCTIONS
IDDE-2.1-a	Incorporate spill prevention goal into Leaders in Sustainability Certification by Dec. 31, 2017.	Date spill prevention goal added to Leaders in Sustainability Certification.	The goal is to complete a task by a date. When the task is completed, report the date in the MS4 Annual Report.
IDDE-2.1-d	Develop or update a Spill Prevention and Response Plan for 100% of qualifying facilities by Dec. 31, 2018.	- Number of qualifying facilities with a Spill Prevention and Response Plan by Dec. 31, 2018. - Number of qualifying facilities. - Percentage of qualifying facilities with a Spill Prevention and Response Plan by Dec. 31, 2018.	The goal is to finish a percentage of identified tasks by a certain date. The tracking measures include a numerator, a denominator, and the resulting percentage. Calculate the tracking measures for the next MS4 Annual Report after the goal is due.
IDDE-2.1-e	Each year report 100% of reportable spills at qualifying municipal facilities to state and federal authorities within required reporting timelines.	- Annual number of spills at qualifying municipal facilities reported within required timelines. - Annual total of reportable spills at qualifying municipal facilities. - Annual percentage of spills at qualifying municipal facilities reported within required timelines.	The goal is to finish a percentage of identified tasks each year. The tracking measures include a numerator, a denominator, and the resulting percentage. Calculate the tracking measures anew each year (annually).
IDDE-2.2-b	Train 100% of WES Field Operations staff on spill response at least once during the MS4 Permit term.	- Running total of WES Field Operations staff trained during the MS4 Permit term. - Running total of WES Field Operations staff. - Percentage of WES Field Operations staff trained to date.	The goal is to finish a percentage of identified tasks by the end of the MS4 Permit term. The tracking measures include a numerator, a denominator, and the resulting percentage. Calculate running totals for the tracking measures each year beginning with the first reporting year of the MS4 Permit. The denominator (number of staff) could change over time through hiring or staffing transfers. Any additions to staff and any additional completed training are added to previous years' totals. The calculated percentage changes each year to reflect the updated totals.

ID	EXAMPLE MEASURABLE GOALS	EXAMPLE TRACKING MEASURES	CALCULATION INSTRUCTIONS
MAINT-4.1-b	Correct 100% of maintenance deficiencies discovered during a Residential Maintenance Agreement inspection within two years.	- Running total of deficiencies found during Residential Maintenance Agreement inspections that were corrected within two years. - Running total of deficiencies found during Residential Maintenance Agreement inspections through Dec. 31, 2020. - Percentage of deficiencies found during Residential Maintenance Agreement inspections that were corrected within two years to date.	The goal is to finish a percentage of identified tasks within a lengthy time period that is triggered by an unscheduled event – failing a maintenance inspection. The tracking measures include a numerator, a denominator, and the resulting percentage. Calculate running totals for the tracking measures each year, beginning with the first reporting year of the MS4 Permit. Stop adding to the denominator two years before the MS4 Permit term ends. The denominator (deficiencies found during an inspection) will change over time as more inspections are completed. The time period that is triggered by the event is so long (two years) that it is necessary to stop adding to the denominator two years prior to the end of the MS4 Permit term to have a chance to achieve the 100% goal. The calculated percentage changes each year to reflect the updated totals.

Call-Outs

Sidebar call-outs throughout the text provide the reader additional information.

These call-outs cross-reference related BMPs in the Shared SWMP.

These call-outs give the reader information about supplementary actions or related activities by regional partners. These are not considered part of the Shared SWMP.

Terms, Abbreviations, and Acronyms

The following list of terms, abbreviations, and acronyms are used in the Shared SWMP. A definitions section is also provided at the back of the document.

Terms, Abbreviations, and Acronyms	
1200-Z permit	NPDES Industrial Stormwater General Permit, issued by Oregon DEQ
Accela	Municipal work management platform
BMP	Best Management Practice
BCC	Clackamas County Board of County Commissioners
CCSD#1	Clackamas County Service District No. 1
CFD#1	Clackamas Fire District No. 1
CIP	Capital Improvement Project
Clackamas County Group permit	NPDES MS4 discharge permit No. 101348
cMMS	Computerized Maintenance Management System
DTD	Clackamas County Department of Transportation and Development
EPA	United States Environmental Protection Agency
EPSC	Erosion Prevention and Sediment Control
DEQ	Oregon Department of Environmental Quality
Districts	As used in this document, CCSD#1, SWMACC, and WES
GIS	Geographic Information System
IDDE	Illicit Discharge Detection and Elimination
IPM	Integrated Pest Management
IVM	Integrated Vegetation Management
LID	Low Impact Development
MS4	Municipal Separate Storm Sewer System
NPDES	National Pollutant Discharge Elimination System permit program
Permitted area	Entire coverage area of the Clackamas County Group MS4 Permit No. 101348
MS4 Permit	Clackamas County Group MS4 Permit No. 101348
MS4 Permit term	The five-year term of the Clackamas County Group Permit anticipated to begin during or after 2017
Plan Participants	The five co-permittees of the Clackamas County Group Permit that participate in the Shared SWMP
PPALs	Pollutant Parameter Action Levels
OAR	Oregon Administrative Rules
ODOT	Oregon Department of Transportation
OERS Report	Oregon Emergency Response System Report
OLSD	Oak Lodge Sanitary District, now a part of Oak Lodge Water Services District (OLWS)
OLWS	Oak Lodge Water Services
ORS	Oregon Revised Statutes
RIMS	Roadway Inventory Management System

Terms, Abbreviations, and Acronyms	
ROW	Right-of-Way, Rights-of-Way
RCSW	DTD's Resource Conservation & Solid Waste group
SCAP	Storm Drain Cleaning Assistance Program
SFR	Single-family Residential
Shared SWMP	The 2017 MS4 Permit Shared Stormwater Management Plan for Clackamas County, Clackamas County Service District No. 1, Surface Water Management Agency of Clackamas County, Happy Valley, and Rivergrove (this document)
SIC	Standard Industrial Classification
SOP	Standard Operating Procedure
SWMACC	Surface Water Management Agency of Clackamas County
SWMP	Stormwater Management Plan, as required by MS4 Permit Schedule A.4
SWM plan	Stormwater management plan, as required by Plan Participants for the review and approval of stormwater management controls on development and redevelopment sites
State	State of Oregon
TMDL	Total Maximum Daily Load
UGB	Urban Growth Boundary
WES	Clackamas County Water Environment Services
WHEP	Watershed Health Education Program

Introduction

Terms, Abbreviations, and Acronyms

This page concludes the
Introduction.

A. Illicit Discharge Detection and Elimination

Regulatory Overview

The MS4 Permit Schedule A.4.a requires Plan Participants to prohibit, detect, and respond to illicit discharges to the MS4. The MS4 Permit defines an illicit discharge as a discharge (flow) to the MS4 that is not entirely composed of stormwater, except for certain authorized discharges. Illicit discharges carry pollutants such as oil, solvents, nutrients, bacteria, and others to receiving waters.

Requirements include inspecting the MS4 during dry weather to detect illicit discharges and responding to complaints or reports of potential illicit discharges. Once an illicit discharge is detected, a Plan Participant must control it or require the discharger to control it. If the illicit discharge originates from or flows to another jurisdiction, the Plan Participant must inform the affected jurisdiction. The MS4 Permit also requires Plan Participants to prevent and mitigate accidental discharges by having a spill prevention program and responding promptly to reports of spills.

Requirements Summary for Illicit Discharge Detection and Elimination					
	BMPs				
	IDDE-1 Illicit Discharge Legal Authority	IDDE-2 Spill Prevention and Response	IDDE-3 Dry-weather Inspections	IDDE-4 Illicit Discharge Response and Enforcement	IDDE-5 Outfall Mapping
Full text of Schedule A.4.a may be found in the MS4 Permit.					
i. Prohibit, through ordinance or other regulatory mechanism, illicit discharges into the MS4.	■				
ii. Describe enforcement response procedures.		■		■	
iii. Develop or identify dry-weather field screening pollutant parameter action levels.			■		
iv. Conduct annual dry-weather inspection.			■		
v. Investigate suspected illicit discharges and non-stormwater discharges.				■	
vi. Require spill prevention measures, and contain and mitigate spills that may discharge into the MS4.		■			
vii. Remove illicit discharges from the MS4.				■	

Element A: Illicit Discharge Detection and Elimination

BMP: IDDE-1 Illicit Discharge Legal Authority

Requirements Summary for Illicit Discharge Detection and Elimination					
	BMPs				
	IDDE-1 Illicit Discharge Legal Authority	IDDE-2 Spill Prevention and Response	IDDE-3 Dry-weather Inspections	IDDE-4 Illicit Discharge Response and Enforcement	IDDE-5 Outfall Mapping
Full text of Schedule A.4.a may be found in the MS4 Permit.					
viii. Document response procedures and track responses.		■		■	
ix. Notify downstream neighboring MS4 of illicit discharge from Plan Participant's MS4.		■		■	
x. Notify upstream neighboring MS4 when Plan Participant identifies an illicit discharge originating from connected MS4.		■		■	
xi. Map MS4 outfalls discharging to Waters of the State.					■
xii. Allow certain non-stormwater discharges.	■				

BMPs

IDDE-I Illicit Discharge Legal Authority

Purpose

The purpose of this BMP is to establish and maintain the Plan Participants' authority to prohibit, investigate, and control illicit discharges, including the authority to conduct enforcement actions against dischargers. Illicit discharges are any discharges to an MS4 that are not composed entirely of stormwater, except for discharges authorized in Schedule A.4.a.xii of the MS4 Permit, discharges permitted by another NPDES permit, or discharges otherwise authorized by DEQ.

Geography

✓	CCSD#1-UGB, including Happy Valley
✓	SWMACC, including Rivergrove
✓	County-maintained ROW
	Municipal Facilities in permitted area

General Responsibility

✓	WES
	Happy Valley
✓	Clackamas County DTD
	Other Clackamas County department
	Rivergrove
✓	OLWS (see OLWS SWMP)

Background

The elected officials of CCSD#1, SWMACC, and Clackamas County adopt the policies, rules, and regulations that prohibit illicit discharges into the Plan Participants' MS4s. On behalf of Plan Participants, WES tracks the status of legal authority.

Roads with surface-discharging drainage systems are part of the MS4. DTD has the authority to prohibit discharge of wastes and materials in the County ROW through Clackamas County Code (CCC) 10.03.080, which prohibits illegal dumping.

CCSD#1 Rules and Regulations Section 3.1.2 and *SWMACC Rules and Regulations* Section 3.1.1 each prohibit illicit discharge into the districts' MS4s. Rules and regulations apply to all properties with a service connection to the MS4 in either of the two districts.

Detailed Description

IDDE-1.1 – REVIEW AND UPDATE LEGAL AUTHORITY

TYPE: ONGOING

STATUS: ONGOING

County Rights-of-Way

DTD will maintain the authority to prohibit illicit discharges in the County ROW through Clackamas County Code. DTD will review its authority one time during the MS4 Permit term.

CCSD#1 and SWMACC

CCSD#1 and SWMACC will maintain the authority to prohibit illicit discharges through *CCSD#1 Rules and Regulations* and *SWMACC Rules and Regulations*. WES will review each district's authority one time during the MS4 Permit term.

There is no responsibilities matrix for this BMP.

IDDE-I Measurable Goals and Tracking Measures

ID	MEASURABLE GOALS	TRACKING MEASURES
IDDE-1.1-a	Review and update legal authority as necessary to prohibit illicit discharges to County ROW by Dec. 31, 2018.	• Date legal authority reviewed. • Date legal authority updated, if necessary.
IDDE-1.1-b	Review and update legal authority as necessary to prohibit illicit discharges to MS4s in CCSD#1 and SWMACC by Dec. 31, 2018.	• Date legal authority reviewed. • Date legal authority updated, if necessary.

IDDE-2 Spill Prevention and Response

Purpose

The purpose of this BMP is to reduce the discharge of pollutants to the MS4 by preventing and responding to accidental spills of oil, hazardous substances, sewage, or other pollutants. Accidental spills at businesses, municipal facilities, or on roadways can enter the MS4 and discharge to receiving waters. Spill prevention focuses on providing education and technical assistance to businesses and Plan Participant operations that have a potential for accidental spills. Spill response focuses on containing and mitigating spills that may discharge to the MS4.

Geography

✓	CCSD#1-UGB, including Happy Valley
✓	SWMACC, including Rivergrove
✓	County-maintained ROW
✓	Municipal Facilities in permitted area

General Responsibility

✓	WES
✓	Happy Valley
✓	Clackamas County DTD
	Other Clackamas County department
	Rivergrove
✓	OLWS (see OLWS SWMP)

Background

WES currently implements a spill response program described in both the *Water Environment Services' Standard Operating Procedure for Spills and/or Releases of Dangerous and/or Hazardous Materials to the Environment*, dated Feb. 23, 2005, (Spill Response SOP) and the *Summary of Spill Response and Reporting Procedures*, dated Sept. 2, 2014.

DTD, WES, and Happy Valley each provide immediate spill response in their jurisdictions. When the spill is an emergency, Clackamas Fire District No. 1 or other emergency responders provide the incident management and response.

BMP Organization

This BMP has two sub-components. IDDE-2.1 is a new program to promote spill prevention. IDDE-2.2 continues the current spill response program.

Detailed Description

IDDE-2.1 – SPILL PREVENTION PROGRAM

TYPE: ONGOING

STATUS: FUTURE

WES and DTD will identify and reach out to businesses and to City and County municipal property operators that have a potential to spill oil, hazardous substances, or other materials to the MS4.

Business Outreach

Spill prevention outreach to businesses will be integrated into DTD's Resource Conservation and Solid Waste (RCSW) program's Leaders in Sustainability Certification. The program, which supports businesses seeking to adopt and

Clackamas River Water Providers also provides spill prevention coordination and technical assistance to municipal agencies (WES, CFD1, and Gresham Hazmat) and local businesses.

strengthen sustainable best practices, will provide voluntary inspections and pollution prevention education markers for storm drains. WES Watershed Protection will work with RCSW to integrate additional spill prevention activities in the program.

WES will create spill prevention messages for distribution through all types of interactions with businesses. The spill prevention messages will be included in contacts with businesses under COMM-2.3, Priority Commercial and Industrial Facility Inspections, ED-6 Regulated Private Storm System Outreach and Education, and MAINT-7, Regulated Private Storm System Inspection and Maintenance.

Qualifying Municipal Facilities

Within the permitted area, each municipal facility owned or operated by a Plan Participant, including any department of Clackamas County, that stores or transfers oils, hazardous substances, or dangerous liquid materials in a quantity exceeding the reportable quantity listed in Oregon Administrative Rules (OAR) 340-142-0050 ("qualifying municipal facility") will develop and follow a Spill Prevention and Response Plan. A similar plan or strategy under an NPDES industrial stormwater permit (1200-Z permit), other similar permit, or BMP PREV-3, Pollution Prevention for Municipal Waste Facilities, will meet this requirement. WES will provide assistance developing the plan when the facility is not otherwise obligated to develop one (e.g. for a 1200-Z permit).

OAR 340-142-0050 lists reportable quantities of numerous substances.

Examples include:

- 42 gallons of oil;
- 200 pounds (25 gallons) of pesticide residue; and
- One pound (one cup) of dry cleaning solvent.

A Spill Prevention and Response Plan for a qualifying municipal facility will include general requirements for storage and transfer of hazardous substances and may include:

- Requirements specific to the facility;
- Containment and response practices;
- Emergency procedures;
- Preventive inspection procedures;
- Spill reporting procedures;
- Inventory of hazardous substances stored or used on the site;
- Inspection log;
- Spill log; and
- Training log.

Staff involved in the storage or use of dangerous or hazardous substances will be trained in the specific procedures described in the Spill Prevention and Response Plan developed for the facility.

IDDE-2.2 – SPILL RESPONSE PROGRAM

TYPE: ONGOING

STATUS: ONGOING

Spills may be reported to Plan Participants by the public, emergency responders, or municipal field crews.

Element A: Illicit Discharge Detection and Elimination

BMP: IDDE-2 Spill Prevention and Response

WES, DTD, and Happy Valley will each respond to spills on roadways, storm sewers, properties, or in drainage systems that discharge to the MS4.

DTD and Happy Valley will respond to spills reported in their ROW. WES will provide assistance and backup when requested.

WES will respond to reports of spills on private property that may discharge to the MS4.

Plan Participants will respond to hazardous spills immediately and will call for emergency response from Clackamas Fire District No. 1 or other emergency responders as necessary. Non-hazardous spills will be responded to and evaluated within five working days. Plan Participants will clean up non-hazardous spills, or develop an action plan to clean them up, within fifteen working days.

If a spill into, or that discharges to, the MS4 is cleaned up within 24 hours, then WES will track the spill as an illicit discharge in accordance with IDDE-4, Illicit Discharge Response and Enforcement. If a spill into, or that discharges to, the MS4 cannot be or is not cleaned up within 24 hours, then WES will follow the *WES MS4 Permit IDDE Enforcement Response Plan* in accordance with IDDE-4.

Plan Participants will continue to provide routine training in spill response procedures to field staff (see ED-3).

Update Procedures

During the MS4 Permit term, WES will update the Spill Response SOP with the input of DTD Transportation Maintenance and Happy Valley Public Works. Updates will standardize spill response between the agencies.

The updated SOP will include reporting, safety, and immediate actions to prevent harm to people, property, and the environment. The SOP will provide guidance in the following areas:

- Spill reporting under federal and state laws
- Reportable quantities
- Warning of persons in the immediate area
- Spill containment and control
- Notification of emergency responders
- Cleanup
- Cleanup reporting

Clackamas River Water Providers is developing Geographic Response Plans describing specific strategies and resources for responding to spills in specific areas of the Clackamas River watershed.

A spill on a roadway, in the drainage system, or that reaches the MS4 is an illicit discharge and is investigated and reported in accordance with IDDE-

4

Element A: Illicit Discharge Detection and Elimination
BMP: IDDE-2 Spill Prevention and Response

IDDE-2 Responsibilities for Spill Prevention and Response

Responsibilities Matrix	WES Watershed Protection	WES Field Ops	WES Source Control	DTD RCSW	DTD Transpo Maint	Happy Valley Public Works	Clackamas County Facilities Mgmt., Sheriff, Other Depts.
Spill prevention message creation	P	I	I	I			I
Spill prevention business outreach	P	I	P	P	I	I	I
Identify and contact qualifying municipal facility operators	P	I			I	I	I
Develop Spill Prevention and Response Plan at each qualifying municipal facility	C	P			P	P	P
Implement Spill Prevention and Response Plans at municipal facility	C	P			P	P	P
Roadway spill response	C/S	P			P	P	
Private property discharge to MS4 spill response	C/S	P			C/S	C/S	
Spill reporting to agencies ^①	I	P			P	P	P
Notify WES Field Ops of spill		I			P	P	P
Track spills in cMMS		P			C	C	C

P = Performs Task, C = Consulted, S = Supports, I = Informed

^① Plan Participants will contact the National Response Center and the Oregon Emergency Response System when required by federal or state law or when directed by a standard operating procedure or plan for spill response.

IDDE-2 Measurable Goals and Tracking Measures

ID	MEASURABLE GOALS	TRACKING MEASURES
IDDE-2.1-a	Incorporate spill prevention goal into Leaders in Sustainability Certification by Dec. 31, 2017.	Date spill prevention goal added to Leaders in Sustainability Certification.
IDDE-2.1-b	Identify qualifying municipal facilities within the permitted area by Dec. 31, 2017.	Date qualifying municipal facilities identified.
IDDE-2.1-c	Contact qualifying municipal facilities by Jun. 30, 2018.	Date qualifying municipal facilities contacted.
IDDE-2.1-d	Develop or update a Spill Prevention and Response Plan for 100% of qualifying facilities by Dec. 31, 2018.	- Number of qualifying facilities with a Spill Prevention and Response Plan by Dec. 31, 2018. - Number of qualifying facilities. - Percentage of qualifying facilities with a Spill Prevention and Response Plan by Dec. 31, 2018.
IDDE-2.1-e	Each year report 100% of reportable spills at qualifying municipal facilities to state and federal authorities within required reporting timelines.	- Annual number of spills at qualifying municipal facilities reported within required timelines. - Annual total of reportable spills at qualifying municipal facilities. - Annual percentage of spills at qualifying municipal facilities reported within required timelines.

Element A: Illicit Discharge Detection and Elimination

BMP: IDDE-3 Dry-weather Inspections

ID	MEASURABLE GOALS	TRACKING MEASURES
IDDE-2.2-a	Each year report 100% of reportable spills on public roadways or in the storm sewer to state and federal authorities within required reporting timelines.	- Annual number of reportable spills on public roadways or in the storm sewer reported within required timelines. - Annual number of reportable spills on public roadways or in the storm sewer. - Annual percentage of reportable spills on public roadways or in the storm sewer reported within required timelines.
IDDE-2.2-b	Train 100% of WES Field Operations staff on spill response at least once during the MS4 Permit term.	- Running total of WES Field Operations staff trained during the MS4 Permit term. - Running total of WES Field Operations staff. - Percentage of WES Field Operations staff trained to date.
IDDE-2.2-c	Train 100% of DTD Road Maintenance staff and each Road Operations Supervisor on spill response at least once during the MS4 Permit term.	- Running total of DTD staff in identified positions trained during the MS4 Permit term. - Running total of DTD staff in identified positions. - Percentage of DTD staff in identified positions trained to date.
IDDE-2.2-d	Train 100% of Happy Valley road crews on spill response at least once during the MS4 Permit term.	- Running total of Happy Valley staff in identified positions trained during the MS4 Permit term. - Running total of Happy Valley staff in identified positions. - Percentage of Happy Valley staff in identified positions trained to date.
IDDE-2.2-e	Review and revise "Illicit Discharge and Spill Response SOP" once during the MS4 Permit term.	- Date the SOP was reviewed. - Date the SOP was revised, if necessary.

IDDE-3 Dry-weather Inspections

Purpose

The purpose of this BMP is to detect illicit discharges and other polluted non-stormwater flows in the MS4 so they can be controlled to reduce the release of pollutants to receiving waters. Dry-weather inspections are used for detecting illicit discharges because discharges are more noticeable during dry weather, when stormwater discharges are not present and pollutant concentrations are not diluted by stormwater runoff.

Geography

✓	CCSD#1-UGB, including Happy Valley
✓	SWMACC, including Rivergrove
✓	County-maintained ROW
	Municipal Facilities in permitted area

General Responsibility

✓	WES
	Happy Valley
	Clackamas County DTD
	Other Clackamas County department
	Rivergrove
✓	OLWS (see OLWS SWMP)

Background

WES currently maintains a list of 37 priority locations for dry-weather inspections in the districts. Priority locations include all major outfalls in CCSD#1 and all outfalls in SWMACC. WES inspects these outfalls once a year during the dry season and after a period of no precipitation.

WES also maintains Pollutant Parameter Action Levels (PPALs), most recently described in a letter to DEQ dated Oct. 29, 2012. Discharges with visible water quality issues or measurements exceeding the PPALs are traced to their source then addressed, and if necessary, controlled.

BMP Organization

This BMP contains three sub-components. IDDE-3.1 is a one-time task. IDDE-3.2 and 3.3 are annual tasks.

Detailed Description

IDDE-3.1 – POLLUTANT PARAMETER ACTION LEVELS

TYPE: ONE-TIME

STATUS: COMPLETE

WES will continue to maintain the list of PPALs used for quantitative assessment of suspected illicit discharges.

IDDE-3.2 – MAINTAIN AND UPDATE LIST OF PRIORITY LOCATIONS

TYPE: ONE-TIME

STATUS: ONGOING

WES Watershed Protection will maintain and update the list of priority locations for dry-weather inspections. The list will include all major outfalls and other minor outfalls identified after equitably considering the hydrologic, land use, and pollutant characteristics as listed in the MS4 Permit Schedule A.4.a.iv. A major outfall meets the criteria given in the CWA below:

- A large pipe (≥ 36 " inside diameter); or
- A conveyance other than circular pipe that serves a drainage area of more than 50 acres; or
- A single pipe (≥ 12 " inside diameter) if it also receives drainage from lands zoned for industrial activity; or
- A single conveyance other than a circular pipe that receives drainage from more than two acres of land zoned for industrial activity.

Priority locations will be mapped in a GIS. WES will update the analysis identifying priority locations once during the MS4 Permit term.

Element A: Illicit Discharge Detection and Elimination

BMP: IDDE-3 Dry-weather Inspections

IDDE-3.3 – INSPECTIONS AND ANALYSIS

TYPE: ANNUAL

STATUS: ONGOING

WES will conduct an annual dry-weather inspection of each priority location to detect illicit discharges.

WES Source Control will inspect priority locations during the Willamette Valley's seasonal dry period (summer and early fall) and after a minimum of 72 hours has passed since any measurable rain (0.1 inch) has fallen. Inspectors will use visual assessment techniques and hand-held water quality monitoring equipment. An inspection form will be completed at each location.

Data collected will include:

- Inspector name
- Date and time of visit
- Date of last measurable rainfall (0.1 inch)
- Presence of water flow
- Indicators of an illicit discharge (odors, colors, solids), if present
- Action taken (sampling, upstream investigation)
- If flow is present, some water quality data (such as water temp, pH, salinity, etc.)
- Other data, such as photographs, as necessary

When the inspection reveals dry-weather flow, staff will immediately use hand-held analytical equipment to determine if the flow exceeds the PPALs. If necessary to confirm and identify the discharge, samples will be collected and sent to WES' in-house accredited laboratory, or at to a third-party accredited laboratory.

When the on-site analysis reveals a potential illicit discharge, WES Source Control will immediately investigate upstream to locate the discharge. If possible, staff will control or contain the discharge immediately.

Suspected illicit discharges and those that are confirmed through immediate investigation or later analysis will be referred to WES Field Operations for follow-up (see IDDE-4).

Allowed non-stormwater discharges discovered by WES Source Control during dry-weather inspections will be tracked in a database for future reference. Non-stormwater discharges allowed by Schedule A.4.a.xii include pavement washing, excess irrigation flows, and other types of discharges.

Inspection forms will be submitted to WES Watershed Protection for tracking.

Element A: Illicit Discharge Detection and Elimination
BMP: IDDE-3 Dry-weather Inspections

IDDE-3 Responsibilities for Dry-weather Inspections

Responsibilities Matrix	WES Source Control	WES Watershed Protection	WES Information Management	WES Field Operations
Maintain PPALs	I	P		
Update priority locations based on audit of outfall locations (see BMP IDDE-5) and new analysis	I	P	S	
Conduct dry-weather inspections	P			C/S
Laboratory analysis (if needed)	P			I
Refer confirmed and suspected illicit discharges to WES Field Ops for response (this initiates BMP IDDE-4)	P	I		I
Submit inspection forms	P	I		I
Track inspections		P		

P = Performs Task, C = Consulted, S = Supports, I = Informed

IDDE-3 Measurable Goals and Tracking Measures

ID	MEASURABLE GOALS	TRACKING MEASURES
IDDE-3.1-a	Review and update PPALs one time during the MS4 Permit term.	• Date PPALs reviewed and updated.
IDDE-3.2-a	Update list of priority locations one time during the MS4 Permit term.	• Date priority locations updated.
IDDE-3.3-a	Each year inspect 100% of priority locations as identified in the most recent list.	• Annual number of priority locations inspected. • Number of priority locations in most recent list. • Annual percentage of priority locations inspected.
IDDE-3.3-b	Each year refer 100% of confirmed (and suspected unconfirmed) illicit discharges discovered through dry-weather inspection to WES Field Operations within one working day.	• Annual number of confirmed and suspected unconfirmed illicit discharges referred to WES Field Operations within one working day. • Annual number of confirmed and suspected unconfirmed illicit discharges discovered through dry-weather inspection. • Annual percentage of confirmed and suspected unconfirmed illicit discharges referred to WES Field Operations within one working day.
IDDE-3.3-c	Track allowed non-stormwater discharges discovered through dry-weather inspections.	• Annual number of allowed non-stormwater discharges discovered during dry-weather inspections.

IDDE-4 Illicit Discharge Response and Enforcement

Purpose

The purpose of this BMP is to provide documented procedures for responding to reports of illicit discharges. Response often includes inspections and conducting enforcement actions in response to confirmed illicit discharges.

Geography

✓	CCSD#1-UGB, including Happy Valley
✓	SWMACC, including Rivergrove
✓	County-maintained ROW
	Municipal Facilities in permitted area

General Responsibility

✓	WES
✓	Happy Valley
✓	Clackamas County DTD
	Other Clackamas County department
	Rivergrove
✓	OLWS (see OLWS SWMP)

Background

Illicit discharge response and enforcement is triggered by any report of a suspected illicit discharge, regardless of how the report is received: a complaint received from the public, a report from another co-permittee or agency, discovery during the annual dry-weather inspections (see IDDE-3), discovery during routine maintenance of stormwater facilities and storm sewers (see MAINT-4, MAINT-5, MAINT-6), or during other routine work.

Reports of spills of oil, hazardous substances, or sewage onto a street or into the drainage system are also illicit discharges. Happy Valley Public Works and DTD Transportation Maintenance personnel who encounter a spill during their work will report them to WES and take immediate action based on the Spill Response SOP (see IDDE-2). If a spill is cleaned up within 24 hours and reported to state and federal agencies as required, then WES will track the spill as an illicit discharge, but will not investigate or respond further.

Also see spill prevention and response activities described in IDDE-2.

WES currently implements the *Illicit Discharge Detection & Elimination Program Enforcement Response Plan* dated Apr. 15, 2014, which provides enforcement guidance to ensure a consistent response to illicit discharges. It is used to respond to suspected illicit discharges regardless of how they are brought to WES' attention.

Most illicit discharges to the Plan Participants' MS4s occur in CCSD#1 and SWMACC; a few occur outside the districts.

BMP Organization

This BMP has two sub-components: IDDE-4.1 and IDDE-4.2 both of which are currently ongoing.

Detailed Description

IDDE-4.1 – ILLICIT DISCHARGE INVESTIGATION AND CONFIRMATION

TYPE: ONGOING

STATUS: ONGOING

On behalf of Plan Participants, WES will investigate reports of illicit discharges. If an illicit discharge investigation will take place in the permitted area outside of CCSD#1 or SWMACC, WES will coordinate the investigation with DTD.

In cases where the source of an illicit discharge has not been immediately identified and controlled by the initial responders, WES Field Operations will investigate upstream to locate, document, and confirm the discharge. WES will attempt to identify the responsible party. If sampling is necessary, WES Source Control will support the investigation with sampling and analysis.

The initial responder (WES, Happy Valley, or DTD) will report illicit discharges and spills to DEQ Northwest Region. The initial responder or WES will notify adjacent MS4 operators when a confirmed illicit discharge originates from or flows to an adjacent MS4.

IDDE-4.2 – ILLICIT DISCHARGE RESPONSE AND ENFORCEMENT

TYPE: ONGOING

STATUS: ONGOING

Once an illicit discharge is confirmed and the source is located, WES, DTD, or Happy Valley will immediately evaluate steps to remove the discharge.

Also see spill response activities described in IDDE-2.

CCSD#1 and SWMACC

WES will control the illicit discharge as soon as possible, typically within an hour of discovery for a simple illicit discharge. For discharges that cannot be controlled immediately, the initial evaluation of removing the discharge will take place within five working days of locating the source. If the elimination will take more than 15 working days, WES will develop an action plan.

When the responsible party is identified, WES will implement the *Illicit Discharge Detection & Elimination Program Enforcement Response Plan*, which documents Plan Participant authority, appropriate levels of enforcement, and enforcement steps. The discharger will be required to stop and clean up the discharge. WES will contact the site owner and provide technical assistance or enforcement to address or control the discharge. Based on the severity and persistence of the discharge, WES may conduct further enforcement actions and/or may control the discharge in an emergency.

WES may require or apply any of the following control options, when appropriate for the discharge:

- Removing an illicit connection to the storm sewer from sanitary sewer system pipe, floor drain pipe, or other illicit connection;
- Implementing operational source control BMPs (e.g. cease use of soap when washing vehicles; wash vehicles indoors);
- Directing discharge to dry land or sanitary sewer, if permitted;
- Construction of a water quality facility (e.g. oil/water separator);
- Capturing and hauling wastewater off-site for proper disposal; or
- Applying for a discharge permit from DEQ.

Element A: Illicit Discharge Detection and Elimination
BMP: IDDE-4 Illicit Discharge Response and Enforcement

Permitted Area Outside of Districts

In the rare case when an illicit discharge to a Plan Participant's MS4 outside of the districts, and requires enforcement, DTD or Happy Valley will control the discharge as soon as possible. DTD or Happy Valley will conduct enforcement activities consistent with County Code or Happy Valley Municipal Code.

IDDE – 4 Responsibilities for Illicit Discharge Response and Enforcement

Responsibilities Matrix	WES Source Control	WES Watershed Protection	WES Field Ops	DTD Transpo Maint	Happy Valley Street Maint	Discharger ❶	Other Agencies / Public❶	OR DEQ ❶
Report suspected illicit discharges	P	P	P/I	P	P	P	P	P
Refer reports to WES	P	P	I	P	P		P	
Investigate reports of suspected illicit discharges	I	S	P					
Sampling and analysis support, if needed	P	I	I					
Confirm illicit discharge			P					
Notify adjacent MS4 operators	I	I	P	P/I	P/I		I	
Evaluate steps to remove discharge	C	C	P	P	P	S		
Develop removal action plan, if necessary		C	P	P	P	S		
Oversee elimination by discharger		I	P	P	P	I		
Eliminate discharge		I	C	C	C	P		
Optionally eliminate discharge	I	S	P	P	P	I		
Enforcement	P	I	S	P	P	I		
Notify DEQ		S	P	P	P			I
Track reports, investigations, and enforcement in cMMS	P	I	P	S	S			

P = Performs Task, C = Consulted, S = Supports, I = Informed

❶ These entities do not participate in this Plan and are not required to comply with it. Plan Participants are not responsible for the actions of these entities. Information is provided for the reader's convenience.

IDDE-4 Measurable Goals and Tracking Measures

ID	MEASURABLE GOALS	TRACKING MEASURES
IDDE-4.1-a	Each year investigate and confirm 100% of reports of suspected illicit discharges within 24 hours.	- Annual number of illicit discharges investigated within 24 hours. - Annual number of reported suspected illicit discharges. - Annual percentage of illicit discharges investigated within 24 hours.

ID	MEASURABLE GOALS	TRACKING MEASURES
IDDE-4.2-a	Each year evaluate removal of 100% confirmed illicit discharges within five working days of determining the source of the discharge.	- Annual number of illicit discharges evaluated for removal within five working days. - Annual number of confirmed illicit discharges (not including spills cleaned up within 24 hours). - Annual percentage of illicit discharges evaluated for removal within five working days.
IDDE-4.2-b	Each year halt 100% of illicit discharges within 15 working days after the source has been confirmed.	- Annual number of illicit discharges removed within 15 working days. - Annual number of confirmed illicit discharges (not including spills cleaned up within 24 hours). - Annual percentage of illicit discharges removed within 15 working days.

IDDE-5 Outfall Mapping

Purpose

The purpose of this BMP is to map MS4 outfalls in the Plan Participants jurisdictions. A complete and updated inventory and map of storm sewer outfalls discharging from the MS4 is an essential first step in identifying priority locations for dry-weather inspection and tracking pollutant discharges from their sources.

Geography

✓	CCSD#1-UGB, including Happy Valley
✓	SWMACC, including Rivergrove
✓	County-maintained ROW
	Municipal Facilities in permitted area

General Responsibility

✓	WES
✓	Happy Valley
✓	Clackamas County DTD
	Other Clackamas County department
✓	Rivergrove
✓	OLWS (see OLWS SWMP)

Background

WES currently maintains a map and list of priority locations for dry-weather inspection and a geographic information system (GIS) data layer of the storm sewer systems in CCDS1 and SWMACC. The map and list of priority locations is used to conduct dry-weather inspections (see IDDE-3). However, the existing inventory and map are incomplete. DTD maintains an inventory of the storm sewer system in the County ROW, including outfalls, in RIMS.

Detailed Description

IDDE-5.1 – OUTFALL MAPPING

TYPE: ONGOING

STATUS: ONGOING

Once during the MS4 Permit term, WES will expand, audit, and update the outfall inventory and map. The first year will focus on completing an accurate outfall inventory and map. WES will also update the inventory on an ongoing basis when a new outfall is added to a Plan Participant's MS4.

Element A: Illicit Discharge Detection and Elimination

BMP: IDDE-5 Outfall Mapping

Expand Outfall Inventory

WES will expand its list and map of outfalls, which currently includes only those from CCSD#1 and SWMACC, to include outfalls from all Plan Participants' MS4s. To support this effort, DTD will provide an inventory of its outfalls to WES.

Audit Outfall Inventory

WES will audit the current inventory to ensure the list and map is accurate. To support this effort, data will be collected in the field and from as-builts and record drawings. WES Field Operations will survey portions of the MS4 to identify, characterize, and locate coordinates of the outfalls. Data collected will include Global Positioning System (GPS) coordinates, pipe diameter, and pipe materials. As-builts and other record drawings will be used to fill other data gaps. This data will be provided to WES Information Management by the Plan Participants.

Update Outfall Inventory and Map

One time during the MS4 Permit term, WES will update the outfall list and map to include DTD's outfalls and to update data based on audit results.

On an ongoing basis, WES will update the inventory and map when a new outfall is constructed. Plan Participants will inform WES when new storm sewer outfalls are constructed in their jurisdictions. Plan Participants will provide as-builts or other record drawings with sufficient information to allow WES to locate and characterize the outfall.

IDDE – 5 Responsibilities for Outfall Mapping

Responsibilities Matrix	WES Watershed Protection	WES Info Mgmt	WES Field Ops	WES Dev Review	DTD Transpo Maint	DTD Transpo Const	DTD Building Dept	Happy Valley Eng
Provide current DTD outfall inventory to WES		I			P			
Field survey to locate outfall coordinates and collect data		I	P	C/S	C/S	C/S	C/S	C/S
Review as-builts and record drawings		P		C		C		C
Inform WES of new outfall from MS4		I		P	P	P		P
Inventory/Map outfalls in GIS	I	P	C/S		I			I

P = Performs Task, C = Consulted, S = Supports, I = Informed

IDDE-5 Measurable Goals and Tracking Measures

ID	MEASURABLE GOALS	TRACKING MEASURES
IDDE-5.1-a	Complete audit of outfall inventory by Dec. 31, 2018.	Date field and record data collection completed.
IDDE-5.1-b	Update GIS inventory and map by Jun. 30, 2019.	Date inventory and map updated.

This page concludes Illicit Discharge Detection and Elimination.

B. Industrial and Commercial Facilities

Regulatory Overview

The MS4 Permit Schedule A.4.b requires Plan Participants to implement a program to reduce pollutants in stormwater discharges from industrial and commercial facilities in their jurisdictions. Material handling and storage, equipment maintenance and cleaning, and other activities at industrial and commercial facilities are often exposed to the weather. Runoff from rainfall or snowmelt that comes in contact with these activities can pick up pollutants and transport them to a nearby water body, either directly or indirectly through a storm sewer.

Federal regulations require stormwater discharges associated with specific categories of industrial activity to be covered under an NPDES industrial stormwater permit (in Oregon these are 1200-Z permits administered by DEQ). The Plan Participants are required to screen new and existing facilities to determine if they require a 1200-Z permit. Additionally, the Plan Participants are required to adopt and implement a strategy to reduce pollutants from those industrial and commercial facilities that do not require a 1200-Z permit where site-specific information has identified a discharge that contributes a significant pollutant load to the MS4.

Requirements Summary for Industrial and Commercial Facilities		
	BMPs	
	COMM-1 Identify Industrial NPDES Permit Facilities	COMM-2 Industrial/Commercial Stormwater Pollutant Reduction
The full text of Schedule A.4.b may be found in the MS4 Permit.		
i. Screen existing and new industrial facilities to assess whether they have the potential to be subject to an industrial stormwater NPDES permit or have the potential to contribute a significant pollutant load to the MS4.	■	
ii. Within 30 days after the facility is identified, notify the industrial facility and DEQ that an industrial facility is potentially subject to an industrial stormwater NPDES permit.	■	
iii. Implement a strategy to reduce pollutants in stormwater discharges to the MS4 from industrial and commercial facilities where site-specific information has identified a discharge as a source that contributes a significant pollutant load to the MS4.		■

BMPs

COMM-I Identify Industrial NPDES Permit Facilities

Purpose

The purpose of this BMP is to ensure all industrial facilities in the Plan Participants' jurisdictions that require a 1200-Z NPDES industrial stormwater permit are known to DEQ.

Geography

✓	CCSD#1-UGB, including Happy Valley
	SWMACC, including Rivergrove
✓	County-maintained ROW
	Municipal Facilities in permitted area

General Responsibility

✓	WES
	Happy Valley
	Clackamas County DTD
	Other Clackamas County department
	Rivergrove
✓	OLWS (see OLWS SWMP)

Background

This BMP applies where stormwater is discharged from a private industrial property to the MS4. CCSD#1, Happy Valley, and OLWS are the only areas where industrial facilities discharge to a Plan Participant's MS4.

In the 2012-2017 MS4 Permit term, WES conducted a review of existing industrial sites in CCSD#1 and Happy Valley to identify those sites that may have required an NPDES industrial stormwater permit (1200-Z permit) but had not been issued one by DEQ. WES also reviewed new industrial facilities in CCSD#1 and Happy Valley to determine if they potentially required 1200-Z permit. WES notified the facilities and DEQ within 30 days of identifying facilities.

BMP Organization

This BMP consists of three sub-components. COMM-1.1 and COMM-1.3 are ongoing tasks. COMM-1.2 will occur once during the MS4 permit term. Tasks for all sub-components are summarized in the responsibilities matrix at the end of the detailed description.

Detailed Description

COMM-1.1 – IDENTIFY NEW INDUSTRIAL FACILITIES REQUIRING NPDES PERMITS

TYPE: ANNUAL

STATUS: ONGOING

One time each year, WES Development Review will review development applications for new industrial sites to determine whether any new facilities would be subject to 1200-Z permit. Alternately, WES may elect to perform this review at the time of post-construction stormwater plan review (see POST-2).

The determination will be based on a review of a facility's proposed activities and the applicable Standard Industrial Classification (SIC) codes related to the 1200-Z permit. If a site is identified as potentially meeting the eligibility requirements of the 1200-Z permit or the No Exposure Waiver

from the requirement to have this permit WES will notify the facility operator and DEQ of its findings within 30 days.

COMM-1.2 – IDENTIFY EXISTING INDUSTRIAL FACILITIES REQUIRING NPDES PERMITS

TYPE: ONE-TIME

STATUS: ONGOING

WES conducted an identical survey of existing industrial facilities during the 2012-2017 permit MS4 Permit term.

Once during the MS4 Permit term, WES Watershed Protection will review existing industrial sites to determine whether any facilities may require, but do not currently hold, a 1200-Z permit. WES Watershed Protection will use the annual CCSD#1 Industrial Pretreatment Users survey to conduct this review. WES Watershed Protection will include on the survey questions relating to a facility's eligibility for a 1200-Z permit. During this process, if WES Watershed Protection identifies an existing industrial site that may require 1200-Z permit, WES Watershed Protection will notify the facility operator and DEQ of its findings within 30 days.

COMM-1.3 – TRACK 1200-Z PERMITS

TYPE: ONGOING

STATUS: ONGOING

To support its efforts to refer industrial sites to DEQ when appropriate, WES Information Management will maintain a database of 1200-Z permits in CCSD#1 and Happy Valley.

COMM-1 Responsibilities for Identifying Industrial NPDES Permit Facilities

Responsibilities Matrix	WES Dev Review	WES Watershed Protection	WES Information Management	WES Source Control
Review new development applications for 1200-Z permit eligibility	P	I		
Review existing industrial sites for 1200-Z permit eligibility		P		S
Maintain database of 1200-Z permitted sites in CCSD#1	C	C	P	C
Notify DEQ and site operator when 1200-Z permit may be required		P		I

P = Performs Task, C = Consulted, S = Supports, I = Informed

COMM-I Measurable Goals and Tracking Measures

ID	MEASURABLE GOALS	TRACKING MEASURES
COMM-1.1-a	Review new industrial development applications for applicability of 1200-Z permit one time each year.	Date new development applications were reviewed.
COMM-1.2-a	Survey existing industrial facilities for 1200-Z permit applicability once during the MS4 Permit term.	Date survey sent via U.S. mail.

Element B: Industrial and Commercial Facilities

BMP: COMM-2 Industrial/Commercial Stormwater Pollutant Reduction

ID	MEASURABLE GOALS	TRACKING MEASURES
COMM-1.1-b and COMM-1.2-b	Each year notify facility operator and DEQ of 100% of facilities newly identified as potentially needing a 1200-Z permit within 30 days.	• Annual number of facilities where operator and DEQ were notified within 30 days. • Annual number of newly identified facilities. • Annual percentage of facilities where operator and DEQ were notified within 30 days.
COMM-1.3-a	Update the inventory of 1200-Z permits one time each year.	• Date inventory was updated.

COMM-2 Industrial/Commercial Stormwater Pollutant Reduction

Purpose

The purpose of this BMP is to reduce discharge of contaminated stormwater to the MS4 from commercial and industrial lands that drain to it. Polluted discharges are reduced by apply pollution source control BMPs at commercial and industrial facilities. This BMP addresses commercial and industrial sites that are not required to have coverage under the DEQ-issued 1200-Z permit.

Geography

✓	CCSD#1-UGB, including Happy Valley
✓	SWMACC, including Rivergrove
✓	County-maintained ROW
	Municipal Facilities in permitted area

General Responsibility

✓	WES
	Happy Valley
	Clackamas County DTD
	Other Clackamas County department
	Rivergrove
✓	OLWS (see OLWS SWMP)

Background

This BMP applies where stormwater is discharged to one of the Plan Participants' MS4s from a private industrial or commercial property that is not eligible for the 1200-Z permit.

During the 2012-2017 MS4 Permit term, WES developed the *Strategy for the WES Industrial/Commercial Stormwater Program in the City of Happy Valley and in the portions of SWMACC and CCSD#1 which are regulated by the MS4 permit*, which was last updated on Jun. 28, 2013. The strategy describes WES' approach to complying with MS4 Permit Schedule A.4.b.

This BMP describes and updates portions of the strategy that respond to Schedule A.4.b.iii – activities to “reduce pollutants in stormwater discharges to the MS4 from industrial and commercial facilities where site-specific information has identified a discharge as a source that contributes a significant pollutant load to the MS4.”

The current strategy uses complaints and reports from citizens, DEQ, and other County and City employees as the trigger for inspecting a facility to determine whether the site contributes a significant pollutant load to the MS4.

BMP Organization

This BMP consists of four sub-components. COMM-2.1 continues the current complaint-based inspection strategy. Sub-components COMM-2.2 and 2.3 develop a proactive inspection strategy. COMM-2.4 describes the response when an inspection reveals inadequate source controls.

Detailed Description

COMM-2.1 – COMPLAINT-BASED INVESTIGATIONS

TYPE: ONGOING

STATUS: ONGOING

Plan Participants will respond to complaints or referrals about potential contaminated discharges to the MS4 or mishandling of potential stormwater contaminants on commercial or industrial sites.

Complaints or referrals may arise from the public; from WES staff conducting other business, such as Industrial Pretreatment inspections for sanitary sewer, inspections of regulated private storm sewer systems (see MAINT-7), or monitoring storm events or instream water quality; or from other agencies' staff (e.g. Clackamas Fire District No. 1). Some referrals may also result from source tracing of suspected illicit discharges (see IDDE-4).

When a Plan Participant receives such a complaint or referral, WES may request permission from the site operator to inspect the site. If the site operator denies a request to inspect the facility, WES may request the operator to collect a stormwater sample. WES may also elect to collect a stormwater sample where the facility connects to the MS4.

WES will assess the presence of excess levels of pollution using either visual/olfactory or analytical methods. If the runoff quality exceeds, or is likely to exceed based on visual/olfactory cues, the DEQ's surface water quality standards described in OAR 340's Division 41, then WES will initiate source control technical assistance to improve the site's stormwater control measures (see COMM-2.4).

COMM-2.2 – IDENTIFY AND INVENTORY FACILITIES OF CONCERN

TYPE: ONGOING

STATUS: ONGOING

WES Watershed Protection will continue to maintain an inventory of industrial and commercial facilities in CCSD#1 and SWMACC that do not require a 1200-Z permit.

To support a new inspection-based program (see COMM-2.3), WES will prioritize those inventoried facilities that may pose a higher risk of discharging pollutants to the MS4 based on the site's SIC. Sites with higher-risk SICs will be designated as priority commercial and industrial facilities.

WES will update the inventory and prioritize the facilities early in the MS4 Permit term.

Element B: Industrial and Commercial Facilities

BMP: COMM-2 Industrial/Commercial Stormwater Pollutant Reduction

COMM-2.3 – PRIORITY COMMERCIAL AND INDUSTRIAL FACILITY SOURCE CONTROL INSPECTIONS

TYPE: ONGOING

STATUS: FUTURE

WES Watershed Protection will implement a program to inspect the pollutant source control measures at priority commercial and industrial facilities in CCSD#1 and SWMACC.

WES inspectors will evaluate pollutant source control measures in outdoor areas used for work, storage, and materials handling and transfer. Spill prevention education and technical assistance will be provided during these inspections if dangerous or hazardous materials are used, handled, or stored in any portion of the facility drained by a storm sewer system (see IDDE-2). Inside and outside the facility, inspectors will seek cross connections and illicit connections of sanitary sewers and floor drains. An inspection report will be completed for each site.

WES will combine stormwater source control inspections of priority facilities with other inspections when possible. Other inspections include various sanitary sewer inspections and regulated storm sewer inspections (MAINT-7.2).

When WES suspects inadequate source control measures on a site, WES will assess the presence of excess levels of pollution using either visual/olfactory or analytical methods. If the runoff quality exceeds, or is likely to exceed based on visual/olfactory cues, the DEQ's surface water quality standards described in OAR 340's Division 41, then WES will initiate technical assistance to improve the site's stormwater control measures (see COMM-2.4).

COMM-2.4 – SOURCE CONTROL TECHNICAL ASSISTANCE

TYPE: ONGOING

STATUS: ONGOING

When WES Watershed Protection finds inadequate source controls on an industrial or commercial site, WES will offer technical assistance to improve the operator's pollution prevention practices. The facility operator may be asked to trace the source of pollutants or to implement new or additional stormwater source control measures. General recommendations for structural controls may be offered where appropriate. WES will continue to provide technical assistance until the stormwater discharge quality improves above DEQ's surface water quality standards described in OAR 340's Division 41.

If excess pollutant discharge to the MS4 is confirmed as an illicit discharge, WES will conduct enforcement actions to halt the discharge in accordance with BMP IDDE-4, Illicit Discharge Response and Enforcement.

COMM -2 Responsibilities for Industrial/Commercial Stormwater Pollutant Reduction

Responsibilities Matrix	WES Watershed Protection	WES Source Control
Inspect commercial/industrial sites based on complaint/referral	P	C/S
Maintain inventory of industrial/commercial facilities in the districts	P	
Identify priority commercial and industrial facilities	P	

Element B: Industrial and Commercial Facilities
BMP: COMM-2 Industrial/Commercial Stormwater Pollutant Reduction

Responsibilities Matrix	WES Watershed Protection	WES Source Control
Inspect priority commercial and industrial facilities (standalone inspections)	P	
Incorporate stormwater source control inspections into Industrial Pretreatment inspections		P
Refer observations of potential pollutant sources discovered during Industrial Pretreatment inspections to WES	I	P
Provide technical assistance	P	S
<i>Initiate IDDE enforcement, if warranted (see IDDE-4)</i>		P
Track referrals and inspection reports	P	

P = Performs Task, C = Consulted, S = Supports, I = Informed

COMM-2 Measurable Goals and Tracking Measures

ID	MEASURABLE GOALS	TRACKING MEASURES
COMM-2.1-a	Each year inspect 100% of sites referred through complaint or referral within ten business days.	- Annual number of sites inspected within ten business days based on complaint or referral. - Annual total of complaints and referrals. - Annual percentage of sites inspected within ten business days based on complaint or referral.
COMM-2.2-a	Update and prioritize existing list of commercial/industrial facilities that do not require a 1200-Z permit by Jun. 30, 2017.	Date list prioritized.
COMM-2.3-a	Beginning in 2018, conduct a source control inspection of 30% of priority commercial/industrial facilities on the list each year.	- Annual number of priority facilities inspected each year. - Number of priority facilities on the list on Jun. 30, 2017. - Annual percentage of top priority facilities inspected each year.
COMM-2.4-a	Each year, initiate technical assistance for 100% of sites where inspection finds inadequate source controls within 30 days.	- Annual number of technical assistance actions initiated within 30 days. - Annual total of inspection reports indicating inadequate source controls. - Annual percentage of technical assistance actions initiated within 30 days.

This page concludes Industrial
and Commercial Facilities.

C. Construction Site Runoff Control

Regulatory Overview

The MS4 Permit Schedule A.4.c requires Plan Participants to control and prevent polluted runoff from construction sites to the MS4. The primary pollutant of concern from construction sites is sediment. As a result, Plan Participants are required to have ordinances or other regulatory mechanisms to require the implementation of proper erosion prevention and sediment control (EPSC) measures, as well as the control of other pollutants, on construction sites that result in a land disturbance of 1,000 square feet or greater. Proper site planning to prevent erosion and implementation of sediment controls are important measures to prevent sediment and pollutants from entering the MS4 and receiving waters. Plan Participants are required to review site plans prior to construction and inspect construction sites to confirm operators are complying with requirements.

Requirements Summary for Construction Site Runoff Control			
	BMPs		
	EPSC-1 Construction Site Runoff Legal Authority	EPSC-2 EPSC Plan Review	EPSC-3 EPSC Inspection and Enforcement
The full text of the Schedule A.4.c may be found in the MS4 Permit.			
i. Include enforceable regulatory mechanisms that require erosion and sediment controls.	■		
ii. Require construction site operators to develop site plans and to implement and maintain effective erosion and sediment control best management practices.	■	■	
iii. Require construction site operators to prevent or control non-stormwater waste.	■	■	
iv. Establish site plan review procedures.		■	
v. Perform on-site inspections in accordance with documented procedures and criteria.			■
vi. Describe in an enforcement response plan or similar document the enforcement response procedures the permittee will implement.			■

BMPs

EPSC-I Construction Site Runoff Legal Authority

Purpose

The purpose of this BMP is to establish and maintain the Plan Participants' legal authority to require EPSC measures at construction sites, to review EPSC plans prior to construction, and to inspect EPSC measures during construction.

Construction activities remove vegetation and other cover, which exposes soil to the weather and increases erosion. Sediment and other pollutants from construction sites cause significant harm to receiving waters. This BMP addresses the adverse effects of these pollutants on receiving waters by providing the legal authority to require and inspect EPSC measures at construction sites.

Geography

✓	CCSD#1-UGB, including Happy Valley
✓	SWMACC, including Rivergrove
✓	County-maintained ROW
	Municipal Facilities in permitted area

General Responsibility

✓	WES
✓	Happy Valley
✓	Clackamas County DTD
	Other Clackamas County department
	Rivergrove
✓	OLWS (see OLWS SWMP)

Background

The elected officials of CCSD#1, SWMACC, Clackamas County, and Happy Valley adopt policies, rules, and regulations that require pollution control measures on construction sites that drain into the Plan Participants' MS4s.

On behalf of Plan Participants, WES tracks the status of legal authority.

County-maintained ROW

County capital improvement projects (CIPs) are designed and constructed by DTD using professional services contracts and construction bid contracts. Some are also designed or constructed by DTD personnel. When a County CIP is within the permitted area, DTD exercises the County's contracting authority to require EPSC plans and construction methods in its construction contracts.

Happy Valley

Happy Valley Municipal Code (HVMC) Chapter 15.20 prohibits visible or measurable erosion and other contaminants from being discharged into the MS4 during construction. The Chapter requires approval of an erosion control plan and issuance of an erosion control permit on any site where construction activity will disturb an area in excess of 500 square feet.

Happy Valley CIPs are designed and constructed by Happy Valley using professional services contracts and construction bid contracts. Some are also designed or constructed by City personnel. Happy Valley exercises the City's contracting authority to require EPSC plans and construction methods in its construction contracts.

Many construction sites are also subject to the Oregon NPDES Construction Stormwater Discharge Permit (1200-C and 1200-CN).

CCSD#1

CCSD#1 Rules and Regulations establish construction site erosion control and pollution prevention rules, which apply to all parcels within the authority of the district, in Section 14.

CCSD#1 Rules and Regulations:

- Prohibit erosion from leaving construction sites;
- Limit exposure of bare soil to wet weather;
- Require preparation of EPSC plans;
- Require an erosion control permit at a threshold established in the *CCSD#1 Stormwater Standards*;
- Require effective maintenance of EPSC measures;
- Prohibit discharge of other pollutants (e.g. fuel, concrete) to the MS4 and other locations; and
- Require water quality treatment of sediment-laden water prior to discharge to a surface water system.

CCSD#1 Rules and Regulation adopt the *CCSD#1 Stormwater Standards* to describe thresholds and BMPs for construction site pollution prevention. The *CCSD#1 Stormwater Standards*, Section 6:

- Require an EPSC plan and EPSC permit for sites disturbing 800 square feet or more;
- Require all sites, regardless of size, to prevent visible or measurable erosion from leaving the site; and
- Establish minimum construction site pollution prevention measures.

SWMACC

SWMACC Rules and Regulations establish construction site erosion control and pollution prevention rules, which apply to all parcels within the authority of the district, in Sections 4.2, 4.4, and 4.7.

SWMACC Rules and Regulations:

- Prohibit erosion from leaving the property;
- Prohibit sediment, mud, and other similar pollutants from being tracked or released on the street or MS4;
- Limit exposure of bare soil to wet weather;
- Require preparation of EPSC plans using BMPs in WES' erosion prevention manual;
- Require an erosion control permit for sites that disturb 800 square feet or more;
- Require effective maintenance of EPSC measures;
- Prohibit discharge of other pollutants (e.g. fuel, concrete) to the MS4 and other locations
- Require water quality treatment of sediment-laden water prior to discharge to a surface water system;
- Require use of source control BMPs for materials on the site (e.g. stockpiles, chemicals); and
- Establish minimum construction site pollution prevention measures.

Element C: Construction Site Runoff Control

BMP: EPSC-2 EPSC Plan Review

Detailed Description

EPSC-1.1 – REVIEW AND UPDATE LEGAL AUTHORITY

TYPE: ONE-TIME

STATUS: FUTURE

Plan Participants will review legal authority to require, inspect, and enforce erosion control and pollution prevention measures on construction sites in alignment with Schedule A.4.c one time during the MS4 Permit term.

There is no responsibilities matrix for this BMP.

EPSC-I Measurable Goals and Tracking Measures

ID	MEASURABLE GOALS	TRACKING MEASURES
EPSC-1.1-a	Review, and update if necessary, DTD's boilerplate contract terms to ensure EPSC plans are required in construction contracts by Dec. 31, 2018.	• Date legal authority reviewed. • Date legal authority updated, if necessary.
EPSC-1.1-b	Review, and update if necessary, Happy Valley code to ensure alignment with the MS4 Permit Schedule A.4.c by Dec. 31, 2018.	• Date legal authority reviewed. • Date legal authority updated, if necessary.
EPSC-1.1-c	Review, and update if necessary, <i>CCSD#1 Rules and Regulations</i> to ensure alignment with MS4 Permit Schedule A.4.c by Dec. 31, 2020.	• Date legal authority reviewed. • Date legal authority updated, if necessary.
EPSC-1.1-d	Review, and update if necessary, <i>SWMACC Rules and Regulations</i> to ensure alignment with MS4 Permit Schedule A.4.c by Dec. 31, 2020.	• Date legal authority reviewed. • Date legal authority updated, if necessary.

EPSC-2 EPSC Plan Review

Purpose

The purpose of this BMP is to prevent sediment and other pollutants from leaving construction sites and entering the MS4. Plan Participants adopt clear EPSC plan requirements and implement efficient and consistent EPSC plan review procedures to provide guidance to construction site operators. This BMP helps ensure proper implementation of erosion and pollution prevention measures on construction sites.

Geography

✓	CCSD#1-UGB, including Happy Valley
✓	SWMACC, including Rivergrove
✓	County-maintained ROW
	Municipal Facilities in per mitted area

General Responsibility

✓	WES
✓	Happy Valley
✓	Clackamas County DTD
	Other Clackamas County department
	Rivergrove
✓	OLWS (see OLWS SWMP)

Background

Depending on the construction site's location, staff from either WES or Happy Valley reviews the EPSC plans. Both of these Plan Participants administratively adopted the current *EPSC Planning and Design Manual* to describe site planning requirements and BMPs for construction site pollution control.

BMP Organization

EPSC Plan Review procedures differ by site location. EPSC-2.1 describes procedures for County CIPs, EPSC-2.2 describes procedures in Happy Valley, and EPSC-2.3 describes procedures in SWMACC and unincorporated CCSD#1.

Detailed Description

EPSC-2.1 – EPSC REVIEW FOR COUNTY CIPs

TYPE: ONGOING

STATUS: ONGOING

For a CIP within the permitted area that disturbs more than 800 square feet, DTD Transportation Construction will develop an EPSC plan with the project's construction documents. DTD will internally review the plan. Contractors will be required by DTD to follow the EPSC plan.

EPSC 2.1 Responsibilities for EPSC Plan Review for County CIPs

Responsibilities Matrix	DTD Transportation Construction	Construction Site Contractor ^①
Determine if CIP requires EPSC plan	P	
Develop EPSC plan	P	
Install and maintain EPSC measures	I	P
Track EPSC plans	P	

P = Performs Task, C = Consulted, S = Supports, I = Informed

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EPSC-2.2 – EPSC REVIEW IN HAPPY VALLEY

TYPE: ONGOING

STATUS: ONGOING

Happy Valley will conduct EPSC plan review for all construction sites in the City that disturb more than 500 square feet, including the portions of the City within CCSD#1.

Applicants will be required to apply for an EPSC permit and to submit an EPSC plan. EPSC plans will be required to use the minimum control measures described in *CCSD#1 Rules and Regulations*, Section 14, and to include a site plan and BMPs in accordance with the *EPSC Planning and Design Manual*. The submittal will be required to describe operational methods and temporary facilities

Element C: Construction Site Runoff Control

BMP: EPSC-2 EPSC Plan Review

to control sediment during construction and to include schedules for construction and maintenance of BMPs.

The Happy Valley Engineering Division will review EPSC permit applications and plans associated with land use applications (e.g. commercial, multi-family, and subdivisions), and Happy Valley Building Division will review them with building permits. An EPSC permit will be issued before the City issues a development or building permit.

EPSC-2.2 Responsibilities for EPSC Plan Review in Happy Valley

Responsibilities Matrix	Happy Valley Engineering or Building	Applicant ^①
Submit EPSC plan and EPSC permit application	I	P
Review EPSC plan	P	
Approve EPSC plan and issue EPSC permit	P	I
Attend pre-construction meeting (land use review projects only)	P	P
<i>Initiate EPSC Inspection and Enforcement (see EPSC-3)</i>	P	
Track EPSC permits	P	

P = Performs Task, C = Consulted, S = Supports, I = Informed

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EPSC-2.3 – EPSC REVIEW IN SWMACC AND UNINCORPORATED CCSD#1

TYPE: ONGOING

STATUS: ONGOING

WES will review the EPSC plans of all new construction and redevelopment projects that disturb 800 square feet or greater of land in SWMACC or in unincorporated CCSD#1. Reviews will be conducted in accordance with the *CCSD#1 Rules and Regulations* or *SWMACC Rules and Regulations*, as pertinent.

Applicants will be required to apply for an EPSC permit and to submit an EPSC plan. EPSC plans will be required to use the minimum control measures described in the district's rules and regulations and to include a site plan and BMPs in accordance with the *EPSC Planning and Design Manual*. The submittal will be required to describe operational methods and temporary facilities to control sediment during construction and to include schedules for construction and maintenance of BMPs.

The County's DTD Permit Counter will receive applications for all land use reviews and building permits in unincorporated Clackamas County and Rivergrove. This will initiate the EPSC review process for sites in SWMACC and in unincorporated CCSD#1.

DTD will provide WES a sign-off in the building permits system so that building permits are not issued (when applicable) until WES issues the EPSC permit.

Land Use Approvals

For construction sites associated with land use reviews (e.g. commercial, multi-family, subdivisions) applicants will submit construction documents, including an EPSC plan, after land use approval and before construction begins. WES will review the EPSC plan concurrently with the site's post-construction stormwater plan (see POST-2).

If DTD and the applicant elect to hold a pre-construction meeting, WES will attend it.

After approval of the EPSC plan, WES will issue the EPSC permit and then will initiate EPSC Inspection and Enforcement (see EPSC-3).

EPSC-2.3 Responsibilities for EPSC Plan Review of Land Use Approvals in SWMACC and Unincorporated CCSD#1

Responsibilities Matrix	WES Development Review	Applicant ¹
Submit EPSC plan with construction documents	I	P
Review EPSC plan	P	
Approve EPSC plan and issue EPSC permit	P	I
Attend pre-construction meeting	P	P
<i>Initiate EPSC Inspection and Enforcement (see EPSC-3)</i>	P	
Track EPSC permits	P	

Single-Family Building Permits

EPSC review of single-family residence (SFR) building permits will be coordinated with post-construction stormwater review of these sites (see POST-2).

DTD Building Department will route building permit applications to WES Development Review when the DTD Permit Counter receives an application for a site that is, or may be, within SWMACC or unincorporated CCSD#1. WES Development Review will determine if the activity requires an EPSC permit. If an EPSC permit is required, then WES Development Review will contact the applicant to require submittal of the SFR EPSC Application.

WES will review and approve SFR EPSC Applications based on the *EPSC Planning and Design Manual*. WES will issue the EPSC permit to the applicant before DTD releases the building permit.

After approval, WES Development Review will initiate EPSC Inspection and Enforcement (see EPSC-3).

EPSC-2.3 Responsibilities for EPSC Plan Review of Single Family Building Permits in SWMACC and Unincorporated CCSD#1

Responsibilities Matrix	WES Development Review	DTD Building Department	WES Watershed Protection	Applicant ¹
Route building permit application to WES	I	P	I	

Element C: Construction Site Runoff Control

BMP: EPSC-2 EPSC Plan Review

Responsibilities Matrix	WES Development Review	DTD Building Department	WES Watershed Protection	Applicant ¹
Mail EPSC Application to applicant	P			I
Submit EPSC Application	I			P
Review EPSC plan	P		I	
Sign of on building permit	P	I		
Issue EPSC permit	P	I	I	I
<i>Initiate EPSC Inspection and Enforcement (see EPSC-3)</i>	P	I		
Track EPSC permits	P			

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EPSC-2 Measurable Goals and Tracking Measures

ID	MEASURABLE GOALS	TRACKING MEASURES
EPSC-2.1-a	Internally review the EPSC plan of 100% of County CIPs going to construction in the permitted area each year. (DTD)	- Annual number of County CIP EPSC plans reviewed by DTD. - Annual number of County CIPs going to construction in the permitted area. - Annual percentage of County CIP EPSC plans reviewed by DTD.
EPSC-2.2-a	Review EPSC plan of 100% of land use and building permit applications meeting threshold for erosion prevention and sedimentation control in Happy Valley each year. (Happy Valley)	- Annual number of EPSC reviews conducted by Happy Valley. - Annual number of new land use and building permit applications meeting threshold for EPSC in Happy Valley. - Annual percentage of EPSC reviews conducted by Happy Valley.
EPSC-2.3-a	Review EPSC plan of 100% of land use reviews and building permit applications meeting threshold for erosion prevention and sediment control in SWMACC and unincorporated CCSD#1. (WES)	- Annual number of EPSC reviews conducted by WES. - Annual number of new land use reviews and building permit applications meeting threshold for EPSC in SWMACC and unincorporated CCSD#1. - Annual percentage of EPSC reviews conducted by WES.
EPSC-2.3-b	Attend 80% of pre-construction meetings for projects meeting threshold for erosion prevention and sediment control in SWMACC and unincorporated CCSD#1. (WES)	- Annual number of pre-construction meetings attended by WES. - Annual number of pre-construction meetings for projects needing EPSC held in SWMACC and unincorporated CCSD#1. - Annual percentage of pre-construction meetings attended by WES.

EPSC-3 EPSC Inspection and Enforcement

Purpose

The purpose of this BMP is to ensure EPSC measures and other pollution prevention measures are in place and functioning correctly during construction. Plan Participants ensure EPSC measures are in place by conducting inspections before construction starts, during construction, and after construction is complete and the site is stabilized.

Geography

✓	CCSD#1-UGB, including Happy Valley
✓	SWMACC, including Rivergrove
✓	County-maintained ROW
	Municipal Facilities in permitted area

General Responsibility

✓	WES
✓	Happy Valley
✓	Clackamas County DTD
	Other Clackamas County department
	Rivergrove
✓	OLWS (see OLWS SWMP)

Background

Plan Participants inspect sites before and during construction. Inspections and enforcement give Plan Participants an opportunity to provide additional guidance and education, to require changes to the EPSC plan, issue warnings, or assess penalties.

Each site receives a minimum of three inspections: an initial and final inspection and at least one unscheduled inspection during construction. Additional inspections may be conducted based on complaints, history of failing inspection, or the nature and extent of construction activity and site characteristics.

Enforcement Authority

DTD exercises the County's contracting authority to conduct EPSC inspections and enforce EPSC measures on County CIPs.

Happy Valley's enforcement authority is described in HVMC Chapters 20.15 and 15.20.080. The building official or designee is authorized to issue a stop work order, prevent certification of occupancy, and issue fines if the Chapter is violated. The City's erosion inspection report form also describes enforcement steps. Happy Valley exercises the City's contracting authority to conduct EPSC inspections and enforce EPSC measures on City CIPs.

CCSD#1's enforcement authority is described in *CCSD#1 Rules and Regulations* Section 14. Enforcement procedures are described in *CCSD#1 Stormwater Standards* Section 7.

SWMACC's enforcement authority and procedures are described in *SWMACC Rules and Regulations* Section 9.

BMP Organization

EPSC inspections and enforcement procedures are described by site location. EPSC-3.1 describes procedures for County CIPs, EPSC-3.2 describes procedures in Happy Valley, and EPSC-3.3 describes procedures in SWMACC and unincorporated CCSD#1.

Element C: Construction Site Runoff Control
BMP: EPSC-3 EPSC Inspection and Enforcement

Detailed Description

EPSC-3.1 – COUNTY CIP INSPECTION AND ENFORCEMENT

TYPE: ONGOING

STATUS: ONGOING

DTD Transportation Construction will conduct regular construction inspections of the County's CIPs within the permitted area. Sites will be inspected a minimum of three times to verify proper installation, maintenance, and use of EPSC measures. DTD will require improvements when warranted and will enforce contract terms to ensure effective pollutant reduction measures, if necessary.

EPSC-3.1 Responsibilities for County CIP EPSC Inspection and Enforcement

Responsibilities Matrix	DTD Capital Project Supervisor
<i>Contractor begins site construction</i>	I
Inspect EPSC measures on County CIPs	P
Enforce EPSC requirements	P

P = Performs Task, C = Consulted, S = Supports, I = Informed

EPSC-3.2 – HAPPY VALLEY INSPECTION AND ENFORCEMENT

TYPE: ONGOING

STATUS: ONGOING

Happy Valley will conduct EPSC inspections a minimum of three times. For building permit construction sites, the Happy Valley Building Division will conduct EPSC inspections concurrently with building inspections. For site development construction, such as subdivision, multi-family, and commercial development sites, Happy Valley Engineering Division will conduct an EPSC inspection whenever the inspector is on the site, often weekly.

Initial Inspections

Prior to building permit construction, the Happy Valley Building Division will inspect the site to ensure EPSC measures conform to the approved EPSC plan and are correctly implemented. The initial inspection will be conducted by a building inspector concurrently with a footings and foundations inspection.

Prior to site development construction, the Happy Valley Engineering Division inspector will inspect and approve the installed EPSC measures.

Unscheduled Monitoring Inspection(s)

At least one unscheduled inspection will take place during construction. An unscheduled inspection may also occur in response to a complaint.

If EPSC measures are not correctly implemented and maintained, the inspector will initiate enforcement action. Inspectors will conduct additional monitoring inspections as necessary.

Final Inspections

For building permit construction, the Happy Valley Building Division inspector will perform a final inspection after temporary EPSC measures have been removed and the contractor has stabilized the site. Final EPSC inspection will be required prior to occupancy certification.

For site development construction, the Happy Valley Engineering Division inspector will conduct a final EPSC inspection to confirm that all disturbed areas of the site are covered and the site is stabilized. This inspection will occur prior to acceptance of the residential, multi-family, or commercial development by the City.

Enforcement

If an inspection finds EPSC measures to be absent or incorrectly applied, Happy Valley will initiate enforcement action in accordance with its enforcement procedures, described above.

Tracking

The Happy Valley Building Division will track EPSC inspections and enforcement in spreadsheet database (currently Accela). The Happy Valley Engineering Division will track EPSC inspections and enforcement in a spreadsheet.

City CIPs

The Happy Valley Engineering Division will conduct regular construction inspections of its CIPs. Inspections will verify proper installation, maintenance, and use of EPSC measures. Happy Valley will require improvements when warranted and will enforce contract terms to ensure effective pollutant reduction measures, if necessary.

EPSC-3.2 Responsibilities for Happy Valley EPSC Inspection and Enforcement

Responsibilities Matrix	Happy Valley Building or Engineering <i>Inspector Depends on Type of Construction Site</i>	Site Operator ^❶
<i>Applicant installs EPSC measures</i>	I	P
Call for initial inspection	I	P
Inspect construction site EPSC	P	I
Enforcement, as needed	P	I
Final EPSC Inspection	P	I
Close EPSC Permit	P	I
Track inspections and enforcement	P	

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Element C: Construction Site Runoff Control
BMP: EPSC-3 EPSC Inspection and Enforcement

EPSC-3.3 – CCSD#1 AND SWMACC INSPECTION AND ENFORCEMENT

TYPE: ONGOING

STATUS: ONGOING

WES Development Review will inspect EPSC measures on construction sites in SWMACC and unincorporated CCSD#1 a minimum of three times.

Single-family builders will request the initial and final EPSC inspections by contacting DTD; these inspections will be coordinated with the footings inspection and the final building inspection. Operators of non-single family development sites will contact WES directly to schedule the initial and final EPSC inspections.

WES will document inspections and enforcement in a database (Permits 2015, currently). In addition, DTD will document the initial and final EPSC inspections for single-family residential building sites in its permit tracking database (Accela, currently).

WES' inspectors will look for proper implementation and maintenance of EPSC measures.

Initial Inspection

Before construction begins, WES will inspect construction sites to ensure EPSC measures conform to the EPSC plan and are correctly installed. DTD Building Division will require the initial EPSC inspection to be completed prior to scheduling the footings inspection or for the two inspections to be scheduled concurrently.

Unscheduled Monitoring Inspection(s)

At least once during construction, WES will conduct an unscheduled monitoring inspection of construction sites to verify proper implementation of required BMPs. WES Development Review will conduct additional monitoring inspections as necessary.

An unscheduled inspection may also occur in response to a complaint.

Final Inspection

After stabilization and clean-up of the site and removal of temporary EPSC measures, WES will conduct a final EPSC inspection. The inspection will confirm removal of temporary BMPs and stabilization of disturbed areas.

Enforcement

If inspection finds that EPSC measures are absent or incorrectly applied, WES will initiate a graduated enforcement action in accordance with district rules and regulations. WES inspectors have the authority to issue deficiency notices, charge re-inspection fees, issue fines and stop land-disturbing development work at the site until provisions of the regulations are met.

EPSC-3.3 Responsibilities for SWMACC and Uninc. CCSD#1 EPSC Inspection and Enforcement

Responsibilities Matrix	WES Development Review	DTD Building Division	Site Operator ^❶
<i>Applicant installs EPSC measures</i>			P
<i>Applicant calls for initial inspection (includes footing inspections for building permits)</i>	I	I	P
Hold initial footing inspection OR coordinate scheduling with WES (for bldg. permits only)	I	P	
Inspect construction site EPSC – initial inspection	P		I
Notify DTD Building to allow initial footing inspection (if held)	P	I	
Allow initial footing inspection (if held)		P	I
Monitoring (and other) EPSC inspections	P		I
Enforcement, as needed	P		I
Final EPSC inspection	P	I	
Close EPSC Permit	P	I	I
Track inspections and enforcement	P		

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EPSC-3.4 – ADOPT EROSION CONTROL ENFORCEMENT RESPONSE PLAN

TYPE: ONE-TIME

STATUS: FUTURE

During the MS4 Permit term, WES will administratively adopt an Erosion Control Enforcement Response Plan to clarify the procedures for erosion control enforcement contained in the *CCSD#1 Stormwater Standards* Section 7. Clarifications may include, but will not be limited to, documenting the preferred initial technical assistance procedures and establishing the number of erosion control violations that constitute a misdemeanor.

EPSC-3.4 Responsibilities for Adopting Erosion Control Enforcement Response Plan

Responsibilities Matrix	WES Watershed Protection
Write and adopt Erosion Control Enforcement Response Plan	P

Element C: Construction Site Runoff Control
BMP: EPSC-3 EPSC Inspection and Enforcement

EPSC-3 Measurable Goals and Tracking Measures

ID	MEASURABLE GOALS	TRACKING MEASURES
EPSC-3.1-a	Conduct at least three EPSC inspections over the life of the project at 100% of County CIP construction sites within the permitted area that require EPSC review. (DTD)	• Annual number of County CIP projects in the permitted area that completed construction and that DTD inspected for EPSC at least three times over the life of the project. • Annual number of County CIP projects in the permitted area that met the threshold for EPSC review and that completed construction. • Annual percentage of County CIP projects that DTD inspected for EPSC at least three times.
EPSC-3.2-a	Each year conduct the initial EPSC inspection prior to construction at 100% of EPSC permitted sites in Happy Valley. (Happy Valley)	• Annual number of EPSC permitted sites that received an initial EPSC inspection by Happy Valley prior to construction. • Annual number of EPSC permitted sites that began construction in Happy Valley. • Annual percentage of EPSC permitted sites that received an initial EPSC inspection by Happy Valley prior to construction.
EPSC-3.2-b	Inspect 90% of EPSC permitted sites in Happy Valley at least three times over the life of the project. (Happy Valley)	• Annual number of EPSC permitted sites that completed construction in Happy Valley and received at least three EPSC inspections over the life of the project. • Annual number of EPSC permitted sites that completed construction in Happy Valley. • Annual percentage of EPSC permitted sites in Happy Valley that received at least three EPSC inspections.
EPSC-3.2-c	Inspect 100% of EPSC permitted sites in Happy Valley at least twice over the life of the project. (Happy Valley)	• Annual number of EPSC permitted sites that received at least two EPSC inspections by Happy Valley over the life of the project. • Annual number of EPSC permitted sites that completed construction in Happy Valley. • Annual percentage of EPSC permitted sites in Happy Valley that received at least two EPSC inspections.
EPSC-3.3-a	Each year conduct the initial EPSC site inspection prior to construction at 100% of EPSC permitted sites in SWMACC and unincorporated CCSD#1. (WES)	• Annual number of EPSC permitted sites that received an initial EPSC inspection by WES prior to construction. • Annual number of EPSC permitted sites that began construction in SWMACC and unincorporated CCSD#1. • Annual percentage of EPSC permitted sites that received an initial EPSC inspection by WES prior to construction.

Element C: Construction Site Runoff Control
BMP: EPSC-3 EPSC Inspection and Enforcement

ID	MEASURABLE GOALS	TRACKING MEASURES
EPSC-3.3-b	Inspect 90% of EPSC permitted sites in SWMACC and unincorporated CCSD#1 at least three times over the life of the project. (WES)	• Annual number of EPSC permitted sites that received at least three EPSC inspections by WES over the life of the project. • Annual number of EPSC permitted sites that completed construction in SWMACC and unincorporated CCSD#1. • Annual percentage of EPSC permitted sites in SWMACC and unincorporated CCSD#1 that received at least three EPSC inspections.
EPSC-3.3-c	Inspect 100% of EPSC permitted sites in SWMACC and unincorporated CCSD#1 at least twice over the life of the project. (WES)	• Annual number of EPSC permitted sites that received at least two EPSC inspections by WES over the life of the project. • Annual number of EPSC permitted sites that completed construction in SWMACC and unincorporated CCSD#1. • Annual percentage of EPSC permitted sites in SWMACC and unincorporated CCSD#1 that received at least two EPSC inspections.
EPSC-3.3-d	EPSC measures are fully corrected within three business days after a failed EPSC inspection in SWMACC and unincorporated CCSD#1 90% of the time. (WES)	• Running total of re-inspections in SWMACC and unincorporated CCSD#1 that showed corrections were made within three business days. • Running total of failed EPSC inspections in SWMACC and unincorporated CCSD#1. • Percentage of re-inspections in SWMACC and CCSD#1 that showed corrections were made within three business days.
EPSC-3.3-e	Each year, reduce the percentage of active EPSC permitted sites in SWMACC and unincorporated CCSD#1 that require any enforcement action beyond a re-inspection for an EPSC violation. (WES)	• Annual number of EPSC permitted sites in SWMACC and CCSD#1 that required an enforcement action beyond a re-inspection. • Annual number of active EPSC-permitted construction sites in SWMACC and unincorporated CCSD#1. • Annual percentage of active EPSC permitted sites that required an enforcement action beyond re-inspection. • Compare percentages year over year.
EPSC-3.4-a	Adopt an Erosion Control Enforcement Response Plan by Dec. 31, 2019. (WES)	• Date Erosion Control Enforcement Response Plan adopted.

The page concludes Construction
Site Runoff Control.

D. Education and Outreach

Regulatory Overview

These BMPs respond to the MS4 Permit Schedule A.4.d requirement to conduct public education and outreach activities. This requirement is intended to increase public knowledge of stormwater impacts and the behaviors that can reduce impacts. The education and outreach program also supports other aspects of the stormwater management program. The MS4 Permit requires public outreach to facilitate reporting of illicit discharges and spills, advertise training for construction site operators, train municipal employees, and provide information and training for maintenance and operation of private stormwater quality systems.

Requirements Summary for Education and Outreach						
	BMPs					
	ED-1 Implement the Stormwater Public Education and Outreach Strategy	ED-2 Facilitate Illicit Discharge Reporting	ED-3 Employee Training	ED-4 Public Education Effectiveness Evaluation	ED-5 Erosion Control Outreach	ED-6 Private Stormwater Facility Operations and Maintenance Outreach
The full text of Schedule A.4.d may be found in the MS4 Permit.						
i. Continue to implement a documented public education and outreach strategy that promotes pollutant source control and a reduction of pollutants in stormwater discharges. Identify pollutants of concern, targeted audiences, and specific education activities.	■					
ii. Educate the community about the impacts of stormwater discharges on water bodies and actions the public can take to reduce pollutants in stormwater runoff.	■					
iii. Provide public education on the proper use and disposal of pesticides, herbicides, fertilizers and other household chemicals.	■					
iv. Provide education on the proper operation and maintenance of stormwater management facilities.						■
v. Direct construction site operators to erosion control training opportunities.					■	
vi. Conduct or participate in an effectiveness evaluation to measure the success of public education activities during the term of this permit.				■		

Requirements Summary for Education and Outreach						
	BMPs					
	ED-1 Implement the Stormwater Public Education and Outreach Strategy	ED-2 Facilitate Illicit Discharge Reporting	ED-3 Employee Training	ED-4 Public Education Effectiveness Evaluation	ED-5 Erosion Control Outreach	ED-6 Private Stormwater Facility Operations and Maintenance Outreach
The full text of Schedule A.4.d may be found in the MS4 Permit.						
vii. Include training for employees involved in MS4-related activities.			■			
viii. Promote and facilitate public reporting of illicit discharges.		■				

BMPs

ED-1 Implement the Stormwater Public Education and Outreach Strategy

Purpose

The purpose of this BMP is to promote pollutant source control among members of the public through education and outreach activities. The Stormwater Public Education and Outreach Strategy will guide the Plan Participants' activities to reach specific education and outreach goals and to coordinate activities to ensure coverage and reduce redundancy.

Geography

✓	CCSD#1-UGB, including Happy Valley
✓	SWMACC, including Rivergrove
✓	County-maintained ROW
	Municipal Facilities in permitted area

General Responsibility

✓	WES
✓	Happy Valley
✓	Clackamas County DTD
	Other Clackamas County department
✓	Rivergrove
✓	OLWS (see OLWS SWMP)

Background

Communications Plan

On behalf of all Plan Participants, WES published the *Communications Plan – Surface Water Program – DRAFT 4* (Communications Plan), which was updated Jun. 2, 2014, to document the stormwater public education and outreach strategy. The Communications Plan describes outreach programs that are intended to reduce pollutants in stormwater discharges through knowledge

and behavior change. The Communications Plan identifies target pollutants of concern, targeted audiences, and specific education activities.

Pollutants of concern include:

- Pesticides and herbicides
- Petroleum products
- Bacteria (E. Coli)
- Total Suspended Solids (TSS), sediment

Target audiences include:

- General public
- Homeowners
- Pet owners
- Vehicle owners
- Farmers
- Landscape businesses

Specific communications techniques and education programs include:

- Support the EcoBiz program
- Participate in Regional Coalition for Clean Rivers and Streams
- Website and social media
- Pamphlets and flyers distributed through bill inserts, lobbies, and events
- Provide dog waste bags to pet owners
- Newsletter and newspaper articles
- Signage at municipal properties
- Public education on illicit discharges and spills reporting

Plan Participants conduct the education and outreach activities described in the Communications Plan.

Other Outreach

The Plan Participants engage in a range of other water quality focused education and outreach activities as part of their stormwater programs. These activities often target broad segments of the population or broad watershed health knowledge rather than the specific stormwater quality issues and audiences associated with the MS4 Permit requirements. As a result they serve a key purpose in educating the public, but do not target discrete educational goals. These activities include the Watershed Health Education Program (WHEP), social media campaigns telling the story of the surface water program, partnerships with other water quality organizations, and cooperation with regional watershed councils.

In the 2012-2017 MS4 Permit term, CCSD#1 developed two Watershed Action Plans. As an outcome of developing the Watershed Action Plans, WES developed WHEP to provide water quality-focused curriculum and science instruction for school ages K-12. The goal of WHEP is to engage, inspire, and educate students to protect and restore watershed health and to influence the

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BMP: ED-1 Implement the Stormwater Public Education and Outreach Strategy

larger community. The program also supports broader science, technology, engineering, and math (STEM) and Next Generation Science Standards (NGSS) educational goals.

Social media campaigns use video and interactive activities to build support for watershed protection. These campaigns tell the story of the surface water program and encourage public engagement (such as encouraging the public to upload photos). The campaigns may target specific education and outreach goals or may have a more general intent of increasing the audience's knowledge of and connection to local watersheds.

Partnerships with other organizations increase the impact of education and outreach funds and activities. The Plan Participants partner with the watershed councils in the region and other public agencies in the Portland-Vancouver metropolitan area as part of the Regional Coalition for Clean Rivers and Streams. This organization allows members to coordinate education and outreach activities. This coordination extends the reach of agencies' messages to connected watersheds and improves message consistency across the region.

Detailed Description

ED-1.1 – IMPLEMENT THE STORMWATER PUBLIC EDUCATION AND OUTREACH STRATEGY

TYPE: ONGOING

STATUS: ONGOING

On an ongoing basis, Plan Participants will implement the latest version of the Communications Plan. Each Plan Participant will contribute to implementing at least one outreach activity during the MS4 Permit term. Activities will take place throughout the year to maintain public awareness of issues, and activities will be timed to address seasonal topics when appropriate.

Plan Participant's Communications and Community Relations departments will continue to maintain stormwater information on their websites. WES will continue to create public service announcements and send out newsletters. WES Community Relations will continue to implement WHEP. WES Watershed Protection and Field Operations and DTD RCSW will continue to include stormwater messages in business outreach efforts.

ED-1.2 – UPDATE THE STORMWATER PUBLIC EDUCATION AND OUTREACH STRATEGY

TYPE: PERIODIC

STATUS: ONGOING

On behalf of Plan Participants, WES will update the Communications Plan every two years beginning in 2017.

The first update will incorporate Plan Participants' ongoing outreach activities that are not currently documented in the plan, include the addition of education goals, and will allocate specific responsibilities to each Plan Participant. Other updates will include developing new goals responsive to newly identified issues and improvements to activities targeting the existing goals.

In developing goals, WES will consider pollutants of concern identified in the 2015 *TMDL Pollutant Load Reduction Evaluation* and the *303(d) Evaluation* dated 2015 or the latest versions

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adopted by WES, as well as any new issues identified by staff in the previous year. If new goals are developed, WES will identify relevant audiences and activities to achieve each goal. Plan Participant staff members will also evaluate progress on existing goals and determine what changes, if any, need to be made to existing activities including the addition targeting of new audiences.

New target audiences may include:

- Students
- Owners and operators of dumpsters and compactors
- Mobile businesses operators
- General business operators
- Construction site operators
- Commercial property owners and managers
- Plan Participant employees
- Employees of County service districts (e.g. Clackamas Fire District No. 1, North Clackamas Parks and Recreation District)

New communications techniques and education programs may include:

- Riparian planting, vegetation maintenance, and cleanup events for the public; and
- Voluntary inspections and technical assistance for businesses

The updated strategy may also describe complementary activities by neighboring agencies in the region, which support the education and outreach goals in the strategy. The strategy would include a brief description of each organization, a summary of relevant activities, and an explanation of how these activities support the Plan Participants' education goals.

Organizations engaged in stormwater pollutant reduction outreach in the region include, but are not limited to:

- Portland Metro
- Clackamas River Water Providers
- Watershed councils
- Oak Creek Watershed Council
- OLWS
- Cities

ED-1 Responsibilities for Implementing the Stormwater Public Education and Outreach Strategy

Responsibilities Matrix	WES Community Relations / Communications	WES Watershed Protection	WES Field Ops	DTD RCSW	DTD Comm Relations	Happy Valley Comm Relations	Rivergrove City Manager
Maintain WES website	P						
Maintain DTD website					P		
Maintain Happy Valley website						P	
Maintain Rivergrove website							P

Element D: Education and Outreach

BMP: ED-2 Facilitate Illicit Discharge Reporting

Responsibilities Matrix	WES Community Relations / Communications	WES Watershed Protection	WES Field Ops	DTD RCSW	DTD Comm Relations	Happy Valley Comm Relations	Rivergrove City Manager
Supervise WHEP	P						
Conduct business outreach		P	P	P			
Prepare newsletters	P				P		
Create PSAs	P						
Update Communications Plan	P			C/S	C/S	C/S	C/S

P = Performs Task, C = Consulted, S = Supports, I = Informed

ED-I Measurable Goals and Tracking Measures

ID	MEASURABLE GOALS	TRACKING MEASURES
ED-1.1-a	Over the MS4 Permit term, include educational goals targeting at least five separate audiences in the Communications Plan.	Running total of target audiences included in the Communications Plan.
ED-1.1-b	Over the MS4 Permit term, include discussions about at least four pollutants of concern in the Communications Plan.	Running total of pollutants of concern included in the Communications Plan.
ED-1.1-c	Each year complete at least 90% of written communication outputs (e.g. newsletters, websites, and pamphlets) described in the Communications Plan.	- Annual number of written communication outputs completed. - Annual number of planned written communication outputs. - Annual percentage of written communication outputs completed.
ED-1.1-d	Each year hold or co-sponsor at least three in-person public education opportunities (e.g. training, seminars, and kids' programs).	Annual number of in-person education opportunities.
ED-1.1-e	Each year hold or co-sponsor at least one volunteer activity with an education component.	Annual number of volunteer activities with an education component.
ED-1.2-a	Update the Surface Water Communications Plan once before Dec. 31, 2017 and an additional two times during the MS4 Permit term.	Date(s) the plan was updated.

ED-2 Facilitate Illicit Discharge Reporting

Purpose

The purpose of this BMP is to encourage the public to report illicit discharges and spills by raising awareness and providing easy methods of public reporting.

Geography

✓	CCSD#1-UGB, including Happy Valley
✓	SWMACC, including Rivergrove
	County-maintained ROW
	Municipal Facilities in permitted area

General Responsibility

✓	WES
	Happy Valley
	Clackamas County DTD
	Other Clackamas County department
	Rivergrove
✓	OLWS (see OLWS SWMP)

Background

Prompt public reporting of illicit discharges and spills is an important tool for finding and controlling pollutant discharges to the MS4. The following options are available to the public to report illicit discharges and spills:

- WES' non-emergency reporting hotline
 - During business hours: 503-742-4567
 - After hours: 503-655-8211
- Electronic report from WES' homepage:
<https://web3.clackamas.us/up/forms/reportproblem.jsp>
- Happy Valley Public Works non-emergency response number: 503-783-3800.
- Happy Valley Report-a-Concern website: <http://www.happyvalleyor.gov/report-a-concern/>
- Spills or illicit discharges that constitute an emergency can be reported by calling 911.
- The Oregon Emergency Management Division operates the Oregon Emergency Response System (OERS): 800-452-0311.

Reports to the WES hotline and website are processed in accordance with the *Summary of Spill Response & Reporting Procedures* dated Sept. 2, 2014 (see IDDE-2).

Detailed Description

ED-2.1 FACILITATE ILLICIT DISCHARGE REPORTING

TYPE: ONGOING

STATUS: ONGOING

WES will publicize the available illicit discharge reporting methods to increase the likelihood that members of the public who witness an illicit discharge or spill will report it. WES will include messages about preventing and identifying illicit discharges in other planned outreach activities or publications, and DTD and Happy Valley will participate in these efforts (see ED-1).

ED-2 Responsibilities for Facilitating Illicit Discharge Reporting

Responsibilities Matrix	WES Watershed Protection	WES Community Relations	DTD Community Relations	Happy Valley Public Works
Conduct public outreach to encourage illicit discharge reporting	C/S	P	S	S

P = Performs Task, C = Consulted, S = Supports, I = Informed

ED-2 Measurable Goals and Tracking Measures

ID	MEASURABLE GOALS	TRACKING MEASURES
ED-2.1-a	Conduct at least one IDDE reporting publicity campaign during the MS4 Permit term.	Running total of IDDE reporting publicity campaigns to date.

ED-3 Employee Training

Purpose

The purpose of this BMP is to provide training to Plan Participants' employees engaged in stormwater-related activities to increase their knowledge and awareness of stormwater management topics. Under the Shared SWMP, Plan Participants will plan training together to reduce costs and share expertise.

Geography

✓	CCSD#1-UGB, including Happy Valley
✓	SWMACC, including Rivergrove
✓	County-maintained ROW
✓	Municipal Facilities in permitted area

General Responsibility

✓	WES
✓	Happy Valley
✓	Clackamas County DTD
✓	Other Clackamas County department
	Rivergrove
✓	OLWS (see OLWS SWMP)

Background

This BMP applies to a wide variety of employees including those directly involved in storm sewer maintenance and those engaged in activities that indirectly affect the MS4 such as landscape maintenance and construction site plan review.

Each Plan Participant selects training for its employees based on staff positions and regulatory requirements. Training is conducted in-house or by sending employees to courses or seminars related to their duties.

BMP Organization

This BMP consists of three sub-components: ED-3.1 is a one-time task, ED-3.2 is annual, and ED-3.3 is ongoing.

Detailed Description

ED-3.1 – ESTABLISH TRAINING COORDINATORS

TYPE: ONE-TIME

STATUS: FUTURE

Each Plan Participant will identify a staff position as a training coordinator to work with WES to meet the stormwater training needs of the organization and track their organizations' stormwater related training. The WES training coordinator will assist the other Plan Participants and other Clackamas County departments with identifying stormwater related training needs. The WES

training coordinator will also compile training data from the other Plan Participants and Clackamas County departments for annual reporting purposes.

ED-3.2 – DETERMINE TRAINING NEEDS

TYPE: ANNUAL

STATUS: ONGOING

Annually, WES and the Plan Participants' training coordinators will identify the staff categories engaged in stormwater-related activities and activities potentially impacting stormwater runoff.

Within each organization, training coordinators will identify each employee's specific training needs. WES' training coordinator will help the other training coordinators to identify training relevant to their organizations, establish training goals, and schedule training events. Training will focus on new staff, staff with new duties, and refresher/recertification training.

Staff engaged in stormwater-related activities includes, but is not limited to, those conducting:

- Street maintenance
- Industrial/commercial stormwater quality inspections
- Sanitary collection system operation and maintenance
- Fleet maintenance
- Building operations and maintenance
- Landscape maintenance
- Building permit review
- Building inspections
- EPSC inspections
- IDDE dry-weather inspections at priority monitoring sites
- Stormwater system inspections, cleaning, and maintenance
- Capital project engineering design
- Development review
- Business inspections through the Resource Conservation and Solid Waste Program

Training for staff may include, but is not limited to:

- Illicit discharge identification and investigation.
- Spill prevention and response.
- Source control of pollution
- Hazmat awareness training.
- Inspection and maintenance of structural stormwater BMPs
- Inspection of erosion control BMPs
- Stormwater regulations and enforcement procedures
- Pesticide application
- Low Impact Development (LID) facility operations and maintenance
- LID facility design

Element D: Education and Outreach

BMP: ED-3 Employee Training

ED-3.3 – CONDUCT TRAINING

TYPE: ONGOING

STATUS: ONGOING

WES, DTD, Happy Valley, and Rivergrove will continue to conduct stormwater-related training for their own employees. WES will work with the Plan Participants and other Clackamas County departments to plan and schedule required training throughout the year. Plan Participants will provide trainers when internal expertise is available and will cooperate in arranging training from outside organizations when expertise is not available or when trainees require certification or licensing. Where possible, training will be conducted jointly by the Plan Participants to reduce training costs.

ED-3 Responsibilities for Employee Training

Responsibilities Matrix	WES Watershed Protection	WES Training Coord	DTD Transpo Maint	DTD Training Coord	Happy Valley Public Works	Happy Valley Training Coord	Clackamas County Facilities Management, Sheriff, Other Departments
Assign Training Coordinator	P/I		P		P		
Identify WES and other County staff with stormwater-related duties		P					S
Identify DTD staff with stormwater-related duties		C		P			
Identify Happy Valley staff with stormwater-related duties		C				P	
Determine WES and other County staff training requirements		P					C
Determine DTD staff training requirements		C		P			
Determine Happy Valley staff training requirements		C				P	
Schedule training events / find appropriate third-party trainings		P		P		P	I
Track training completion		P		P		P	

P = Performs Task, C = Consulted, S = Supports, I = Informed

ED-3 Measurable Goals and Tracking Measures

ID	MEASURABLE GOALS	TRACKING MEASURES
ED-3.1-a	Identify a training coordinator by Jun. 30, 2017 (DTD).	• Date training coordinator identified by DTD.
ED-3.1-b	Identify a training coordinator by Jun. 30, 2017 (WES).	• Date training coordinator identified by WES.
ED-3.1-c	Identify a training coordinator by Jun. 30, 2017 (HV).	• Date training coordinator identified by Happy Valley.
ED-3.2-a	Each year determine training needs by Feb. 1.	• Date training needs were identified each year.

Element D: Education and Outreach
BMP: ED-4 Public Education Effectiveness Evaluation

ID	MEASURABLE GOALS	TRACKING MEASURES
ED-3.3-a	Within six months of hire or transfer into new position, provide at least one type of stormwater-related training to 90% of new/transferred Plan Participant employees with stormwater-related duties. (WES, DTD, Happy Valley)	- Running total of new/transferred Plan Participant employees who received at least one stormwater-related training within six months of hire/transfer. - Running total of new and transferred Plan Participant employees with stormwater-related duties. - Percentage of new/transferred Plan Participant employees who received at least one stormwater-related training within six months of hire/transfer.
ED-3.3-b	Provide either Hazmat Operations + Awareness Training or equivalent spill prevention and control training to an average of 50% of Plan Participant employees whose duties include responding to spills or illicit discharges each per year. (WES, DTD, Happy Valley)	- Annual number of Plan Participant employees receiving specified training. - Annual number of Plan Participant employees with spill response or illicit discharge response duties. - Percentage of identified Plan Participant employees receiving specified training.
ED-3.3-c	Hold at least five internal trainings for Plan Participant employees on any stormwater topic listed in BMP-3.2 during the MS4 Permit term. (Employee trainings required by other BMPs may contribute to meeting this requirement.)	Running total of internal trainings held on stormwater topics.

ED-4 Public Education Effectiveness Evaluation

Purpose

The purpose of this BMP is to assess public education activities and provide information to assist with the adaptive management of the education and outreach program.

Geography

✓	CCSD#1-UGB, including Happy Valley
✓	SWMACC, including Rivergrove
	County-maintained ROW
	Municipal Facilities in permitted area

General Responsibility

✓	WES
	Happy Valley
	Clackamas County DTD
	Other Clackamas County department
	Rivergrove
✓	OLWS (see OLWS SWMP)

Background

The 2012-2017 MS4 Permit required the co-permittees to conduct a Public Education Effectiveness Evaluation (evaluation) to measure the success of public education activities.

WES published the *Clackamas County Water Environment Services Public Education Effectiveness Evaluation* dated Jun. 30, 2015 on behalf CCSD#1 and SWMACC. The evaluation summarized WES' public education and outreach activities and evaluated the effectiveness of one of these programs: the Watershed Health Education Program (WHEP).

Element D: Education and Outreach
BMP: ED-5 Erosion Control Outreach

Detailed Description

ED-4.1 – PUBLIC EDUCATION EFFECTIVENESS EVALUATION

TYPE: ONE-TIME

STATUS: FUTURE

During the MS4 Permit term, WES will evaluate one or more of the public education and outreach activities as documented in the Stormwater Public Education and Outreach Strategy (see ED-1). The evaluation will be published on the WES website, and WES will use it to adaptively manage the education and outreach activities.

ED-4 Measurable Goals and Tracking Measures

ID	MEASURABLE GOALS	TRACKING MEASURES
ED-4.1-a	Assess the effectiveness of one outreach activity or program during the MS4 Permit term	• Date effectiveness evaluation completed.
ED-4.1-b	Document adaptive management actions resulting from effectiveness evaluation once during the MS4 Permit term.	• Date adaptive management documented.

ED-5 Erosion Control Outreach

Purpose

The purpose of this BMP is to assist construction site operators to effectively prevent and control release of sediment and other pollutants from construction sites.

Geography

✓	CCSD#1-UGB, including Happy Valley
✓	SWMACC, including Rivergrove
✓	County-maintained ROW
✓	Municipal Facilities in permitted area

General Responsibility

✓	WES
✓	Happy Valley
✓	Clackamas County DTD
	Other Clackamas County department
	Rivergrove
✓	OLWS (see OLWS SWMP)

Background

Plan Participants publish and make available the *Erosion Prevention and Sediment Control Planning and Design Manual* (EPSC Manual). The manual includes design details, which are also available in AutoCAD file format on WES' website. The EPSC Manual is at <http://www.clackamas.us/wes/designmanual.html>, and the details are at <http://www.clackamas.us/wes/1200docs.html>.

Erosion control education and training for construction site operators is voluntary. Plan Participants offer guidance and information.

Detailed Description

ED-5.1 – EROSION CONTROL OUTREACH

TYPE: ONGOING

STATUS: ONGOING

Plan Participants will continue to offer the EPSC Manual on their websites.

Plan Participants will also offer information on their websites and in their permit lobbies about state NPDES construction site discharge permits (1200-C and 1200-CN), which are required by DEQ for some construction sites.

Happy Valley and WES will offer specific EPSC advice during pre-construction meetings for subdivision, partition, and commercial/industrial construction projects, as well as for their own CIPs. DTD will provide information about EPSC requirements at pre-construction meetings for County CIPs.

WES will maintain a list of local and regional training opportunities for construction site erosion control and pollution prevention. WES will distribute the list to other Plan Participants. All Plan Participants will post the list to their websites.

ED-5 Responsibilities for Erosion Control Outreach

Responsibilities Matrix	WES Development Review	DTD Permit Lobby	Happy Valley Building Division	Happy Valley Engineering Division	DTD Transportation Construction
Offer <i>Erosion Prevention and Sediment Control Planning and Design Manual</i> on website	P	P	P		
Offer EPSC brochures, flyers, and 1200-C info in permit lobbies	P	P	P		
Annually update EPSC training opportunities list	P	C/S	C/S		
Publish EPSC training opportunities list on websites		P	P		
Provide EPSC information at pre-construction meetings	P	S		P	P

P = Performs Task, C = Consulted, S = Supports, I = Informed

ED-5 Measurable Goals and Tracking Measures

ID	MEASURABLE GOALS	TRACKING MEASURES
ED-5.1-a	Each year, verify that the <i>Erosion Prevention and Sediment Control Planning and Design Manual</i> and AutoCAD details are on WES' website.	Date(s) web links were verified.
ED-5.1-b	Update and distribute the list of local and regional EPSC training opportunities each year.	Date each year list was sent to DTD and Happy Valley

ED-6 Private Stormwater Facility Operations and Maintenance Outreach

Purpose

The purpose of this BMP is to reduce pollutant discharge to the MS4 from private stormwater management facilities by providing educational information to the owners and operators of the facilities.

Private stormwater facilities serve industrial properties, commercial properties, churches and other religious institutions, multi-family residential properties (apartment complexes), and subdivisions. When developed, many of these properties were required to construct pollutant removal, infiltration/retention, and flow control facilities designed to mitigate the impact of increased stormwater and pollutant runoff from impervious surfaces. Proper maintenance of these facilities prevents stormwater runoff and pollutants in excess of design limits from entering the MS4 and discharging to receiving waters.

Geography

✓	CCSD#1-UGB, including Happy Valley
✓	SWMACC, including Rivergrove
	County-maintained ROW
	Municipal Facilities in permitted area

General Responsibility

✓	WES
	Happy Valley
	Clackamas County DTD
	Other Clackamas County department
	Rivergrove
	OLWS (see OLWS SWMP)

Background

Owners and operators of private stormwater facilities serving industrial, commercial, churches and other religious institutions, multi-family residential properties, and subdivisions are obligated to inspect and maintain their facilities. Many of these private operators have signed stormwater facility maintenance agreements with CCSD#1 and SWMACC describing these obligations. WES currently offers minimal guidance to private facility owners on the operation and maintenance of their facilities. Some guidance is provided in the Storm Drain Cleaning Assistance Program (SCAP) mailers (see MAINT-7.1).

Private stormwater facility maintenance handouts will be based on the maintenance criteria and inspection schedule developed in BMP MAINT-3.

BMP Organization

This BMP consists of two sub-components. Both will be one-time activities.

Detailed Description

ED-6.1 – PRIVATE STORMWATER FACILITY MAINTENANCE HANDOUTS

TYPE: ONE-TIME

STATUS: FUTURE

WES will create private stormwater facility maintenance handouts to guide operators of private stormwater facilities. Handouts will describe

DTD RCSW conducts conservation and sustainability business outreach this program will also distribute stormwater maintenance brochures.

Element D: Education and Outreach
BMP: ED-6 Private Stormwater Facility Operations and Maintenance Outreach

an inspection schedule and maintenance tasks based on the Plan Participants' maintenance criteria and inspection schedule (see MAINT-3). Handouts will be posted to Plan Participants' websites, advertised with SCAP notices, and handed out during private stormwater facility inspections (see MAINT-7).

ED-6.2 – MAINTENANCE WORKSHOP

TYPE: ONE-TIME

STATUS: FUTURE

During the MS4 Permit term, WES will hold one maintenance workshop for the owners and operators of private stormwater facilities to provide information on the private stormwater facility inspection schedule and maintenance criteria. WES will invite operators through the SCAP program notices (see MAINT-7.1) or other outreach.

ED-6 Responsibilities for Private Stormwater Facility Maintenance Operations and Maintenance Outreach

Responsibilities Matrix	WES Watershed Protection	WES Community Relations	WES Field Operations	DTD Resource Conservation and Solid Waste
Prepare stormwater facility maintenance handouts	P	S	C	
Post handouts to website		P		
Distribute handouts during voluntary inspections			P	P
Include links to handouts in SCAP notices	P	I		
Hold maintenance workshop	P	I		

P = Performs Task, C = Consulted, S = Supports, I = Informed

ED-6 Measurable Goals and Tracking Measures

ID	MEASURABLE GOALS	TRACKING MEASURES
ED-6.1-a	Create private stormwater facility maintenance handouts by Dec. 31 2018.	Date handouts created.
ED-6.2-a	Hold one maintenance workshop during the MS4 Permit term.	- Date of workshop. - Number of owner/operators invited to workshop. - Number of attendees at workshop.

Element D: Education and Outreach

BMP: ED-6 Private Stormwater Facility Operations and Maintenance Outreach

This page concludes Education
and Outreach.

E. Public Participation

Regulatory Overview

The MS4 Permit Schedule A.4.e requires the Plan Participants to give the public opportunities to participate in the development, implementation, and modification of their stormwater management programs. The Plan Participants must receive and consider public comments on the Shared SWMP and development of Total Maximum Daily Load (TMDL) pollutant load reduction benchmarks, annual reports, and other documents.

Requirements Summary for Public Participation	
	BMP
	PP-I Public Participation
The full text of Schedule A.4.e may be found in the MS4 Permit.	
i. Co-permittees must implement a public participation approach that provides opportunities for the public to effectively participate in the development, implementation, and modification of the co-permittee's stormwater management program. The approach must include provisions for receiving and considering public comments on the monitoring plan, annual reports, SWMP revisions, and the TMDL pollutant load reduction benchmark development.	■

BMPs

PP-I Public Participation

Purpose

The purpose of the BMP is to include residents, property owners, developers, and other stakeholders affected by the Shared SWMP in the decisions that will affect them. By engaging stakeholders in the process, the Plan Participants hope to draw on stakeholders' experiences to inform decisions and build support for the plan's activities.

Geography

✓	CCSD#1CCSD#1-UGB, including Happy Valley
✓	SWMACC, including Rivergrove
✓	County-maintained ROW
	Municipal Facilities in permitted area

General Responsibility

✓	WES
✓	Happy Valley
✓	Clackamas County DTD
	Other Clackamas County department
✓	Rivergrove
✓	OLWS (see OLWS SWMP)

Background

Each Plan Participant provides opportunities for the public to participate in the development of the stormwater management program. During the 2012-2017 MS4 Permit term, the Plan Participants each posted their draft SWMPs on their websites and provided the public a minimum 30 day period to comment. Each year, the Plan Participants have also published MS4 Permit Annual Reports.

Before each term of the MS4 Permit expires, Plan Participants are required to submit a renewal application to DEQ. On Jan. 20, 2017 WES published the following draft components of an MS4 Permit renewal package for the Plan Participants to its website for a 31-day comment period:

- The draft Shared SWMP;
- The Plan Participants' latest MS4 Permit Annual Reports; and
- A summary of the TMDL pollutant load reduction benchmarks.

Detailed Description

PP-1.1 – PUBLIC PARTICIPATION

TYPE: ONGOING

STATUS: ONGOING

WES will lead the public participation outreach for the Shared SWMP, and the Plan Participants will each provide information about it through their normal public communications channels. The Plan Participants will use digital and print communications as well as events to give the public opportunities to participate in the development of the Shared SWMP.

During the MS4 Permit term, the Plan Participants will post the Shared SWMP on their websites. The final Shared SWMP, or the most current Shared SWMP if any updates are made, will be available throughout the MS4 Permit term. Plan Participants will also publish the most recent MS4 Permit Annual Report on their websites each year.

During the MS4 Permit term, the Plan Participants will provide opportunities for public participation by publishing draft documents for public comment. WES will offer an opt-in email list for notifications about opportunities to participate in the development, implementation, and modification of the stormwater management program.

Plan Participants will provide other opportunities for the public to participate in the development, implementation, and modification of the stormwater management program. Other opportunities will include:

- CCSD#1 RiverHealth Advisory Board meetings
- Ad hoc and task force advisory committee meetings for specific plan activities
- Budget committees
- Development-related committees (e.g. Clackamas County Development Liaison Committee)

PP-1 Responsibilities for Public Participation

Responsibilities Matrix	WES Watershed Protection	WES Community Relations	DTD Community Relations	Happy Valley Public Works	Rivergrove City Manager
Post MS4 Permit renewal documents to website		P	P	P	P
Collect public comments on MS4 Permit renewal and SWMP update	P	I			
Review and respond to public comments	P	C/S			
Attend RiverHealth Advisory Board meetings	P			P	
Attend other events	P	P	S	S	S
Post MS4 Annual Report to website		P	P	P	P

P = Performs Task, C = Consulted, S = Supports, I = Informed

PP-1 Measurable Goals and Tracking Measures

ID	MEASURABLE GOALS	TRACKING MEASURES
PP-1.1-a	Post MS4 Permit renewal documents to WES website by Mar. 1, 2017.	Date documents posted.
PP-1.1-b	Review and document 100% of public comments on MS4 Permit renewals and SWMP update and summary of TMDL benchmarks prior to Jun. 1, 2017.	- Number of public comments reviewed and documented by Jun. 1, 2017. - Number of public comments received. - Percentage of public comments reviewed and documented by Jun. 1, 2017.
PP-1.1-c	Post MS4 Annual Report to each Plan Participant's website by Nov. 5 each year.	Date(s) MS4 Annual Report posted to each Plan Participant's website each year.

This page concludes Public
Participation.

F. Post-Construction Site Runoff

Regulatory Overview

The MS4 Permit Schedule A.4.f requires Plan Participants to implement a program to control pollutants and runoff from new development and redevelopment projects that create or replace impervious surfaces.

The program must include ordinances and regulations to require stormwater management controls to remain permanently on the development site to control and cleanse site runoff after the construction phase is completed (post-construction site runoff). It must also include design standards, procedures for plan review, and enforcement. The MS4 Permit requires Plan Participants to develop and enforce standards for on-site retention; post-development runoff volume, duration, and rates of discharge; and water quality treatment.

Requirements Summary for Post-Construction Site Runoff					
	BMPs				
	POST-1 Post-Construction Legal Authority	POST-2 Stormwater Management Plan (SWM Plan) Review	POST-3 Post-Construction Verification and Acceptance	POST-4 Stormwater Standards and Design Tools	POST-5 LID Barriers Analysis
The full text of Schedule A.4.f may be found in the MS4 Permit.					
i. Implement a post-construction runoff control program to: 1) target pre-development hydrologic functions and optimize retention on-site, 2) reduce runoff volume, duration, and rates, 3) prioritize Low-Impact Development (LID), and 4) capture and treat 80% of the annual average runoff volume.	■			■	
ii. Minimize or eliminate code barriers to LID design techniques that minimize impervious surfaces and reduce stormwater runoff.					■
iii. Develop a post-construction stormwater quality management manual or equivalent document that includes thresholds, water quality design storm, LID runoff reduction, LID applicability, BMPs, and pollutant removal efficiency goals.				■	
iv. Review, approve, and verify post-construction site plans and controls.		■	■		

Requirements Summary for Post-Construction Site Runoff					
	BMPs				
	POST-1 Post-Construction Legal Authority	POST-2 Stormwater Management Plan (SWM Plan) Review	POST-3 Post-Construction Verification and Acceptance	POST-4 Stormwater Standards and Design Tools	POST-5 LID Barriers Analysis
The full text of Schedule A.4.f may be found in the MS4 Permit.					
v. Require equivalent pollutant reduction measures when on-site stormwater management is limited due to site conditions.	■	■			
vi. Describe inspection and enforcement procedures.			■		

BMPs

POST-1 Post-Construction Legal Authority

Purpose

The purpose of this BMP is to establish and maintain the Plan Participants' legal authority to require post-construction stormwater controls on both public and private property. New development and redevelopment can have a significant effect on receiving water bodies by increasing stormwater runoff and increasing the type and quantity of pollutants in stormwater runoff including sediment, oil, pesticides, heavy metals, and nutrients. Effective post-construction stormwater controls can reduce the negative impacts of development by reducing the increase in runoff, removing pollutants, and retaining stormwater on site. This BMP addresses the negative impacts of development by providing the legal authority to require post-construction stormwater controls, review plans, and inspect controls for proper construction and function prior to site occupation.

Geography

✓	CCSD#1-UGB, including Happy Valley
✓	SWMACC, including Rivergrove
✓	County-maintained ROW
	Municipal Facilities in permitted area

General Responsibility

✓	WES
	Happy Valley
✓	Clackamas County DTD
	Other Clackamas County department
	Rivergrove
✓	OLWS (see OLWS SWMP)

Background

The elected officials of CCSD#1 and SWMACC adopt the policies, rules, and regulations that require development and redevelopment sites in the districts to provide post-construction stormwater management controls. DTD adopts the policies that require County road improvement projects to provide post-construction stormwater management controls.

CCSD#1

CCSD#1 Rules and Regulations require post-construction stormwater standards to be met by all developments and redevelopments in the district that add or replace 5,000 square feet or more of impervious surface. Stormwater management requirements include on-site flow control, water quality treatment, infiltration, and conveyance to reduce and minimize the impacts of stormwater runoff.

Rules require submittal of a stormwater management plan (SWM plan) for review and approval, inspection of post-construction stormwater management facilities, and ongoing maintenance of stormwater facilities.

WES also administratively adopts the *CCSD#1 Stormwater Standards*, which contain specific performance standards and design criteria for the required stormwater management facilities.

SWMACC

SWMACC Rules and Regulations require post-construction stormwater standards to be met by all developments and redevelopments in the district that add or replace 5,000 square feet or more of impervious surface. Requirements include on-site flow control, water quality treatment, infiltration, and conveyance to reduce and minimize the impacts of stormwater runoff.

Rules require submittal of a SWM Plan for review and approval, inspection of post-construction stormwater management facilities, and ongoing maintenance of stormwater facilities.

SWMACC Rules and Regulations establish enforcement authority to verify construction, performance standards, and perpetual maintenance of stormwater facilities.

County CIPs

County CIPs often are designed and constructed using DTD personnel or professional services contracts and construction bid contracts.

DTD incorporates post-construction stormwater design standards for CIPs into its contracts. Projects within the permitted area that add or replace 5,000 square feet of impervious area must be designed in accordance with *CCSD#1 Stormwater Standards*, *SWMACC Rules and Regulations*, or an equivalent.

Detailed Description

POST-1.1 – REVIEW AND UPDATE LEGAL AUTHORITY

TYPE: ONE-TIME

STATUS: FUTURE

Element F: Post-Construction Site Runoff

BMP: POST-2 Stormwater Management Plan (SWM Plan) Review

Plan Participants will review legal authority to require stormwater management facilities and controls on development and redevelopment sites one time during the MS4 Permit term.

Plan Participants also will review and update rules and regulations to consider improving the standards. Improvements to standards could include lowering the thresholds when post-construction controls are required, establishing a specific performance standard for reducing stormwater discharge volumes, and requiring other BMPs to reduce levels of pollution discharged to the MS4.

There is no responsibilities matrix for this BMP.

POST-1 Measurable Goals and Tracking Measures

ID	MEASURABLE GOALS	TRACKING MEASURES
POST-1.1-a	Review and update legal authority of CCSD#1 and SWMACC once during the MS4 Permit term.	• Date(s) legal authority of CCSD#1 and SWMACC were reviewed. • Date legal authority updated, if necessary.
POST-1.1-b	By Dec. 31, 2018, review, and update if necessary, DTD's boilerplate contract terms to ensure SWM plans meeting the standards of CCSD#1 or an equivalent are required by professional services contracts for CIP design.	• Date legal authority reviewed. • Date legal authority updated, if necessary.

POST-2 Stormwater Management Plan (SWM Plan) Review

Purpose

The purpose of this BMP is to control the amount of runoff and pollutants entering receiving waters after construction of new developments and redevelopments. Plan Participants review and approve stormwater management plans proposed by applicants to ensure post-construction runoff control measures conform to design standards for pollutant removal, infiltration/retention, and flow control. Documented review, approval, and inspection procedures allow Plan Participants to apply standards consistently when determining the stormwater management requirements for development and redevelopment projects.

Geography

✓	CCSD#1-UGB, including Happy Valley
✓	SWMACC, including Rivergrove
✓	County-maintained ROW
	Municipal Facilities in permitted area

General Responsibility

✓	WES
✓	Happy Valley
✓	Clackamas County DTD
	Other Clackamas County department
	Rivergrove
✓	OLWS (see OLWS SWMP)

Background

WES reviews and approves the SWM plans of those development and redevelopment projects that meet the minimum threshold for impervious surface creation. SWM plan review is one component of the larger development review process, which includes pre-application meetings, land use, site

planning, engineering, building permit review, and inspections. Consequently, SWM plan review requires extensive coordination and routing between Plan Participants and departments.

For private development and redevelopment projects, WES provides the technical review of the on-site SWM plans, while DTD and Happy Valley participate within their respective jurisdictions by accepting land use and building permit applications, routing application materials to WES, and coordinating with the applicants.

For Plan Participants' CIPs, WES coordinates with the Plan Participant's capital improvement workgroups.

WES reviews and approves SWM plans in accordance with the *WES Stormwater Management Development Guide* to ensure conformance with the applicable adopted standards.

BMP Organization

Procedures for plan review and approval vary by location of the development proposal and by type of project. POST-2.1 describes procedures for County CIPs, POST-2.2 describes procedures for Single Family Residences, and POST-2.3 describes procedures for projects that require land use approval.

Detailed Description

POST-2.1 – SWM PLAN REVIEW FOR TRANSPORTATION CIPs

TYPE: ONGOING

STATUS: ONGOING

For the Plan Participants' CIPs within the districts, WES will review and approve SWM plans and enforce the *CCSD#1 Stormwater Standards* or the *SWMACC Rules and Regulations*, depending on the site location.

On County ROW in the permitted area outside of the districts (e.g. in OLWS, Oregon City, Milwaukie, or another co-permittee city), DTD will design CIPs using the *Clackamas County Roadway Standards*, which includes stormwater standards similar to those in CCSD#1. DTD will submit the SWM plan for any CIP in the permitted area to the appropriate co-permittee with authority to review and approve it. DTD as a Plan Participant and co-permittee is responsible for ensuring compliance with MS4 Permit requirements within other jurisdictions in the permitted area.

For Happy Valley CIPs, Happy Valley Engineering Division will design projects using the *CCSD#1 Stormwater Standards*.

POST-2.1 Responsibilities for Post-Construction SWM Plan Review – Transportation CIPs

Responsibilities Matrix	DTD Transportation Construction or Happy Valley Engineering <i>Depends on Site Location</i>	WES Development Review or Other Co-Permittee● <i>Depends on Site Location</i>
Prepare CIP SWM plan per applicable design standard	P	

Element F: Post-Construction Site Runoff

BMP: POST-2 Stormwater Management Plan (SWM Plan) Review

Responsibilities Matrix	DTD Transportation Construction or Happy Valley Engineering <i>Depends on Site Location</i>	WES Development Review or Other Co-Permittee ^❶ <i>Depends on Site Location</i>
Submit plan for review and approval (to applicable authority)	P	C
Review submitted SWM plan	C	P
Return comments and approval	I	P
SWM plan revisions (if necessary)	P	I
Approve SWM plan	I	P

P = Performs Task, C = Consulted, S = Supports, I = Informed

❶ Other co-permittees do not participate in this Plan and are not required to comply with it. Plan Participants are not responsible for the actions of other co-permittees. Information is provided for the reader's convenience.

POST-2.2 – SWM PLAN REVIEW FOR SINGLE-FAMILY BUILDING PERMITS

TYPE: ONGOING

STATUS: ONGOING

For SFR building permits, WES will review the SFR SWM plan while the building permit is under review by the pertinent building department – either DTD or Happy Valley. The building department will wait for WES' approval of the SFR SWM plan before issuing the building permit.

POST-2.2 Responsibilities for SFR SWM Plan Review

Responsibilities Matrix	DTD Permit Counter or Happy Valley Building Division <i>Building Authority Depends on Site Location</i>	WES Development Review	Applicant ^❶
Submit building permit application	I		P
Building permit application intake	P		
Determine if site location may be in CCSD#1 or SWMACC	P		
Route application to WES	P	I	
<i>Initiate SFR EPSC Plan Review (see EPSC-2.3)</i>		P	
Review SFR SWM plan		P	
Notify building department of WES' approval	I	P	
Issue building permit	P	I	I
<i>Initiate Post-construction Verification and Acceptance (see POST-3)</i>		P	

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❶ These entities do not participate in this Plan and are not required to comply with it. Plan Participants are not responsible for the actions of these entities. Information is provided for the reader's convenience.

Element F: Post-Construction Site Runoff
BMP: POST-2 Stormwater Management Plan (SWM Plan) Review

POST-2.3 – SWM PLAN REVIEW FOR LAND USE APPLICATIONS

TYPE: ONGOING

STATUS: ONGOING

For any development that requires a land use application, the coordination of SWM plan review will be initiated by the appropriate planning department and will conclude with approval of the SWM construction plans and issuance of applicable permits.

Applicants will submit land use applications and plans to the pertinent land use authority, either Happy Valley Planning Division or DTD Planning, and WES will review the stormwater management aspects of the plans. WES will provide the planning department conditions of approval and comments for incorporation into the land use decision. After receiving a land use decision, applicants may submit stamped engineered construction plans for review and approval directly to WES.

Two responsibilities matrices are shown below – one for commercial sites and one for subdivisions/partitions. For the purposes of this BMP, a commercial development site includes multi-family and non-residential land uses (e.g. commercial, industrial, religious, etc.).

POST-2.3 Responsibilities for Commercial Site SWM Plan Review

Responsibilities Matrix		WES Dev Review	DTD Planning or Happy Valley Planning <i>Depends on Site Location</i>	DTD Engineering or Happy Valley Planning <i>Depends on Site Location</i>	Applicant ^❶
Pre-App ^❷	Submit plans and request pre-application meeting		I		P
	Schedule pre-application meeting and invite stakeholders	I	P		I
	Attend pre-app meeting; share stormwater requirements	P	P		P
Land Use Review	Submit preliminary SWM plan with land-use application	I	I		P
	Review feasibility of stormwater proposal (uninc. only)	P	I		I
	Submit land use application		I		P
	Route land use application for comments and conditions	I	P		
	Review application and recommend conditions of approval to Planning	P	I		
	Approve or deny application and set final conditions of approval	I	P		I
Construction Plan Review ^❸	Submit SWM construction plans including EPSC plan <i>(this initiates EPSC Plan Review, EPSC-2)</i>	I		I	P
	Review and approve/deny SWM construction plans	P		C/I	C
	Sign off on building permit application	P		C/I	I
	<i>Initiate Post-construction Verification and Acceptance (BMP POST-3)</i>	P			

P = Performs Task, C = Consulted, S = Supports, I = Informed

❶ These entities do not participate in this Plan and are not required to comply with it. Plan Participants are not responsible for the actions of these entities. Information is provided for the reader's convenience.

❷ The pre-application process is optional for all applicants.

❸ Commercial building permits that do not need a land use approval begin the process here.

Element F: Post-Construction Site Runoff

BMP: POST-2 Stormwater Management Plan (SWM Plan) Review

POST-2.3 Responsibilities for Subdivision/Partition Stormwater Management Plan Review

Responsibilities Matrix		WES Development Review	DTD Planning or Happy Valley Planning <i>Planning Authority – Depends on Site Location</i>	DTD Engineering or Happy Valley Planning <i>Depends on Site Location</i>	Applicant ^①
Pre-App ^②	Submit plans and request pre-application meeting		I		P
	Schedule pre-application meeting and invite stakeholders	I	P		I
	Attend pre-app meeting; share stormwater requirements	P	P		P
Land Use Review	Submit preliminary SWM plan with land-use application	I	I		P
	Review feasibility of stormwater proposal (unincorporated County only)	P	I		I
	Submit land use application		I		P
	Route land use application for comments and conditions	I	P		
	Review application and recommend conditions of approval to Planning	P	I		
	Approve or deny application and set final conditions of approval	I	P		I
Construction Plan Review	Submit SWM construction plans including EPSC plan (<i>this initiates EPSC Plan Review, EPSC-2</i>)	I		I	P
	Review and approve/deny SWM construction plans	P	I	C/I	
	Hold pre-construction meeting (stamp SWM construction plans at meeting)	C	P		S
	Submit plat and maintenance agreement for review and approval			I	P
	Route plat to WES	I		P	
	Sign off on applicable site development permits	P		C/I	I
	<i>Initiate Post-construction Verification and Acceptance (see POST-3)</i>	P			

P = Performs Task, C = Consulted, S = Supports, I = Informed

① These entities do not participate in this Plan and are not required to comply with it. Plan Participants are not responsible for the actions of these entities. Information is provided for the reader's convenience.

② The pre-application process is optional for all applicants.

Element F: Post-Construction Site Runoff
BMP: POST-3 Post-Construction Verification and Acceptance

POST-2 Measurable Goals and Tracking Measures

ID	MEASUREABLE GOAL	TRACKING MEASURE
POST-2.1-a	Submit 100% of County CIP SWM plans that meet the minimum impervious surface threshold within CCSD#1 and SWMACC to WES each year. (DTD)	- Annual number of CIP SWM plans submitted to WES by DTD for review and approval. - Annual number of County CIPs that meet the minimum impervious surface threshold approved for construction within CCSD#1 and SWMACC. - Annual percentage of CIP SWM plans submitted to WES by DTD for review and approval.
POST-2.2-a	Review 100% of SFR SWM plans received prior to signing off on building permit each year. (WES)	- Annual number of SFR SWM plans reviewed by WES prior to signing off on building permit. - Annual number of SFR building permit applications referred to WES. - Annual percentage of SFR SWM plans reviewed by WES prior to signing off on building permit.
POST-2.3-a	Attend 100% of pre-application meetings for land use applications in Happy Valley and in SWMACC and unincorporated CCSD#1 each year. (WES)	- Annual number of pre-application meetings attended by WES. - Annual number of pre-application meetings held for applicants in SWMACC and unincorporated CCSD#1. (DTD) - Annual number of pre-application meetings held for applicants in Happy Valley. (Happy Valley) - Annual percentage of pre-application meetings attended by WES.
POST-2.3-b	Review and approve 100% of non-SFR SWM plans for projects that meet the minimum impervious threshold each year. (WES)	- Annual number of non-SFR SWM plans approved by WES. - Annual number of non-SFR stormwater management plans submitted to WES. - Annual percentage of non-SFR SWM plans approved by WES.
POST-2.3-c	Each year, 100% of non-SFR projects' approved SWM plans comply fully without requiring a modification of the applicable stormwater design standards. (WES)	- Annual number of non-SFR projects approved without receiving a modification related to stormwater design. - Annual number of non-SFR SWM plans reviewed and approved by WES. - Annual percentage of non-SFR projects approved without receiving a modification related to stormwater design.

POST-3 Post-Construction Verification and Acceptance

Purpose

The purpose of this BMP is to ensure post-construction stormwater controls will function as intended prior to approving construction for occupancy. This BMP documents the inspection and enforcement procedures Plan Participants follow to verify stormwater controls are constructed in conformance with the approved SWM plans and to assure ongoing operations and maintenance.

Element F: Post-Construction Site Runoff

BMP: POST-3 Post-Construction Verification and Acceptance

Geography

✓	CCSD#1-UGB, including Happy Valley
✓	SWMACC, including Rivergrove
✓	County-maintained ROW
	Municipal Facilities in permitted area

General Responsibility

✓	WES
✓	Happy Valley
✓	Clackamas County DTD
	Other Clackamas County department
	Rivergrove
✓	OLWS (see OLWS SWMP)

Background

This BMP is initiated when construction begins on a site with an approved SWM plan. Post-construction verification and acceptance is one component of a larger process for ensuring the safety and acceptability of public and private stormwater management improvements. Consequently, this process requires coordination and routing between Plan Participants and departments.

Through this process, Plan Participants verify the following for each project:

- The stormwater management system was constructed in accordance with the *CCSD#1 Stormwater Standards* or the *SWMACC Rules and Regulations*;
- The stormwater management facilities have the full design volume;
- The flow control devices/facilities were constructed in accordance with approved plans and function as designed;
- The on-site storm sewer system is properly connected to the MS4; and
- Ongoing operation and maintenance of the stormwater facilities is assured (see below for detailed discussion of verifying ongoing operations).

Assuring Ongoing Operation and Maintenance of Privately-Owned and Operated Systems

Plan Participants must assure long-term operation and maintenance of post-construction stormwater management facilities. Facilities that will be privately owned and operated must submit a maintenance plan and other legal assurances as described below.

Single-family residential subdivisions and partitions with private storm systems are required record the annual maintenance obligation or a maintenance agreement in a covenant or easement with the County Clerk. Often, these sites elect to form a Homeowners Association to manage stormwater facility maintenance.

Privately-owned and operated storm systems on multi-family and non-residential sites are required to sign a private maintenance agreement to annually inspect, maintain, and clean the storm system.

See BMPs MAINT-4 and MAINT-7 for ongoing maintenance requirements, implementation, and enforcement.

Assuring Ongoing Operation and Maintenance of Publicly-Operated Systems

WES offers the Residential Maintenance Agreement Program¹ to ensure perpetual maintenance of the stormwater facilities for single-family residential subdivisions and partitions. Through this program, WES maintains a residential subdivision's stormwater systems in exchange for a monthly service fee. In these cases, WES must first agree to accept the facility for public maintenance and operation.

Detailed Description

POST-3.1 – VERIFY SINGLE-FAMILY RESIDENTIAL BUILDING SITE STORMWATER SYSTEMS

TYPE: ONGOING

STATUS: ONGOING

On a SFR building site, a plumbing inspector from the pertinent building department – either DTD or Happy Valley – will inspect the site's approved point of connection to the public or private storm sewer.

POST-3.1 Responsibilities for Verifying and Accepting Stormwater Systems on SFR Building Sites

Responsibilities Matrix	WES Development Review	DTD Building Department or Happy Valley Building Division <i>Building Authority – Depends on Site Location</i>	Applicant ^①
<i>Applicant constructs project</i>			P
Sanitary and storm service connection inspection (plumbing inspection) <i>(coordinate with final EPSC Inspection, see EPSC-3)</i>	I	P	C
Submit plumbing inspection report to WES	I	P	I
Finalize permit and file customer account	P		

P = Performs Task, C = Consulted, S = Supports, I = Informed

① These entities do not participate in this Plan and are not required to comply with it. Plan Participants are not responsible for the actions of these entities. Information is provided for the reader's convenience.

POST-3.2 – VERIFY SUBDIVISION/PARTITION STORMWATER SYSTEMS

TYPE: ONGOING

STATUS: ONGOING

On a subdivisions or partition, WES will inspect, verify, and accept the stormwater management facilities and the site's connection to the MS4.

¹ Within the districts, Plan Participants assure ongoing maintenance of public stormwater facilities serving the Plan Participants' CIPs by conveying the responsibility to WES to maintain and operate the facilities.

Element F: Post-Construction Site Runoff

BMP: POST-3 Post-Construction Verification and Acceptance

The applicant's engineer will be required to submit a stamped certificate of completion to certify:

- The stormwater management system was constructed in accordance with the *CCSD#1 Stormwater Standards* or the *SWMACC Rules and Regulations*;
- The stormwater management facilities have the full design volume; and
- The flow control devices/facilities were constructed in accordance with the approved plans and function as designed.

The engineer of record will be required to submit as-built drawings, and the applicant will be required to provide for long-term operation and maintenance of the stormwater facilities. For single-family subdivisions, most applicants will elect to enroll the subdivision in WES' Residential Maintenance Agreement Program to provide for long-term operation and maintenance.

POST-3.2 Responsibilities for Verifying and Accepting Stormwater Systems on Subdivisions and Partitions

Responsibilities Matrix	WES Development Review	WES Information Management	DTD Engineering or Happy Valley Planning <i>Authority – Depends on Site Location</i>	Applicant / Applicant's Engineer ^❶
<i>Constructs subdivision / partition</i>				P
conduct field construction inspections	I		I	P
Submit completion certificate, as-builts, test results, service connection drawings, and maintenance agreement	I		I	P
Final SWM construction site inspection <i>(coordinate with final EPSC review EPSC-2)</i>	P		C	C
Submit maintenance agreement	I		P	I
Submit stormwater improvement warranty bond	I		I	P
Approve the recording of the Plat,	P		I	
Send acceptance letter to applicant (storm, sanitary)	P		I	I
Route as-builts to WES Information Management	P	I		
<i>Initiate inventory and mapping of facilities (see MAINT-2)</i>		P		
Inspect stormwater facilities prior to warranty bond release	P		I	C
Release stormwater improvement warranty bond	P	I	I	I

P = Performs Task, C = Consulted, S = Supports, I = Informed

❶ These entities do not participate in this Plan and are not required to comply with it. Plan Participants are not responsible for the actions of these entities. Information is provided for the reader's convenience.

POST-3.3 – VERIFY COMMERCIAL DEVELOPMENT STORMWATER SYSTEMS

TYPE: ONGOING

STATUS: ONGOING

On a commercial development site, WES will inspect and verify the stormwater management facilities and the site's connection to the MS4.

The applicant's engineer will be required to submit a stamped certificate of completion to certify the following:

- The stormwater management system was constructed in accordance with the *CCSD#1 Stormwater Standards* or the *SWMACC Rules and Regulations; and Standards*,
- The stormwater management facilities have the full design volume; and
- The flow control devices/facilities were constructed in accordance with the approved plans and function as designed.

The applicant will be required to submit as-built drawings and to sign and record an agreement to annually inspect, maintain, and clean the site's stormwater management devices/facilities. During the MS4 Permit term, WES may elect to begin requiring these multi-family and non-residential private maintenance agreements to be recorded in a covenant or easement with the County Clerk.

For the purposes of this BMP, a commercial development site includes multi-family and non-residential land uses (e.g. commercial, industrial, religious, etc.).

POST-3.3 Responsibilities for Verifying and Accepting Commercial Stormwater Systems

Responsibilities Matrix	WES Dev Review	WES Info Mgmt	DTD Engineering or Happy Valley Planning <i>Depends on Site Location</i>	DTD Building or Happy Valley Building <i>Depends on Site Location</i>	Applicant / Applicant's Engineer ^❶
<i>Constructs commercial development</i>					P
Conduct field construction inspections	I		I	I	P
Submit completion certificate, as-builts, test results, service connection drawings, and maintenance agreement	I		I		P
Final SWM site construction inspection <i>(coordinate with final EPSC Inspection see EPSC-s)</i>	P		C	C	C
Approve issuance of Temporary Certificate of Occupancy	P			I	
Submit final as-builts	I		I	I	P
Approves issuance of Certificate of Occupancy	I		I	P	I
Route as-builts to WES Info Management	P	I			
<i>Initiate inventory and mapping of facilities (see MAINT-2)</i>		P			
<i>Initiate regulated private facility inspections (see MAINT-7)</i>	P				I

P = Performs Task, C = Consulted, S = Supports, I = Informed

❶ These entities do not participate in this Plan and are not required to comply with it. Plan Participants are not responsible for the actions of these entities. Information is provided for the reader's convenience.

Element F: Post-Construction Site Runoff

BMP: POST-3 Post-Construction Verification and Acceptance

POST-3.4 – VERIFY PLAN PARTICIPANT CIPs' STORMWATER SYSTEMS

TYPE: ONGOING

STATUS: FUTURE

When a Plan Participant constructs a CIP in CCSD#1 or SWMACC, the Plan Participant will verify the function of the stormwater facilities. The Plan Participant's engineer will submit an inspection report and as-builts by e-mail to WES verifying the following:

- The stormwater management system was constructed in accordance with the *CCSD#1 Stormwater Standards* or the *SWMACC Rules and Regulations*;
- The stormwater management facilities have the full design volume; and
- The stormwater management flow control devices/facilities were constructed in accordance with approved plans and function as designed.

WES will inspect the facilities prior to accepting them for ongoing maintenance and operation.

POST-3.4 Responsibilities for Verifying and Accepting Stormwater Systems Serving Plan Participants' CIPs in CCSD#1 and SWMACC

Responsibilities Matrix	WES Development Review	WES Information Management	DTD Transportation Construction or WES Capital Projects or Happy Valley Engineering or Rivergrove <i>Depends on Plan Participant Constructing CIP</i>
Inspect CIP stormwater facilities			P
Submit inspection report and as-builts to WES	I		P
Perform site construction inspection of stormwater facilities	P		I
<i>Initiate inventory and mapping of stormwater facilities (MAINT-2)</i>	I	P	P
<i>Initiate public facility inspection and maintenance (MAINT-4)</i>	P		

P = Performs Task, C = Consulted, S = Supports, I = Informed

POST-3 Measurable Goals and Tracking Measures

ID	MEASURABLE GOALS	TRACKING MEASURES
POST-3.1-a	None	• None
POST-3.2-a	Perform final SWM construction site inspection on 100% of subdivision and partition sites in CCSD#1 and SWMACC each year.	• Annual number of final SWM construction site inspections performed on subdivision and partition development sites in CCSD#1 and SWMACC. • Annual number of subdivision and partition development sites that complete construction in CCSD#1 and SWMACC. • Annual percentage of final SWM construction site inspections performed on subdivision and partition development sites in CCSD#1 and SWMACC.

Element F: Post-Construction Site Runoff
BMP: POST-4 Stormwater Standards and Design Tools

ID	MEASURABLE GOALS	TRACKING MEASURES
POST-3.3-a	Perform final SWM construction site inspection on 100% of commercial development sites in CCSD#1 and SWMACC each year.	• Annual number of final SWM construction site inspections performed on commercial development sites in CCSD#1 and SWMACC. • Annual number of commercial development sites that complete construction in CCSD#1 and SWMACC. • Annual percentage of final SWM construction site inspections performed on commercial development sites in CCSD#1 and SWMACC.
POST-3.4-a	Inspect 100% of stormwater facilities for new County CIPs and new Happy Valley CIPs in the districts. (WES)	• Annual number of stormwater facility inspections of new County and Happy Valley CIPs performed by WES in CCSD#1 and SWMACC. • Annual number of County CIPs completing construction in CCSD#1 and SWMACC. • Annual number of Happy Valley CIPs completing construction. • Annual percentage of stormwater facility inspections of new County and Happy Valley CIPs.

POST-4 Stormwater Standards and Design Tools

Purpose

The purpose of this BMP is to aid site designers (usually engineers) in designing stormwater facilities that meet the districts' rules, regulations, and standards by providing a standards manual and other tools for meeting requirements.

Geography

✓	CCSD#1-UGB, including Happy Valley
✓	SWMACC, including Rivergrove
✓	County-maintained ROW
	Municipal Facilities in permitted area

General Responsibility

✓	WES
	Happy Valley
✓	Clackamas County DTD
	Other Clackamas County department
	Rivergrove
✓	OLWS (see OLWS SWMP)

Background

For CCSD#1, WES publishes and requires use of the *CCSD#1 Stormwater Standards* manual, which is used for all types of development activities such as private and public development projects and City and County transportation CIPs.

The *CCSD#1 Stormwater Standards*, last updated in 2013, requires and provides:

- Performance standards for SWM plans for sites creating or replacing 5,000 square feet or more of impervious surface;
- Capture and treatment of the 80th percentile design storm event;
- Infiltration of the first ½ inch of rainfall in 24 hours;

Element F: Post-Construction Site Runoff

BMP: POST-4 Stormwater Standards and Design Tools

- Onsite detention to reduce the rate and timing of stormwater runoff by matching the 2-year 24-hours post-developed runoff rate to ½ the 2-year 24-hour pre-developed runoff rate;
- BMPs, including design criteria;
- Conditions where BMPs apply based on drainage area and site conditions; and
- Standards for access roads to public and private stormwater facilities to support maintenance activities.

There is no administratively-adopted design manual for projects in SWMACC.

During the 2012-2017 MS4 Permit term, WES developed and published the BMP Sizing Tool, a simplified modeling application for sizing on-site stormwater facilities to mitigate the effects of stormwater runoff, and draft LID standards and details. WES stopped offering these tools for use near the end of the 2012-2017 MS4 Permit term.

BMP Organization

This BMP consists of three sub-components: POST-4.1 updates the stormwater standards design manual, POST-4.2 establishes an off-site water quality mitigation program, and POST-4.3 updates the BMP Sizing Tool.

Detailed Description

POST-4.1 – UPDATE STORMWATER STANDARDS DESIGN MANUAL

TYPE: ONE-TIME

STATUS: FUTURE

WES will review and update the *CCSD#1 Stormwater Standards*. The scope of the manual also will be expanded to apply to projects in SWMACC. An update to the *CCSD#1 Stormwater Standards* would be coordinated with an update to legal authority and requirements in the *CCSD#1 Rules and Regulations* and the *SWMACC Rules and Regulations* (see POST-1). Updates to the standards may include:

- Prioritizing LID or other techniques that address hydromodification for on-site stormwater management;
- Listing conditions where the use of LID may be infeasible;
- Listing accepted LID BMPs, and providing applicability, selection, and design criteria for them
- Adopting LID engineering details;
- Adopting LID and vegetated facility plant lists, plant material specifications, and planting guidelines; and
- Developing or referencing infiltration testing and reporting requirements.

WES will consult with Happy Valley Public Works and Happy Valley Engineering Division. WES will include outreach to the development and building community in this effort.

POST-4.1 Responsibilities for Updating the Stormwater Standards Design Manual

Responsibilities Matrix	WES Watershed Protection	WES Development Review	WES Community Relations	Happy Valley Public Works & Engineering
Coordinate update of standards manual with updates to <i>CCSD#1 Rules and Regulations</i> and <i>SWMACC Rules and Regulations</i> (see POST-1)	P	C	I	C
Develop LID infeasibility, applicability, selection, design, engineering details, and specifications	C/S	P		C
Develop infiltration testing and reporting requirements	C/S	P		C
Outreach to development and building community	S	S	P	S
Publish updated standards manual	S	P	S	I

P = Performs Task, C = Consulted, S = Supports, I = Informed

POST-4.2 – ESTABLISH OFF-SITE WATER QUALITY MITIGATION PROGRAM

TYPE: ONE-TIME

STATUS: FUTURE

WES will document a policy and establish a program to allow applicants to provide off-site equivalent pollutant reduction measures, as required by Schedule A.4.f.v, when on-site stormwater management is not feasible due to constrained site conditions. Examples of constraints include contaminated soils and poorly-drained soils.

An off-site mitigation program will provide a helpful tool to applicants with difficult sites. Off-site measures could include participating in LID demonstration projects, purchasing water quality mitigation bank credits, or paying a water quality, infiltration and/or detention in-lieu fee.

To understand the extent of the need for an off-site water quality mitigation program, WES will begin tracking development applications that have site constraints limiting the use of on-site BMPs.

POST-4.2 Responsibilities for Establishing an Off-site Water Quality Mitigation Program

Responsibilities Matrix	WES Watershed Protection	WES Development Review	WES Community Relations
Track development applications with site constraints limiting use of on-site BMPs	I	P	
Develop a policy for allowing equivalent mitigation to be provided off-site	C/S	P	
Establish program tracking measures for off-site mitigation		P	
Develop an in-lieu fee program	S	P	I
Publicize off-site mitigation program		S	P

P = Performs Task, C = Consulted, S = Supports, I = Informed

Element F: Post-Construction Site Runoff
BMP: POST-4 Stormwater Standards and Design Tools

POST-4.3 – UPDATE BMP SIZING TOOL

TYPE: ONE-TIME

STATUS: FUTURE

During the MS4 Permit term, WES will update or replace the BMP Sizing Tool, which is no longer in use. Update or replacement of the BMP Sizing Tool will incorporate any new changes to the districts' rules and regulations and stormwater standards (see POST-1 and POST-4.4).

WES will coordinate this effort with Happy Valley and DTD. WES will provide outreach to the development and building community, including training, as part of this effort.

POST-4.3 Responsibilities for Providing a BMP Sizing Tool

Responsibilities Matrix	WES Watershed Protection	WES Development Review	WES Community Relations	DTD Engineering	Happy Valley Engineering
Coordinate update/replacement of BMP Sizing Tool with updates to the stormwater standards design manual (see POST-4.1)	P	I	I		
Technical project management of tool design	P	I			
Provide comments and technical input	S	P		P	P
Outreach to development and building community	S	S	P		
Publicize and make BMP Sizing Tool available	I	P	S		
Coordinate training for staff and development and building community	P	S	S		

P = Performs Task, C = Consulted, S = Supports, I = Informed

POST-4 Measurable Goals and Tracking Measures

ID	MEASURABLE GOALS	TRACKING MEASURES
POST-4.1-a	Update and expand stormwater design manual (currently CCSD#1 Stormwater Standards) by Dec. 31, 2019.	Date stormwater design manual was updated and expanded.
POST-4.2-a	Document the policy for allowing equivalent mitigation or in-lieu fee when on-site measures are not feasible and establish program options for equivalent mitigation by Dec. 31, 2018.	Date program established.
POST-4.2-b	Offer and require equivalent mitigation options for 100% of sites unable to meet on-site requirements beginning Jan. 1, 2019.	- Annual number of development sites meeting requirements via equivalent off-site mitigation (beginning 2019). - Annual number of sites unable to meet on-site requirements due to site constraints (beginning 2018). - Annual percentage of development sites meeting requirements via equivalent off-site mitigation.
POST-4.3-a	Update or replace BMP Sizing Tool by Dec. 31, 2020.	Date BMP Sizing tool updated or replaced.

POST-5 LID Barriers Analysis

Purpose

The purpose of this BMP is to review Plan Participants' land development regulations to remove barriers to Low impact development (LID). LID is a set of land development and stormwater management practices that minimizes impervious coverage and manages stormwater runoff using distributed BMPs that mimic natural processes through infiltration, evapotranspiration, and flow control, or re-use of stormwater. The Plan Participants will identify and modify those standards that contribute to the creation of impervious surfaces and loss of vegetative land cover during development.

Geography

✓	CCSD#1-UGB, including Happy Valley
✓	SWMACC, including Rivergrove
✓	County-maintained ROW
	Municipal Facilities in permitted area

General Responsibility

✓	WES
✓	Happy Valley
✓	Clackamas County DTD
	Other Clackamas County department
✓	Rivergrove
✓	OLWS (see OLWS SWMP)

Background

WES evaluated the *CCSD#1 Stormwater Standards* for barriers to LID in 2013.

Detailed Description

POST-5.1 EXPAND LID BARRIERS ANALYSIS

TYPE: PERIODIC

STATUS: ONGOING

WES will identify barriers to LID in Plan Participants' development codes. Barriers will include codes and standards that promote creation of impervious surfaces, allow or promote loss of trees and native vegetation, or inhibit use of LID BMPs in transportation ROW and on development sites. The analysis will include the Clackamas Zoning and Development Ordinance, *Clackamas County Roadway Standards*, Happy Valley Municipal Code, *City of Happy Valley Engineering Design and Standard Details Manual*, and Rivergrove's ordinances.

County and City planning departments will assist WES in the technical review.

WES will share results of the analysis with DTD Planning, DTD Transportation Planning, Happy Valley Department of Economic Development and Community Development, and the Rivergrove City Manager. These officials may elect to make recommendations to their elected officials – the Board of County Commissioners, Happy Valley City Council, and Rivergrove City Council – to update codes and standards.

WES will incorporate outreach to the development and building community as part of this effort.

Element F: Post-Construction Site Runoff

BMP: POST-5 LID Barriers Analysis

POST-5 Responsibilities for LID Barriers Analysis

Responsibilities Matrix	WES Watershed Protection	WES Community Relations	DTD Planning	DTD Transportation Planning	Happy Valley Department of Economic & Community Development	Rivergrove City Manager
Review ordinances and standards to identify barriers to LID	P		C/S	C/S	C/S	C/S
Outreach to development and building community	S	P	C	C		
Recommend updates to codes and standards	P		I	I	I	I
Propose updates to codes and standards to Elected Officials or other decision-makers	S		P	P	P	P

P = Performs Task, C = Consulted, S = Supports, I = Informed

Measureable Goals and Tracking Measures

ID	MEASURABLE GOALS	TRACKING MEASURES
POST-5.1-a	Review listed codes and standards for barriers to LID implementation by Dec. 31, 2018.	Date LID code review completed.

This page concludes Post-Construction Site Runoff.

G. Pollution Prevention for Municipal Operations

Regulatory Overview

The MS4 Permit Schedule A.4.g requires the Plan Participants, as property owners and managers, and as operators of public streets and roads, to manage their operations in a manner that reduces the discharge of pollutants. Requirements include best management practices for materials transfer and storage; application of chemicals such as pesticides and fertilizers; sanitary sewer collections and conveyance; and road maintenance practices. Additionally, the MS4 Permit requires Plan Participants to add pollutant removal capabilities to existing stormwater facilities.

Requirements Summary for Pollution Prevention for Municipal Operations						
	BMPs					
	PREV-1 Pollution Prevention in Road Operations	PREV-2 Pollution Prevention for Landscape Maintenance and Vegetation Control	PREV-3 Pollution Prevention for Municipal Waste Facilities	PREV-4 Control Sewage Infiltration	PREV-5 Pollution Prevention in Fire-Fighting Training	PREV-6 Storm System Retrofit Program
The full text of Schedule A.4.g may be found in the MS4 Permit.						
i. Operate and maintain public streets and roads to minimize the discharge of stormwater pollutants.	■					
ii. Control the use and application of pesticides, herbicides, and fertilizers on municipally-owned properties.		■				
iii. Reduce the impact of stormwater runoff from municipal facilities that treat, store or transport municipal waste.			■			
iv. Limit infiltration of seepage from the municipal sanitary sewer system to the MS4 where necessary.				■		
v. Control the release of materials related to fire-fighting training activities.					■	
vi. Retrofit municipal flood control projects to provide pollutant removal.						■

BMPs

PREV-I Pollution Prevention in Road Operations

Purpose

The purpose of this BMP is to reduce the discharge of pollutants from roadways by adopting maintenance practice that reduce the use of potential pollutants and prevent the discharge of roadway pollutants to storm drains and ditches. Stormwater runoff from roadways picks up petroleum products, heavy metals, trash, and other pollutants and carries them to the MS4 and receiving waters. Additionally, some maintenance activities, such as de-icing, pest control, and vegetation control contribute additional pollutants to roadway runoff. This BMP addresses the adverse impacts of roadway runoff on the MS4 and receiving waters by modifying maintenance to reduce pollutants and regularly sweeping roadways.

Geography

✓	CCSD#1-UGB, including Happy Valley
✓	SWMACC, including Rivergrove
✓	County-maintained ROW
	Municipal Facilities in permitted area

General Responsibility

	WES
✓	Happy Valley
✓	Clackamas County DTD
	Other Clackamas County department
	Rivergrove
✓	OLWS (see OLWS SWMP)

Background

Plan Participants operate public roadways and preserve the intended drainage capacity of public roadside ditches under their authority in a manner that reduces discharge of pollutants to the MS4. Roadway operations include street sweeping, road repair, cleaning culverts, and other routine road maintenance activities.

Happy Valley and DTD are the two Plan Participants that routinely operate public roads. WES does not operate any roads but may elect to provide enhanced street sweeping for roads within SWMACC and CCSD#1 through agreements with other Plan Participants.

Street sweeping is provided most often on arterial and major curbed roadways and less often on local streets.

Plan Participants use pollution control BMPs from approved manuals, such as the Oregon Department of Transportation (ODOT) *Routine Road Maintenance Water Quality and Habitat Guide: Best Management Practices*, revised 2014 (ODOT Guide 2014), whenever they are doing work to improve or maintain a public road under their authority.

BMP Organization

This BMP has two sub-components. PREV-1.1 is for street sweeping and PREV-1.2 is for pollutant source control in roadway operations.

Detailed Description

PREV-1.1 – STREET SWEEPING

TYPE: ONGOING

STATUS: ONGOING

DTD and Happy Valley will continue to implement a program to routinely sweep arterial and other major curbed streets under their authority in the permitted area. At a minimum DTD and Happy Valley will sweep arterial streets four times per year. Other major curbed streets will be swept as resources allow.

DTD and Happy Valley will also sweep as necessary to remove sand applied to snowy or icy roadways.

PREV-1.2 - CONTROL POLLUTANTS IN ROADWAY OPERATIONS

TYPE: ONGOING

STATUS: ONGOING

Operational activities will be conducted using appropriate BMPs to reduce or prevent trash, sediment, nutrients, and chemicals from discharging into storm drains and ditches. Plan Participants will use BMPs from adopted manuals during the following road and ROW maintenance activities:

- Repairing roads
- Cleaning culverts
- Ditching
- De-icing
- Removing solid waste dumps found within the ROW

DTD Transportation Maintenance will continue to use pollution control BMPs in the most recent ODOT Guide or will adopt an approved alternative.

The Happy Valley Street Maintenance Division will continue to follow the ODOT Guide 2014, or as updated, for pollution prevention during routine road maintenance.

Pest and vegetation control in the ROW is described in BMP PREV-2.

Pollution reduction activities will include temporary erosion and sedimentation control; proper application of chemicals during road repair and de-icing; proper disposal of solid and liquid wastes removed from ROW; and removal of trash, litter, and waste.

PREV-1 Responsibilities for Pollution Prevention in Roadway Operations

Responsibilities Matrix	DTD Transportation Maintenance	Happy Valley Street Maintenance	WES Watershed Protection
Sweep County-maintained roads	P		I
Sweep City streets		P	I

Element G: Pollution Prevention for Municipal Operations

BMP: PREV-2 Pollution Prevention for Landscape Maintenance and Vegetation Control

Responsibilities Matrix	DTD Transportation Maintenance	Happy Valley Street Maintenance	WES Watershed Protection
Control pollutants in County roadway operations	P		I
Control pollutants in City street operations		P	I

P = Performs Task, C = Consulted, S = Supports, I = Informed

PREV-I Measurable Goals and Tracking Measures

ID	MEASURABLE GOALS	TRACKING MEASURES
PREV-1.1-a	Sweep Plan Participants' curbed arterials four times per year.	- Annual arterial curb miles swept in Happy Valley - Annual arterial curb miles of County-maintained ROW in the permitted area swept. - Total curb miles of County-maintained arterial roadways in permitted area. - Total curb miles of Happy Valley arterial roadways.
PREV-1.2-a	Remove 90% of solid waste dumps in Plan Participants' ROW within six weeks of notification or discovery.	- Annual number of solid waste dumps removed within six weeks. - Annual number of solid waste dumps discovered or notified about. - Annual percentage of solid waste dumps removed within six weeks.

PREV-2 Pollution Prevention for Landscape Maintenance and Vegetation Control

Purpose

The purpose of this BMP is to reduce the quantity of pollutants that enter runoff and contribute pollutants to receiving waters from municipal landscaping and vegetation control operations. Pesticides, herbicides, and fertilizers used in these operations can wash into the MS4 and receiving waters and become pollutants. This BMP seeks to reduce the application of pesticides, herbicides, and fertilizers in municipal operations and ROW vegetation control and to ensure these substances are stored and used in ways that minimize the potential to pollute runoff.

Geography

✓	CCSD#1-UGB, including Happy Valley
✓	SWMACC, including Rivergrove
✓	County-maintained ROW
✓	Municipal Facilities in permitted area

General Responsibility

✓	WES
✓	Happy Valley
✓	Clackamas County DTD
✓	Other Clackamas County department
✓	Rivergrove
✓	OLWS (see OLWS SWMP)

Background

Plan Participants maintain landscapes and control vegetation on a variety of municipal properties and roads located throughout the permitted area. To guide vegetation and pest control activities, Plan Participants follow either the 2012 *Integrated Pest Management Plan for the Surface Water*

Element G: Pollution Prevention for Municipal Operations
BMP: PREV-2 Pollution Prevention for Landscape Maintenance and Vegetation Control

Management Agency of Clackamas County, Clackamas County Service District No. 1, and the City of Happy Valley (IPM Plan), the Clackamas County Integrated Vegetation Management Plan, dated 2000, (IVM Plan), or an equivalent plan. These plans are intended to prevent or mitigate damage from undesirable plant, fungal, and invertebrate pests with the least possible hazard to people, property, and the environment.

Parks

Happy Valley and Rivergrove each own and operate parks in the permitted area to which this BMP applies.

Clackamas County Business and Community Services Department operates some of the North Clackamas Parks and Recreation District's parks within the permitted area to which this BMP applies.

Municipal Buildings

Clackamas County and Happy Valley each own or lease municipal buildings and facilities covered by this BMP. On behalf of Clackamas County, Clackamas County Facilities Management provides landscape maintenance and building management services to facilities that house County departments. Happy Valley hires contractors for municipal facility maintenance.

Maintenance Yards

DTD and Happy Valley each own and operate a maintenance yard in the permitted area to which this BMP applies.

Rights-of-Way

DTD and Happy Valley each operate transportation ROW in the permitted area to which this BMP applies.

BMP Organization

This BMP has three sub-components. PREV-2.1 covers landscape maintenance at municipally-operated facilities that are not roads, PREV-2.2 covers vegetation maintenance on ROW, and PREV-2.3 is technical assistance and training.

Detailed Description

PREV-2.1 – INTEGRATED PEST MANAGEMENT FOR PARKS, BUILDINGS, AND MAINTENANCE YARDS

TYPE: ONGOING

STATUS: ONGOING

Clackamas County Facilities Management will adopt and use the IPM Plan or an equivalent plan. The IPM Plan will be used for landscape management of all County owned or operated buildings and facilities in the permitted area.

Happy Valley will continue to use the IPM Plan, as updated. When facilities management is contracted to a private company, contractors will be required to use the IPM Plan or an equivalent plan and to submit chemical spray logs to the City. Happy Valley Parks Maintenance staff will use the IPM Plan for vegetation maintenance of City parks.

Element G: Pollution Prevention for Municipal Operations

BMP: PREV-2 Pollution Prevention for Landscape Maintenance and Vegetation Control

DTD will continue to use the IVM Plan, dated 2000 or as updated, to guide vegetation control activities at DTD maintenance yards in the permitted area.

PREV-2.2 – VEGETATION MAINTENANCE IN RIGHTS-OF-WAY

TYPE: ONGOING

STATUS: ONGOING

For vegetation maintenance in the County-maintained ROW, DTD will prioritize mowing and will use spot spraying of herbicides on an as-needed basis. DTD will continue to follow the IVM Plan, dated 2000, or as updated, for vegetation control in the ROW. During the MS4 Permit term, DTD will adopt and use the most recent version of the ODOT Guide or an approved alternative.

Happy Valley will continue to use mowing as the preferred method of vegetation management in City ROW. Herbicides will be used consistent with product labels. Happy Valley will follow the IPM Plan for pest control activities in the ROW.

PREV-2.3 – TECHNICAL ASSISTANCE AND TRAINING

TYPE: ONGOING

STATUS: ONGOING

On behalf of Plan Participants, WES will provide annual training and technical assistance as needed on pollution prevention BMPs to Happy Valley and Clackamas County personnel who maintain landscaping at municipal facilities and buildings in the permitted area.

PREV-2 Responsibilities for Pollution Prevention in Landscape Maintenance and Vegetation Control

Responsibilities Matrix	WES Watershed Protection	Clackamas Co Facilities Maint	DTD Admin	DTD Transpo Maint	Happy Valley Facilities	Happy Valley Street Maint	Happy Valley Parks Maint
Identify all City and County properties subject to this BMP within the permitted area	P						
Adopt and implement IPM Plan or equivalent for County buildings and facilities	C/S	P	C/S				
Implement the IPM Plan for City parks	C/S						P
Implement the IPM Plan for City facilities (through contracts)	C/S				P		
Implement IVM for DTD maintenance yards	C/S			P			
Implement the IPM Plan for City street ROW	C/S					P	
Implement IVM for County-maintained ROW	C/S		P	P			
Adopt and implement the most recent ODOT Guide or an approved alternative for vegetation maintenance on County-maintained ROW			P				
Provide technical assistance and training	P	I	I	I	I	I	I

P = Performs Task, C = Consulted, S = Supports, I = Informed

Element G: Pollution Prevention for Municipal Operations
BMP: PREV-3 Pollution Prevention for Municipal Waste Facilities

PREV-2 Measurable Goals and Tracking Measures

ID	MEASURABLE GOALS	TRACKING MEASURES
PREV-2.1-a	Identify and list all City and County properties subject to this BMP within the permitted area by Dec. 31, 2017.	Date list compiled.
PREV-2.2-a	Adopt and implement the most recent ODOT Guide or an approved alternative for vegetation maintenance in County-maintained ROW by Dec. 31, 2019.	Date manual adopted.
PREV-2.3-a	Hold one IPM training for Plan Participant staff during the MS4 Permit term.	Date of training.

PREV-3 Pollution Prevention for Municipal Waste Facilities

Purpose

The purpose of this BMP is to prevent materials collected and stored at municipal waste facilities from washing into the MS4 and polluting receiving waters. Solid and liquid wastes collected by Plan Participants through street sweeping, sanitary and storm sewer cleaning activities, and vegetation maintenance activities are collected and processed at municipal waste facilities. Such facilities are also used to store liquid petroleum products and chemicals, stockpile solid material for road and landscape maintenance, and maintain fleet vehicles and equipment. If improperly handled, the wastes and materials stored at these facilities could leach or wash into the MS4 and discharge pollutants to receiving waters. This BMP describes pollution prevention procedures and controls implemented at municipal waste facilities keep these materials out of the MS4.

Geography

	CCSD#1-UGB, including Happy Valley
	SWMACC, including Rivergrove
	County-maintained ROW
✓	Municipal Facilities in permitted area

General Responsibility

✓	WES
✓	Happy Valley
✓	Clackamas County DTD
	Other Clackamas County department
	Rivergrove
	OLWS (see OLWS SWMP)

Background

Within the permitted area, WES, Happy Valley, and Clackamas County DTD each operates a facility that handles municipal waste and is not covered under a separate NPDES permit. These facilities include:

- A CCSD#1 decant facility on SE Evelyn Street in Clackamas;
- A Happy Valley Public Works maintenance facility on SE Ridgecrest Road in Happy Valley; and
- A DTD Transportation Maintenance facility on Abernethy Road in Oregon City.

WES and Happy Valley follow the *Strategy for qualifying Municipal Facilities owned/operated by the City of Happy Valley, Clackamas County, CCSD#1, and/or SWMACC which are also located in the City of Happy Valley, SWMACC, or CCSD#1 (issued on Jun. 28, 2013 and revised on Aug. 31, 2016)* (Strategy for Municipal Facilities). The document provides a list of potential pollutants at these

Element G: Pollution Prevention for Municipal Operations
BMP: PREV-3 Pollution Prevention for Municipal Waste Facilities

facilities, operational and structural source control BMPs, and a description of intent to annually assess the effectiveness of structural source control measures.

DTD's Transportation Maintenance facility is currently listed in the Strategy for Municipal Facilities as a facility that might be subject to the requirements of Schedule A.4.g.iii; however a source control strategy for the facility is not included.

Detailed Description

PREV-3.1 – MUNICIPAL WASTE FACILITY SOURCE CONTROL STRATEGY

TYPE: ONGOING

STATUS: ONGOING

WES will adaptively manage the Strategy for Municipal Facilities. Adaptive management will include: evaluating new facilities, and new functions at existing facilities, for applicability of Schedule A.4.g.iii requirements; evaluating and updating the list of stored materials and activities; updating BMPs to reflect changed inventory of stored materials and activities; and updating BMPs that may prove ineffective as demonstrated through site inspections.

WES will update the Strategy for Municipal Facilities as a result of adaptive management.

WES will also expand the scope of the document to include each municipal waste facility operated by a Plan Participant in the permitted area. To support the update, DTD will provide information to WES about potential pollutants and source control activities at its Transportation Maintenance facility on Abernethy Road for inclusion in the strategy.

Site operators including WES, Happy Valley, and DTD will implement the Strategy for Municipal Facilities at their respective facilities, including annual inspections.

PREV-3 Responsibilities for Pollution Prevention for Municipal Waste Facilities

Responsibilities Matrix	WES Watershed Protection	WES Field Operations	DTD Transportation Maintenance	Happy Valley Public Works
Develop source control strategy for DTD Transportation Maintenance facility	I		P	
Implement source control strategy for DTD Transportation Maintenance facility			P	
Implement source control strategy for Happy Valley maintenance facility				P
Implement source control strategy for the CCSD#1 decant facility	I	P		
Inspect each facility annually	C	P	P	P
Update source control strategy	P		C/S	C/S

P = Performs Task, C = Consulted, S = Supports, I = Informed

PREV-3 Measurable Goals and Tracking Measures

ID	MEASURABLE GOALS	TRACKING MEASURES
PREV-3.1-a	Each year inspect 100% of municipal waste facilities at least once beginning in 2018. (WES, DTD, Happy Valley)	- Annual number of municipal waste facilities inspected. - Annual number of municipal waste facilities. - Annual percentage of municipal waste facilities inspected.
PREV-3.1-b	Correct 100% of deficient operational source control BMPs at municipal waste facilities within three months. (WES, DTD, Happy Valley)	- Running total of operational source control BMP deficiencies at municipal waste facilities that were corrected within three months. - Running total of operational source control BMP deficiencies found at municipal waste facilities. - Percentage of deficient operational source control BMPs corrected within three months.
PREV-3.1-c	Correct 100% of deficient structural source control BMPs at municipal waste facilities within one year. (WES, DTD, Happy Valley)	- Running total of structural source control BMP deficiencies at municipal waste facilities that were corrected within one year. - Running total of structural source control BMP deficiencies found at municipal waste facilities. - Percentage of deficient structural source control BMPs corrected within one year.
PREV-3.1-d	Expand scope of strategy to include DTD facility, and others, if necessary, by Jun. 30, 2018.	Date strategy expanded.
PREV-3.1-e	Evaluate strategy for adaptive management at least once during the MS4 Permit term.	Date strategy evaluated for adaptive management.

PREV-4 Control Sewage Infiltration

Purpose

The purpose of this BMP is to prevent sewage carried by the sanitary sewer system from entering the MS4 and discharging to receiving waters. Raw sewage can enter the MS4 through cross connections between the sanitary sewer and MS4 or through infiltration from damaged pipes. Raw sewage introduces a variety of pollutants to stormwater systems including disease-causing organisms, metals, and nutrients. This BMP describes the procedures the Plan Participants will use to prevent sewage from entering the MS4.

Geography

✓	CCSD#1-UGB, including Happy Valley
	SWMACC, including Rivergrove
	County-maintained ROW
	Municipal Facilities in permitted area

General Responsibility

✓	WES
	Happy Valley
✓	Clackamas County DTD
	Other Clackamas County department
	Rivergrove
✓	OLWS (see OLWS SWMP)

Background

CCSD#1 Rules and Regulations prohibit cross connection of sanitary sewer lines to the MS4 in new development and redevelopment, and WES and DTD enforce this prohibition through the development and building permit review processes.

As part of its routine maintenance program for sanitary sewer operations, WES inspects sanitary sewer lines in CCSD#1 using television cameras to identify damaged pipes for repair.

BMP Organization

This BMP contains two sub-components. Both PREV-4.1 and 4.2 are ongoing.

Detailed Description

PREV-4.1 – INSPECT SANITARY SEWER LINES

TYPE: ONGOING

STATUS: ONGOING

WES will routinely inspect CCSD#1's publicly-operated sanitary sewer lines for leaks, and will clean and maintain lines as necessary. Lines will be inspected with a television camera on a periodic basis, and tree roots will be removed whenever identified.

Activities responsive to Schedule A.4.a to detect and eliminate illicit discharges will also contribute to complying with this requirement. For example, if WES locates a discharge from sanitary sewer to the MS4, WES will eliminate the discharge in compliance with MS4 Permit Schedule A.4.a.vii following BMP IDDE-4, Illicit Discharge Detection and Elimination.

PREV-4.2 – PREVENT CROSS-CONNECTIONS IN NEW DEVELOPMENT / RE-DEVELOPMENT

TYPE: ONGOING

STATUS: ONGOING

WES will review development plans (see POST-2) for cross connections between the sanitary and storm sewer systems. DTD Building Department will inspect new construction in SWMACC and unincorporated CCSD#1. The Happy Valley Building Division will inspect new construction in Happy Valley. These inspections will ensure that conveyance systems are correctly plumbed into the storm system, sanitary sewer system, or a private septic system (see POST-3).

PREV-4 Responsibilities for Controlling Sewage Infiltration

Responsibilities Matrix	WES Development Review	WES Field Operations	DTD Building Department or Happy Valley Building Division <i>Depends on Site Location</i>
Inspect storm system and/or sanitary sewer connection and lines		P	
Review development plans to prevent cross connections (see POST-2)	P		
Inspect new and redevelopment for cross connections (see POST-3)	I		P

P = Performs Task, C = Consulted, S = Supports, I = Informed

Element G: Pollution Prevention for Municipal Operations
BMP: PREV-5 Pollution Prevention in Fire-Fighting Training

PREV-4 Measurable Goals and Tracking Measures

ID	MEASURABLE GOALS	TRACKING MEASURES
PREV-4.1-a	Each year complete 100% of scheduled TV inspections of the public sanitary sewer system.	• Annual length (linear feet) of public storm sewer pipe TV inspected. • Annual length (linear feet) of public storm sewer pipe scheduled for TV inspection. • Annual percentage of scheduled TV inspections of public sanitary sewer system completed.
PREV-4.1-b	Eliminate 100% of sanitary sewer discharges to the MS4 public within five days of discovery each year.	• Annual number of discharges to the MS4 resulting from cracked or broken public sanitary sewer lines that were eliminated within five days of discovery. • Annual number of discharges to the MS4 resulting from cracked or broken public sanitary sewer lines. • Annual percentage of discharges to the MS4 resulting from cracked or broken public sanitary sewer lines that were eliminated within five days of discovery.
PREV-4.2-a	Temporarily block or permanently eliminate 100% of sanitary sewer cross connections to the MS4 within 12 hours of discovery each year.	• Annual number of cross connections temporarily blocked or permanently eliminated within 12 hours. • Annual number of cross connections discovered. • Annual percentage of cross connections temporarily blocked or permanently eliminated within 12 hours.

PREV-5 Pollution Prevention in Fire-Fighting Training

Purpose

The purpose of this BMP is to prevent non-stormwater discharges to the MS4 from fire-fighting training events. Fire-fighting training can introduce pollutants from fire-fighting foam and training fires into the MS4. This BMP describes the actions taken by the Plan Participants to limit the pollutants entering the MS4 from routine fire-fighter training.

Geography

✓	CCSD#1-UGB, including Happy Valley
	SWMACC, including Rivergrove
	County-maintained ROW
	Municipal Facilities in permitted area

General Responsibility

✓	WES
	Happy Valley
	Clackamas County DTD
	Other Clackamas County department
	Rivergrove
	OLWS (see OLWS SWMP)

Background

Fire-fighting services in CCSD#1 are provided by Clackamas Fire District No. 1 (CFD#1). CFD#1 is a special service district and is not a co-permittee of the Clackamas County Group MS4 Permit.

Element G: Pollution Prevention for Municipal Operations

BMP: PREV-6 Storm System Retrofit Program

CFD#1 owns and operates a training center within CCSD#1, where a valve is used to divert wastewater flows from training activities to CCSD#1's sanitary sewer system. CFD#1 maintains a standard operating procedure for using the diversion valve, which is posted on a sign above the valve.

WES provides pollutant reduction outreach and technical assistance related to controlling releases from fire-fighting training activities to CFD#1.

Detailed Description

PREV-5.1 – POLLUTION PREVENTION IN FIRE-FIGHTING TRAINING

TYPE: ANNUAL

STATUS: ONGOING

WES Watershed Protection will contact CFD#1 to offer guidance on using the valve to divert training flows from the storm sewer to the sanitary sewer. WES Watershed Protection will visit the training site to inspect the position of the diversion valve.

PREV-5 Responsibilities for Pollution Prevention in Fire-Fighting Training

Responsibilities Matrix	WES Watershed Protection	WES Training Coordinator	CFD#1❶
Provide technical assistance to CFD#1	P		C
Review position of diversion valve at training site	P		I
Invite CFD#1 to pollution prevention employee training		P	I

P = Performs Task, C = Consulted, S = Supports, I = Informed

❶ CFD#1 does not participate in this Plan and is not required to comply with it. Plan Participants are not responsible for the actions of CFD#1. Information is provided for the reader's convenience.

PREV-5 Measurable Goals and Tracking Measures

ID	MEASURABLE GOALS	TRACKING MEASURES
PREV-5.1-a	Perform one unscheduled site visit to CFD#1 training center each year to review position of diversion valve and offer verbal guidance.	Date(s) of unscheduled site visits.

PREV-6 Storm System Retrofit Program

Purpose

The purpose of this BMP is to improve quality of runoff from urbanized areas that were developed prior to effective water quality controls and of flood waters controlled or abated by capital improvements owned or operated by a Plan Participant. The BMP implements Plan Participants' stormwater retrofit strategies required under Schedule A.6 of the MS4 Permit.

Element G: Pollution Prevention for Municipal Operations
BMP: PREV-6 Storm System Retrofit Program

Geography

✓	CCSD#1-UGB, including Happy Valley
✓	SWMACC, including Rivergrove
✓	County-maintained ROW
	Municipal Facilities in permitted area

General Responsibility

✓	WES
✓	Happy Valley
✓	Clackamas County DTD
	Other Clackamas County department
	Rivergrove
✓	OLWS (see OLWS SWMP)

Background

Retrofits address water quality impacts (discharge of pollutants), hydrologic impacts (changes to volume, rate, and duration of discharges), or both from urbanized areas and from existing flood control projects² owned by a Plan Participant.

Retrofit projects may be undertaken at a local or a regional scale. Retrofits may be standalone projects, demonstration projects, or may be integrated into other planned capital improvements such as transportation projects.

Stormwater Retrofit Plan

On behalf of CCSD#1 and SWMACC, including the cities, WES submitted the *Clackamas County Water Environment Services Stormwater Retrofit Plan* (Retrofit Plan) to DEQ in accordance with MS4 Permit Schedule A.6 on Jun. 30, 2015.

During the 2012-2017 MS4 Permit term, WES implemented the Retrofit Plan, constructing one stormwater planter at Clackamas High School and completing 92 riparian enhancements for a total of 71.27 acres enhanced. WES also designed, but has not constructed, two detention pond retrofits in CCSD#1.

In 2016, WES diverted resources from the two detention pond retrofits to a pilot project to install OptiRTC continuous monitoring and active controls to address flooding and water quality performance at two regional stormwater ponds. In these pilot projects, a software program uses data from on-site sensors and weather forecasts to predict needed volume, allowing WES to release water from the ponds prior to storms.

Detailed Description

PREV-6.1 – STORMWATER RETROFIT PROGRAM

TYPE: ONGOING

STATUS: ONGOING

WES will continue to implement the Retrofit Program and/or other retrofit opportunities such as the OptiRTC pilot.

² A “flood control project” is defined in ORS 549.10 as “any plan, system, manner or means for the control, diversion, conservation or abatement of floodwaters or any excessive or unusual accumulation of water in any natural or artificial stream or body of water, or for protection of life and property against danger, menace, injury or damage resulting therefrom.”

Element G: Pollution Prevention for Municipal Operations
BMP: PREV-6 Storm System Retrofit Program

On behalf of Plan Participants, WES Watershed Protection will update the Retrofit Plan during the MS4 Permit term, expanding the scope to include County-maintained ROW. WES will develop the Retrofit Plan, coordinate its implementation, involve the public, and report on progress. Happy Valley, DTD, and Rivergrove each will be responsible for identifying potential projects, cultivating partnership opportunities, participating in public involvement, and providing resources for project design and construction, if feasible.

Each Plan Participant will assist in the update by providing potential projects to WES. The following areas and types of facilities will be candidates for retrofit:

- Existing ponds and below-ground tanks/pipes which were designed to provide only stormwater detention (lacking water quality);
- Discharges into the MS4 from existing private properties: residential, commercial, and industrial urbanized areas that lack water quality or hydrologic controls;
- Public roadways owned or operated by a Plan Participant that lack water quality or hydrologic controls; and
- Existing flood control projects owned or operated by a Plan Participant that lack water quality treatment.

After reviewing candidate projects, WES will prioritize them for retrofit, adding water quality and hydrologic controls as capital improvement funds allow.

PREV-6 Responsibilities for Stormwater Retrofit Program

Responsibilities Matrix	WES Watershed Protection	WES Field Ops	WES Comm Relations	DTD Transpo Const	DTD Transpo Planning	Happy Valley Eng	Rivergrove
Refer problems / potential retrofits to WES	I	P		P	P	P	P
Track potential projects	P						
Update strategy	P			I	I	I	
Public involvement	S		P				
Coordinate project selection	P	I	I	S	S	S	
Project design	P	I	I	S	S	S	
Construction	P	I	I	S			
Tracking and reporting	P						

P = Performs Task, C = Consulted, S = Supports, I = Informed

PREV-6 Measurable Goals and Tracking Measures

ID	MEASURABLE GOALS	TRACKING MEASURES
PREV-6.1-a	Refer problem areas / potential projects to WES one time during the MS4 Permit term. (Happy Valley, DTD, Rivergrove)	• Date problem areas / potential projects referred to WES by Happy Valley. • Date problem areas / potential projects referred to WES by DTD.

Element G: Pollution Prevention for Municipal Operations
BMP: PREV-6 Storm System Retrofit Program

ID	MEASURABLE GOALS	TRACKING MEASURES
		Date problem areas / potential projects referred to WES by Rivergrove.
PREV-6.1-b	Update Retrofit Plan once during the MS4 Permit term.	Date the Retrofit Plan was updated.
PREV-6.1-c	Add water quality treatment to a minimum of 10 acres of existing commercial/industrial/non-local roadway during the MS4 Permit term through small-scale local-level retrofits.	Running total acres of commercial/industrial/non-local roadway treated through retrofit.
PREV-6.1-d	Decrease durations of discharges from two existing residential subdivisions during the MS4 Permit term.	Running total of residential subdivisions retrofitted with hydrologic controls that reduce discharge durations.
PREV-6.1-e	Complete one large (>\$50,000) retrofit project in CCSD#1 during the MS4 Permit term.	Date large retrofit project completed.

This page concludes Pollution
Prevention for Municipal
Operations.

H. Stormwater Management Facilities Operation and Maintenance

Regulatory Overview

MS4 Permit Schedule A.4.h requires Plan Participants to implement a program to verify that stormwater management facilities and controls are inspected, operated, and maintained for effective pollutant removal, infiltration/retention, and flow control. To facilitate these activities, the program also includes activities to inventory and map public and private stormwater management facilities. Stormwater management facilities include, but are not limited to catch basins, detention tanks/pipes, ponds, swales, rain gardens, and pollution control manholes. Requirements apply to both publicly-owned or operated systems and privately-owned and operated systems.

Requirements Summary for Stormwater Management Facilities Operation and Maintenance								
	BMPs							
	MAINT-1 Operation and Maintenance Legal Authority	MAINT-2 Inventory and Map Facilities	MAINT-3 Inspection Schedule and Maintenance Standards	MAINT-4 Public Facility Inspection and Maintenance	MAINT-5 Inspect and Clean Catch Basins	MAINT-6 Public Conveyance Cleaning and Maintenance	MAINT-7 Regulated Private System Inspection and Maintenance Program	MAINT-8 Urgent Conditions / Storm Preparation and Response
The full text of Schedule A.4.h may be found in the MS4 Permit.								
i. Verify that stormwater management facilities and controls are inventoried, mapped, inspected, operated, and maintained for effective pollutant removal, infiltration, and/or flow control.	■	■	■					
ii. (1) A strategy for publicly-owned or operated stormwater facilities must include: an inventory and mapping process; inspection and maintenance schedule; inspection, operation and maintenance criteria and priorities; description of inspector type and staff position or title; and, inspection and maintenance tracking mechanisms. <i>(Item ii is continued on the next page.)</i>		■	■	■	■	■		■

Requirements Summary for Stormwater Management Facilities Operation and Maintenance								
	BMPs							
	MAINT-1 Operation and Maintenance Legal Authority	MAINT-2 Inventory and Map Facilities	MAINT-3 Inspection Schedule and Maintenance Standards	MAINT-4 Public Facility Inspection and Maintenance	MAINT-5 Inspect and Clean Catch Basins	MAINT-6 Public Conveyance Cleaning and Maintenance	MAINT-7 Regulated Private System Inspection and Maintenance Program	MAINT-8 Urgent Conditions / Storm Preparation and Response
The full text of Schedule A.4.h may be found in the MS4 Permit.								
ii. (2) A strategy for privately-owned or operated stormwater facilities must include: identify the types of facilities to be inventoried; procedures for inventory and mapping; inspection criteria, rationale, priorities, inspection frequency, and procedures; required qualifications to inspect stormwater facilities; reporting requirements; and a tracking mechanism.		■	■				■	

BMPs

MAINT-1 Operation and Maintenance Legal Authority

Purpose

The purpose of this BMP is to establish and maintain the legal authority for Plan Participants to require maintenance of private stormwater facilities and to conduct inspections. Privately-owned or operated storm systems discharge to the Plan Participants' MS4s. Improperly maintained storm systems can contribute pollutants and excessive runoff to the MS4.

Geography

✓	CCSD#1-UGB, including Happy Valley
✓	SWMACC, including Rivergrove
	County-maintained ROW
	Municipal Facilities in permitted area

General Responsibility

✓	WES
	Happy Valley
	Clackamas County DTD
	Other Clackamas County department
	Rivergrove
✓	OLWS (see OLWS SWMP)

Background

The elected officials of CCSD#1 and SWMACC adopt the policies, rules, and regulations that require operation and maintenance of privately-owned and operated stormwater management facilities. WES tracks and coordinates this BMP.

CCSD#1 Rules and Regulations Section 12.10 requires maintenance of stormwater management facilities and annual reporting of maintenance. *SWMACC Rules and Regulations* Sections 5.1.10 through 5.1.13 address maintenance and reporting requirements for surface water facilities.

WES' administrative requirement for either an easement or a private maintenance agreement during stormwater management plan review and approval (see POST-2) augments the districts' rules and regulations.

Detailed Description

MAINT-1.1 – CCSD#1 AND SWMACC

TYPE: ONE-TIME

STATUS: FUTURE

One time during the MS4 Permit term, WES will review the legal authority to require maintenance and allow inspections in each district's rules and regulations. Requirements will be applicable to all private lands within the districts that drain into the MS4.

WES will track and coordinate updates to legal authority, if necessary.

There is no responsibilities matrix for this BMP.

MAINT-1 Measurable Goals and Tracking Measures

ID	MEASURABLE GOALS	TRACKING MEASURES
MAINT-1.1-a	Review, and update if necessary, legal authority in CCSD#1 and SWMACC to require maintenance and inspect private storm sewer systems once during the MS4 Permit term.	• Date legal authority verified. • Date legal authority updated, if necessary.

MAINT-2 Inventory and Map Facilities

Purpose

The purpose of this BMP is to map stormwater management facilities in the Plan Participants jurisdictions. A complete and updated inventory and map of stormwater management facilities is an essential first step in maintaining public facilities and regulating private facilities and helps Plan Participants track progress toward meeting measurable goals of related BMPs.

Element H: Stormwater Management Facilities Operation and Maintenance

BMP: MAINT-2 Inventory and Map Facilities

Geography

✓	CCSD#1-UGB, including Happy Valley
✓	SWMACC, including Rivergrove
✓	County-maintained ROW
✓	Municipal Facilities in permitted area

General Responsibility

✓	WES
✓	Happy Valley
✓	Clackamas County DTD
	Other Clackamas County department
✓	Rivergrove
✓	OLWS (see OLWS SWMP)

Background

Stormwater management facilities are defined as those structures with pollutant removal, infiltration/retention, or flow control capabilities. These include, but are not limited to, catch basins, detention tanks/pipes, detention ponds, infiltration ponds, swales, rain gardens, and pollution control manholes.

Public and Private Facilities

Stormwater management facilities may be public or private.

Public facilities include both those constructed as part of a Plan Participant's CIPs and those added to the public system through private development. For the purposes of this BMP, the definition of a public facility includes those privately-owned publicly-operated facilities in single-family residential subdivisions that are enrolled in WES' Residential Maintenance Agreement Program.

Private facilities are those stormwater management facilities owned and operated by commercial, industrial, multi-family residential, and institutional property owners (civic, religious, etc.). Facilities owned and operated by other public agencies, such as schools, fire districts, and ODOT, are also defined as private for the purposes of this BMP.

WES has primary responsibility for executing this BMP. All Plan Participants are responsible for notifying WES of new stormwater structures.

BMP Organization

This BMP contains three sub-components. MAINT-2.1 will be ongoing and MAINT-2.2 and 2.3 will be one-time efforts.

Detailed Description

MAINT-2.1 – INVENTORY AND MAP NEW STORMWATER MANAGEMENT FACILITIES

TYPE: ONGOING

STATUS: ONGOING

WES Information Management will inventory and map new public and private stormwater management facilities that drain to the MS4 in a GIS data layer.

See BMP POST-3, Post-Construction Verification and Acceptance, for more information on the authorization or acceptance of stormwater management facilities.

Element H: Stormwater Management Facilities Operation and Maintenance
BMP: MAINT-2 Inventory and Map Facilities

Plan Participants will cooperate by supplying information about new public and private facilities as they are constructed and authorized or accepted.

WES will annually report on the inventory of public and private stormwater management facilities to Plan Participants. The inventory report will document the ownership status and maintenance responsibility status of each facility. Plan Participants may use the annual inventory report as the basis for calculating maintenance-related tracking measures for the year.

MAINT-2.1 Responsibilities for Inventorying and Mapping New Stormwater Management Facilities

Responsibilities Matrix	WES Field Ops	WES Dev Review	WES Info Mgmt	DTD Transpo Const	Happy Valley Eng	Rivergrove	WES Capital Projects
<i>Constructs new public stormwater facilities and submits as-builts (see POST-3.4)</i>		I		P	P	P	P
<i>Accept as-builts of private development stormwater facilities (see POST-3)</i>		P					
File and track notifications			P				
Forward As-built plans to WES Information management		P	I				
Seek additional Info as needed		I/C/S	P	I/C/S	I/C/S	I/C/S	I/C/S
Inventory/Map assets in GIS	C/S		P				
Produce annual inventory report	I	I	P	I	I	I	

P = Performs Task, C = Consulted, S = Supports, I = Informed

MAINT-2.2 – DEVELOP MAPPING STRATEGY

TYPE: ONE-TIME

STATUS: FUTURE

Within the first year of the MS4 Permit term, WES will develop a strategy to improve and maintain its existing GIS inventory and map of public and private stormwater management facilities. The strategy will include:

- Definitions of facility types;
- A process for updating the GIS with ownership and responsibility attributes;
- Criteria for determining ownership and responsibility attributes (e.g. defining “maintenance agreement” facilities as public);
- Criteria for including private stormwater management facilities in the inventory.
- A process and procedure for inventory and mapping of new facilities;
- A process and timeline for updating existing records, including data verification and populating records with new attribute values; and
- A plan for sharing the GIS among Plan Participants.

Element H: Stormwater Management Facilities Operation and Maintenance

BMP: MAINT-2 Inventory and Map Facilities

WES may elect to offer the stormwater GIS as a service for facilities outside the permitted area (e.g. to Clackamas County for facilities outside of the districts) and to other co-permittees (e.g. OLWS).

MAINT-2.2 Responsibilities for Developing the Stormwater Mapping Strategy

Responsibilities Matrix	WES Field Ops	WES Dev Review	WES Info Mgmt	DTD Transpo Maint	Happy Valley Planning	Happy Valley Public Works
Define facility types	C	C	P	C	C	C
Define facility ownership criteria	C	C	P	C	C	C
Develop private facility inclusion criteria	C	C	P		C	C
Develop process for updating existing records	I	I	P	I	I	I
Develop database sharing/ integration plan	I	I	P	S	I	S

P = Performs Task, C = Consulted, S = Supports, I = Informed

MAINT-2.3 – UPDATE GIS AND EXISTING RECORDS

TYPE: ONE-TIME

STATUS: FUTURE

After completing MAINT-2.2 to develop a mapping strategy, WES will upgrade the existing GIS with new attribute fields and structural changes necessary to execute the strategy.

Plan Participants will cooperate by supplying information on ownership and maintenance responsibility of existing facilities as documented in their own records as needed by WES.

Following database upgrades, WES will review and update existing records accordingly, and will implement the plan for sharing the GIS or its data among Plan Participants.

MAINT-2.3 Responsibilities for Updating GIS and Existing Records

Responsibilities Matrix	WES Field Ops	WES Dev Review	WES Info Mgmt	DTD Transpo Maint	Happy Valley Planning	Happy Valley Public Works
Upgrade GIS Database Structure			P			
Provide ownership & responsibility records to WES Information management	C	P	I	P	C	P
Review and update existing records	C	C	P	C	C	C
Field-verify select GIS records	P		S	P		
Provide GIS database for use	I	I	P	I	I	I

P = Performs Task, C = Consulted, S = Supports, I = Informed

Element H: Stormwater Management Facilities Operation and Maintenance
BMP: MAINT-3 Inspection Schedule and Maintenance Standards

MAINT-2 Measurable Goals and Tracking Measures

ID	MEASURABLE GOALS	TRACKING MEASURES
MAINT-2.1-a	Map 100% of all new public and private facilities within six months of construction acceptance or authorization.	- Running total of public/private facilities mapped within six months of construction acceptance or authorization. - Running total of public and private facilities reaching construction acceptance or authorization. - Percentage to date of new public and private facilities mapped within six months of construction acceptance or authorization.
MAINT-2.2-a	Develop a mapping strategy by Dec. 31, 2017.	Date mapping strategy completed.
MAINT-2.3-a	Upgrade GIS database structure in support of mapping strategy by Jun. 30, 2018.	Date database upgrade completed.

MAINT-3 Inspection Schedule and Maintenance Standards

Purpose

The purpose of this BMP is to provide criteria for determining stormwater facility maintenance needs, so the Plan Participants and the owners and operators of private facilities can protect the pollutant removal, infiltration/retention, and flow control capacities of facilities.

The Plan Participants will develop standards that document the observable conditions that indicate stormwater management facilities require maintenance and a standardized schedule for conducting inspections. Maintenance standards provide the foundation for an inspection-based maintenance program for public facilities (see MAINT-4 and MAINT-5).

Geography

✓	CCSD#1-UGB, including Happy Valley
✓	SWMACC, including Rivergrove
✓	County-maintained ROW
✓	Municipal Facilities in permitted area

General Responsibility

✓	WES
✓	Happy Valley
✓	Clackamas County DTD
✓	Other Clackamas County department
	Rivergrove
✓	OLWS (see OLWS SWMP)

Background

On behalf of Plan Participants, WES is primarily responsible for implementing this BMP. Plan Participants are responsible for participating in the development of inspection and maintenance standards.

Element H: Stormwater Management Facilities Operation and Maintenance
BMP: MAINT-3 Inspection Schedule and Maintenance Standards

Detailed Description

MAINT-3.1 – INSPECTION SCHEDULE AND MAINTENANCE STANDARDS

TYPE: ONE-TIME

STATUS: FUTURE

WES will develop and publish a single set of maintenance criteria for stormwater management facilities for all Plan Participants. Criteria for inspection and prioritization will differ based on operational responsibility – public or private.

Definitions of facility types will align with those in BMP MAINT-2, Inventory and Map of Facilities.

WES will distribute the document internally to Plan Participants and will publicize it for use by private storm sewer system owners and operators.

For both public and private facilities, the document will include:

- Definitions of facility types; and
- Maintenance criteria (condition when maintenance is required; condition when proper maintenance has been achieved).

Public facility criteria will include the following items:

- Narrative of priorities for inspection and maintenance based on a variety of factors, including but not limited to:
 - Facility type
 - Facility features (e.g. catch basins with sumps or without sumps)
 - Priority locations
- Inspection schedule based on documented priorities;
- Time allowed to perform maintenance after failing inspection;
- Scheduled preventive maintenance programs (e.g. routine vegetation control); and
- Inspection and maintenance tracking procedures.

Private facility criteria will include the following items:

- Narrative of priorities for inspection and maintenance;
- Inspection schedule;
- Time allowed to perform maintenance after failing inspection;
- Required training or qualifications to inspect private facilities; and
- Summary and citation of the legal requirements, including reporting.

MAINT-3 Responsibilities for Inspection Schedule and Maintenance Standards

Responsibilities Matrix	WES Watershed Protection	WES Field Ops	WES Source Control	WES Comm Relations	DTD Transpo Maint	Happy Valley Public Works	Clackamas Co Facilities Mgmt
Develop maintenance criteria	P	C			S	S	S
Develop inspection priorities and schedule	P	S			S	S	S

Element H: Stormwater Management Facilities Operation and Maintenance
BMP: MAINT-4 Public Facility Inspection and Maintenance

Responsibilities Matrix	WES Watershed Protection	WES Field Ops	WES Source Control	WES Comm Relations	DTD Transpo Maint	Happy Valley Public Works	Clackamas Co Facilities Mgmt
Develop time allowances for maintenance	P	C			C	C	C
Develop preventive maintenance schedule	P	S			S	S	S
Develop tracking procedures for public facilities	P	S			C	S	S
Develop qualifications for inspecting private facilities	P	C	C		C	C	C
Update reporting procedures for private facilities (See BMP MAINT-7)	P	S					
Distribute internal document to Plan Participants	P	I	I	S	I	I	I
<i>Initiate Private Stormwater Facility Operations and Maintenance Outreach (see ED-6)</i>	P						

MAINT-3 Measurable Goals and Tracking Measures

ID	MEASURABLE GOALS	TRACKING MEASURES
MAINT-3.1-a	Complete Inspection Schedule and Maintenance Standards document by Mar. 30, 2018.	Date Inspection Schedule and Maintenance Standards document completed.

MAINT-4 Public Facility Inspection and Maintenance

Purpose

The purpose of this BMP is to verify and maintain the effective pollutant removal, infiltration/retention, and flow control functions of public stormwater facilities. The facilities covered by this BMP include both publicly-owned facilities and privately-owned facilities that are publicly-operated under WES' Residential Maintenance Agreement Program or other maintenance agreements.

Geography

✓	CCSD#1-UGB, including Happy Valley
✓	SWMACC, including Rivergrove
✓	County-maintained ROW
✓	Municipal Facilities in permitted area

General Responsibility

✓	WES
✓	Happy Valley
✓	Clackamas County DTD
✓	Other Clackamas County department
	Rivergrove
✓	OLWS (see OLWS SWMP)

Background

Ownership

Plan Participants inspect and maintain stormwater management facilities that are publicly-owned and/or operated. Within the permitted area, Plan Participants own stormwater management facilities that are in ROW and on dedicated tracts, municipal campuses, and other properties.

Operational responsibility for a privately-owned facility is assigned to a Plan Participant in a couple of ways. WES is commonly granted operational responsibility through maintenance agreements for privately-owned facilities serving residential subdivisions. Occasionally, operational responsibility is assigned to a Plan Participant through an easement.

See BMP MAINT-7 for information about operation and maintenance of privately-maintained storm sewer systems.

Facility Types

This BMP applies to stormwater management facilities that have a primary pollutant removal, infiltration/retention, or flow control functions, such as:

- Above-ground and below-ground water quality treatment facilities, including:
 - Proprietary pollution control devices
 - Sedimentation manholes
- Detention facilities, including:
 - Detention ponds
 - Below-ground detention tanks and large-diameter pipes
- LID flow-through facilities; and
- Infiltration facilities, including infiltrating LID facilities.

Catch basins are addressed in a separate BMP.

BMP Organization

This BMP contains three sub-components. MAINT-4.1 will be ongoing until superseded by MAINT-4.2 and 4.3, which will be ongoing after they start.

Detailed Description

MAINT-4.1 – ONGOING FACILITY MAINTENANCE (CONTINUE CURRENT LEVEL OF EFFORT)

TYPE: ONGOING UNTIL SUPERSEDED BY MAINT-4.2 AND 4.3

STATUS: ONGOING

Plan Participants will continue using established schedules and practices described in the 2012-2017 SWMPs for public facility maintenance until new inspection schedules and maintenance standards have been completed (see MAINT-3).

Both DTD and WES will use Vactor trucks to remove sediment from the conveyance system and structural controls. WES will dedicate one full time equivalent (FTE) to inspect structures in a specified area prior to assigning a maintenance vehicle to that area. Both DTD and WES will hire Clackamas County Corrections crews for maintenance of vegetated detention ponds and water quality ponds.

WES will track maintenance activities in a cMMS. DTD Administration will track maintenance activities in the Roadway Inventory Management System (RIMS).

Plan Participants will continue their activities at frequencies shown in the table below.

Element H: Stormwater Management Facilities Operation and Maintenance
BMP: MAINT-4 Public Facility Inspection and Maintenance

MAINT-4.1 – Ongoing Facility Maintenance Tasks

Facility Type	Geography	Who	Frequency	Activity Type
Structural water quality facility in ROW	CCSD#1 & SWMACC	WES	Every 3 years	Vactor
Residential Maintenance Agreement facility (detention, water quality, conveyance)	CCSD#1 & SWMACC	WES	70% annually	Inspect If needed, vactor, trash pickup, mow
Residential Maintenance Agreement facility (detention, water quality, conveyance)	CCSD#1 & SWMACC	WES	100% annually	Mow, cut brush/weeds
Non-maintenance agreement residential facility (detention, water quality, conveyance)	CCSD#1 & SWMACC	WES	Complaint response	Vactor, trash pickup, mow
Stormwater treatment: above-ground facility, sedimentation manhole, underground proprietary treatment	County-maintained ROW in permitted area outside of CCSD#1 and SWMACC	DTD	Every 3 years As-needed	Vactor, trash pickup, and mowing. Replace proprietary components

MAINT-4.1 Responsibilities for Ongoing Facility Maintenance (Current Level of Effort)

Responsibilities Matrix	WES Field Ops	DTD Transportation Maintenance	DTD Admin
Vactor structural water quality facilities	P		
Inspect Residential Maintenance Agreement facilities	P		
Refer Residential Maintenance Agreement facilities needing maintenance to WES	P / I		
Vactor, trash pickup, or mow Residential Maintenance Agreement facilities needing maintenance	P		
Respond to complaints about non-maintenance agreement residential facilities	P		
Vactor, trash pickup, mow, replace proprietary components of County-owned treatment facilities in ROW		P	
Respond to complaints about County-owned vegetated or underground facilities in the ROW		P	
Submit maintenance reports	P/I	P	I
Track maintenance activities in the cMMS	P		P

Element H: Stormwater Management Facilities Operation and Maintenance
BMP: MAINT-4 Public Facility Inspection and Maintenance

MAINT-4.2 – PREVENTIVE MAINTENANCE

TYPE: ONGOING

STATUS: FUTURE

Implementation of MAINT-4.2 will depend on the completion of the maintenance schedule in MAINT-3.

Plan Participants will schedule and perform stormwater facility routine preventive maintenance tasks that are not inspection-dependent. These tasks will include trash pickup, mowing, vegetation control requiring hand tools, and other routine tasks.

MAINT-4.2 depends on the completion of BMP MAINT-3, Inspection Schedule and Maintenance Standards.

MAINT-4.2 Responsibilities for Preventive Maintenance

Responsibilities Matrix	WES Watershed Protection	WES Field Ops	WES Info Mgmt	DTD Transpo Maint	DTD Admin	Happy Valley Street Maint	Happy Valley Public Works Admin
Trash pickup	C	P		P		P	
Mowing	C	P		P		P	
Vegetation control / weeding	C	P		P		P	
Submit activity reports / documentation	C	P	S	P	S	P	S
Compile reports / electronic tracking in cMMS or RIMS	C		P		P		P
Submit data for annual report / tracking	C	S	P	S	P	S	P

P = Performs Task, C = Consulted, S = Supports, I = Informed

MAINT-4.3 – INSPECTION-BASED FACILITY MAINTENANCE

TYPE: ONGOING

STATUS: FUTURE

When the *Inspection Schedule and Maintenance Standards* have been completed (see MAINT-3), then Plan Participants will begin to inspect all types of stormwater management facilities identified in this BMP using the schedule and standards in that document. Inspectors will use criteria to determine facility maintenance status and needs. Inspection reports will be compiled in a cMMS and will be used to determine maintenance requirements.

MAINT-4.3 depends on the completion of BMP MAINT-3, Inspection Schedule and Maintenance Standards.

When an inspection shows the need for maintenance, then the Plan Participant will perform the maintenance within a timeline established in the *Inspection Schedule and Maintenance Standards*. Maintenance records will be compiled in a cMMS.

Inspection-based maintenance tasks will include:

- Replacing proprietary filter media;

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- Removing sediment from manholes, pipes (within the facility's system), vaults, tanks, and pre-settling basins;
- Restoring and/or replenishing energy dissipation elements (e.g. rock pads);
- Removing sediment from and re-grading ponds and swales;
- Revegetating and mulching bare spots in surface ponds and swales;
- Replacing soil media and vegetation in LID facilities; and
- Other maintenance as needed.

These tasks will often include use of Vactor trucks, backhoes, and other equipment.

MAINT-4.3 Responsibilities for Inspection-Based Facility Maintenance

Responsibilities Matrix	WES Watershed Protection	WES Field Ops	WES Info Mgmt	DTD Transpo Maint	Happy Valley Street Maint	Happy Valley Public Works Admin	Clackamas Co Facilities Mgmt
Inspector Classification(s)❶	Technical Services Specialist Sanitary and Storm Technician			Road Maint Worker	Utility Worker I & II		Facilities Maint Supervisor
Inspect facilities	C	P		P	P	C	P
Submit inspection report		P	I	P	P	I	
Compile reports / electronic tracking		C	P	C	C	P	P
Issue maintenance tickets/work order (when needed)		P	I	I	I	P	P
Schedule & assign maintenance		P		P	P	I	P
Perform scheduled maintenance (Vactor)		P		P			P
Perform scheduled maintenance (backhoe)				P	P		P
Perform scheduled maintenance (other)		P		P	P		P
Submit maintenance report		P	I	P	P	I	
Compile reports / electronic tracking			P			P	
Submit data for annual report	C	S	P	S	S	P	P

P = Performs Task, C = Consulted, S = Supports, I = Informed

❶ These classifications of employees are authorized to perform inspections of public stormwater management facilities.

MAINT-4 Measurable Goals and Tracking Measures

ID	MEASURABLE GOALS	TRACKING MEASURES
Continue using existing goals and tracking measures as described below for MAINT-4.1 until the sub-component is superseded by MAINT-4.2 and 4.3.		
MAINT-4.1-a	Each year inspect the stormwater systems in 70% of subdivisions/partitions enrolled in WES' Residential Maintenance Agreement Program. (WES)	• Annual number of Residential Maintenance Agreement subdivisions/ partitions inspected. • Total number of subdivisions/partitions in WES' Residential Maintenance Agreement Program during reporting year. • Annual percentage of Residential Maintenance Agreement subdivisions/ partitions inspected.

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BMP: MAINT-4 Public Facility Inspection and Maintenance

ID	MEASURABLE GOALS	TRACKING MEASURES
MAINT-4.1-b	Correct 100% of maintenance deficiencies discovered during a Residential Maintenance Agreement inspection within two years. (WES)	- Running total of deficiencies found during Residential Maintenance Agreement inspections that were corrected within two years. - Running total of deficiencies found during Residential Maintenance Agreement inspections through Dec.31. 2020. - Percentage of deficiencies corrected within two years to date.
MAINT-4.1-c	Each year mow and/or cut brush and weeds from stormwater facilities within 100% of subdivisions/partitions enrolled in WES' Residential Maintenance Agreement Program. (WES)	- Annual number of subdivisions/partitions where stormwater facilities were mowed/brushed. - Total number of subdivisions/ partitions in WES' Residential Maintenance Agreement Program during reporting year. - Annual percentage of Residential Maintenance Agreement subdivisions/partitions where stormwater facilities were mowed/brushed.
MAINT-4.1-d	Each year remove sediment and trash from 30% of underground public water quality facilities operated by WES. (WES)	- Annual number of underground water quality facilities where WES removed sediment and trash. - Total number of underground public water quality facilities operated by WES in reporting year. - Annual percentage of underground water quality facilities where WES removed sediment and trash.
MAINT-4.1-e	Each year respond to 100% of non-emergency complaints and referrals for facility maintenance within 72 hours. (WES)	- Annual number of non-emergency complaints and referrals for facility maintenance responded to within 72 hours. - Annual number of non-emergency complaints and referrals for facility maintenance received by WES. - Annual percentage of non-emergency complaints and referrals for facility maintenance responded to within 72 hours.
MAINT-4.1-f	Each year mow 33% of vegetated facilities operated by DTD. (DTD)	- Annual number of vegetated facilities mowed by DTD. - Total number of vegetated facilities operated by DTD in reporting year. - Annual percentage of vegetated facilities mowed by DTD.
MAINT-4.1-g	Each year replace proprietary components in 100% of facilities operated by DTD in which a proprietary component needs replacement. (DTD)	- Annual number of facilities with proprietary components that have been replaced. - Annual number of facilities with proprietary components that need replacement. - Annual percentage of facilities with proprietary components that have been replaced.
MAINT-4.1-h	Each year respond to 100% of non-emergency complaints and referrals for facility maintenance within 72 hours. (DTD)	- Annual number of non-emergency complaints and referrals for facility maintenance responded to within 72 hours. - Annual number of non-emergency complaints and referrals for facility maintenance received by DTD. - Annual percentage of non-emergency complaints and referrals for facility maintenance responded to within 72 hours.

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BMP: MAINT-5 Inspect and Clean Catch Basins

ID	MEASURABLE GOALS	TRACKING MEASURES
Begin using goals and tracking measures as described below for MAINT-4.2 and 4.3 when the Plan Participants implement the inspection-based maintenance program, supported by MAINT-3, Inspection Schedule and Maintenance Standards.		
MAINT-4.2-a	Complete 90% of scheduled preventive maintenance on time each year. (WES, DTD)	- Annual number of preventive maintenance activities completed on time. - Annual number of scheduled preventive maintenance activities. - Annual percentage of preventive maintenance activities completed on time.
MAINT-4.3-a	Perform 100% of scheduled facility inspections each year. (WES, DTD)	- Annual number of facility inspections conducted. - Annual number of facility inspections scheduled. - Annual percentage of facility inspections completed.
MAINT-4.3-b	Correct 100% of maintenance deficiencies discovered during a public facility inspection within allowed time period. (WES, DTD) (Allowed time period based on maintenance schedule established in MAINT-3.) (Does not include repairs.)	- Running total of facilities with maintenance deficiencies (excluding repairs) that were corrected within the allowed time period. - Running total of facilities with maintenance deficiencies (excluding repairs) discovered during public facility inspection. - Percentage of maintenance deficiencies corrected within allowed time period.

MAINT-5 Inspect and Clean Catch Basins

Purpose

Catch basins and inlets primarily perform a conveyance function; however, some catch basins also serve a water quality function by capturing sediment and debris. The purpose of this BMP is to maintain conveyance capacity and eliminate pollutants from the MS4 by removing sediment and debris from catch basins.

Geography

✓	CCSD#1-UGB, including Happy Valley
✓	SWMACC, including Rivergrove
✓	County-maintained ROW
✓	Municipal Facilities in permitted area

General Responsibility

✓	WES
	Happy Valley
✓	Clackamas County DTD
	Other Clackamas County department
	Rivergrove
✓	OLWS (see OLWS SWMP)

Background

Plan Participants remove sediment from publicly owned or operated catch basins and inlets on a routine basis. Only catch basins and inlets with sumps, which trap debris and sediment, are routinely cleaned.

Catch basins are often located in the ROW but may also be located in easements. WES implements this BMP on County and City ROW, municipal facilities, and easements within the boundaries of CCSD#1 and SWMACC. DTD implements this BMP on County-maintained ROW in the permitted area outside of the districts.

Element H: Stormwater Management Facilities Operation and Maintenance

BMP: MAINT-5 Inspect and Clean Catch Basins

BMP Organization

This BMP contains two sub-components. MAINT-5.1 will be ongoing until superseded by MAINT-5.2, which will be ongoing after it starts.

Detailed Description

MAINT-5.1 – ROUTINE CATCH BASIN CLEANING (CONTINUE CURRENT LEVEL OF EFFORT)

TYPE: ONGOING UNTIL SUPERSEDED BY MAINT-5.2

STATUS: ONGOING

Plan Participants will continue the current levels of effort described in the 2012-2017 SWMPs for cleaning catch basins and inlets.

WES will remove sediment from catch basins and inlets (with sumps) with a Vactor truck. Activity will occur primarily during the dry weather season, but some structures may be cleaned more frequently in fall. WES will document catch basin cleaning in a cMMS. To provide data for inspection schedules, described in MAINT-3, WES field operators will record the depth of the sump and the depth of sediment in the sump at every 10th structure cleaned.

In the permitted area outside of CCSD#1 and SWMACC, DTD will remove sediment from catch basins and inlets (with sumps) in County-maintained ROW using a Vactor truck. DTD will record the depth of the sump and the depth of the sediment in each sump. DTD will document maintenance activity in RIMS.

MAINT-5.1 Responsibilities for Routine Catch Basin Cleaning (Continued Level of Effort)

Responsibilities Matrix	WES Field Operations	WES Information Management	WES Watershed Protection	DTD Transportation Maintenance
<i>Map and inventory catch basins/inlets (see MAINT-2)</i>	I	P		I
Schedule routes for routine cleaning	P			P
Routine catch basin cleaning	P			P
Record sump depth / sediment depth	P	I		P
Document cleaning activities in the cMMS / RIMS	P	I		P
Report tracking measures to WES	P		I	P

P = Performs Task, C = Consulted, S = Supports, I = Informed

MAINT-5.2 – INSPECTION-BASED CATCH BASIN CLEANING AND MAINTENANCE

TYPE: ONGOING

STATUS: FUTURE

When the *Inspection Schedule and Maintenance Standards* is complete (see MAINT-3), WES and DTD will implement a catch basin/inlet inspection and maintenance program based on documented priorities, criteria, and agreed responsibilities.

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BMP: MAINT-5 Inspect and Clean Catch Basins

Inspectors will use criteria established in MAINT-3 to determine maintenance status and needs.

Cleaning and maintenance will be based on inspection results. Cleaning will be required when sediment depth in the sump exceeds the established standard. Repair or replacement will be required based on an assessment of the structure's condition.

Plan Participants will clean and repair or replace catch basins within timelines established in the *Inspection Schedule and Maintenance Standards*.

This sub-component depends on the completion of BMP MAINT-3, Inspection Schedule and Maintenance Standards.

Inspection reports and maintenance records will be compiled in the cMMS and RIMS.

MAINT-5.2 Responsibilities for Inspection-Based Catch Basin Cleaning and Maintenance

Responsibilities Matrix	WES Field Operations	WES Information Management	WES Watershed Protection	DTD Transportation Maintenance
<i>Map and inventory catch basins/inlets (see MAINT-2)</i>	I	P		P
Schedule areas for inspection-based program	P		S	P
Perform inspections	P			P
Document inspections and results in the cMMS / RIMS	P			P
Generate maintenance tickets	P			P
Inspection-based cleaning	P			P
Inspection-based repair or replacement	I			P
Document cleaning and repair activities in the cMMS / RIMS	P	I		P
Report tracking measures to WES	P		I	P

P = Performs Task, C = Consulted, S = Supports, I = Informed

MAINT-5 Measurable Goals and Tracking Measures

ID	MEASURABLE GOALS	TRACKING MEASURES
Continue using existing goals and tracking measures as described below for MAINT-5.1 until the sub-component is superseded by MAINT-5.2.		
MAINT-5.1-a	Clean 33% of catch basins and inlets (with sumps) under WES responsibility each year.	- Annual number of catch basins and inlets cleaned. - Total number of catch basins and inlets (with sumps) under WES responsibility in reporting year - Annual percentage of catch basins and inlets (with sumps) cleaned.
MAINT-5.1-b	Clean 33% of catch basins and inlets (with sumps) under DTD responsibility each year.	- Annual number of catch basins and inlets cleaned. - Total number of catch basins and inlets (with sumps) under DTD responsibility in reporting year. - Annual percentage of catch basins and inlets (with sumps) cleaned.

Element H: Stormwater Management Facilities Operation and Maintenance

BMP: MAINT-5 Inspect and Clean Catch Basins

ID	MEASURABLE GOALS	TRACKING MEASURES
Begin using goals and tracking measures as described below for MAINT-5.2 when the Plan Participants implement the inspection-based maintenance program, supported by BMP MAINT-3, Inspection Schedule and Maintenance Standards.		
MAINT-5.2-a	Perform 100% of WES' scheduled catch basin/inlet inspections each year. (Number of scheduled inspections may differ each year, based on priorities and schedules established in MAINT-3.)	- Annual number of catch basins/inlets inspections performed by WES. - Annual number of WES' scheduled catch basin/inlet inspections. - Annual percentage of catch basins/inlets inspected.
MAINT-5.2-b	Perform 100% of DTD's scheduled catch basin/inlet inspections each year. (Number of scheduled inspections may differ each year, based on priorities and schedules established in MAINT-3.)	- Annual number of catch basins/inlets inspections performed by DTD. - Annual number of DTD's scheduled catch basin/inlet inspections. - Annual percentage of catch basins/inlets inspected.
MAINT-5.2-c	Clean 90% of catch basins/inlets under WES' responsibility that fail a sediment depth inspection within allowed time period. (Allowed time period based on maintenance schedule established in MAINT-3.)	- Running total of catch basins/inlets that were cleaned by WES within the allowed time period. - Running total of catch basins/inlets that failed WES' sediment depth inspection. \Percentage of catch basins/inlets that were cleaned within the allowed time period to date.
MAINT-5.2-d	Clean 90% of catch basins/inlets under DTD's responsibility that fail a sediment depth inspection within allowed time period. (Allowed time period based on maintenance schedule established in MAINT-3.)	- Running total of catch basins/inlets that were cleaned by DTD within the allowed time period. - Running total of catch basins/inlets that failed DTD's sediment depth inspection. - Percentage of catch basins/inlets that were cleaned within the allowed time period to date.
MAINT-5.2-e	Repair or replace 80% of catch basins/inlets that fail condition inspection within allowed time period from date of WES' inspection. (Allowed time period based on maintenance schedule established in MAINT-3.)	- Running total of catch basins/inlets that were repaired or replaced by WES within the allowed time period. - Running total of catch basins/inlets that failed WES' condition assessment. - Percentage of catch basins/inlets that were repaired or replaced within the allowed time period to date.
MAINT-5.2-f	Repair or replace 80% of catch basins/inlets that fail condition inspection within allowed time period from date of DTD's inspection. (Allowed time period based on maintenance schedule established in MAINT-3.)	- Running total of catch basins/inlets that were repaired or replaced by DTD within the allowed time period. - Running total of catch basins/inlets that failed DTD's condition assessment. - Percentage of catch basins/inlets that were repaired or replaced within the allowed time period to date.

MAINT-6 Public Conveyance Cleaning and Maintenance

Purpose

The purpose of this BMP is to prevent pollutants from discharging from the MS4 by maintaining public conveyances. Maintenance of conveyances can remove pollutants from the MS4, prevent erosion by stabilizing ditches and flow paths, and prevent localized flooding which can re-contaminate treated flows.

Geography

✓	CCSD#1-UGB, including Happy Valley
✓	SWMACC, including Rivergrove
✓	County-maintained ROW
✓	Municipal Facilities in permitted area

General Responsibility

✓	WES
✓	Happy Valley
✓	Clackamas County DTD
	Other Clackamas County department
	Rivergrove
✓	OLWS (see OLWS SWMP)

Background

Conveyances include storm sewer pipes and ditches. The most common location of public conveyances is transportation ROW.

Plan Participants will clean and maintain ditches and storm sewer lines under their authority. WES cleans storm sewer pipes greater than 8" in diameter, and DTD cleans those that are greater than 12" in diameter.

Catch basins and inlets are conveyance system components that are covered under a separate BMP, MAINT-5.

Detailed Description

MAINT-6.1 - PUBLIC CONVEYANCE CLEANING AND MAINTENANCE

TYPE: ONGOING

STATUS: ONGOING

WES will clean storm lines as needed in subdivisions enrolled in WES' Residential Maintenance Agreement Program as part of MAINT-4, Stormwater Public Facility Inspection and Maintenance. WES will clean storm pipe in County-maintained ROW inside CCSD#1 and SWMACC as needed based on complaints or field crew observations. Because of the low number of ditches owned by CCSD#1 and SWMACC, WES will coordinate with Happy Valley or DTD to meet its infrequent need for cleaning or re-grading of ditches within the districts.

DTD will clean ditches in the County-maintained ROW. Ditch segments will be prioritized based on upcoming scheduled road work and complaints. DTD will clean storm lines in County-maintained ROW within the permitted area outside of CCSD#1 and SWMACC as needed.

MAINT-6 Responsibilities for Public Conveyance Cleaning and Maintenance

Responsibilities Matrix	WES Field Operations	DTD Transportation Maintenance	Happy Valley Public Works
Accept conveyance complaints from public	P	P	P

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BMP: MAINT-7 Regulated Private Storm System Inspection and Maintenance Program

Responsibilities Matrix	WES Field Operations	DTD Transportation Maintenance	Happy Valley Public Works
Refer conveyance complaints based on geography and type	P	P	P
Schedule routes for WES Residential Maintenance Agreement subdivisions (see MAINT-4)	P		
Clean storm pipes as needed	P	P	
Schedule DTD ditch cleaning based on upcoming road resurfacing work schedule		P	
Respond to complaints within area of responsibility	P	P	P
Track miles of ditch cleaned or restored; track linear feet of storm pipe cleaned	P	P	P

P = Performs Task, C = Consulted, S = Supports, I = Informed

MAINT-6 Measurable Goals and Tracking Measures

ID	MEASURABLE GOALS	TRACKING MEASURES
MAINT-6.1-a	Respond to 90% of public complaints of ditch and storm line flooding during non-emergency weather events within 24 hours. (WES, DTD, Happy Valley)	- Annual number of public complaints regarding ditch or storm line flooding during non-emergency weather events responded to within 24 hours. - Annual number of public complaints received by WES, DTD, and Happy Valley. - Annual percentage of public complaints regarding ditch or storm line flooding during non-emergency weather events responded to within 24 hours.

MAINT-7 Regulated Private Storm System Inspection and Maintenance Program

Purpose

The purpose of this BMP is to reduce stormwater discharge volumes and pollutant discharge to the Plan Participants' MS4s by verifying that privately-owned storm sewer systems are operated to maintain their pollutant removal, stormwater infiltration/retention, and flow control functions. This BMP covers privately-owned storm sewer systems that serve multi-family residential properties, commercial and industrial properties, or institutions (religious, civic, etc.) and that discharge to an MS4.

Geography

✓	CCSD#1-UGB, including Happy Valley
✓	SWMACC, including Rivergrove
	County-maintained ROW
	Municipal Facilities in permitted area

General Responsibility

✓	WES
	Happy Valley
	Clackamas County DTD
	Other Clackamas County department
	Rivergrove
✓	OLWS (see OLWS SWMP)

Element H: Stormwater Management Facilities Operation and Maintenance
BMP: MAINT-7 Regulated Private Storm System Inspection and Maintenance Program

Background

Operators of regulated storm sewer systems are required to self-report inspection and maintenance of their systems annually.

For the purposes of this BMP, a regulated private storm sewer system is one that discharges to the MS4 and is on a privately-owned multi-family or non-residential site (e.g. commercial, industrial, religious etc.).

CCSD#1 and SWMACC maintain legal authority to regulate operation and maintenance of these systems in their rules and regulations (see MAINT-1). Many regulated private system operators are also obligated by a signed commercial/industrial storm sewer system facility maintenance agreement to inspect and maintain the property's stormwater facilities and to report their activities annually to WES.

During the 2012-2017 MS4 Permit term, WES began participating in the voluntary regional Storm Drain Cleaning Assistance Program (SCAP) with partners in the Portland-Metro area.

The program uses voluntary measures paired with an inspection and enforcement program to verify and track maintenance of regulated private stormwater systems. This BMP contains two elements that WES may use interchangeably or in combination at its discretion to meet the measurable goals.

BMP Organization

This BMP contains two sub-components. MAINT-7.1 is ongoing and will continue. MAINT-7.2 will be ongoing after it starts.

Detailed Description

MAINT-7.1 – STORM DRAIN CLEANING ASSISTANCE PROGRAM

TYPE: ONGOING

STATUS: ONGOING

WES will continue to cooperate with partners to implement the SCAP to help regulated private system operators maintain catch basins.

SCAP implementation will include notification, cleaning assistance, and report tracking. SCAP partner agencies will negotiate with vendors and obtain the lowest qualifying price quote for inspection and cleaning of catch basins. WES Watershed Management will send an annual maintenance reminder and SCAP invitation to its private facility maintenance agreement holders and other commercial and industrial facilities that operate regulated storm sewer systems. The Reminder may list the types of facilities not included in the SCAP offer, such as ponds, swales, and LID features that must also be maintained.

Property owners who respond to the invitation will be referred to the vendor. The vendor will inspect and clean structures and report the number of facilities visited, number, and type of structures maintained, and the volume of material removed. WES Information Management will track the vendor's reports.

Element H: Stormwater Management Facilities Operation and Maintenance
BMP: MAINT-7 Regulated Private Storm System Inspection and Maintenance Program

MAINT-7.1 Responsibilities for Storm Drain Cleaning Assistance Program

Responsibilities Matrix	WES Watershed Protection	WES Information Management	SCAP Partners ^❶	Vendor ^❶	Regulated Private System Operators ^❶
<i>Maintain inventory of regulated private storm sewer systems in CCSD#1 and SWMACC (see BMP MAINT-2)</i>	C	P			
Negotiate vendor price	I		P	C	
Compose and send annual maintenance reminder and SCAP invitation	P			I	I
RSVP to WES	I			I	P
Perform inspection and cleaning				P	C
Report tracking measures to WES	I			P	

P = Performs Task, C = Consulted, S = Supports, I = Informed

❶ These entities do not participate in this Plan and are not required to comply with it. Plan Participants are not responsible for the actions of these entities. Information is provided for the reader's convenience.

Element H: Stormwater Management Facilities Operation and Maintenance
BMP: MAINT-7 Regulated Private Storm System Inspection and Maintenance Program

MAINT-7.2 – REGULATED STORM SEWER INSPECTION AND ENFORCEMENT

TYPE: ONGOING

STATUS: FUTURE

This sub-component depends on the completion of BMP MAINT-3, Inspection Schedule and Maintenance Standards.

WES will implement a new inspection and enforcement program to verify operation and maintenance of regulated private storm sewer systems.

WES Watershed Protection will prioritize sites for inspection based on risk factors. Selection criteria will be documented in the MS4 annual report.

WES Watershed Protection will inspect regulated private storm sewer systems at the prioritized sites. Inspections may be conducted independently or may be combined with other types of inspections that WES performs, such as: sanitary sewer system inspections for Industrial Pretreatment and the Fats, Oils, & Grease Program (WES Source Control); and priority commercial and industrial facility stormwater quality inspections (WES Watershed Protection) (see COMM-2.3).

Inspectors will evaluate the maintenance condition of each site's storm sewer system, including stormwater management facilities, using the maintenance standards established in MAINT-3. If a regulated private storm sewer system fails an inspection, WES will follow an escalating enforcement strategy that begins with education and technical assistance.

Business Outreach

Storm sewer system maintenance outreach to businesses will also be integrated into DTD's Resource Conservation and Solid Waste (RCSW) program's Leaders in Sustainability Certification, which supports businesses seeking to adopt and strengthen sustainable best practices. DTD will update the certification program to include points for a properly maintained storm sewer system.

MAINT-7.2 Responsibilities for Regulated Private Storm Sewer Inspection and Enforcement

Responsibilities Matrix	WES Watershed Protection	WES Source Control	WES Field Operations	WES Information Management	DTD Resource Conservation Solid Waste
Develop maintenance criteria handouts based on MAINT-3	P		C		I
<i>Maintain inventory of regulated private stormwater systems in CCSD#1 and SWMACC (see BMP MAINT-2)</i>	I	I		P	I
Prioritize geographic areas or business types	P		C	C	
Incorporate storm sewer system maintenance into Leaders in Sustainability Program	I				P
Perform maintenance inspections of prioritized sites	P		S		
Include storm sewer inspections with ongoing sanitary system-related inspections	S	P			
Submit inspection reports to WES	P	P			
Technical assistance and enforcement, as needed	P	S	S		
Track inspections and enforcement	P	S		S	

P = Performs Task, C = Consulted, S = Supports, I = Informed

MAINT-7 Measurable Goals and Tracking Measures

ID	MEASURABLE GOALS	TRACKING MEASURES
MAINT-7.1-a	None	• None
MAINT-7.2-a	Beginning in 2019, inspect 70% of prioritized regulated private storm sewer systems in CCSD#1 and SWMACC each year. (WES)	• Annual number of regulated private storm sewer systems inspected at least one time. • Total number of prioritized regulated private storm sewer systems in CCSD#1 and SWMACC in reporting year. • Annual percentage of prioritized regulated private storm sewer systems inspected.
MAINT-7.2-b	Each year, 50% of inspected regulated private storm sewer systems pass initial inspection.	• Annual number of regulated private storm sewer systems that passed initial inspection. • Annual number of regulated private systems inspected. • Annual percentage of regulated private storm sewer systems that passed initial inspection.
MAINT-7.2-c	Provide technical assistance to 90% of regulated private storm sewer systems found to have a maintenance deficiency within one year.	• Running total of regulated private storm sewer systems that received technical assistance within one year of an inspection that discovered a maintenance deficiency. • Running total of regulated private storm sewer systems where an inspection discovered a maintenance deficiency. • Percentage of regulated private storm sewer systems that received technical assistance within one year to date.

MAINT-8 Urgent Conditions / Storm Preparation and Response

Purpose

The purpose of this BMP is to prepare for and respond to storms or other urgent situations. This BMP includes immediate response to calls for unblocking conveyances and culverts to prevent or mitigate localized flooding. Plan Participants also take preventive actions to help ensure proper drainage and maintain water quality functions where possible prior to predicted storms.

Geography

✓	CCSD#1-UGB, including Happy Valley
✓	SWMACC, including Rivergrove
✓	County-maintained ROW
✓	Municipal Facilities in permitted area

General Responsibility

✓	WES
✓	Happy Valley
✓	Clackamas County DTD
✓	Other Clackamas County department
	Rivergrove
✓	OLWS (see OLWS SWMP)

Background

Plan Participants unblock conveyances and stormwater management facilities during storms in response to calls from the public.

Element H: Stormwater Management Facilities Operation and Maintenance
BMP: MAINT-8 Urgent Conditions / Storm Preparation and Response

Detailed Description

MAINT-8.1 – URGENT CONDITIONS/STORM PREPARATION AND RESPONSE

TYPE: ONGOING

STATUS: ONGOING

Plan Participants will mobilize and respond to problems on public and private property causing or caused by flooding of public facilities and conveyances during storms and urgent conditions. Crews will respond within any portion of the permitted area that the Plan Participant's crews normally operate. Each Plan Participant will integrate storm response activities into call-out procedures.

A response involving a public treatment or flow control facility (e.g. detention pond, swale) will be documented as a maintenance activity and forwarded to WES for tracking in the cMMS.

WES Field Operations and DTD will maintain lists of conveyances and facilities to inspect and clear of debris and blockages when weather reports call for rainstorms.

There are no measureable goals or responsibilities matrices for this BMP.

This page concludes Stormwater
Management Facilities
Operations and Maintenance.

Definitions

TERM	DEFINITION
Adaptive management	A structured, iterative process designed to refine and improve stormwater programs over time by evaluating results and adjusting actions on the basis of what has been learned.
Best Management Practices (BMPs)	The schedule of activities, controls, prohibition of practices, maintenance procedures and other management practices designed to prevent or reduce pollution. BMPs also include treatment requirements, operating procedures and practices to control stormwater runoff.
Clean Water Act (CWA)	The Federal Water Pollution Control Act enacted by Public Law 92-500, as amended by Public Laws 95-217, 95-576, 96-483 and 97-117 33 U.S.C. 1251 et seq.
Conveyance system	Drainage facilities and features that collect, contain, and provide for the flow of surface and storm water from the highest points on the land down to a receiving water. Conveyance systems are made up of natural elements and of constructed facilities.
County Roads	A public road under the jurisdiction of a county that has been designated as a county road under ORS 368.016 (County authority over roads). County roads have been accepted by the county for maintenance, and the county is authorized to spend county road funds for improving and maintaining.
Flood control project	Any plan, system, manner or means for the control, diversion, conservation or abatement of floodwaters or any excessive or unusual accumulation of water in any natural or artificial stream or body of water, or for protection of life and property against danger, menace, injury or damage resulting therefrom.
Illicit discharge	Any discharge to a municipal separate storm sewer that is not composed entirely of stormwater, except discharges pursuant to a NPDES permit or other state or federal permit, or otherwise authorized by the Department of Environmental Quality, and discharges resulting from firefighting activities.
Impervious surface	Any surface resulting from development activities that prevents the infiltration of water or results in more runoff than in the undeveloped condition. Common impervious surfaces include building roofs, traditional concrete or asphalt paving on walkways, driveways, parking lots, gravel roads, and packed earthen materials.
Low Impact Development (LID)	A stormwater management approach that seeks to mitigate the impacts of increased runoff and stormwater pollution using a set of planning, design and construction approaches and stormwater management practices that promote the use of natural systems for infiltration, evapotranspiration, and reuse of rainwater, and can occur at a wide range of landscape scales (i.e., regional, community and site).

Definitions

TERM	DEFINITION
Major outfall	A municipal separate storm sewer outfall that discharges from a single pipe with an inside diameter 36 inches or more or its equivalent (discharge from a single conveyance other than circular pipe which is associated with a drainage area of more than 50 acres) or from municipal separate storm sewers that receive stormwater from lands zoned for industrial activities (based on comprehensive zoning plans or the equivalent), an outfall that discharges from a single pipe with an inside diameter of 12 inches or more or from its equivalent (discharge from other than a circular pipe associated with a drainage area of 2 acres or more).
Maximum Extent Practicable (MEP)	The statutory standard that establishes the level of pollutant reductions that operators of regulated MS4s must achieve. This standard is considered met if the conditions of the MS4 Permit are met.
Measurable goals	BMP objectives or targets used to identify progress of SWMP implementation. Measurable goals are prospective and, wherever possible, quantitative. Measurable goals describe what the co-permittee intends to do and when they intend to do it.
Minor outfall	A municipal separate storm sewer outfall that is not a major outfall.
Municipal Separate Storm Sewer System (MS4)	A conveyance or system of conveyances (including roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, manmade channels, or storm drains): • Owned or operated by a state, city, town, borough, county, parish, district, association, or other public body (created by or pursuant to state law) having jurisdiction over disposal of sewage, industrial wastes, stormwater or other wastes, including special districts under state law such as a sewer district, flood control district or drainage district, or similar entity, or an Indian tribe or an authorized Indian Tribal organization, or a designated and approved management agency under §208 of the CWA that discharges to waters of the United States designed or used for collection or conveying stormwater; • Which is not a combined sewer; and • Which is not part of a Publicly Owned Treatment Works (POTW) as defined by 40 CFR §122.2.
Non-stormwater discharge	Any discharge to the storm sewer that is not composed entirely of stormwater. Non-stormwater discharges can include discharges of process water, air conditioner condensate, non-contact cooling water, vehicle wash water, irrigation, or sanitary wastes. Some non-stormwater discharges are regulated and authorized by an NPDES permit or allowed by Plan Participants. If a non-stormwater discharge is not allowed by a Plan Participant or authorized by a NPDES, it is an illicit discharge.

TERM	DEFINITION
Operational source control BMPs	Non-structural practices that prevent or reduce pollutants from entering stormwater. Examples include formation of a pollution prevention team, good housekeeping practices, preventive maintenance procedures, spill prevention and cleanup, employee training, inspections of pollutant sources, and record keeping. They can also include process changes, raw material/product changes, and recycling wastes.
Outfall	A point source as defined by 40 CFR §122.2 at the point where a municipal separate storm sewer discharges to waters of the United States and does not include open conveyances connecting two municipal separate storm sewers, or pipes, tunnels or other conveyances which connect segments of the same stream or other waters of the United States and are used to convey waters of the United States.
MS4 Permit	The NPDES municipal separate storm sewer system (MS4) permit issued to the Clackamas County Group, authorizing the permittees to discharge from the MS4.
Permitted area	Entire coverage area of MS4 Permit No. 101348
Public facility (stormwater management)	A stormwater management facility owned or operated by one of the Plan Participants.
Public road	A road over which the public has a right of use that is a matter of public record.
Regulated private storm sewer system	A storm sewer system that discharges to one of the Plan Participants' MS4s, is on a privately-owned industrial, commercial, religious institution, or multi-family residential property, and is privately-operated.
Road	The entire right of way of any public or private way that provides ingress to or egress from property by means of vehicles or other means or that provides travel between places by means of vehicles. Road includes, but is not limited to: (a) Ways described as streets, highways, throughways or alleys; (b) Road related structures that are in the right of way such as tunnels, culverts or similar structures; and (c) Structures that provide for continuity of the right of way such as bridges.
Spill	An unintentional release of a non-stormwater substance related to a single event that does or may enter the stormwater drainage system. Many times they are associated with emergency situations such as an automobile accident spilling oil or other automotive fluids onto the highway surface and potentially flowing into the stormwater drainage system.
Storm sewer	A conveyance structure designed to carry only storm waters, surface water runoff, and/or drainage.
Stormwater	Stormwater runoff, snowmelt runoff, and surface runoff and drainage.

Definitions

TERM	DEFINITION
Stormwater facility / stormwater management facility	Engineered facilities that are designed to convey storm runoff, remove pollutants and to control flow rates. These facilities include pipes, ditches, swales, filters, ponds, underground tanks, and vaults. These systems are specifically designed to capture, treat, store and then slowly release stormwater runoff downstream or into the ground.
Stormwater management program	A comprehensive set of activities and actions, including policies, procedures, standards, ordinances, criteria, and best management practices established to reduce the discharge of pollutants from the MS4 to the Maximum Extent Practicable, to protect water quality, and to satisfy the appropriate water quality requirements of the Clean Water Act.
Structural water quality facility / structural control (obsolete)	Constructed elements providing stormwater treatment including, but not limited to, vegetated aboveground stormwater detention facilities, sedimentation manholes, and various types of underground proprietary pollution control systems. Note: these terms are obsolete in the Shared SWMP. They are used in the Plan Participants' previous SWMPs and are used only in the Shared SWMP to describe ongoing activities of the Plan Participants.
Structural source control BMPs / measures	Physical, structural, or mechanical devices or facilities that are intended to prevent pollutants from entering stormwater. Structural source control BMPs typically include enclosing the pollutant source in a building or under a roof, segregating the pollutant source to prevent run-on of stormwater, and directing only contaminated stormwater to appropriate treatment BMPs (e.g. oil/water separator).
Waters of the State	Lakes, bays, ponds, impounding reservoirs, springs, wells, rivers, streams, creeks, estuaries, marshes, inlets, canals, the Pacific Ocean within the territorial limits of the State of Oregon, and all other bodies of surface or underground waters, natural or artificial, inland or coastal, fresh or salt, public or private (except those private waters that do not combine or effect a junction with natural surface or underground waters) that are located wholly or partially within or bordering the state or within its jurisdiction.
Year	Calendar year except where otherwise defined.

This page concludes the Definitions.

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Appendix B:

Proposed program modifications, including changes made to the
Stormwater Management Plan

Appendix B:

Proposed program modifications, including changes made to the Stormwater Management Plan

At the present time – February 2017 – the five Coordinated Participants (Clackamas County, CCSD#1, the SWMACC, the Cities of Rivergrove and Happy Valley) implement their MS4 permit programs through three separate SWMPs. The co-owners/implementers of these three SWMPs are:

- Clackamas County DTD
- The City of Happy Valley and CCSD#1
- The City of Rivergrove and the SWMACC

To improve coordination and overall program effectiveness, the five Coordinated Participants recently chose to create a single, combined, Shared SWMP (Shared SWMP). This proposed Shared SWMP is in Appendix A of this permit renewal application package.

A substantial number of modifications were made to various BMPs (Best Management Practices) during the process of integrating the three existing SWMPs into the Shared SWMP. The Shared SWMP has thirty-six (36) BMPs, many of which have new, improved measurable goals and tracking measures. A summary of these modifications is provided in the tables on the following pages.

Appendix B: Summary of Proposed Changes to Best Management Practices

Changes to Illicit Discharge Detection and Enforcement BMPs					
2012-2017 SWMPs BMPs		Shared SWMP BMPs		Changes	
CCSD#1, SWMACC, Happy Valley and Rivergrove Title and Number		DTD No.	ID	Title	
Conduct Dry Weather Inspections	1	1	IDDE-3 IDDE-4 IDDE-5	Dry-weather Inspections Illicit Discharge Response and Enforcement Outfall Mapping	1. Reorganized to separate dry-weather inspections, outfall mapping, and illicit discharge response and enforcement into separate BMPs. 2. Changed dry-weather inspections to require 72-hours of dry-weather before inspections occur. 3. Added IDDE-5 to document outfall mapping procedures. 4. Measurable goals: • Added goal to review and update PPALs. • Added goal to audit the outfall inventory.
Implement the Spill Response Plan	2	2	IDDE-2	Spill Prevention and Response	1. Added spill prevention program for municipal and commercial properties. 2. Measurable goals: • Added goal to incorporate spill prevention into the Leaders in Sustainability Certification. • Added goals to identify, contact, and develop spill prevention and response plans for qualifying municipal facilities. (“Qualifying municipal facility” is defined in the proposed Shared SWMP.) • Added goal to report spills at qualifying municipal facilities to state and federal authorities within required reporting timelines. • Added goal to report reportable spills on public roadways or in the storm sewer to state and federal authorities within required reporting timelines. • Added goal to train WES Field Operations, DTD Road Maintenance staff, Happy Valley road crews on spill response.
Respond to Reports Involving Illicit Discharge	3	3	IDDE-1 IDDE-4	Illicit Discharge Legal Authority Illicit Discharge Response and Enforcement	1. Reorganized to separate legal authority from response and enforcement procedures. 2. Added IDDE-1 to document the Plan Participant’s legal authority. 3. Clarified that the response and enforcement procedures are applicable to all illicit discharges, regardless of how discovered or reported. 4. Measurable goals: • Added goal review and revise the Illicit Discharge and Spill Response SOP. • Added tracking goal to track allowed non-stormwater discharges.

Appendix B: Summary of Proposed Changes to Best Management Practices

Industrial and Commercial Facilities					
2012-2017 SWMPs BMPs		Shared SWMP BMPs		Changes	
CCSD#1, SWMACC, Happy Valley and Rivergrove Title and #	DTD #	ID	Title		
Screen Existing and New Industrial Facilities	4	N/A	COMM-1	Identify Industrial NPDES Permit Facilities	1. Measurable goals: - Added goals to review new industrial development applications one time each year and survey existing industrial facilities for 1200-Z permit applicability one time each MS4 permit term. - Added goal to notify facility operator and DEQ of facilities newly identified as potentially needing a 1200-Z permit within 30 days of identification. - Added goal to update the inventory of 1200-Z permits.
Address Other Industrial Facilities	5	N/A	COMM-2	Industrial/Commercial Stormwater Pollutant Reduction	1. Added a commercial property stormwater source control inspection program. 2. Measurable goals: - Updated measurable goal to conduct source control technical assistance. - Added goal to inspect sites for which complaints or referrals are received. - Added goal to update and prioritize the existing list of commercial/industrial facilities that do not require a 1200-Z permit. - Added goal to conduct a source control inspection of priority commercial/industrial facilities (“priority facilities” is defined in the proposed Shared SWMP).

Appendix B: Summary of Proposed Changes to Best Management Practices

Construction Site Runoff					
2012-2017 SWMPs BMPs			Shared SWMP BMPs		Changes
CCSD#1, SWMACC, Happy Valley and Rivergrove Title and No.		DTD No.	ID	Title	
Conduct Procedures for Site Planning	6	4	EPSC-2	Erosion Prevention and Sediment Control (EPSC) Plan Review	1. Added formal process for reviewing Plan Participants’ CIP EPSC plans. 2. Measurable goal: Added goal for stormwater development review to attend pre-construction meetings.
Implement Requirements for Structural and Non-Structural Best Management Practices	7	5	EPSC-1 EPSC-2	Construction Site Runoff Legal Authority EPSC Plan Review	1. Reorganized into two BMPs: - Added EPSC-1 to document Plan Participants’ legal authority to require construction site operators to implement ESPC practices. - EPSC-2 documents Plan Participants’ EPSC Plan Review procedures. 2. Measurable goals: - Added goal to review and update DTD’s boilerplate contract terms to ensure EPSC plans are required in construction contracts. - Added goals to review and update municipal codes and district rules requiring EPSC measures.
Conduct Training for Construction Site Operators	8	N/A	ED-1 ED-3 ED-5	Implement the Stormwater Public Education and Outreach Strategy Employee Training Erosion Control Outreach	1. Moved the activities of this BMP to Education: - ED-1 includes some activities targeting construction site operators in the Stormwater Public Education and Outreach Strategy. - ED-3 documents all Plan Participants’ employee training including training for EPSC plan review and inspection. - ED-5 replaces the construction site runoff BMP “Conduct Training for Construction Site Operators”. 2. Measurable goals for ED-5: - Added goal to provide web access to the EPSC design manual. - Added goal to update and distribute a list of local and regional EPSC training opportunities.
Identify Priorities for Inspecting Sites and Conducting Enforcement Actions	9	6, 7	EPSC-3	EPSC Inspection and Enforcement	1. Added an activity for the Plan Participants to adopt an Erosion Control Enforcement Response Plan that clarifies the procedures for erosion control enforcement.

Appendix B: Summary of Proposed Changes to Best Management Practices

Education and Outreach					
2012-2017 SWMPs BMPs		Shared SWMP BMPs		Changes	
CCSD#1, SWMACC, Happy Valley and Rivergrove Title and No.	DTD No.	ID	Title		
Public Education to Reduce Discharges of Pesticides, Herbicides, and Fertilizers	10	8, 9	ED-1	Implement the Stormwater Public Education and Outreach Strategy	1. Reorganized these activities into a single BMP to implement the required Stormwater Public Education and Outreach Strategy, ED-1. 2. ED-1 adopts the <i>Communications Plan – Surface Water Program – DRAFT 4</i> updated Jun. 2, 2014 or an updated version as part of the SWMP. 3. Measurable goals: - Updated goals to reflect cooperation between Plan Participants. - Updated goals with more specific education and outreach targets. - Added goal to update the Stormwater Public Education and Outreach Strategy. - Deleted “Pursue additional relevant USGS studies if the opportunity presents itself.” - Deleted “Refer all pesticide/herbicide disposal related calls to Metro.”
Proper Disposal Practices to Reduce Discharges of Pesticides, Herbicides, and Fertilizers	11				
Facilitate Reporting of Illicit Discharges and Spills and Other Types of Improper Disposal of Materials	12	N/A	ED-2	Facilitate Illicit Discharge Reporting	1. Measurable goals: Updated goal to conduct IDDE reporting publicity for the MS4 Permit term.
Participate in a Public Education Effectiveness Evaluation	13	10	ED-4	Public Education Effectiveness Evaluation	1. Measurable goals: Added goal to document adaptive management actions.
Training for Employees	14	11	ED-3 PREV-5	Employee Training Pollution Prevention in Fire-Fighting Training	1. Added training coordinator positions to facilitate training tracking. 2. Moved construction site runoff training for employees here from Construction Site Runoff. 3. Added goal to provide Hazmat Operations + Awareness Training to Plan Participant employees whose duties include responding to spills or illicit discharges. 4. Moved activities to control the release of materials related to fire-fighting training to Pollution Prevention for Municipal Operations. These activities were moved from the employee training because Clackamas Fire District No. 1 (CFD#1) is not a Plan Participant or permittee. 5. Measurable goals: - Updated ED-3 goals to make training targets more specific. - Added goal to PREV-5 perform unscheduled site visits to the CFD#1 training center.

Appendix B: Summary of Proposed Changes to Best Management Practices

Education and Outreach					
2012-2017 SWMPs BMPs		Shared SWMP BMPs		Changes	
CCSD#1, SWMACC, Happy Valley and Rivergrove Title and No.	DTD No.	ID	Title		
Public Involvement and Participation					
2012-2017 SWMPs BMPs		Shared SWMP BMPs		Changes	
CCSD#1, SWMACC, Happy Valley and Rivergrove Title and No.	DTD No.	ID	Title		
Provide for Public Participation with SWMP and Benchmark Submittals	15	12	PP-1	Public Participation	1. Measurable goals: Updated public participation goals for the MS4 Permit term.

Appendix B: Summary of Proposed Changes to Best Management Practices

Post-construction Site Runoff					
2012-2017 SWMPs BMPs		Shared SWMP BMPs		Changes	
CCSD#1, SWMACC, Happy Valley and Rivergrove Title and No.		DTD No.	ID		Title
Planning Procedures for New Development and Significant Redevelopment	16	12	POST-1 POST-2 POST-3	Post-Construction Legal Authority Stormwater Management Plan (SWM Plan) Review Post-Construction Verification and Acceptance	1. Reorganized to separate the activities from this BMP into three BMPs: POST-1, POST-2, and POST-3: - Added POST-1 to document the Plan Participants’ legal authority to review post-construction stormwater management plans and inspect facilities. - POST-2 documents post-construction stormwater management plan review procedures. - POST-3 documents the Plan Participants’ post-construction BMP inspection and acceptance procedures. 2. Measurable goals: - Added goal to review and update legal authority. - Added goal to review and update DTD’s boilerplate contract ensure post-construction controls meet design standards. - Added goals to review post-construction plans for Plan Participants’ CIPs. - Added goals to ensure post-construction plans are reviewed prior to issuing building permits. - Added goals to ensure stormwater facilities are inspected prior to issuing certificates of occupancy. - Added goal to inspect stormwater facilities for Plan Participants’ CIPs. - Moved goal to map new facilities to MAINT-2. - Moved goal to check compliance with private facility maintenance agreements to MAINT-7.
Update Procedures for New Development and Significant Redevelopment	17	13	POST-1 POST-4 POST-5	Post-Construction Legal Authority Stormwater Standards and Design Tools LID Barriers Analysis	1. Reorganized these activities into separate BMPs: - POST-1 reviews and updated Plan Participants’ legal authority. - POST-4 reviews and updates post-construction runoff standards and procedures. - Added POST-5 to review Plan Participants’ codes and standards to identify and eliminate barriers to LID implementation. 2. Measurable goals: - Updated goal to review and update standards and design manual. - Moved and updated goal to review codes and standards for barriers to LID implementation to POST-5.

Appendix B: Summary of Proposed Changes to Best Management Practices

Post-construction Site Runoff					
2012-2017 SWMPs BMPs		Shared SWMP BMPs		Changes	
CCSD#1, SWMACC, Happy Valley and Rivergrove Title and No.		DTD No.	ID		
BMP Sizing Tool Development to address Hydromodification	18	N/A	POST-4	Stormwater Standards and Design Tools	1. Included the activities of BMP 18 “BMP Sizing Tool Development to address Hydromodification” to provide design tools for post-construction runoff control in POST-4. 2. Measurable goals: - Added a goal to establish program options for equivalent mitigation. - Added a goal to require equivalent mitigation for sites unable to meet on-site requirements. - Added goal to update or replace the BMP Sizing Tool.

Appendix B: Summary of Proposed Changes to Best Management Practices

Pollution Prevention for Municipal Operations BMPs					
2012-2017 SWMPs BMPs			Shared SWMP BMPs		Changes
CCSD#1, SWMACC, Happy Valley and Rivergrove Title and No.		DTD No.	ID	Title	
Street Sweeping	19	15	PREV-1	Pollution Prevention in Road Operations	1. Reorganized to combine BMPs 19 and 20 into one BMP for road operations, PREV-1. 2. Adopts the <i>Oregon Department of Transportation (ODOT) Routine Road Maintenance Water Quality and Habitat Guide: Best Management Practices</i>, revised 2014 or an updated version as part of the SWMP. 3. Reorganized to combine BMPs 21 and 22 into one BMP for reducing the discharge of pesticides, herbicides, and fertilizers, PREV-2. 4. PREV-2 adopts the <i>2012 Integrated Pest Management Plan for the Surface Water Management Agency of Clackamas County, Clackamas County Service District No. 1, and the City of Happy Valley</i> and the <i>Clackamas County Integrated Vegetation Management Plan</i>, dated 2000 as part of the SWMP. 5. Measurable goals: • Updated street sweeping goals. • Updated removal of illegal solid waste dumps goal. • Updated goal to adopt the 2009 ODOT Guide to the most recent ODOT Guide or an approved alternative. • Replaced non-goal language. • Updated goals to develop an Integrated Pest Management plan with a goal to hold IPM training.
Operations & Maintenance for Public Streets	20	15			
Proper Road Maintenance Practices to Reduce the Discharge of Pesticides, Herbicides and Fertilizers	21	15, 16	PREV-2	Pollution Prevention for Landscape Maintenance and Vegetation Control	
Landscape Maintenance Practices to Reduce the Discharge of Pesticides Herbicides, and Fertilizers	22	16			

Appendix B: Summary of Proposed Changes to Best Management Practices

Pollution Prevention for Municipal Operations BMPs					
2012-2017 SWMPs BMPs			Shared SWMP BMPs		Changes
CCSD#1, SWMACC, Happy Valley and Rivergrove Title and No.		DTD No.	ID	Title	
None	N/A	N/A	PREV-3	Pollution Prevention for Municipal Waste Facilities	1. This BMP documents the Plan Participants' activities to prevent materials collected and stored at municipal waste facilities from washing into the MS4 and polluting receiving waters. 2. Adopts the <i>Strategy for qualifying Municipal Facilities owned/ operated by the City of Happy Valley, Clackamas County, CCSD#1, and/ or SWMACC which are also located in the City of Happy Valley, SWMACC, or CCSD#1</i> (issued on Jun. 28, 2013 and revised on Aug. 31, 2016) as part of the SWMP. 3. Expands scope of strategy to include DTD waste facility. 4. Measurable goals: • Added goal to inspect municipal waste facilities. • Added goal to correct deficient operational source control BMPs at municipal waste facilities. • Added goal to correct deficient structural source control BMPs at municipal waste facilities. • Added goal to evaluate strategy for adaptive management.
Control Infiltration and Cross Connection to the District's Stormwater System	23	N/A	PREV-4	Control Sewage Infiltration	1. Measurable goals: • Updated goal to eliminate sanitary discharges. • Added goal to TV inspect the public sewer system.
Flood Management Projects and Water Quality	24	N/A	PREV-6	Storm System Retrofit Program	1. Moved consideration of water quality for new capital improvement projects to POST-2 "Stormwater Management Plan (SWM) Plan Review". 2. Reorganized to combine the activities of BMPs 25 and BMP 26 into a single BMP to retrofit storm systems, PREV-6. 3. Measurable goals: • Updated goals to reflect cooperation between Plan Participants. • Added a goal to update the Retrofit Plan in the MS4 Permit term. • Updated specified retrofit targets.
Detention Pond Retrofit Program	25				

Appendix B: Summary of Proposed Changes to Best Management Practices

Structural Stormwater Facility Operations and Maintenance					
2012-2017 SWMPs BMPs			Shared SWMP BMPs		Changes
CCSD#1, SWMACC, Happy Valley and Rivergrove Title and No.		DTD No.	ID	Title	
None	N/A	N/A	MAINT-1	Operation and Maintenance Legal Authority	1. This BMP documents the Plan Participants' legal authority to inspect private stormwater facilities and require maintenance. 2. Measurable goals: Added goal to review and update legal authority.
None	N/A	N/A	MAINT-2	Inventory and Map Facilities	1. This BMP documents procedures to map public and private stormwater facilities in all Plan Participants' jurisdictions. 2. The BMP will include facility definitions, mapping and verification processes, mapping criteria, and a plan to share the data between Plan Participants. 3. Measurable goals: • Updated goal to map all new public and private facilities. • Updated goal to develop a mapping strategy. • Updated goal to upgrade the GIS database structure.
None	N/A	N/A	MAINT-3	Inspection Schedule and Maintenance Standards	1. This BMP establishes goals for adopting inspection schedules and maintenance standards for public and private stormwater facilities. Once adopted, the inspection schedules and maintenance standards will drive maintenance activities in MAINT-4, MAINT-5, MAINT-6, and MAINT-7. 2. Measurable goals: Added goal to complete an inspection schedule and maintenance standards document.

Appendix B: Summary of Proposed Changes to Best Management Practices

Structural Stormwater Facility Operations and Maintenance					
2012-2017 SWMPs BMPs		Shared SWMP BMPs		Changes	
CCSD#1, SWMACC, Happy Valley and Rivergrove Title and No.		DTD No.	ID		Title
Maintenance of Conveyance System Components and Structural Controls	26	17	MAINT-4 MAINT-6	Public Facility Inspection and Maintenance Public Conveyance Cleaning and Maintenance	1. Reorganized to separate stormwater facility and conveyance system maintenance - MAINT-4 documents procedures to inspect and maintain public stormwater facilities for effective pollutant removal, infiltration/retention, and flow control functions. - MAINT-6 documents procedures to maintain conveyance systems without a primary treatment function. 2. MAINT-4 will continue the level of effort in BMP 26 until MAINT-3 “Inspection Schedule and Maintenance Standards” is complete. Then MAINT-4 will shift from a schedule based maintenance program to an inspection based maintenance program.3. Measurable goals: - The current schedule based measurable goals for BMP 26 will be used until MAINT-3 is complete at which point all current measurable goals for MAINT-4 will be updated to inspection based goals. - Added measurable goal for MAINT-6 “Respond to 90% of public complaints of ditch and storm line flooding during non-emergency weather events within 24 hours”.
Conduct Catch Basin Cleaning and Maintenance	27	17	MAINT-5	Inspect and Clean Catch Basins	1. MAINT-5 will continue the level of effort in BMP 27 until MAINT-3 “Inspection Schedule and Maintenance Standards” is complete. Then MAINT-5 will shift from a schedule based maintenance program to an inspection based maintenance program.2. Measurable goals: The current schedule based measurable goals for BMP 27 will be used until MAINT-3 is complete at which point all current measurable goals for MAINT-5 will be updated to inspection based goals.

Appendix B: Summary of Proposed Changes to Best Management Practices

Structural Stormwater Facility Operations and Maintenance					
2012-2017 SWMPs BMPs		Shared SWMP BMPs		Changes	
CCSD#1, SWMACC, Happy Valley and Rivergrove Title and No.		DTD No.	ID		Title
Storm Drain Cleaning Assistance Program	28	N/A	MAINT-4	Public Facility Inspection and Maintenance	1. Deleted BMP 28, the Storm Drain Cleaning Assistance Program is now one part of MAINT-7 which documents inspection of private storm systems and requirements for maintenance of private storm systems. 2. Reorganized to move activities to maintain facilities in the Residential Maintenance Agreement Program to MAINT-4 as publicly operated facilities are considered public not private. 3. MAINT-4 will continue the level of effort in BMP 29 until MAINT-3 “Inspection Schedule and Maintenance Standards” is complete. Then MAINT-4 will shift from a schedule based maintenance program to an inspection based maintenance program. 4. Added activities to MAINT-7 for Plan Participants to inspect private storm systems and provide technical assistance to private storm system owners and operators. 5. Measurable goals: - Added measurable goals for MAINT-7 to inspect private facilities and provide technical assistance. Deleted the measurable goals for BMP 28, private facilities will now be inspected to verify maintenance is completed. - The current schedule based measurable goals for BMP 29 will be used until MAINT-3 is complete at which point the measurable goals will be updated to inspection based goals.
Private Water Quality Facility Maintenance Program	29		MAINT-7	Regulated Private Storm System Inspection and Maintenance Program	
None	N/A	N/A	MAINT-8	Urgent Conditions / Storm Preparation and Response	1. This BMP documents the Plan Participants’ procedures for preparation and response to storms and other urgent situations that affect the storm system.

Appendix C

Expected Service Area Expansion and Updated Total Annual Pollutant Loads

Description of Service Area Expansion and Total Annual Pollutant Load Updates

Prepared for
Clackamas County
Clackamas County Service District #1 (CCSD#1),
the Stormwater Management Agency of Clackamas County (SWMACC),
the City of Rivergrove, and
the City of Happy Valley, Oregon
February 2017



6500 SW Macadam Avenue, Suite 200
Portland, OR 97239
Phone: 503.244.7005
Fax: 503.244.9095

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List of Abbreviations

µg	microgram(s)	TMDL	total maximum daily load
ac	acre(s)	TSS	total suspended solids
ACWA	Association of Clean Water Agencies	UCL	upper confidence level
BMP	best management practice	UGB	Urban Growth Boundary
BOD ₅	5-day biochemical oxygen demand	UIC	underground injection control
CCSD1	Clackamas County Service District 1	UPA	Urban Planning Area
CFU	colony-forming unit(s)	WES	Water Environment Services
City	City of Happy Valley	WLA	waste load allocation
COD	chemical oxygen demand	WPCF	water pollution control facility
COM	commercial		
DEQ	Department of Environmental Quality		
DO	dissolved oxygen		
DTD	Clackamas County Department of Transportation and Development		
EMC	event mean concentration		
EPA	U.S. Environmental Protection Agency		
IND	industrial		
L	liter(s)		
lb	pound(s)		
LCL	lower confidence level		
LUCS	Land Use Compatibility Statement		
MFR	multi-family residential		
mg/L	milligram(s) per liter		
mL	milliliter(s)		
MS4	municipal separate storm sewer system		
NPDES	National Pollutant Discharge Elimination System		
OAR	Oregon Administrative Rule		
ODOT	Oregon Department of Transportation		
PLRE	pollutant load reduction evaluation		
POS	parks and open space		
RES	residential		
ROW	right-of-way		
SFR	single-family residential		
SVS	settleable volatile solids		
SWMACC	Stormwater Management Agency of Clackamas County		
SWMP	stormwater management plan		

Section 1

Introduction

As part of the Clackamas County Service District #1 (CCSD#1), the Surface Water Management Agency of Clackamas County (SWMACC), which includes the City of Rivergrove, Clackamas County Department of Transportation and Development (DTD), and the City of Happy Valley's (City's) renewal application for the National Pollutant Discharge Elimination System (NPDES) municipal separate storm sewer system (MS4) permit, CCSD#1, SWMACC, and the City are required to provide a description of anticipated service area expansions and an updated estimate of total annual stormwater pollutant loads for applicable total maximum daily load (TMDL) pollutants. Schedule B.6 of the permit outlines the following elements to be included in the permit renewal application:

- c. An updated estimate of total annual stormwater pollutant loads for applicable TMDL pollutants or applicable surrogate parameters, and the following pollutant parameters: BOD₅, COD, nitrate, total phosphorus, dissolved phosphorus, cadmium, copper, lead, and zinc. The estimates must be accompanied by a description of the procedures for estimating pollutant loads and concentrations, including any modeling, data analysis, and calculation methods.*
- e. A description of any service area expansions that are anticipated to occur during the following permit term and a finding as to whether or not the expansion is expected to result in a substantial increase in area, intensity or pollutant load.*

Based on the methodology and assumptions detailed in the Districts' (CCSD#1 and SWMACC) and the City's previous permit renewal application (2008), the updated estimate of total annual stormwater pollutant loads should account for projected annexations through the end of the anticipated permit term. Therefore, evaluations to address Schedule B.6 (c and e) above have been provided together in this report.

To address these requirements, this report is organized as follows:

- Section 2: Description of Service Area Expansions
- Section 3: Updated Estimate of Total Annual Pollutant Loads
- Section 4: Qualitative Evaluation

Section 2

Description of Service Area Expansions

This section provides a definition of the MS4 permit area for the Districts and City and describes the projected expansion of the Districts' and City's NPDES MS4 service area anticipated over the next permit term.

2.1 Definition of the NPDES MS4 Permit Area

CCSD#1's NPDES MS4 permit area or "service area" is defined as the area included within its service district for which CCSD#1 has responsibility for implementing a stormwater management program. This area is defined as predominantly unincorporated Clackamas County within the Portland metropolitan urban growth boundary (UGB), including the urbanized portions of the City. Historically, CCSD#1 boundaries have fluctuated according to areas annexed into adjacent cities (e.g., Milwaukie) or previously unincorporated and unsewered areas that are annexed into CCSD#1.

SWMACC's NPDES MS4 permit area or "service area" is defined as the area included within its service district for which SWMACC has responsibility for implementing a stormwater management program. This area includes portions of unincorporated Clackamas County within the Tualatin River watershed and within the Portland metropolitan UGB. SWMACC's service area includes most of the City of Rivergrove, except for a small portion located in Washington County. As with CCSD#1, SWMACC's boundary fluctuates according to area annexed into adjacent cities (e.g., Lake Oswego); however, given the limited and non-contiguous service area, new areas are not being annexed into SWMACC.

The city limits of Happy Valley extend past the portions of the City that are managed by CCSD#1. In these non-urban portions of the City, the City maintains responsibility for implementing a stormwater management program until the area is annexed into CCSD#1.

The NPDES MS4 service area for the Districts and City generally excludes open water bodies and areas operated by another entity that is permitted to manage stormwater. For this analysis, areas excluded from the Districts' and City's NPDES MS4 service area include the following:

- Major open water bodies.
- The rights-of-way (ROWs) associated with state highways and freeways. The Oregon Department of Transportation (ODOT) has its own NPDES MS4 permit covering ROWs associated with state highways and freeways.
- Areas managed under the District's water pollution control facility (WPCF) permit for public underground injection controls (UICs) to manage stormwater runoff. These areas do not discharge to the MS4.

One exception to this designation of NPDES MS4 service area is Clackamas County roads, which are operated by the Clackamas County Department of Transportation and Development (DTD). Clackamas County DTD is a separate co-permittee on the Clackamas County NPDES MS4 and is responsible for management of stormwater runoff within the ROW and implementing stormwater management best management practices (BMPs) as specified under its own stormwater management plan (SWMP). However, for purposes of this analysis and the calculation of total annual

pollutant loads, the Clackamas County DTD service area in CCSD#1 and the City was included as part of the Districts' service area.

Through 2016, the CCSD#1 NPDES MS4 permit area was calculated to be 13,415 acres (ac) and the SWMACC NPDES MS4 permit area was calculated to be 703 acres. Non-urban area within the City of Happy Valley and not otherwise included in CCSD#1, was calculated to be 1,996 acres.

Significant area belonging to the Districts and City drains directly to surface waters without being served by the MS4. This area was accounted for in the pollutant load estimate (see Section 3), consistent with the methodology used in 2008. As a result, estimated pollutant loads documented in this report are likely higher than the actual pollutant loads discharged by the MS4.

2.2 Identification of Projected Service Area Expansions

This section summarizes how service area expansions were estimated and projected for the Districts and City for the next permit term (through 2022).

2.2.1 CCSD#1 and SWMACC

Annexations to the Districts occur based on need from the surrounding communities and are development-driven. Annexation into CCSD#1 is almost exclusively the result of development activities that occur within the city limits of the City of Happy Valley, and that occur from outside the city limits but within the City's Urban Planning Area (UPA). CCSD#1 has a policy of only annexing areas that have already been annexed into a city. As a result, land use approvals and the land use process are conducted by the City. Based on the recorded changes to CCSD#1's service area during the last 2 years, an average of approximately 160 acres of the City's service area is annexed into CCSD#1 each year.

For SWMACC, areas are not annexed into the District, but instead are removed from the District via annexation to a neighboring city (e.g., Lake Oswego). The City of Lake Oswego is a co-permittee on the Clackamas NPDES MS4 permit, and thus is required to implement a stormwater management program consistent with the requirements defined for SWMACC.

Because of the variable nature of the annexation process affecting CCSD#1 and SWMACC, and the fact that annexations involve service area transfers from one Clackamas County co-permittee to another (e.g., SWMACC to Lake Oswego, the City to CCSD#1), no projected service area expansions have been identified for the Districts as a whole.

2.2.2 Happy Valley

For the City, annexations are primarily voluntary and initiated by the applicant, though "island annexations" have occurred. The process for annexation is outlined in Section 16.67.070 of the City's Land Development Code. For properties within the City's existing UPA, annexation to the City may occur within 60 to 90 days, and subsequent development is subject to developer timelines and the availability of public facilities. For properties outside the City's existing UPA, annexation to the City may occur within 60 to 90 days, but subsequent development would require adoption of an acknowledged comprehensive plan and extension of public facilities; therefore, development is not considered immediate for these areas.

The City last updated its comprehensive plan in 2009. A future comprehensive plan update is anticipated with the annexation of area outside of the existing UPA, associated with the former city of Damascus. The timeline for the aforementioned update is currently unknown, but once started is estimated to take approximately 2 years to complete.

Annexations in the City typically fall under the expedited annexation process. Under the expedited process, annexations are heard and decided only by the City Council. This is for annexation areas that are within the UPA and include no planned changes to zoning designations. Non-expedited annexations require an evidentiary hearing before the City's Planning Commission and recommendation to City Council, followed by a City Council evidentiary hearing, where approval of the annexation requires a vote and majority approval by City Council.

In the City, future expansion areas anticipated during the next permit term (through 2022) were identified by reviewing documented publications of population growth projections in Clackamas County and historical annexation rates into the City. Between March 2015 and November 2016, a total of 551 acres were annexed into the City. A meeting was held in October 2016 between Clackamas County Water Environment Services (WES) staff, consultant staff, and City planning staff to define the basis for assumptions and verify potential annexation areas in conjunction with current land owner discussions. Current trends in annexation to the City reflect the incorporation of area outside of the UPA, along the eastern city boundary, once part of the City of Damascus.

For purposes of this permit renewal effort, a total of approximately 2,300 acres have been identified for potential future annexation into the City during the next permit term, bringing the City's total anticipated NPDES MS4 permit service area to 4,304 acres. This total anticipated service area does not reflect area that would subsequently be annexed into CCSD#1 (and removed from the City's NPDES MS4 permit area) in conjunction with development activities. City planning staff anticipate that the likelihood of annexation of these parcels in the next 5 years is high and consistent with the historical rate of annexation, but ultimately will depend on the applicant's objectives. Development of area outside of the UPA is dependent on a number of factors, including but not limited to the time frame for a comprehensive plan update and the availability of public facilities and services.

The future annexation areas identified for the City include rural residential areas within the UGB, composed of large-lot single-family residential (SFR) dwellings with accompanying agricultural (hobby farm) or open space areas. These areas currently have Clackamas County zoning established, and upon annexation would retain their existing zoning until such time that a comprehensive plan for these areas is acknowledged, and the properties are re-zoned consistent with City Code. Annexation into the city would extend and increase available municipal and public services (e.g., established development standards, code enforcement, and increased police protection) and allow areas to be part of the city, but ultimately these areas will remain rural residential until development pressure (and associated sanitary services) are available. These parcels are generally served by septic systems and drinking water wells. With annexation, adoption of a comprehensive plan, and subsequent re-zoning, these annexed areas would have the potential to subdivide and be developed in accordance with the City-approved zoning designation; however, the time frame for that would extend beyond the next 5-year permit term, depend on future comprehensive planning updates, and depend on CCSD#1-driven extensions of sewer services. These areas have been defined as rural residential for the purposes of estimating total annual pollutant loads (see Section 3) and are discussed in the qualitative evaluation of pollutant load impacts (see Section 4).

Locations of anticipated service area expansions in the City are shown on the MS4 maps, included in the permit renewal application.

Section 3

Updated Estimate of Total Annual Pollutant Loads

This section outlines the modeling methods, assumptions, and results associated with developing an updated estimate of total annual pollutant loads.

The Districts submitted their original estimate of total annual pollutant loads in Part 2 of the 1993 NPDES MS4 permit application. Area-specific loads were not calculated separately for CCSD#1 and SWMACC. The Districts provided their most recent updated estimate of total annual pollutant loads with the NPDES MS4 permit renewal application in 2008. The total modeled MS4 permit area for the Districts in 2008 was 13,457 acres, which reflected the combined CCSD#1 and SWMACC service area and did not reflect any projected annexations. A spreadsheet loads model, using the U.S. Environmental Protection Agency (EPA) simple method equation, was developed and used for the 2008 analysis.

The City did not submit an estimate of total annual pollutant loads in 2008 for the rural, undeveloped portion of the City, which was not in CCSD#1 at that time.

Modeling methods and assumptions that were used for this estimate of total annual pollutant loads are detailed below and are generally consistent with the approach used in 2008. As exceptions, total annual pollutant loads have been calculated and reported on separately for the Districts, and an estimate has been provided for the City.

3.1 Modeling Methods and Assumptions

Total annual pollutant loads were calculated for the Districts and the City's current NPDES MS4 service area and annexations anticipated to occur through the end of the permit term (expected to be 2022). The total modeled MS4 permit area is 13,415 for CCSD#1, 703 acres for SWMACC, and 4,304 acres for the City, consistent with the discussion of anticipated NPDES MS4 service area expansions outlined in Section 2.

Total annual pollutant loads are required to be calculated for TMDL pollutants, or applicable pollutant surrogates, and additional parameters as listed in Schedule B.6.c. For the Districts and the City, the Willamette Basin TMDL (Lower and Middle Willamette subbasins, Johnson Creek subbasin, and Clackamas River subbasin) includes waste load allocations (WLAs) for bacteria (*E. coli*). Johnson Creek itself also includes a WLA for DDT and dieldrin, but as described in the Districts' and City's pollutant load reduction evaluation (PLRE), no current sources of DDT and dieldrin exist and pollutant load reduction is reliant on processes of natural degradation. With limited, relevant monitoring data to assess current DDT and dieldrin loading, these parameters are not included in the annual loads estimate.

Specific for SWMACC, the Tualatin Basin TMDL includes WLAs for bacteria (*E. coli*), total phosphorus (as a surrogate for chlorophyll a and pH), and settleable volatile solids (SVS) (as a surrogate for dissolved oxygen [DO]). As described in the District's PLRE, given the lack of data for SVS, the Tualatin Subbasin TMDL references total suspended solids (TSS) as a common parameter to evaluate instead of SVS.

A spreadsheet pollutant loads model using the EPA simple method was used for the pollutant load calculations. The spreadsheet loads model is consistent with the model used in 2008 and contains baseline land use event mean concentrations (EMCs), which were developed in 2008 based on regionally collected data as part of a coordinated effort between the Oregon Association of Clean Water Agencies (ACWA) and Oregon Phase I jurisdictions. Land use EMCs were calculated as a range reflecting the upper and lower 95 percent confidence limit, and reflect general land use categories (commercial [COM], residential [RES], industrial [IND], parks and open space [POS]). Table 3-1 summarizes the land use EMCs that were used in the model.

The spreadsheet loads model and land use EMCs per Table 3-1 were also used to conduct the 2017 PLRE and benchmark evaluation (see the permit renewal application).

Table 3-1. Land Use EMC Values used in the Total Annual Pollutant Load Estimate					
Parameter	Land use	Count ^a	Bootstrapped values		
			95% LCL	Mean	95% UCL
TSS, mg/L	COM ^c	72	64	82	103
	IND	48	117	184	284
	POS	10	16	31	50
	RES ^b	65	44	66	99
<i>E. coli</i> , CFU/100 mL (geomean)	COM ^c	52	573	1,247	2,409
	IND	58	154	438	1,004
	POS	9	57	87	124
	RES ^b	65	970	1,656	2,651
BOD ₅ , mg/L	COM ^c	22	8.5	11.9	16.6
	IND	23	26.1	39.6	56.1
	POS	3	2.4	3.3	4.2
	RES ^b	28	5.9	8.1	10.8
COD, mg/L	COM ^c	26	51.8	65.1	81.5
	IND	25	76.8	102.6	134.1
	POS	9	11.1	19.6	27.6
	RES ^b	36	37.4	50.9	66.0
Nitrate, mg/L	COM ^c	46	0.27	0.38	0.53
	IND	22	0.18	0.24	0.31
	POS	263	1.36	1.51	1.66
	RES ^b	32	0.60	0.91	1.33
Total phosphorus, mg/L	COM ^c	26	0.280	0.380	0.500
	IND	25	0.400	0.510	0.640
	POS	8	0.095	0.120	0.150
	RES ^b	36	0.230	0.340	0.480
Dissolved phosphorus, mg/L	COM ^c	46	0.09	0.11	0.14
	IND	21	0.10	0.17	0.27
	POS	261	0.04	0.04	0.04
	RES ^b	30	0.08	0.11	0.15

Table 3-1. Land Use EMC Values used in the Total Annual Pollutant Load Estimate

Parameter	Land use	Count ^a	Bootstrapped values		
			95% LCL	Mean	95% UCL
Cadmium, total, µg/L	COM ^c	53	0.75	1.11	1.56
	IND	23	2.27	3.47	5.00
	POS	131	0.10	0.11	0.13
	RES ^b	45	0.41	0.53	0.66
Copper, total, µg/L	COM ^c	26	20.8	28.6	38.2
	IND	26	33.8	45.5	58
	POS	10	2.0	2.5	3.0
	RES ^b	33	10.5	13.4	17.1
Lead, total, µg/L	COM ^c	25	37.8	54.0	72.7
	IND	22	32.7	48.3	67.0
	POS	9	0.6	0.8	1.1
	RES ^b	28	11.0	17.7	27.6
Zinc, total, µg/L	COM ^c	28	130.0	170.0	217.0
	IND	24	283.0	674.0	1,353.0
	POS	9	6.3	7.8	9.5
	RES ^b	39	77.0	104.0	134.0

Note: Data range (+/- 95%) provided by the City of Portland; based on modified ACWA data set (see 2015 PLRE).

a. Count refers to the number of samples used to calculate the land use EMC.

b. Land use EMCs for RES were used to simulate runoff concentrations from SFR, MFR, and rural residential land uses.

c. Land use EMCs for COM land use were used to simulate runoff concentrations from agriculture land use.

Full buildout conditions (i.e., no remaining vacant lands) were simulated in the spreadsheet loads model, consistent with the 2008 assumptions. As the Districts and City do not maintain a current condition land use coverage map, the modeled land use categories were based instead on zoning. Clackamas County zoning coverage was used to establish development conditions for the Districts and City. Rural residential land use was assigned to future annexation areas into the City. Zoning categories were reviewed and consolidated into those categories for which land use concentration information (see Table 3-1) exists, consistent with the consolidation documented in the 2017 PLRE and benchmark evaluation.

Calculation of pollutant loads using the EPA simple method requires runoff coefficients reflective of each land use category. Consistent with assumptions and methodology described in the 2015 PLRE, the runoff coefficients were calculated from estimated impervious percentages for each land use category. These values are consistent with the 2008 assumptions. Table 3-2 below summarizes the modeled area by service area, land use category, and associated impervious percentages used for this estimation of total annual pollutant loads.

Table 3-2. Modeled Area by Land Use Category and Impervious Percentage

Modeled land use category	Modeled impervious percentage (%)	CCSD #1 model area (ac)	SWMACC model area (ac)	Happy Valley model area (ac)
SFR	42	7,883.7	596.8	763.7
MFR	61	1,246.6	--	327.7
Rural residential	10	127.3	40.0	2,585.0
COM	72	1,772.9	4.2	79.1
IND	70	1,808.8	--	207.0
POS	7	357.9	--	--
Agriculture	5	217.4	61.7	341.0
Total permit area (includes anticipated annexations through the permit term)		13,414.6	703.0	4,303.5

The annual pollutant load estimates are based on an average annual rainfall volume of 40 inches, consistent with the rainfall volume assumed in the 2008 NPDES MS4 permit renewal and 2017 PLRE and benchmarks evaluation.

3.2 Updated Estimate of Total Annual Pollutant Loads

Total annual pollutant loads—reflective of full-buildout conditions and the anticipated Districts and City permit area through the end of the permit term—are summarized in Tables 3-3 to 3-5 for the applicable parameters. This updated estimate is presented in terms of a pollutant load range because of the inherent variability in stormwater runoff quality. Pollutant loads are shown in pounds (lb) per year, with the exception of *E. coli*, which is shown as total counts per year.

Table 3-3. Updated Annual Estimate of Pollutant Loads for CCSD #1

Pollutant load parameter	LCL (lb/year or counts/year)	Mean (lb/year or counts/year)	UCL (lb/year or counts/year)
TSS	3,322,600	4,927,792	7,267,809
<i>E. coli</i> (counts)	1.82 x10 ¹⁴	3.32 x10 ¹⁴	5.64 x10 ¹⁴
BOD ₅	549,270	794,267	1,099,606
COD	2,569,362	3,423,582	4,420,707
Nitrate	25,291	37,541	54,018
Total phosphorus	14,688	20,542	27,412
Dissolved phosphorus	4,643	6,564	9,226
Cadmium, total	44.4	64.2	88.5
Copper, total	908	1,204	1,553
Lead, total	1,088	1,637	2,351
Zinc, total	6,778	12,025	20,336

Note: CCSD #1 service area includes urbanized portions of Happy Valley.

Table 3-4. Updated Annual Estimate of Pollutant Loads for SWMACC

Pollutant load parameter	LCL (lb/year or counts/year)	Mean (lb/year or counts/year)	UCL (lb/year or counts/year)
TSS	98,398	146,593	218,455
<i>E. coli</i> (counts)	9.56x10 ¹²	1.64 x10 ¹³	2.64x10 ¹³
BOD ₅	13,188	18,123	24,216
COD	83,452	113,188	146,557
Nitrate	1,299	1,967	2,874
Total phosphorus	510	752	1,059
Dissolved phosphorus	177	242	330
Cadmium, total	0.9	1.2	1.5
Copper, total	24	31	39
Lead, total	26	42	64
Zinc, total	173	234	301

Note: SWMACC service area includes the City of Rivergrove.

Table 3-5. Updated Annual Estimate of Pollutant Loads for Happy Valley

Pollutant load parameter	LCL (lb/year or counts/year)	Mean (lb/year or counts/year)	UCL (lb/year or counts/year)
TSS	497,909	746,618	1,114,818
<i>E. coli</i> (counts)	3.44 x10 ¹³	6.06 x10 ¹³	9.99 x10 ¹³
BOD ₅	78,665	112,490	154,302
COD	395,348	531,987	688,945
Nitrate	4,733	7,119	10,340
Total phosphorus	2,321	3,313	4,559
Dissolved phosphorus	757	1,068	1,494
Cadmium, total	6.1	8.6	11.6
Copper, total	130	169	217
Lead, total	144	222	328
Zinc, total	974	1,647	2,677

Note: The service area includes only the non-urbanized portions of Happy Valley within city limits and future annexation areas.

Section 4

Qualitative Evaluation

This section provides a qualitative evaluation of the potential increases to area, intensity, and pollutant loads because of the projected service area expansions discussed in Section 2. This discussion is required per Schedule B.6.e of the Districts and City's NPDES MS4 permit.

Outcomes from this evaluation are intended to support the Oregon Department of Environmental Quality's (DEQ) determination as to whether the permit renewal will involve a substantial modification or intensification of the permitted activity, as referenced in Oregon Administrative Rule (OAR) Chapter 340, Division 18 regarding completion of a Land Use Compatibility Statement (LUCS). Specifically, OAR 340-018-0050(2)(b), which states:

(b) An applicant's submittal of a LUCS is required for the renewal or modification of the permits identified in OAR 340-018-0030 if the Department determines the permit involves a substantial modification or intensification of the permitted activity.

Based on the average annual rate of 160 acres of annexation observed in CCSD#1 (see discussion in Section 2.2.1), CCSD#1 may expand its service area by approximately 6 percent during the next (2017–22) permit term. However, the expansion reflects area transferred from one Phase I Clackamas County co-permittee (i.e., the City) to another. Annexation is ultimately subject to the availability of public facilities and services to accommodate development. As described in Section 4.2, the Districts have stormwater design standards in place to address and reduce the impacts from development activities associated with these service area expansions.

SWMACC, including the City of Rivergrove, does not expect to expand its MS4 permit service areas during the next permit term, and that is not a focus of the discussion in this section.

The City expects to almost double its service area during the next permit term. As described in Section 2.2.2, this proposed expansion will result in a substantial increase in permit area, but during the next 5-year permit term, should not result in substantial increases in runoff intensity or pollutant loads. This is because new or redevelopment is not expected to occur in conjunction with these expanded service areas until a time when an updated comprehensive plan is developed and public services are extended/provided for these areas.

4.1 Service Area Expansion

Based on the historical and estimated rate of annexation into CCSD#1, CCSD#1 anticipates approximately 800 acres of service area expansion during the next 5-year permit term. This service area expansion represents less than 6 percent of CCSD#1's current NPDES MS4 permit area. All potential annexation areas are within the City's UPA, and the designated UGB, which represents the land area needed to support the growth in the Portland Metro area forecasted over the next 20 years. CCSD#1 does not annex area that is not otherwise part of an incorporated city.

The City anticipates a significant service area expansion because of the annexation of portions of the formerly incorporated City of Damascus. All potential annexation areas are within the UGB. These service area expansions will require adjustment of the City's comprehensive plan boundary and zoning coverage. Given the anticipated area of proposed service area expansion, the City completed a DEQ LUCS, in accordance with OAR 340-018-0050(2)(b), and included it in this MS4 permit renewal application package because these properties are being added for eventual service by its MS4.

At the present time, there is no proposed adjustment to the UGB that would further promote annexation of area outside the current UGB.

4.2 Pollutant Load Discharge

With expansion of the service area, the pollutant load permitted under CCSD#1's and the City's NPDES MS4 permit would increase. However, the incremental increase in pollutant load generation would be addressed and reduced by programmatic and structural stormwater best management practices implemented by CCSD#1 and the City.

A majority of the proposed service area expansions that are affecting CCSD#1 and the City are currently zoned and will remain zoned and developed as SFR. However, these areas may not currently be developed to their full development potential. Thus, the increase in imperviousness (or "intensity" per the NPDES MS4 permit language) and associated pollutant load discharge may change based on development potential.

For CCSD #1, the service area expansions or annexations are development-driven annexations currently within the City that have the ability to connect to CCSD#1 services. These areas may have some limited development—generally large-lot SFRs where native vegetation has been cleared—but there are also portions of relatively undeveloped areas with native vegetation.

Development/redevelopment is almost certain to accompany any annexation into CCSD#1. Such development would be expected to increase the imperviousness or intensity from the current land use, up to the imperviousness associated with the allowable zoning designation. The magnitude of change would ultimately vary depending on the nature of the current and proposed site usage.

For the City (as described in Section 2.2.2) future service area expansions are also applicant-driven but not necessarily development-driven. Some pollutant load is likely generated by these primarily rural areas prior to annexation. With annexation, the imperviousness (or "intensity" per the NPDES MS4 permit language) of these areas is anticipated to increase from the current use in conjunction with development, but as with CCSD#1, the magnitude would vary depending on the nature of the current and proposed site usage. Additionally, the timing of development for these areas is largely unknown (see Section 2.2.2). It should be noted that with annexation, these future service expansion areas would now be included under the respective NPDES MS4 service area boundary, and development activities in these annexation areas would be subject to additional controls that would not otherwise be implemented.

Since 1995, the Districts and City have adaptively managed their stormwater programs as detailed in both SWMPs and in the Districts and Cities' process outlined in the maximum extent practicable evaluation, included in this permit renewal application. The SWMPs include a variety of source control measures targeting typical stormwater pollutants of concern. Newly annexed properties will be subject to control measures outlined in the SWMP applicable to each co-permittee.

CCSD#1 has been implementing its 2013 stormwater design and construction standards, which require water quality treatment and flow controls for new development and redevelopment projects. Structural stormwater controls are required to address and reduce pollutant discharges from new or

redeveloping areas impacting 5,000 square feet or more of impervious surface. Proposed development of newly annexed parcels will be subject to the installation of these stormwater controls to offset the increase in impervious surface and associated pollutant discharge.

4.3 Conclusion

At the present time, there are no anticipated annexations into SWMACC's/the City of Rivergrove's MS4-permitted service area that would result in an increase in the area, intensity, or pollutant loads permitted under SWMACC's NPDES MS4 permit.

At the present time, annexation into CCSD#1's service area is limited to parcels that are currently annexed or that will concurrently be annexed into the City of Happy Valley, who's municipality is also a co-permittee under the NPDES MS4 permit. Annexations to CCSD#1 are development-driven and are not expected to significantly increase the overall NPDES MS4 permitted area (i.e., service area is just being transferred from one co-permittee to another). However, because development/redevelopment is likely with annexation into CCSD#1, an increase in impervious area and pollutant load generation is likely. The magnitude of such an increase would ultimately depend on the change in current site usage. CCSD#1 implements an extensive stormwater program including requirements related to stormwater design standards for new and redevelopment, source controls, and non-structural/programmatic activities, which are expected to address additional pollutant loading from development activities related to service area expansion.

At the present time, future annexation into the City's service area is primarily located along the eastern city boundary and includes areas formerly associated with the City of Damascus. Annexation to the City is expected to significantly increase the overall permitted area. However, annexations are applicant-driven and would not be conducted directly in conjunction with development activities, as development will not be permissible until there is a comprehensive plan update and public facilities and services are available. Therefore, annexations for the upcoming permit term are not an indication of a direct increase in the intensity and pollutant load generation, but may indicate the potential for future, long-term development.

Section 5

References

Brown and Caldwell (BC). 2017. *TMDL Pollutant Load Reduction Evaluation and Benchmark Evaluation*, prepared for the Districts and City, January.

Clackamas County Service District 1 (CCSD #1) and the City of Happy Valley (City). 2010. *MS4 NPDES Stormwater Management Plan*.

EcoNorthwest. 2016. *Population Forecasts for Clackamas County Service Districts*, August 9.

Stormwater Management Agency of Clackamas County (SWMACC) and the City of Rivergrove. 2010. *MS4 NPDES Stormwater Management Plan*.

Appendix D
City of Happy Valley
Land Use Compatibility Statement



LAND USE COMPATIBILITY STATEMENT

What is a land use compatibility statement?

A LUCS is a form developed by DEQ to determine whether a DEQ permit or approval will be consistent with local government comprehensive plans and land use regulations.

Why is a LUCS required?

DEQ and other state agencies with permitting or approval activities that affect land use are required by Oregon law to be consistent with local comprehensive plans and have a process for determining consistency. DEQ activities affecting land use and the requirement for a LUCS may be found in Oregon Administrative Rules (OAR) Chapter 340, Division 18.

When is a LUCS required?

A LUCS is required for nearly all DEQ permits and certain approvals of plans or related activities that affect land use prior to issuance of a DEQ permit or approval. These permits and activities are listed in section 1.D on p. 2 of this form. A single LUCS can be used if more than one DEQ permit or approval is being applied for concurrently.

Permit modifications or renewals also require a LUCS when any of the following applies:

1. Physical expansion on the property or proposed use of additional land;
2. Alterations, expansions, improvements or changes in method or type of disposal at a solid waste disposal site as described in OAR 340-093-0070(4)(b);
3. A significant increase in discharges to water;
4. A relocation of an outfall outside of the source property; or
5. Any physical change or change of operation of an air pollutant source that results in a net significant emission rate increase as defined in OAR 340-200-0020.

How to complete a LUCS:

Step	Who Does It?	What Happens?
1	Applicant	Applicant completes Section 1 of the LUCS and submits it to the appropriate city or county planning office.
2	City or County Planning Office	City or county planning office completes Section 2 of the LUCS to indicate whether the activity or use is compatible with the acknowledged comprehensive plan and land use regulations, attaches written findings supporting the decision of compatibility, and returns the signed and dated LUCS to the applicant.
3	Applicant	Applicant submits the completed LUCS and any supporting information provided by the city or county to DEQ along with the DEQ permit application or approval request.

Where to get help:

For questions about the LUCS process, contact the DEQ staff responsible for processing the permit or approval. DEQ staff may be reached at 1-800-452-4011 (toll-free, inside Oregon) or 503-229-5630. For general questions, please contact DEQ land use staff listed at: www.deq.state.or.us/pubs/permithandbook/lucs.htm.

CULTURAL RESOURCES PROTECTION LAWS: Applicants involved in ground-disturbing activities should be aware of federal and state cultural resources protection laws. ORS 358.920 prohibits the excavation, injury, destruction, or alteration of an archeological site or object or removal of archeological objects from public and private lands without an archeological permit issued by the State Historic Preservation Office. 16 USC 470, Section 106, National Historic Preservation Act of 1966 requires a federal agency, prior to any undertaking, to take into account the effect of the undertaking that is included on or eligible for inclusion in the National Register. For further information, contact the State Historic Preservation Office at 503-378-4168, ext. 232.

**Oregon Department of Environmental Quality
LAND USE COMPATIBILITY STATEMENT (LUCS)**

p. 1 of 2

SECTION 1 - TO BE COMPLETED BY APPLICANT

1A. Applicant Name: City of Happy Valley	1B. Project Name: Future expansion of City limits
Contact Name: Michael D. Walter, AICP	Physical Address: n/a
Mailing Address: 16000 SE Misty Drive	City, State, Zip:
City, State, Zip: Happy Valley, OR 97087	Tax Lot #:
Telephone: 503-703-3839	Township: Range: Section:
Tax Account #:	Latitude:
	Longitude:

1C. Describe the project, include the type of development, business, or facility and services or products provided (attach additional information if necessary):

The City of Happy Valley is anticipating expansion of City limits through annexation of additional territory, to the east of the current City limits, in a geographic area that was formerly within the disincorporated City of Damascus. Future urban development will require the City to adopt an acknowledged Comprehensive Plan for said geographic area, which are outside of the boundary City's current acknowledged Comprehensive Plan.

1D. Check the type of DEQ permit(s) or approval(s) being applied for at this time.

- | | |
|---|--|
| ☐ Air Quality Notice of Construction | ☐ Pollution Control Bond Request |
| ☐ Air Contaminant Discharge Permit (<i>excludes portable facility permits</i>) | ☐ Hazardous Waste Treatment, Storage, or Disposal Permit |
| ☐ Air Quality Title V Permit | ☐ Clean Water State Revolving Fund Loan Request |
| ☐ Air Quality Indirect Source Permit | ☐ Wastewater/Sewer Construction Plan/Specifications (<i>includes review of plan changes that require use of new land</i>) |
| ☐ Parking/Traffic Circulation Plan | ☒ Water Quality NPDES Individual Permit |
| ☐ Solid Waste Land Disposal Site Permit | ☐ Water Quality WPCF Individual Permit (<i>for onsite construction-installation permits use the DEQ Onsite LUCS form</i>) |
| ☐ Solid Waste Treatment Facility Permit | ☐ Water Quality NPDES Stormwater General Permit (<i>1200-A, 1200-C, 1200-CA, 1200-COLS, and 1200-Z</i>) |
| ☐ Solid Waste Composting Facility Permit (includes Anaerobic Digester) | ☐ Water Quality General Permit (<i>all general permits, except 600, 700-PM, 1700-A, and 1700-B when they are mobile.</i>) |
| ☐ Conversion Technology Facility Permit | ☐ Water Quality 401 Certification for federal permit or license |
| ☐ Solid Waste Letter Authorization Permit | |
| ☐ Solid Waste Material Recovery Facility Permit | |
| ☐ Solid Waste Energy Recovery Facility Permit | |
| ☐ Solid Waste Transfer Station Permit | |
| ☐ Waste Tire Storage Site Permit | |

1E. This application is for: ☒ Permit Renewal ☐ New Permit ☐ Permit Modification ☐ Other:

SECTION 2 - TO BE COMPLETED BY CITY OR COUNTY PLANNING OFFICIAL

Instructions: Written findings of fact for all local decisions are required; written findings from previous actions are acceptable. For uses allowed outright by the acknowledged comprehensive plan, DEQ will accept written findings in the form of a reference to the specific plan policies, criteria, or standards that were relied upon in rendering the decision with an indication of why the decision is justified based on the plan policies, criteria, or standards.

2A. The project proposal is located: ☒ Inside city limits ☒ Inside UGB ☐ Outside UGB

2B. Name of the city or county that has land use jurisdiction (the legal entity responsible for land use decisions for the subject property or land use):

City of Happy Valley

**Oregon Department of Environmental Quality
LAND USE COMPATIBILITY STATEMENT (LUCS)**

p. 2 of 2

SECTION 2 - TO BE COMPLETED BY CITY OR COUNTY PLANNING OFFICIAL		
Applicant Name: City of Happy Valley		Project Name: Future expansion of City limits
2C. Is the activity allowed under Measure 49 (2007)? ☒ No, Measure 49 is not applicable ☐ Yes; if yes, then check one:		
☐ Express; approved by DLCD order #:		
☐ Conditional; approved by DLCD order #:		
☐ Vested; approved by local government decision or court judgment docket or order #:		
2D. Is the activity a composting facility? ☒ No ☐ Yes; Senate Bill 462 (2013) notification requirements have been met.		
2E. Is the activity or use compatible with your acknowledged comprehensive plan as required by OAR 660-031? <i>Please complete this form to address the activity or use for which the applicant is seeking approval (see 1.C on the previous page). If the activity or use is to occur in multiple phases, please ensure that your approval addresses the phases described in 1.C. For example, if the applicant's project is described in 1.C as a subdivision and the LUCS indicates that only clearing and grading are allowed outright but does not indicate whether the subdivision is approved, DEQ will delay permit issuance until approval for the subdivision is obtained from the local planning official.</i>		
☐ The activity or use is specifically exempt by the acknowledged comprehensive plan; explain:		
☐ YES, the activity or use is pre-existing nonconforming use allowed outright by (provide reference for local ordinance):		
☒ YES, the activity or use is allowed outright by (provide reference for local ordinance): <i>Section 16.67.070 of the Happy Valley LDC</i>		
☐ YES, the activity or use received preliminary approval that includes requirements to fully comply with local requirements; findings are attached.		
☐ YES, the activity or use is allowed; findings are attached.		
☐ NO, see 2.C above, activity or use allowed under Measure 49; findings are attached.		
☐ NO, (complete below or attach findings for noncompliance and identify requirements the applicant must comply with before compatibility can be determined): Relevant specific plan policies, criteria, or standards: Provide the reasons for the decision:		
Additional comments (attach additional information as needed): <i>MS4 PERMITTING REQUIREMENTS</i>		
Planning Official Signature: <i>Michael J. Water</i>		Title: Economic & Community Dev. Director
Print Name: <i>Michael J. Water</i>		Telephone #: 503-783-3839 Date: 2-9-2017
<i>If necessary, depending upon city/county agreement on jurisdiction outside city limits but within UGB:</i>		
Planning Official Signature:		Title:
Print Name:		Telephone #: Date:

Appendix E

Proposed Monitoring Program Objectives Matrix

Appendix E

Monitoring Program Objectives Matrix

Permit Requirements

Schedule B(6): MS4 Permit Renewal Application Package

...The application package must include an evaluation of the adequacy of the proposed SWMP modifications in reducing pollutants in discharges from the MS4 to the MEP. The application package must contain:

- d. A proposed monitoring program objective matrix and proposed monitoring plan including the information required in Schedule B.2.d for each proposed monitoring project/ task.

This section of the permit renewal provides a summary of the monitoring plan for Clackamas County, CCSD #1, the SWMACC, and the Cities of Rivergrove and Happy Valley and an updated monitoring program objectives matrix.

The monitoring plan and information required in Schedule B(2)(d) of the MS4 permit is provided in the *Comprehensive Clackamas County NPDES MS4 Stormwater Monitoring Plan* (CCCSMP), dated January 2017 (scheduled for implementation July 1, 2017). The CCCSMP is provided in Appendix E in this permit renewal application. The CCCSMP was updated as a joint effort with other participants including Oak Lodge Water Services District (OLWSD) and the cities of Gladstone, Milwaukie, Oregon City, West Linn, and Wilsonville, Oregon.

Per Schedule B(2)(e) of the MS4 permit, the co-permittees were allowed to modify their monitoring plans on the condition that a 30-day notice was provided to the Oregon Department of Environmental Quality (DEQ) for review and approval. Participating co-permittees submitted a modified CCCSMP to DEQ on December 16, 2016 and did not receive comments back from DEQ within the 30-day window. Therefore, participating co-permittees intend to implement the 2017 CCCSMP beginning July 1, 2017. Adaptive management changes that were made to the monitoring plan are summarized in Section 3 of the CCCSMP.

The proposed monitoring program objectives matrix is provided in Table E-1, below. This matrix summarizes the stormwater-related monitoring activities described in the 2017 CCCSMP including instream water quality, instream biological, instream physical condition, stormwater quality, and BMP effectiveness monitoring. The proposed monitoring program objectives matrix provides a summary of how each of the listed monitoring activities is used to address the monitoring objectives that are specified in Schedule B(1)(a) of the NPDES MS4 permit.

Table E-1. Monitoring Objectives Matrix for 2017 Permit Renewal							
Stormwater-related monitoring activity/program	Stormwater-related monitoring activity/program description	DEQ MS4 Monitoring Objectives - Schedule B.1.a.					
		i. Evaluate the sources of the 2004/ 2006 303(d) listed pollutants as applicable.	ii. Evaluate the effectiveness of BMPs in order to help determine BMP implementation priorities.	iii. Characterize MS4 runoff discharges based on land use, seasonality, geography or other catchment characteristics.	iv. Evaluate long-term trends in receiving waters associated with MS4 stormwater discharges.	v. Assess the chemical, biological, and physical effects of MS4 discharges on receiving waters.	vi. Assess progress towards meeting TMDL pollutant load reduction benchmarks.
Environmental Monitoring Activities							
In-Stream Water Quality	• Instream samples will be collected from 25 locations. • Sampling frequencies vary from 3 to 9 times per year depending on the sampling location. • A total of 147 data points will be collected per year. • Depending on the jurisdiction and sampling location, samples will be collected as: 1) ambient scheduled grabs and timed composite grabs if it is raining on the scheduled sampling day, or 2) targeted dry weather grabs and targeted storm event time composites. • Samples will be analyzed for both field and lab parameters (see Table 9 of the CCCSMP).	N/A	There are some paired instream sampling locations that will be used to evaluate and compare upstream and downstream water quality. Results will assist in evaluating effectiveness of the co-permittees overall SWMPs in terms of implementing BMPs.	N/A	Trends will be assessed for each location, based on available data. Trends may be assessed for both dry weather and wet weather data.	Chemical effects of MS4 discharges may be assessed by comparing dry weather and wet weather instream water quality sampling results.	N/A
In-Stream Biological	• Biological samples will be collected from 21 instream locations. • The sampling frequency will be once per permit term. • Samples will be evaluated for the type and number of macroinvertebrates present. Water quality and physical condition monitoring is also conducted at the same locations to help inform results.	N/A	N/A	N/A	N/A	Biological effects may be assessed based on macroinvertebrate sampling results with respect to MS4 discharge locations.	N/A
In-Stream Physical Conditions	• During biological sampling activities, physical conditions are assessed using the modified Rapid Assessment Technique. Physical attributes include stream width/ depth, riparian vegetation, tree canopy, and bank erodibility.	N/A	N/A	N/A	N/A	Physical effects (erodibility) may be assessed through geomorphic monitoring with respect to MS4 discharge locations.	N/A
Stormwater Quality	• Stormwater samples will be collected from 11 locations representing 5 land uses. • Samples will be collected during 3 storm events per year. • A total of 33 data sets will be collected per year (3 events from each of 11 sites). • Samples will be collected as timed composites. • Samples will be analyzed for both field and lab parameters (see Table 9 of the CCCSMP).	The 303(d) parameters bacteria and organics (via TSS as a surrogate) are monitored. Results may provide an indication of the predominant sources of these parameters in terms of general land uses.	As BMP implementation progresses, results of stormwater monitoring over time may help to indicate whether BMPs are effective for the range of parameters.	Stormwater sampling results may be used to characterize runoff quality for the respective contributing land use categories.	N/A	Chemical effects of MS4 discharges on receiving waters may be assessed by comparing MS4 runoff concentrations with instream concentrations.	Land use event mean concentrations (EMCs) are used to model pollutant loads for developing pollutant load reduction benchmarks. EMCs that are used in the model are evaluated periodically to determine whether updates are needed.
BMP Monitoring (Effectiveness)	• Stormwater samples will be collected from a regional water quality facility during 1 storm event per year. Samples will be evaluated for both field and lab parameters (see Table 9 of the CCCSMP).	N/A	Sampling results may be used to understand the effectiveness of this regional water quality/ detention facility.	N/A	N/A	N/A	Sampling results maybe used to refine/update BMP effluent concentrations included in the pollutant loads model used to develop benchmarks.
Program Monitoring Activities							
BMP Monitoring (Programmatic)	Measurable goals and tracking measures are evaluated annually for BMPs listed in the co-permittee's stormwater management plans (SWMPs).	Tracking measures associated with commercial/industrial inspections, illicit discharge investigations, dry weather field screening, and private water quality facility inspections may indicate potential sources of 303(d) pollutants.	Measurable goals and tracking measures are assessed annually to assist in evaluating the effectiveness of SWMP BMPs.	N/A	N/A	N/A	Tracking measures for pollution prevention and operations and maintenance activities will require tracking of water quality facility installations and retrofits. Information will be used to help develop benchmarks.

Appendix F

Proposed Monitoring Plan

Comprehensive Clackamas
County NPDES MS4
Stormwater Monitoring Plan

January 2017

Implementation start: July 1, 2017

Comprehensive Clackamas County NPDES MS4 Stormwater Monitoring Plan

Prepared for

Clackamas County
City of Gladstone, Oregon
City of Milwaukie, Oregon
City of Oregon City, Oregon
City of West Linn, Oregon
City of Wilsonville, Oregon
City of Happy Valley, Oregon
City of Rivergrove, Oregon
Clackamas County Service District #1
Surface Water Management Agency of Clackamas County
Oak Lodge Water Services District

January 2017

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List of Abbreviations

°C	degree(s) Celsius
µg/L	microgram(s) per liter
2004 permit	2004 NPDES MS4 permit
2012 permit	2012 NPDES MS4 permit
ACWA	(Oregon) Association of Clean Water Agencies
BMP	best management practice
BOD	biochemical oxygen demand
CaCO ₃	calcium carbonate
CCSD #1	Clackamas County Service District #1
CFR	Code of Federal Regulations
cm	centimeter(s)
DDE	dichlorodiphenyldichloroethylene
DDT	dichlorophenyltrichloroethane
DEQ	(Oregon) Department of Environmental Quality
DO	dissolved oxygen
EPA	U.S. Environmental Protection Agency
JFA	Joint Funding Agreement
mg/L	milligram(s) per liter
mL	milliliter(s)
MPN	most probable number
MS4	Municipal Separate Storm Sewer System
NPDES	National Pollutant Discharge Elimination System
OLWSDD	Oak Lodge Water Services District
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
Plan	Comprehensive Clackamas County NPDES MS4 Stormwater Monitoring Plan
QA/QC	quality assurance/quality control
RSAT	Rapid Assessment Technique
SM	Standard Methods
SOP	standard operating procedure
SWMACC	Surface Water Management Agency of Clackamas County
SWMP	stormwater management plan
TCE	trichloroethylene
TMDL	total maximum daily load
UIC	underground injection control
USGS	U.S. Geological Survey
WES	(Clackamas County) Water Environment Services

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Section 1 Introduction

As part of the National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) permit requirements, Clackamas County co-permittees are required to develop and implement a stormwater monitoring program. Stormwater monitoring requirements and objectives are outlined in Schedule B of the Clackamas County NPDES MS4 permit (101348), issued March 16, 2012 (2012 permit), and provide the basis for monitoring activities described in this 2017 Comprehensive Clackamas County NPDES MS4 Stormwater Monitoring Plan (Plan).

NPDES stormwater monitoring programs require two components. The first component is **program monitoring**, which involves the tracking and assessment of programmatic activities, as described in the individual permittees' stormwater management plans (SWMPs). The second component is **environmental monitoring**, which includes the actual collection and analysis of samples. The purpose of this 2017 Plan is to address the environmental monitoring component of the requirements.

Clackamas co-permittees initiated implementation of environmental monitoring programs in July 2012 to address requirements of the 2012 permit. Specific monitoring obligations (e.g., data collection requirements, coordinated pesticide monitoring study, mercury monitoring) under the 2012 permit have been completed. This 2017 Plan documents updates to monitoring activities based on outcomes from completed monitoring and includes the following elements referenced in Schedule B.2 of the 2012 permit:

- Identification of how the monitoring objectives are addressed
- Discussion of how the monitoring program is related to adaptive management and a long-term monitoring program strategy
- Documentation and recordkeeping procedures
- Documentation of monitoring sites, parameters, and sample collection frequency and methods
- Identification of the analytical methods
- Protocols for quality assurance and quality control (QA/QC)
- Discussion of data management, review, validation, and verification

Following this introductory Section 1, this 2017 Plan is organized into the following sections:

- Section 2. Objectives- Summarizes objectives of the 2017 Plan, specifically related to the six objectives listed in Schedule B of the 2012 permit
- Section 3. Development and Implementation of the Plan- Provides background information related to the development of the 2017 Plan
- Section 4. Data Gathering Strategies- Outlines various data gathering and data collection strategies and describes how collected data will be used in the adaptive management of the individual stormwater programs and in the development of a long-term monitoring program strategy
- Section 5. Monitoring Activities- Describes environmental monitoring activities including monitoring frequency and locations
- Section 6. Sampling Parameters, Analytical Methods, and Quality Assurance and Control- Provides a summary of sampling parameters, sampling procedures, and analytical methods including applicable QA/QC
- Section 7. Monitoring Data Management and Plan Modifications- Summarizes data analyses, interpretation, and management activities

Section 2 Objectives

Schedule B.1 of the 2012 permit lists six specific monitoring objectives to be addressed with the stormwater monitoring program. The six objectives are listed below:

1. *Evaluate the source(s) of the 2004/2006 303(d) listed pollutants applicable to the co-permittees' permit area;*
2. *Evaluate the effectiveness of Best Management Practices (BMPs) in order to help determine BMP implementation priorities;*
3. *Characterize stormwater based on land use type, seasonality, geography or other catchment characteristics;*
4. *Evaluate status and long-term trends in receiving waters associated with MS4 stormwater discharges;*
5. *Assess the chemical, biological, and physical effects of MS4 stormwater discharges on receiving waters; and,*
6. *Assess progress towards meeting total maximum daily load (TMDL) pollutant load reduction benchmarks.*

Each of the environmental monitoring activities listed in Section 5 below will be conducted in an attempt to answer specific questions to support the monitoring objectives listed above. These questions are listed for each monitoring activity. Descriptions of the monitoring activities also include a narrative describing how the monitoring objectives will be addressed.

Section 3 Development and Implementation of the Plan

Because of the wide range of variability in stormwater data, collecting and analyzing sufficient data to address environmental monitoring requirements and objectives requires significant resources in order to obtain statistically valid and robust data sets. The Oregon Department of Environmental Quality (DEQ) has acknowledged this issue and provided the following clause in the 2012 permit (Schedule B.4) to allow for a coordinated monitoring approach:

Environmental monitoring conducted to meet a permit condition in Table B-1 may be coordinated among co-permittees or conducted on behalf of a co-permittee by a third party. Each co-permittee is responsible for environmental monitoring in accordance with Schedule B requirements. The co-permittee may utilize data collected by another permittee, a third party, or in another co-permittee's jurisdiction to meet a permit condition in Table B-1 provided the co-permittee establishes an agreement prior to conducting coordinated environmental monitoring.

The original Plan was developed in 2006 by nine Clackamas County co-permittees and was implemented beginning in July 2007. In 2016, coverage was expanded to include two additional co-permittees, Oak Lodge Water Services District (OLWSD), formerly Oak Lodge Sanitary District, and the City of Wilsonville. This 2017 Plan reflects this expansion of coverage.

Development of a coordinated monitoring program stemmed from the need to address the monitoring objectives listed in the 2004 NPDES MS4 permit (2004 permit). Previously, jurisdictions were collecting samples based solely on locations and frequencies outlined in the permit without additional consideration of the new monitoring objectives. Given the limited individual monitoring efforts, smaller jurisdictions with less significant environmental monitoring requirements did not

have the resources to address the new monitoring objectives without substantial additional effort beyond the “maximum extent practicable” requirement.

The 2006 Plan was developed by reviewing and compiling each participating co-permittee’s existing monitoring efforts (through annual reports). Information compiled included monitoring locations, sample collection methods, sample collection frequencies, water bodies, TMDL/303(d) list status, and contributing land uses. Jurisdictions participated in a series of workshops to evaluate existing activities combined as a whole. Monitoring activities were then refined to (1) address the identified implementation gaps, (2) minimize duplication of monitoring efforts, and (3) ensure that data collected contained information that was sufficiently comprehensive to address the permit-required monitoring objectives. Key changes and features of the 2006 Plan included the following:

- Additional tracking and targeting of storm events during instream sample collection activities to better evaluate the impacts of stormwater runoff on receiving water quality
- Geographic distribution of instream monitoring locations to avoid “clustering of sites”
- Selection of instream monitoring locations based on “high-priority” tributaries, which were identified as those on the 303(d) list (water quality impaired), and/or those with significant development potential upstream
- Selection of stormwater monitoring locations to ensure representation of varying land use categories
- Changing instream and stormwater sample collection methods from grab sampling to use of a timed-composite sampling method in order to better represent changing runoff conditions throughout a storm event

Since 2006, the Plan has periodically been updated to reflect adjustments in monitoring locations, consistency with revisions to Table B-1 (per the 2012 permit), and inclusion of additional detail related to quality assurance procedures.

As mentioned above, for this 2017 Plan, two additional co-permittees (OLWSD and the City of Wilsonville) joined the coordinated monitoring program. Additionally, in June 2017, the co-permittees’ monitoring obligations under the 2012 permit will be met, prompting this update to the Plan.

This 2017 Plan, to be implemented beginning in July 2017, reflects completion of some select, one-time monitoring obligations under the 2012 permit and refinement of monitoring locations, parameters, and activities based on information collected over the last permit term. Key modifications include the following:

- Inclusion of OLWSD and City of Wilsonville instream, stormwater, and biologic monitoring activities
- Removal of mercury and pesticide monitoring activities, as those obligations have been met
- Removal of biochemical oxygen demand (BOD) and total volatile solids (for co-permittees outside of the Tualatin basin) from the analyte list, because of the limited usefulness of the collected data to date
- Adjustment of analytical methods and reporting limits based on consistency with Code of Federal Regulations (CFR) Title 40 and current laboratory capabilities
- Adjustment of monitoring locations to ensure geographic distribution of data and to continue to inform trends analyses
- Inclusion of routine instream sampling, in addition to targeted dry weather/wet weather instream sampling activities

- Removal of Clackamas County Service District #1's (CCSD #1's) geomorphic monitoring activities from the Plan, as physical conditions are evaluated during biologic (macroinvertebrate) monitoring activities
- Minor editorial updates to improve clarity and consistency with current practices

This 2017 Plan serves as an established agreement to conduct a coordinated monitoring effort. The current participating co-permittees include the cities of Gladstone, Milwaukie, Oregon City, Wilsonville, and West Linn; OLWSD; CCSD #1; and the Surface Water Management Agency of Clackamas County (SWMACC). Monitoring conducted by CCSD #1 and SWMACC is conducted on behalf of Clackamas County and the cities of Happy Valley and Rivergrove, and they are included as participants in this 2017 Plan as well.

Section 4 Data Gathering Strategies

As described in Section 3, development of the original (2006) Plan and subsequent iterations to the Plan have applied adaptive management principles in order to refine individual monitoring activities into a coordinated program and address monitoring objectives. This 2017 Plan reflects the results of these adaptive management efforts.

Three primary strategies are outlined in this 2017 Plan to obtain and review data and information necessary to address the six monitoring objectives of the 2012 permit. These strategies include the following:

1. *Collect water quality data and macroinvertebrate data to address the specified monitoring objectives:* Monitoring locations, frequencies, and parameters were reviewed by the co-permittees as providing beneficial information for the city/jurisdiction in order to address the current monitoring objectives. For some jurisdictions, this exercise resulted in a change (increase or decrease) in data points documented in Table B-1 of the 2012 permit. Selection of the monitoring locations, frequencies, and parameters reflects data that co-permittees have historically collected so that adequate data will be available to assess trends in the future.
2. Conduct literature reviews to track relevant technical information related to stormwater quality that is collected by others, yet representative of co-permittee activities: The scientific community, public agencies, and private organizations interested in stormwater management continue to conduct research related to stormwater characterization and treatment. This costly research is often beyond the means of any one co-permittee to conduct an equivalent type of study. Organizations such as the Oregon Association of Clean Water Agencies (ACWA), Bay Area Stormwater Management Association, Water Environment Research Foundation, state transportation departments, vendors of proprietary stormwater treatment systems, colleges and universities, and others continually conduct this type of research and examine complex stormwater-related issues. By participating in these groups and following current research, co-permittees can realize greater benefits from labor and capital investment than if they were to attempt such studies on their own. As such, the co-permittees plan to rely on information garnered by these organizations to address some of the more complex and costly objectives of the permit, especially with respect to understanding the effectiveness of BMPs.
3. Review and evaluate the monitoring results and other information (literature and stormwater management program tracking measures) collected by the co-permittees to support future decisions related to adaptive management and refinement of both the SWMP and environmental monitoring plan: The compilation of monitoring data during the annual reporting period and the permit renewal period will allow co-permittees to ensure that data are being collected as required and that the data are providing useful information to support adaptive management

goals. In conjunction with the monitoring objectives and adaptive management approach submitted to DEQ by the co-permittees in November 2012, the monitoring data can potentially provide rationale for co-permittees in making decisions related to the allocation of resources among stormwater management activities. Monitoring activities are then revised to better address needs. The intent of the stormwater monitoring program is to provide data to support conclusions related to implementation of the co-permittee's SWMPs (e.g., what are the trends) and NPDES MS4 permit requirements and to ensure that the data continue to provide value as questions are answered or new questions arise.

Section 5 Monitoring Activities

This section describes the coordinated environmental monitoring efforts for the participating Clackamas County co-permittees. This section is organized according to the following monitoring activities:

- Instream monitoring efforts (routine and targeted)
- Stormwater system monitoring efforts
- Biological monitoring efforts
- BMP effectiveness monitoring

The questions to be answered and objectives addressed by each monitoring activity are listed at the beginning of each subsection.

5.1 Instream Monitoring

Instream monitoring throughout the Clackamas MS4 permit area addresses objectives 2, 4 and 5 from Schedule B.1.a of the 2012 permit:

- 2. Evaluate the effectiveness of Best Management Practices (BMPs) in order to help determine BMP implementation priorities;*
- 4. Evaluate status and long-term trends in receiving waters associated with MS4 stormwater discharges; and*
- 5. Assess the chemical, biological, and physical effects of MS4 stormwater discharges on receiving waters.*

Instream monitoring activities will attempt to address the following questions:

- What is the ambient water quality status of the water body?
- What are the trends in water quality observed for the water body?
- How is stormwater runoff impacting receiving water quality?
- How does instream water quality change from an upstream location to a downstream location within an urbanized area?

The following sections describe the instream monitoring locations (Section 5.1.1), sample collection methods (Section 5.1.2), and additional instream sample collection efforts (Section 5.1.3).

5.1.1 Description of Instream Monitoring Locations

Instream monitoring efforts conducted by the participating Clackamas County co-permittees as part of this 2017 Plan include a total of 25 sampling locations representing 20 water bodies.

Instream monitoring site selection was conducted to prioritize locations with water quality impairment, meaning they have a TMDL in place or are 303(d)-listed for a specific parameter. Within the

Clackamas County area, the TMDL water bodies and effective and pending 303(d)-listed water bodies are listed in Table 1.

Table 1. Summary of Clackamas County TMDL and 303(d) Listed Streams																			
Monitored water body	Bacteria	Temperature	Dissolved oxygen (DO)	Ammonia	Phosphorus	pH/chlorophyll a	Mercury	PCBs	TCE	PAHs	DDE/DDT	Pesticides (dieldrin, eldrin aldehyde, endosulfan)	Arsenic	Thallium	Iron	Lead	Copper	Manganese	Zinc
TMDLs																			
Willamette River (and tributaries) (2006)	✓	✓					✓												
Johnson Creek (2006)	✓	✓					✓				✓	✓							
Tualatin River (1998/2001)	✓	✓	✓		✓	✓	✓												
2010 (effective) 303(d) list																			
Johnson Creek								✓		✓									
Willamette River (Lower or Middle)						✓		✓		✓	✓	✓			✓			✓	
Tualatin River/Fanno Creek			✓									✓			✓			✓	
2012 (proposed) 303(d) list (additional parameters)																			
Johnson Creek											✓	✓				✓			
Abernethy Creek			✓																
Kellogg Creek			✓																
Fanno Creek			✓						✓				✓	✓	✓	✓	✓		✓
Willamette River (lower or middle)			✓				✓									✓	✓		
Tualatin River				✓			✓									✓	✓		✓

DDE = dichlorodiphenyldichloroethylene

DDT = dichlorophenyltrichloroethane

PAH = polycyclic aromatic hydrocarbon

PCB = polychlorinated biphenyl

TCE = trichloroethylene

Instream monitoring site selection was also based on the length of record of historical data. Locations are primarily consistent with those included in the 2006 Plan and subsequent updates, to ensure a long enough period of record to inform future trends analyses. Finally, site selection was made to ensure geographic coverage of the participating co-permittees' MS4 permit areas.

Paired instream monitoring locations were selected when possible. Paired monitoring locations include one upstream location that represents more baseflow and/or rural conditions, generally located close to the co-permittee's MS4 permit area boundary, and one downstream location that

represents urban MS4 stormwater runoff and baseflow conditions generated inside of the co-permittee's MS4 permit boundary. Paired monitoring was selected to help identify the effects of urban development on receiving water quality.

Figure 1 identifies the instream monitoring locations and includes the specific water body, responsible jurisdiction, and type of sampling method employed (see Section 5.1.2). Table 2 summarizes the total number of locations and the total number of data points (product of monitoring location and frequency) collected by participating co-permittees each year.

Table 2. Summary of the Clackamas County Co-permittee Instream Monitoring Efforts		
Jurisdiction	Total number of monitoring locations	Data points/year
CCSD #1	8	72
SWMACC	1	9
Milwaukie	1	4
Oregon City	6	24
West Linn	3	15
Gladstone	1	3
OLWSD	3	12
Wilsonville	2	8
Total	25	147

5.1.2 Sample Collection Methods

Instream sample collection methods vary by jurisdiction and include either storm-targeted sample collection efforts or routine sample collection efforts. A description of both methods is provided below.

5.1.2.1 Targeted Sample Collection

The 2006 Plan's instream monitoring efforts were focused on collecting ambient water quality data during both dry weather and wet weather conditions. As instream water quality tends to vary during storm events, sample collection that is targeted during storm events and during dry weather conditions allows jurisdictions that conduct monitoring less frequently to assess water quality impacts associated with MS4 discharges. For this 2017 Plan, select jurisdictions (Milwaukie, West Linn, and OLWSD) opted to continue targeting storm events to meet their instream sampling requirements.

Grab samples will be collected instream during dry weather conditions. During storm events, multiple time-spaced grab samples will be collected throughout the storm event to provide a single time-composited sample. A composite sample collected during a storm event allows for capture of a larger portion of the storm hydrograph and better represents fluctuating pollutant concentrations. Rationale related to the use of a time-composite sampling approach was previously submitted to DEQ in 2012.

Instream sampling procedures applicable to this 2017 Plan are as follows:

1. Instream water quality samples will be collected during both dry and wet weather conditions, to support future trends analyses and evaluate differences in receiving water quality due to weather conditions and MS4 stormwater runoff. A select (varies by jurisdiction) number of samples will be collected during storm events (see Table 3).
2. Samples collected during a storm event will be collected as time-composited grab samples, which will require grab samples to be collected at a defined frequency and combined prior to analysis.
3. A minimum of 14 days shall be maintained between consecutive instream sampling events.

Table 3 outlines the storm-targeted instream monitoring locations, frequencies, and responsible jurisdiction. As shown in Table 3, a total of 31 individual samples are planned for collection via the storm-targeted instream sampling method per year, representing 7 water bodies. Approximately 17 of those samples are time-composited samples collected during storm events.

NOTE: The most resource-intensive element of water quality monitoring is sampling during storm events. Because of the difficulty in identifying suitable storms, the uncertainty associated with weather forecasts, and the need to mobilize in a timely manner to allow for characterizing the storm, storm-targeted sampling requires a significant time commitment. Staff conducting the sampling are typically assigned other responsibilities in addition to stormwater monitoring. To ensure that monitoring does not consume inordinate resources at the expense of activities that reduce pollution, the following limitations apply to the commitments made in this 2017 Plan related to storm event sample collection.

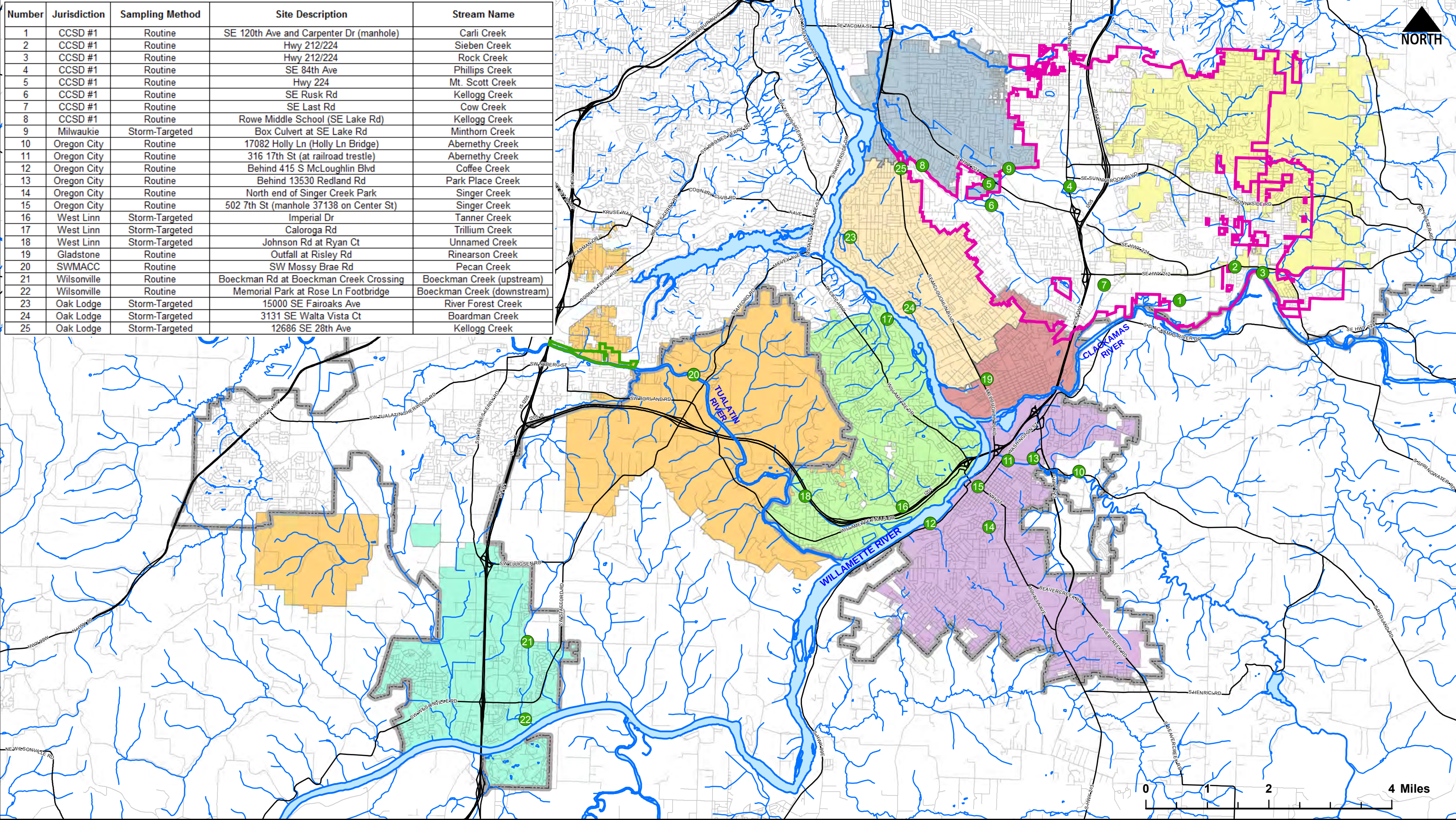
- Storms will not be sampled on major holidays including Thanksgiving Day, Christmas Eve, Christmas Day, New Year's Eve, New Year's Day, President's Day, Independence Day, Labor Day, Memorial Day, and Easter.
- Storm events shall be a minimum of 0.1 inch of rainfall and of a size for which, once a crew is mobilized, runoff is anticipated to occur for a minimum of 2 hours.
- For time-composite sample collection, the duration of time between the collection of individual grab samples will vary as necessary to meet the goal of obtaining at least three grab samples per storm event (these three grab samples will then be combined into one composited sample for analyses). In some cases, a storm may not last long enough to collect three individual grab samples. In these cases, the samples that are collected will be composited and analyzed; no minimum number of samples is specified.

Table 3. Targeted Instream Monitoring Site Summary

Monitored water body	Responsible party	Number of locations	Sampling frequency	Parameters monitored (field/lab) ^a	Storm events targeted
Minthorn Creek	Milwaukie	1	4/year	Field and lab	Y (2 of 4)
Summerlinn Creek	West Linn	1	5/year	Field and lab	Y (3 of 5)
Tanner Creek	West Linn	1	5/year	Field and lab	Y (3 of 5)
Trillium Creek	West Linn	1	5/year	Field and lab	Y (3 of 5)
River Forest Creek	OLWSD	1	4/year	Field and lab	Y (2 of 4)
Boardman Creek	OLWSD	1	4/year	Field and lab	Y (2 of 4)
Kellogg Creek	OLWSD	1	4/year	Field and lab	Y (2 of 4)

a. The term "field" indicates samples that are analyzed using meters in the field—typically for temperature, conductivity, DO, and pH.

Number	Jurisdiction	Sampling Method	Site Description	Stream Name
1	CCSD #1	Routine	SE 120th Ave and Carpenter Dr (manhole)	Carli Creek
2	CCSD #1	Routine	Hwy 212/224	Sieben Creek
3	CCSD #1	Routine	Hwy 212/224	Rock Creek
4	CCSD #1	Routine	SE 84th Ave	Phillips Creek
5	CCSD #1	Routine	Hwy 224	Mt. Scott Creek
6	CCSD #1	Routine	SE Rusk Rd	Kellogg Creek
7	CCSD #1	Routine	SE Last Rd	Cow Creek
8	CCSD #1	Routine	Rowe Middle School (SE Lake Rd)	Kellogg Creek
9	Milwaukie	Storm-Targeted	Box Culvert at SE Lake Rd	Minthorn Creek
10	Oregon City	Routine	17082 Holly Ln (Holly Ln Bridge)	Abernethy Creek
11	Oregon City	Routine	316 17th St (at railroad trestle)	Abernethy Creek
12	Oregon City	Routine	Behind 415 S McLoughlin Blvd	Coffee Creek
13	Oregon City	Routine	Behind 13530 Redland Rd	Park Place Creek
14	Oregon City	Routine	North end of Singer Creek Park	Singer Creek
15	Oregon City	Routine	502 7th St (manhole 37138 on Center St)	Singer Creek
16	West Linn	Storm-Targeted	Imperial Dr	Tanner Creek
17	West Linn	Storm-Targeted	Caloroga Rd	Trillium Creek
18	West Linn	Storm-Targeted	Johnson Rd at Ryan Ct	Unnamed Creek
19	Gladstone	Routine	Outfall at Risley Rd	Rinearson Creek
20	SWMACC	Routine	SW Mossy Brae Rd	Pecan Creek
21	Wilsonville	Routine	Boeckman Rd at Boeckman Creek Crossing	Boeckman Creek (upstream)
22	Wilsonville	Routine	Memorial Park at Rose Ln Footbridge	Boeckman Creek (downstream)
23	Oak Lodge	Storm-Targeted	15000 SE Fair Oaks Ave	River Forest Creek
24	Oak Lodge	Storm-Targeted	3131 SE Walta Vista Ct	Boardman Creek
25	Oak Lodge	Storm-Targeted	12686 SE 28th Ave	Kellogg Creek



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FIGURE 1. INSTREAM MONITORING LOCATIONS

CCSD #1, SWMACC, Happy Valley, Rivergrove, Gladstone, Milwaukie, Oak Lodge, Oregon City, West Linn, and Wilsonville

Instream Monitoring Locations

Urban Growth Boundary

Oak Lodge Sanitary District

CCSD #1

Rivergrove

SWMACC

Gladstone

Happy Valley

Milwaukie

Oregon City

West Linn

Wilsonville

5.1.2.2 Routine Sample Collection Methods

Routine instream monitoring efforts are focused on collecting ambient water quality data year round during both dry weather and wet weather seasons in accordance with a predetermined schedule.

For this 2017 Plan update, select jurisdictions (Wilsonville, Oregon City, Gladstone, SWMACC, and CCSD #1) opted to conduct routine instream monitoring instead of specifically targeting dry weather events and storm events to meet their instream sampling requirements. Routine sampling provides a more unbiased and comprehensive picture of ambient water quality conditions. Routine sampling requires prescheduling of sampling activities, reflective of consistent timing and frequency over the monitoring year. When prescheduled, samples will presumably be collected during both dry weather and wet weather conditions to allow for assessment of water quality impacts associated with MS4 discharges.

As with the storm-targeted instream sampling method, grab samples will be collected instream during dry weather conditions. During storm events, multiple time-spaced grab samples will be collected throughout the storm event to provide a single time-composited sample.

Instream sampling procedures applicable to this 2017 Plan are as follows:

1. Prior to the start of the monitoring year, the co-permittee shall establish an instream sampling schedule, based on frequencies shown in Table 4. Deviation from the predetermined schedule during the monitoring year is to be avoided to the extent possible.
2. Instream water quality samples will be scheduled and collected during both the dry and wet weather seasons. A minimum of 50 percent of the samples will be collected during the wet weather season (October 1 to April 30).
3. If it is raining on a prescheduled sampling day, samples shall be collected as time-composited grab samples, which will require grab samples to be collected at a defined frequency and then combined prior to analysis. Detail related to the time-composite sample collection procedures is provided in Section 5.1.2.1.
4. A minimum of 14 days shall be maintained between consecutive instream sampling events.

Table 4, below, outlines the routine instream monitoring locations, frequencies, and responsible jurisdiction. As shown in Table 4, a total of 116 individual samples are planned for collection via the routine instream sampling method per year, representing 18 locations across 14 water bodies.

Table 4. Routine Instream Monitoring Site Summary

Monitored water body	Responsible party	Number of locations ^a	Sampling frequency	Parameters monitored (field/lab) ^b
Carli Creek	CCSD #1	1	9/year	Field and lab
Cow Creek	CCSD #1	1	9/year	Field and lab
Kellogg Creek	CCSD #1	2	9/year	Field and lab
Mt Scott Creek	CCSD #1	1	9/year	Field and lab
Phillips Creek	CCSD #1	1	9/year	Field and lab
Rock Creek	CCSD #1	1	9/year	Field and lab
Sieben Creek	CCSD #1	1	9/year	Field and lab
Abernethy Creek	Oregon City	2	4/year	Field and lab
Coffee Creek	Oregon City	1	4/year	Field and lab
Park Place Creek	Oregon City	1	4/year	Field and lab
Singer Creek	Oregon City	2	4/year	Field and lab
Pecan Creek	SWMACC	1	9/year	Field and lab
Rinearson Creek	Gladstone	1	3/year	Field and lab
Boeckman Creek	Wilsonville	2	4/year	Field and lab

a. Two locations on the same monitored water body reflects paired sampling sites.

b. The term "field" indicates samples that are analyzed using meters in the field—typically for temperature, conductivity, DO, and pH.

5.1.3 Additional Instream Monitoring Efforts

Since 1998, the City of Milwaukie and Clackamas County Water Environment Services (WES) have participated in a cooperative Johnson Creek watershed study with the U.S. Geological Survey (USGS) and other partners (Gresham, Portland, etc.). The project objectives included the following:

- Assess hydrologic hazards: Analysis of real-time flow and water surface elevations will allow for assessment of flooding conditions as a result of ongoing, significant changes in land use and groundwater discharges.
- Assess water quality: Analysis of stream temperature and turbidity data will provide insight into the effects of land use practices and pollutant sources.
- Assess the interaction between surface water and groundwater: The study provides data and analyses that relate directly to the inter-related nature of the surface and groundwater systems.

As part of this ongoing project, multiple technical reports and publications have been developed. Publications are available for public use and include topics such as: (1) pesticide contributions and transport, (2) overall system hydrology, and (3) suspended sediment loading and the relationship to turbidity levels.

In 2014, the City of Milwaukie and WES (on behalf of CCSD #1) agreed to extend participation in the study through September 2019. Joint Funding Agreements (JFAs) are prepared annually for each partner in order to provide funds to USGS (in part) to operate and monitor continuous flow gauges on Johnson Creek. This monitoring effort directly supports monitoring objective 4 and helps to assess ambient conditions in Johnson Creek. Because of the variable nature of the funding of this study and because future participation is unknown, this effort is referenced separately as an additional instream monitoring activity.

5.2 Stormwater System Monitoring Efforts

Stormwater monitoring throughout the Clackamas County MS4 permit area addresses objectives 1, 2, 3, 5, and 6 from Schedule B.1.a of the 2012 permit:

1. *Evaluate the source(s) of the 2004/2006 303(d) listed pollutants applicable to the co-permittees' permit area;*
2. *Evaluate the effectiveness of Best Management Practices (BMPs) in order to help determine BMP implementation priorities;*
3. *Characterize stormwater based on land use type, seasonality, geography or other catchment characteristics;*
5. *Assess the chemical, biological, and physical effects of MS4 stormwater discharges on receiving waters; and*
6. *Assess progress towards meeting TMDL pollutant load reduction benchmarks.*

Stormwater (outfall) monitoring activities will attempt to address the following questions:

- Are stormwater-related sources of 303(d) pollutants discharging to receiving waters?
- How do stormwater pollutant concentrations vary based on land use?
- How do stormwater pollutant concentrations vary based on BMP implementation upstream?
- Are pollutant loads from stormwater being reduced over time?

The following sections describe outfall monitoring locations (Section 5.2.1) and sample collection methods (Section 5.2.2).

5.2.1 Description of Stormwater Monitoring Locations

Stormwater monitoring efforts conducted by the participating Clackamas County co-permittees as part of this 2017 Plan represent a total of 11 sampling locations and five land use categories. As with the instream monitoring locations, stormwater outfall monitoring locations were originally selected as part of the 2006 Plan development and have been continually refined based on site accessibility and safety.

In 2006, stormwater monitoring locations were originally selected based on the distribution and consistency of the upstream land use type or category (i.e., residential, commercial, industrial, and mixed use). Classification of stormwater quality by land use allows for estimation and evaluation of the sources of specific pollutants. Additionally, the classification of stormwater quality based on land use can be used for pollutant load modeling efforts, and the identification and application of specific BMPs to address specific pollutant loading from a particular land use. Monitoring locations were also selected based on whether non-stormwater flow (e.g., baseflow from groundwater) was present. Samples collected during a storm event from locations with significant baseflow would not be entirely representative of MS4 discharges. Therefore, sites with baseflow were avoided.

Figure 2 identifies the selected stormwater monitoring locations and includes the associated receiving water, upstream contributing land use, and sampling frequency. Table 5, below, summarizes the total number of locations and total number of data points (product of monitoring location and frequency) collected by participating co-permittees each year.

Table 5. Summary of the Clackamas County Co-permittee Stormwater Monitoring Efforts

Upstream land use	Number of outfalls monitored	Total number of samples collected per year
Residential	4	12
Multifamily residential	1	3
Commercial	2	6
Mixed use	3	9
Industrial	1	3
Total	11	33

5.2.2 Sample Collection Methods

Stormwater monitoring efforts are focused on capturing storm-specific data from select outfall locations representing drainage from various land use categories. In conjunction with the monitoring objectives, collection of stormwater samples allows for the identification of pollutant sources, characterization of stormwater (based on land use), and indication of the effects that stormwater runoff may have on instream water quality when compared with instream water quality data.

Samples will be collected as time-composite grab samples. Given the number of stormwater monitoring sites and the geographic coverage of sites, a time-composite sampling method is preferred for participants in the Comprehensive Clackamas County Monitoring Program as opposed to flow composite sampling. Composited samples (either time- or flow-composited samples) collected during storm events allow for capture of a larger portion of the storm hydrograph. As fluctuations of pollutant concentrations vary throughout a storm event, use of composite sampling techniques will better represent those variations during storm events.

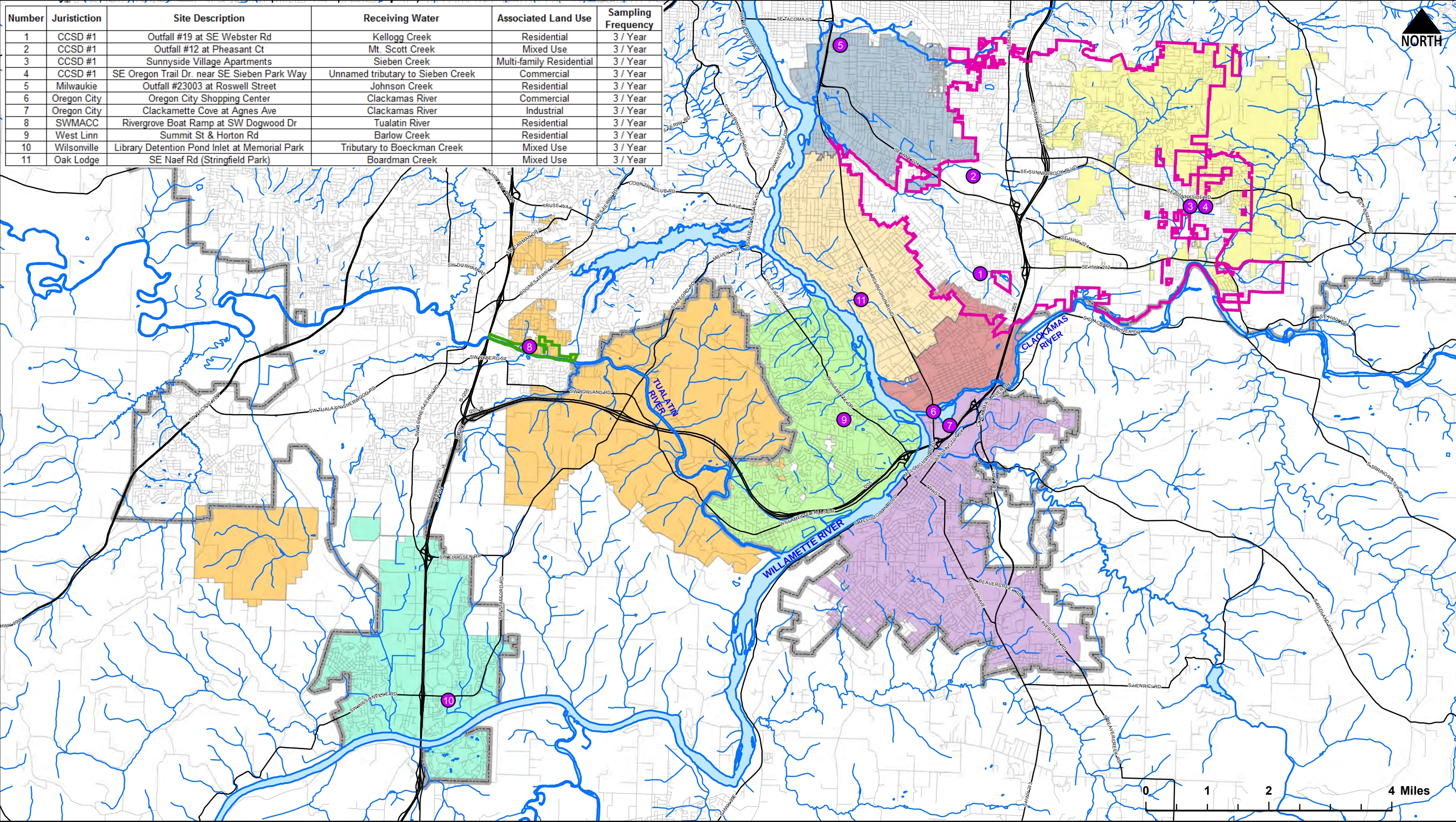
Stormwater sampling procedures are as follows:

1. Qualifying stormwater monitoring events must be associated with a storm event resulting in greater than 0.1 inch of rainfall.
2. As possible, qualifying stormwater monitoring events shall occur after a minimum 24-hour antecedent dry period.
3. Stormwater samples will be collected during three storm events per year per location.
4. For each sampling event, a minimum of three time-spaced grab samples will be collected throughout the storm event. As possible, based on the number and location of stormwater monitoring sites, sample collection will be initiated toward the beginning of the storm event and individual grab samples will be collected throughout the storm event, but no more frequently than one sample per 30 minutes.
5. The time-spaced grab samples collected will be combined into a single time-composited sample in accordance with the field collection methods outlined in Appendix A.

The discussion in Section 5.1.2.1 regarding limitations on the commitments for storm event sampling for instream monitoring efforts is also applicable to stormwater monitoring efforts.

For each monitored storm event, the contributing storm event rainfall depth will be estimated based on local rainfall gauge records. In lieu of storm event rainfall depth estimates, the flow rate in the pipe may be estimated. Flow rate may be estimated using the average depth of flow measurement taken in the pipe (or outfall) during sample collection activities, the pipe (or outfall) slope and diameter, and Manning's equation.

Number	Jurisdiction	Site Description	Receiving Water	Associated Land Use	Sampling Frequency
1	CCSD #1	Outfall #19 at SE Webster Rd	Kellogg Creek	Residential	3 / Year
2	CCSD #1	Outfall #12 at Pheasant Ct	Mt. Scott Creek	Mixed Use	3 / Year
3	CCSD #1	Sunnyside Village Apartments	Sieben Creek	Multi-family Residential	3 / Year
4	CCSD #1	SE Oregon Trail Dr. near SE Sieben Park Way	Unnamed tributary to Sieben Creek	Commercial	3 / Year
5	Milwaukie	Outfall #23003 at Roswell Street	Johnson Creek	Residential	3 / Year
6	Oregon City	Oregon City Shopping Center	Clackamas River	Commercial	3 / Year
7	Oregon City	Clackamette Cove at Agnes Ave	Clackamas River	Industrial	3 / Year
8	SWMACC	Rivergrove Boat Ramp at SW Dogwood Dr	Tualatin River	Residential	3 / Year
9	West Linn	Summit St & Horton Rd	Barlow Creek	Residential	3 / Year
10	Wilsonville	Library Detention Pond Inlet at Memorial Park	Tributary to Boeckman Creek	Mixed Use	3 / Year
11	Oak Lodge	SE Naef Rd (Stringfield Park)	Boardman Creek	Mixed Use	3 / Year



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FIGURE 2. OUTFALL MONITORING LOCATIONS

CCSD #1, SWMACC, Happy Valley, Rivergrove, Gladstone, Milwaukie, Oak Lodge, Oregon City, West Linn, and Wilsonville

	Outfall Monitoring Locations		CCSD #1		Gladstone		Oregon City
	Urban Growth Boundary		Rivergrove		Happy Valley		West Linn
	Oak Lodge Sanitary District		SWMACC		Milwaukie		Wilsonville

Each stormwater monitoring location is listed in Table 6, along with a reference regarding the sampling frequency and parameters monitored.

Table 6. Stormwater System Monitoring Site Summary					
Upstream land use	Outfall description	Receiving water	Responsible party	Sampling frequency	Parameters monitored (field/lab)
Residential	Outfall 19: SE Webster Road	Kellogg Creek	CCSD #1	3/year	Field and lab
Residential	Rivergrove Boat Ramp at SW Dogwood Drive	Tualatin River	SWMACC	3/year	Field and lab
Residential	Outfall 23003 at Roswell Street	Johnson Creek	Milwaukie	3/year	Field and lab
Residential	Summit Street and Horton Road	Barlow Creek	West Linn	3/year	Field and lab
Multifamily residential	Sunnyside Village Apartments	Sieben Creek	CCSD #1	3/year	Field and lab
Mixed use (industrial, highway, commercial, residential)	Outfall 12: SE Pheasant Court	Mt. Scott Creek	CCSD #1	3/year	Field and lab
Mixed use (park, school, commercial, residential)	Inlet to Library Detention Pond at Memorial Park	Unnamed tributary to Boeckman Creek	Wilsonville	3/year	Field and lab
Mixed use (park, highway, commercial, residential)	SE Naef Road at Stringfield Park	Boardman Creek	OLWSD	3/year	Field and lab
Commercial	SE Oregon Trail Drive near SE Sieben Park Way	Unnamed tributary to Sieben Creek	CCSD #1	3/year	Field and lab
Commercial	Oregon City Shopping Center	Clackamas River	Oregon City	3/year	Field and lab
Industrial	Clackamette Cove at Agnes Avenue	Clackamas River	Oregon City	3/year	Field and lab

5.3 Biological Monitoring Efforts

Biological monitoring throughout the Clackamas County MS4 permit area addresses objective 5 from Schedule B.1.a of the 2012 permit:

5. *Assess the chemical, biological, and physical effects of MS4 stormwater discharges on receiving waters.*

Biological monitoring activities will attempt to address the following questions:

- What are the biologic conditions of receiving waters?
- Based on past macroinvertebrate sampling activities, are there noticeable trends of improvement or impairment in receiving waters?

The following sections describe the macroinvertebrate monitoring site locations (Section 5.3.1), sample collection methods (Section 5.3.2), and connection to physical condition monitoring (Section 5.3.3).

5.3.1 Description of Biological Monitoring Locations

Biological monitoring efforts conducted by the participating Clackamas County co-permittees as part of this 2017 Plan include a total of 21 sampling locations representing 17 water bodies.

Biological monitoring sites reflect locations where biologic and water quality sampling has historically been conducted. In some cases, the locations are consistent with previous pesticide monitoring activities and/or ongoing instream water quality monitoring. Conclusions and recommendations from previous biological monitoring efforts related to site conditions and site adjustments were considered for this 2017 Plan.

For CCSD #1 and SWMACC, biological monitoring locations reflect the Clackamas County Water Environmental Services (WES) clustered monitoring approach and locations of detailed, in-stream physical condition assessments, not directly included in this 2017 Plan. WES's clustered monitoring approach is internal to CCSD #1 and SWMACC and is intended to allow for a more comprehensive assessment of watershed conditions at specific sites.

The biological monitoring locations are described in Table 7 and shown graphically in Figure 3.

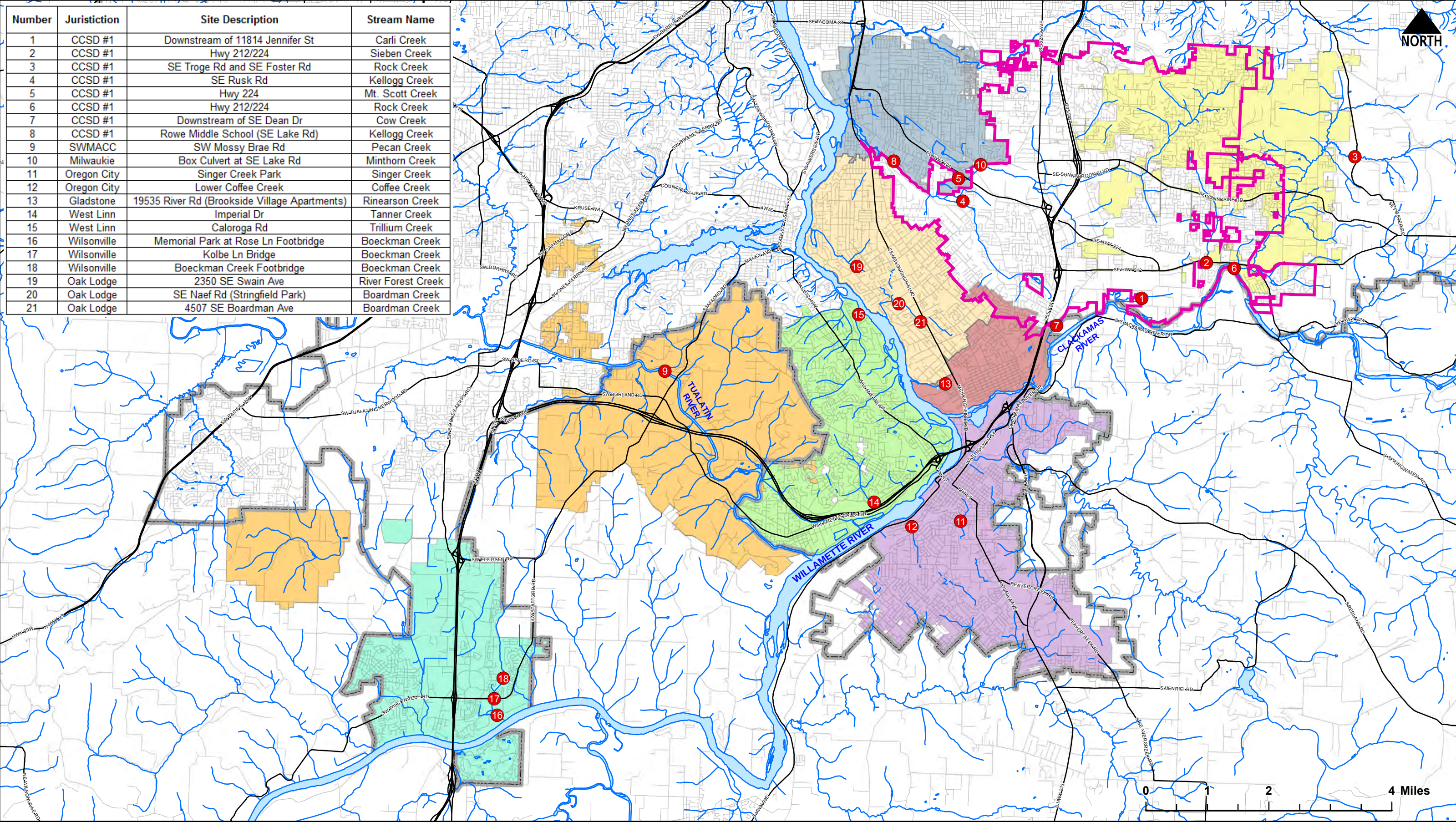
Table 7. Biologic Monitoring Site Summary

Jurisdiction	Target monitoring date	Site description	Receiving water	Past biologic monitoring efforts?	Existing instream water quality monitoring location?
CCSD #1	2018	Rowe Middle School (SE Lake Road)	Kellogg Creek	Y (2009, 2011, 2015)	Y
CCSD #1	2018	Downstream of 11814 Jennifer Street	Carli Creek	Y (2007, 2009, 2011, 2015)	Y ^a
CCSD #1	2018	Highway 212/224, near SE 135th	Sieben Creek	Y (2007, 2009, 2011, 2015)	Y
CCSD #1	2018	SE Troge Road and SE Foster Road	Rock Creek	Y (2007, 2009, 2011, 2015)	N
CCSD #1	2018	SE Rusk Road	Kellogg Creek	Y (2007, 2009, 2011, 2015)	Y
CCSD #1	2018	Highway 224	Mt. Scott Creek	Y (2007, 2009, 2011, 2015)	Y ^b
CCSD #1	2018	Highway 212/224, near SE 142nd Avenue, upstream of confluence with Trillium Creek	Rock Creek	Y (2007, 2009, 2011, 2015)	Y
CCSD #1	2018	Downstream of SE Dean Drive	Cow Creek	Y (2007, 2009, 2011, 2015)	N
SWMACC	2018	SW Mossy Brae Road	Pecan Creek	Y (2007, 2009, 2011, 2015)	Y
Gladstone	2018	River Road (Brookside Village Apartments)	Rinearson Creek	N ^c	N
Milwaukie	2018	SE Lake Road	Minthorn Creek	Y (2013)	Y
Oregon City	2018	Singer Creek Park	Singer Creek	Y (2013)	Y
Oregon City	2018	Lower Coffee Creek	Coffee Creek	Y (2013)	Y
West Linn	2018	Imperial Drive	Tanner Creek	Y (2013)	Y
West Linn	2018	Caloroga Road	Trillium Creek	Y (2013)	Y
Wilsonville	2018	Memorial Park at Rose Lane footbridge	Boeckman Creek	Y (2013)	Y
Wilsonville	2018	Kolbe Lane Bridge	Boeckman Creek	Y (2004, 2013)	N
Wilsonville	2018	Boeckman Creek footbridge	Boeckman Creek	Y (2004, 2013)	N
OLWSD	2018	2350 SE Swain Avenue	River Forest Creek	Y (2013)	N
OLWSD	2018	SE Naef Road at Stringfield Park	Boardman Creek	Y (2013)	N
OLWSD	2018	4507 SE Boardman Avenue	Boardman Creek	Y (2013)	N

a. The Carli Creek biologic monitoring location corresponds to the CCSD #1 instream monitoring location at SE 120th Avenue and Carpenter Drive. This biologic monitoring site description is consistent with the historical biologic monitoring reports.

b. The Mt. Scott Creek biologic monitoring location corresponds to the historical CCSD #1 instream and biologic monitoring location at North Clackamas Park. The past biologic monitoring efforts refer to the North Clackamas Park location. The instream and biologic monitoring site was relocated to Highway 224 for the 2013–14 monitoring year.

c. This site was relocated from the Risley Road instream monitoring location based on recommendations following Gladstone's 2013 biological monitoring effort.



Number	Jurisdiction	Site Description	Stream Name
1	CCSD #1	Downstream of 11814 Jennifer St	Carli Creek
2	CCSD #1	Hwy 212/224	Sieben Creek
3	CCSD #1	SE Troge Rd and SE Foster Rd	Rock Creek
4	CCSD #1	SE Rusk Rd	Kellogg Creek
5	CCSD #1	Hwy 224	Mt. Scott Creek
6	CCSD #1	Hwy 212/224	Rock Creek
7	CCSD #1	Downstream of SE Dean Dr	Cow Creek
8	CCSD #1	Rowe Middle School (SE Lake Rd)	Kellogg Creek
9	SWMACC	SW Mossy Brae Rd	Pecan Creek
10	Milwaukie	Box Culvert at SE Lake Rd	Minthorn Creek
11	Oregon City	Singer Creek Park	Singer Creek
12	Oregon City	Lower Coffee Creek	Coffee Creek
13	Gladstone	19535 River Rd (Brookside Village Apartments)	Rinearson Creek
14	West Linn	Imperial Dr	Tanner Creek
15	West Linn	Caloroga Rd	Trillium Creek
16	Wilsonville	Memorial Park at Rose Ln Footbridge	Boeckman Creek
17	Wilsonville	Kolbe Ln Bridge	Boeckman Creek
18	Wilsonville	Boeckman Creek Footbridge	Boeckman Creek
19	Oak Lodge	2350 SE Swain Ave	River Forest Creek
20	Oak Lodge	SE Naef Rd (Stringfield Park)	Boardman Creek
21	Oak Lodge	4507 SE Boardman Ave	Boardman Creek



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FIGURE 3. MACROINVERTEBRATE MONITORING LOCATIONS

CCSD #1, SWMACC, Happy Valley, Rivergrove, Gladstone, Milwaukie, Oak Lodge, Oregon City, West Linn, and Wilsonville

● Macroinvertebrate Monitoring Sites
▭ Urban Growth Boundary
▭ Oak Lodge Sanitary District

▭ CCSD #1
▭ Rivergrove
▭ SWMACC

▭ Gladstone
▭ Happy Valley
▭ Milwaukie

▭ Oregon City
▭ West Linn
▭ Wilsonville

5.3.2 Sample Collection Methods

Biological monitoring efforts will be conducted by each participating co-permittee a minimum of once over the next 5 years (i.e., July 2017 through July 2022). Efforts include macroinvertebrate sampling and associated physical habitat, riparian assessment, and water chemistry sampling that accompanies the sample collection. Historically, the co-permittees have used a contractor to conduct the sampling and prepare the documentation in a separate report.

Sampling efforts are typically targeted for summer or early fall, low-flow conditions.

Sample collection processes and methods summarized below are consistent with methods previously employed. Detailed documentation of methods can be referenced in the *Clackamas County NPDES MS4 2013 Coordinated Macroinvertebrate Assessment* (February 2014), prepared by Cole Ecological, Inc. on behalf of the cities of Gladstone, Lake Oswego, Milwaukie, Oregon City, West Linn, and Wilsonville. At the time of sampling, sampling methods may be slightly adjusted to conform to new technologies. Such changes will be documented in a final assessment report at the conclusion of the monitoring event.

Macroinvertebrate community sampling will be conducted using the *Benthic Macroinvertebrate Sampling Protocol for Wadeable Rivers and Streams* (DEQ 2003). Samples are sorted and identified to the level of taxonomic resolution recommended for Level 3 macroinvertebrate assessments. Level 3 protocols include duplicate composite sampling for quality assurance. Both glide and riffle samples are assessed using a multi-metric analysis and using a predictive model.

Water temperature, dissolved oxygen (DO), and specific conductivity will be measured at each site. Standard operating procedures (SOPs) and calibration procedures will be provided to participating co-permittees by the contractor prior to field sampling efforts.

5.3.3 Connection to Physical Condition Monitoring

With urbanization and increased development along the stream corridor, the timing and magnitude of discharge to stream channels often results in changes to the geomorphic character of the channel. This physical change to the stream channel can be observed through changes to stream channel width and depth and changes to the riparian vegetation.

During macroinvertebrate community sampling activities, habitat surveys and riparian assessments are conducted to inform the presence or lack of macroinvertebrates. Habitat surveys and riparian assessments are a type of physical condition monitoring that also help to locate areas of erosion, incision, and migration, and other changes to the stream corridor.

The physical conditions of the stream corridor are assessed using the modified Rapid Assessment Technique (RSAT), which includes data collection from channel habitat units (a sample reach equal to 20 times the wetted width or 75 meters, whichever is greater), channel cross sections, and the adjacent riparian zone. Habitat surveys are conducted to measure or visually estimate the number, length, gradient, and depth of pools and riffles instream; the percent of eroding or downcutting banks; woody debris characteristics; and substrate characteristics. Riparian assessment efforts include identification of riparian plant community type and percent vegetative cover present in the riparian area.

5.4 BMP Monitoring Efforts

Monitoring to analyze the effectiveness of BMPs is conducted to address monitoring objective 2 from Schedule B.1.a of the 2012 permit:

2. *Evaluate the effectiveness of BMPs in order to help determine BMP implementation priorities; and,*
6. *Assess progress towards meeting TMDL pollutant load reduction benchmarks.*

BMP monitoring activities will attempt to address the following questions:

- What are the relative pollutant removal capabilities of BMPs being used/implemented in the jurisdiction?
- Has implementation of programmatic BMPs provided information to validate whether stormwater quality improvement is being made, based on defined schedules, and frequencies in the SWMP?

BMP is a broad term that can be used to describe structural water quality facilities and source control/programmatic activities (as reported in the co-permittees' SWMPs). Both are implemented to achieve a net water quality benefit. The monitoring of a structural BMP facility (e.g., detention and retention ponds, swales, constructed wetlands, proprietary systems) would represent an environmental monitoring effort, while monitoring (tracking) of source control/ programmatic activities (erosion and sediment control, stormwater conveyance system cleaning and maintenance, industrial and business inspection programs, and public education and outreach) would represent a program monitoring effort.

This 2017 Plan focuses on environmental monitoring efforts. However, program monitoring is referenced because it also addresses objective 2 from Schedule B.1.a of the 2012 permit. Additionally, the evaluation of stormwater monitoring data, when combined with programmatic monitoring information, may help to quantify the water quality benefit of BMPs.

BMP monitoring also helps indirectly to address monitoring objective 6: *Assess progress towards meeting applicable pollutant load reduction benchmarks*. BMP effectiveness data are used in pollutant load modeling and the development of pollutant load reduction estimates in order to meet requirements for TMDL compliance. Evaluating BMP effectiveness allows for refinement of these effectiveness values used in the model and allows for the pollutant load modeling to reflect current conditions more accurately.

The following sections describe BMP monitoring efforts pertaining to environmental monitoring (Section 5.4.1) and program monitoring (Section 5.4.2).

5.4.1 BMP Monitoring (Environmental)

Limited environmental monitoring is currently being conducted by Clackamas County co-permittees associated with the performance of structural or source control BMPs. Structural BMP monitoring can be a very time- and cost-intensive activity, while the results apply only to the specific characteristics of the sampled BMP. Sampling of stormwater for purposes of evaluating source control activities often provides inconclusive results because of the variability of stormwater runoff, pollutant sources, and implementation efforts.

As stormwater management and stormwater treatment are continually changing and evolving fields, extensive literature regarding the monitoring of various treatment technologies and practices (structural and source control BMPs) is being generated by researchers, public entities, and private companies to meet both regulatory and non-regulatory needs. Clackamas co-permittees collect effectiveness information and cost information for various BMPs in conjunction with implementation of their stormwater programs. When made available from local, regional, and national sources, Clackamas County co-permittees obtain information that aids their individual stormwater management efforts and influences future decision making regarding appropriate levels of treatment technology to require for new development and redevelopment. Review

and application of these findings provides a more cost-effective means of addressing monitoring objective 2.

A number of Clackamas County co-permittees are actively involved in ACWA, which provides an open forum for stormwater management discussions and provides additional educational opportunities for local officials regarding stormwater quality and treatment. Participation in ACWA will continue to support literature tracking efforts.

Finally, the City of Milwaukie will begin monitoring a large, structural BMP that serves as a regional water quality facility. Objectives of the monitoring include evaluation of the performance of the system (from a water quality perspective) and potential refinement of the BMP effluent concentrations used to evaluate pollutant load reduction of the facility in order to establish TMDL benchmarks. Table 8 summarizes the structural BMP to be evaluated, the proposed sampling frequency, and the parameters to be evaluated.

Table 8. Structural BMP Monitoring Site Summary				
Responsible party	Structural BMP description	Receiving water	Sampling frequency	Parameters monitored (field/lab)
Milwaukie	Roswell detention facility	Johnson Creek	1/year	Field and lab

5.4.2 BMP Monitoring (Programmatic)

Clackamas County co-permittees currently conduct a variety of program monitoring efforts, generally related to implementation of their SWMPs. Qualitative information is currently collected in the form of tracking measures. These tracking measures provide valuable information to assist in the assessment of BMPs. Examples of BMP categories that are assessed for effectiveness through the use of tracking measures include the following:

- Illicit discharge detection and elimination (e.g., have the number of illicit discharge incidents decreased?)
- Public education (e.g., based on survey information, is there increased public awareness related to the jurisdiction's stormwater program and overall stormwater management?)
- Maintenance of structural controls (e.g., based on inspection records, is maintenance being performed more regularly? Are facilities operating more consistently?)

Specific tracking measures for these BMP categories are described in each of the co-permittees' SWMPs and are reported on with annual reports.

Quantitative effectiveness data for the programmatic elements outlined in the SWMP are currently not collected, but efforts to look at the effectiveness of these source control activities may occur as discussed above under Section 5.4.1.

Section 6 Sampling Parameters, Analytical Methods, and Quality Assurance and Quality Control

This section includes a summary of sampling parameters and analytical methods (Section 6.1) and a summary of QA/QC procedures (Section 6.2).

6.1 Sampling Parameters and Analytical Methods

The purpose of both instream and stormwater outfall monitoring efforts is to assess the degree to which ambient water quality is impacted by stormwater runoff. Therefore, consistent pollutant parameters are monitored for both instream and outfall (stormwater) sampling locations.

Pollutant parameters for this 2017 Plan are based on Table B-1 of the 2012 permit and are listed below in Table 9. A suggested analytical method is also identified in Table 9; however, use of an alternative, U.S. Environmental Protection Agency (EPA)-approved method listed in the most recent publication of 40 CFR 136 is permissible. The suggested analytical methods documented in Table 9 include both EPA and Standard Methods and (SM) are consistent with provisions of 40 CFR 136.

Table 9. Pollutant Parameters and Analytical Methods

Type (field or lab)	Analyte	Sample type (grab or time-spaced composite)	Unit	Suggested analytical method	Target MDL	Notes
Field	Specific conductivity	Grab	µmhos/cm	SM 2510 B	1	Method assumes use of probe
Field	pH	Grab	Standard units	SM 4500-H B	0.1	Method assumes use of probe
Field	Temperature	Grab	°C	SM 2550-B	0.1	Method assumes use of probe
Field	DO	Grab	mg/L	EPA 360.1	0.1	Method assumes use of probe
Lab	Copper, total	Composite	µg/L	EPA 200.8	0.1	
Lab	Copper, dissolved	Composite	µg/L	EPA 200.8	0.1	
Lab	DO ^a	Grab	mg/L	SM 4500-C	0.02	Conducted to ver- ify field reading
Lab	<i>E. coli</i>	Grab	MPN/100 mL	SM 9223 B	1.0	
Lab	Total hardness	Composite	mg CaCO ₃ /L	SM 2340 C	5	
Lab	Lead, total	Composite	µg/L	EPA 200.8	0.01	
Lab	Lead, dissolved	Composite	µg/L	EPA 200.8	0.01	
Lab	Nitrogen: ammonia	Composite	mg/L	SM 4500 NH ₃ G	0.05	
Lab	Nitrogen: nitrate	Composite	mg/L	SM 4500-NO ₃ F	0.04	
Lab	Phosphorus, total	Composite	mg/L	SM 4500-P A, B, & E	0.04	
Lab	Phosphorus, ortho-phosphate	Composite	mg/L	SM 4500-P FEPA 300.0 365.3	0.02	
Lab	Solids: total suspended	Composite	mg/L	SM 2540 D	1.0	
Lab	Solids: total dissolved	Composite	mg/L	SM 2540 C	5.6	
Lab	Solids: total volatile ^b	Composite	mg/L	SM 2540 B	5.0	
Lab	Zinc, total	Composite	µg/L	EPA 200.8	1	
Lab	Zinc, dissolved	Composite	µg/L	EPA 200.8	1	

a. The Winkler Titration Method is employed to verify field DO readings in accordance with field sampling procedures outlined in Appendix A. Some jurisdictions may opt to analyze DO using only the Winkler Titration Method instead of collecting field samples.

b. Parameter is monitored by SWMACC and West Linn only.

°C = degrees Celsius; µg/L = micrograms per liter; CaCO₃ = calcium carbonate; cm = centimeters; mg/L = milligrams per liter; mL = milliliters; MPN = most probable number.

Water quality monitoring conducted as part of the macroinvertebrate sampling will conform to documented SOPs and may deviate from the approved methods listed in 40 CFR 136.

6.2 Quality Assurance and Quality Control Procedures

For purposes of this 2017 Plan, QA/QC procedures for field analysis are initiated directly by the jurisdiction. QA/QC procedures for laboratories are developed by the individual laboratories and available on request.

Field QA/QC procedures are outlined in Appendix A and included in the SOPs for field sample collection (SOP A-1), chain of custody (SOP A-2), and sample handling and transportation (SOP A-3). General sampling procedures for parameters analyzed in the field are provided in SOP A-4. ACWA developed detailed QA/QC procedures for stormwater data collection and sample handling and custody as part of the ACWA UIC [Underground Injection Control] Monitoring Study. Provisions from this ACWA study have been incorporated into the field QA/QC procedures in Appendix A as appropriate.

Co-permittees will use laboratories that have comprehensive QA programs and are DEQ-accredited. The WES water quality laboratory, which currently conducts laboratory analysis for samples collected by some Clackamas County co-permittees operating under this 2017 Plan, operates under the *WES Water Quality Assurance Manual* (May 17, 2007). This manual outlines pertinent test methods, validation, and reporting limits; equipment calibration and maintenance procedures; sample handling and storage procedures; sample acceptance and results reporting procedures; and data qualification and validation procedures. This manual is available by request from the WES Water Quality Laboratory.

Contracted monitoring activities related to biologic monitoring employ field procedures and protocols unique to the monitoring effort. A description of study methods and QA/QC guidelines will be documented in the final assessment report provided to each jurisdiction at the conclusion of the monitoring event.

Section 7 Monitoring Data Management and Plan Modifications

This section includes a summary of data management procedures (Section 7.1) and procedures for modifying this 2017 Plan (Section 7.2).

7.1 Data Management

Participants in this 2017 Plan individually (or through an inter-governmental agreement) collect samples and are responsible for the quality control of their samples prior to delivery at the laboratory. Field sample collection procedures are outlined in Appendix A. Sample validation and verification is conducted at the laboratory and, following analysis, the monitoring results are provided to the responsible jurisdiction to validate and verify that the findings are consistent with their expectations. Questionable monitoring results will be flagged for further review and possible follow-up in the field. If data quality indicators (i.e., field blanks, field duplicates) suggest that contamination or corruption of the sample occurred, data may be discarded and sampling would be conducted again, and the cause of the failure would be evaluated. If the cause is found to be equipment failure, calibration and/or maintenance techniques will be assessed and improved; if the cause is found to be with the sample collection process, field techniques will be assessed, revised, and retrained as appropriate.

Individual jurisdictions are responsible for the compilation of instream and stormwater monitoring data in database or spreadsheet format. Monitoring data are compiled by monitoring location and monitoring event, and data include times, concentrations, and indication of whether a sample represents a grab- or time-composited sample. Statistics (i.e., mean, maximum, minimum) may be calculated on the data by an individual jurisdiction for its own use. A summary of monitoring results is provided to DEQ with submittal of the individual jurisdiction's NPDES MS4 annual reports. Compiled monitoring data may be provided to DEQ in digital format upon request.

Technical reports documenting results of the biologic monitoring effort shall be maintained by individual jurisdictions and results shall be summarized or attached to the associated NPDES MS4 annual report.

A water quality trends analysis will be conducted during the fifth year of this 2017 Plan implementation, based on the instream monitoring data collected to date. The benefit of a coordinated monitoring program is that resources can be distributed more widely to produce data that will provide comprehensive information for Clackamas County as a whole. As a result, data analyses will be conducted specific to each jurisdiction and water body, but assessment and interpretation can be conducted for watersheds as a whole. As part of the water quality trends analysis effort, previously collected monitoring data specific to the water body will be reviewed.

7.2 Plan Modifications

Modifications to monitoring locations and frequency as outlined in this 2017 Plan are permissible as long as the number of monitoring data points collected on an annual basis (the product of monitoring location and frequency) is not reduced. Additionally, if on an annual basis a participating co-permittee is not able to collect the required samples because of climatic conditions, sampling conditions, equipment malfunction, monitoring location inaccessibility, etc., such inability is not directly reflective of a need to modify the monitoring plan.

Currently, as required in the extended 2012 permit, if a modification to this 2017 Plan is requested or required, such need will be documented to DEQ in the form of a 30-day notice of proposed monitoring plan modification. Written approval must be received from DEQ before such modification can take place. If DEQ does not respond within 30 days, the proposed modification is deemed to be approved without written approval.

Appendix A: Field QA/QC Procedures



Appendix A: Field Quality Assurance and Control Procedures for Sample Collection, Handling, and Custody

SOP A-1: Field Sample Collection Procedures.....	A-1
SOP A-2: Monitoring Field Data Sheets and Chain-of-Custody Records.....	A-5
SOP A-3: Transporting, Packaging, and Shipping of Samples from Field to Lab.....	A-7
SOP A-4: Sampling Procedures for Parameters Analyzed in the Field.....	A-8

SOP A-1: Field Sample Collection Procedures

Field crews are responsible for collecting samples, recording information, and transferring collected samples.

Prior to sample collection, field crews shall verify that adequate sample collection bottles and sample storage equipment are obtained. Sample collection bottles shall be of adequate size and appropriate material, per requirements of the applicable analytical method. Most sample collection bottles are pre-preserved by the laboratory for the appropriate analytical test. If necessary to meet preservation requirements, additional preserving agents will be added to samples by the laboratory upon receipt of the samples.

Upon arrival at the site, field crews shall establish a safety zone for sample collection if necessary (this may include the placement of traffic cones, etc.). Site conditions and other sampling notes shall be recorded in a monitoring log and/or on the Monitoring Field Data Sheet.

Procedures for conducting grab sampling and composite sampling are as follows.

Grab Sampling Procedures

Grab sample collection methods shall be employed for all dry weather instream monitoring activities and for wet weather instream and stormwater (outfall) monitoring activities for select parameters.

Bottle preparation

Obtain clean half-pint, pint, quart, or half-gallon sample bottles from the laboratory conducting the water quality analyses. Each monitoring site would require a minimum number of sample bottles such that separate sample bottles are obtained based on the analytical test methods to be employed by the laboratory. Bottles shall be pre-labeled by field crews or staff to include the site number and monitoring parameter. In some cases, the laboratory may pre-label sample bottles.

1. Based on the number of sampling sites, obtain additional sample bottles for the collection of grab sample duplicates and field blanks. Bottles for duplicate sampling and field blanks shall be obtained from the laboratory conducting the water quality analyses as required. Based on the number of analytical test methods to be employed, the appropriate number of bottles should be obtained for the collection of duplicate samples and field blanks at a site. Bottles for duplicate and field blank samples shall also be pre-labeled with the designated duplicate site number and monitoring parameter.
2. Procedures related to the collection of grab sample duplicates and field blanks are outlined under SOP A-1, QA/QC Sampling Procedures.

Grab sampling technique

Depending on the site characteristics, samples can be obtained by hand or with the aid of tools (i.e., a grab pole).

1. For sample collection from a (flowing) surface water body, the sample should be collected from the middle of the flow stream (if possible). Care must be taken to avoid collecting particulates that are suspended as a result of bumping the bottle on the

streambed. To sample with a hand-held bottle/container, stand downstream of the bottle while it is being filled.

2. If sampling at a surface water outfall, the sample should be collected, if possible, at the point where the flow leaves the pipe.
3. When no sample is collected because of lack of flow or any other circumstances beyond the sampler's control, the associated condition should be noted in the appropriate entry point on the Monitoring Field Data Sheet.
4. Once the bottle is filled to the proper level, replace the lid on the sample bottle and complete the Monitoring Field Data Sheet with appropriate information related to sample collection (i.e., time, sampling conditions, date, etc.).
5. As directed by the laboratory, filter or preserve samples as necessary in accordance with laboratory-issued standard operating procedures. As an example, the WES laboratory requires field filtration of ortho-phosphate at the time of sample collection.
6. Samples should be stored for transport to the laboratory in an "iced" cooler (i.e., using ice or an ice substitute that has been frozen).
7. If a grab sample duplicate is to be obtained at a particular sampling site, the duplicate samples will be obtained by completing the normal grab sampling procedures and documenting information on the Monitoring Field Data Sheet consistent with collection of an actual sample.
8. For samples that are collected for the analysis of bacteria, samples must be transported to the lab within 6 hours of sample collection.
9. Ensure that all elements of the Monitoring Field Data Sheet are complete prior to relinquishing the samples to the laboratory.

Composite Sampling Procedures

Composite sample collection methods shall be employed for wet weather instream and stormwater (outfall) monitoring activities for all laboratory parameters (with the exception of bacteria) as outlined in Table 9 of the Comprehensive Clackamas County NPDES MS4 Stormwater Monitoring Plan.

Bottle preparation

Obtain a minimum of one clean, half-gallon sample bottle from the laboratory or other clean sampling receptacle for collection of the individual samples and one carboy (i.e., large glass or plastic vessel) to combine the individual samples and mix the composited sample. The bottle(s) and the carboy shall be pre-labeled to include the site number.

Obtain additional, clean half-pint, pint, quart, or half-gallon sample bottles for transport of the composited sample to the laboratory. Each monitoring site would require a minimum number of sample bottles such that separate sample bottles are obtained based on the analytical test methods to be employed by the laboratory. Bottles shall be pre-labeled to include the site number and monitoring parameter.

1. Based on the number of sampling sites, obtain the same number of sample bottles as outlined above for the collection of a composite duplicate samples and field blank samples. Bottles for duplicate sampling and field blanks shall also be obtained from the laboratory conducting the water quality analyses as required.

2. Procedures related to the collection of composite duplicate samples and field blank samples are outlined under SOP A-1, QA/QC Sampling Procedures.

Composite sampling technique

Depending on site conditions, samples can be obtained by hand or with the aid of a tool (i.e., grab pole).

Grab sample collection methods, steps 1 through 4 as documented above, should be employed for each of the minimum three individual grab samples collected prior to pouring in the carboy. Composite samples are generally collected at timed intervals and/or on a sampling rotation. Following collection of the minimum three individual grab samples that will compose the composited sample, the following procedures should be followed:

1. Ensure equal portions from individual grab samples are poured into the pre-labeled carboy. This effort shall occur in a closed or covered environment.
2. Properly mix the composited sample and pour a sufficient quantity of water into each pre-labeled sample bottle that is to be relinquished to the lab for analysis.
3. Implement grab sample collection methods, steps 5 through 7.
4. Update the Monitoring Field Data Sheet to document completion of the composite sample collection efforts.

Please note if a composite sample duplicate is to be obtained at a particular sampling site, in order to test the accuracy of the sample collection procedures, the duplicate sample shall be obtained by completing the normal grab sampling procedures, compositing as indicated above, and transferring the composited sample into the pre-labeled sample collection bottles for the laboratory.

QA/QC Sampling Procedures

The use of field blanks and grab and composite sample duplicates will help to identify potential sources of error in the stormwater sampling process, specifically those associated with sample collection, transportation, and analytical procedures.

For grab and composite samples for all parameters, field blanks and grab or composite duplicates shall be collected at a minimum of 10 percent of the total number of monitoring locations for a single event and for samples collected by a single sampling crew. For example, if samples are to be collected at 10 sites or less for one monitoring event, then one field blank and one duplicate sample shall be obtained for that monitoring event. If individual grab samples are to be collected at 12 sites for one monitoring event, then two field blanks and two grab sample duplicates shall be obtained for that monitoring event. A minimum of one field blank and one duplicate shall be obtained for a single monitoring event.

Guidelines related to the collection of a field blank and duplicate sample are outlined below:

1. Procedures for collection of field blank samples should follow the appropriate grab or composite sampling procedures with the exception that the analyte bottle (in the case of grab sample collection) or half-gallon sample bottles (in the case of composite sample collection) are instead filled with deionized (DI) water as provided by the lab. The field blanks shall be transported to all sampling sites associated with a monitoring event in the storage containers with other sample bottles. This will assist with identifying any potential contamination that may occur with the sample collection and transportation of samples.
2. Procedures for collecting the duplicate sample should follow the appropriate grab or composite sample procedures. The duplicate sample bottles shall be pre-labeled with the designated duplicate site number and monitoring parameter. These duplicate samples will assist with identifying any potential contamination that may occur with sample collection or analytical procedures.

SOP A-2: Field Data Sheets and Chain-of-Custody Records

Monitoring Field Data Sheets are completed by field staff conducting the monitoring activities during sample collection activities. Monitoring Field Data Sheets are maintained with the samples during transport to the laboratory.

A chain-of-custody (COC) record is a legal document generated at the laboratory based on information contained in the Monitoring Field Data Sheet. The COC is prepared either prior to or during the delivery of the samples and identifies the person(s) responsible for the sample bottles during all elements of monitoring activity.

The Monitoring Field Data Sheet(s) shall be completed for each sampling location and event. The COC shall be maintained for each sampling event.

The procedures for filling out these forms are as follows.

Before and during Sample Collection

Before sample collection activities, field staff shall document the following general information on a Monitoring Field Data Sheet, unless otherwise documented on the COC:

- Source/location
- Site code or ID
- Person(s) sampling
- Type of sample (instream dry weather/season, instream wet weather/season, or stormwater outfall)
- Date of sample collection
- Time of sample collection
- Number of sample (if applicable): pertains to collection of multiple individual grab samples to compile as a time-composite sample
- Parameters desired for analysis

During sample collection, the Monitoring Field Data Sheet should remain with the sample bottles. During sampling, staff should add to the Monitoring Field Data Sheet for each individual grab sample to document the time and date that the sample was collected.

The Monitoring Field Data Sheets should remain with the samples for the duration of sampling.

After Sample Collection

If composite sampling methods are being used, the Monitoring Field Data Sheet should be updated to include the time and date at which the individual grab samples were composited. If a separate Monitoring Field Data Sheet is completed for the composite sample, any Monitoring Field Data Sheets associated with individual grab samples used to generate the composite sample should be maintained (e.g., stapled to the back) of the composite sample Monitoring Field Data Sheet.

At the Laboratory

The person responsible for completion of the Monitoring Field Data Sheets should be the one to relinquish this paperwork to laboratory personnel or other staff as necessary. At the time of transfer, information contained on the Monitoring Field Data Sheets shall be entered into the laboratory's tracking database (e.g., Clackamas County Water Environment Services Labworks program). In addition to information contained on the Monitoring Field Data Sheets, any special instructions and information related to the transfer of responsibility is also documented.

Using the laboratory's tracking system, the COC is recorded and internal tracking labels may be generated.

SOP A-3: Transporting, Packaging, and Shipping Samples from Field to Lab

Procedures for handling and transportation of samples to the applicable water quality laboratory are as follows:

1. Keep the Monitoring Field Data Sheet with the samples at all times.
2. Pack samples well within ice chest to prevent breakage or leakage.
3. As stated previously, samples should be packed in ice or an ice substitute with a goal to maintain a sample temperature of 4 degrees Celsius during transport. Acquire more ice or ice substitute as necessary.
4. Samples must be delivered to the water quality laboratory within 6 hours (standard for bacteria analysis) or in accordance with required holding times for other parameters.
5. Most samples will be collected in pre-preserved bottles. Some samples may require additional preservation agents to meet preservation requirements. If needed, additional preserving agents will be added to samples by the laboratory personnel upon receipt of the samples.

SOP A-4: Sampling Procedures for Parameters Analyzed in the Field

Sampling procedures for field parameters (i.e., dissolved oxygen [DO]/temperature, conductivity, and pH) are outlined below.

Field Dissolved Oxygen/Temperature Procedure

Meter preparation

1. Check the device for damage.
2. Check and replenish the field supply of deionized (DI) water.
3. Calibrate the device for DO (refer to current manufacturer's calibration instructions). Record calibration in a Calibration Log Book. As necessary, have experienced personnel calibrate the device prior to field sampling event.
4. Verify the device's temperature reading to a National Institute of Standards and Technology (NIST) thermometer. The temperature reading should be within ± 0.5 degree Celsius. Record the temperature verification in a Calibration Log Book.

Analysis timeline

1. All temperature and DO samples are obtained in the field.
2. Samples must be obtained in a fresh glass or plastic bottle or beaker.
3. Sample analysis is performed on site.

Technique

1. Immerse the device directly in the sample. The device is not to be moved around in the sample. Depending on the device used, measurement may occur in a pre-rinsed sample beaker or bottle or directly in the flow path.
2. Record the DO and temperature readings on the Monitoring Field Data Sheet.
3. Remove the device from the sample and rinse with DI water prior to storage or analysis of the next sample.

QA/QC

1. In order to verify DO concentrations obtained in the field, employ the Winkler Titration Method for one sample collected per event. A separate grab sample shall be collected and analyzed at the laboratory, and results shall be compared to the instrument analysis from the same location.
2. In accordance with the rationale outlined in SOP B-1, duplicate samples shall be collected.
3. Monitoring Field Data Sheets are completed during field sample collection and during grab sample collection (when conducting the Winkler test).

Field pH Procedure

Meter preparation

1. Set up the field pH meter(s).
2. Check the device for damage.
3. Check and replenish the buffer solution (4, 7, 10) and DI water.
4. Calibrate the device using at least two pH buffers (4 and 7) and document (refer to current manufacturer's calibration instructions). As necessary, be sure to remove the device's filling solution vent plug before making any pH measurements.

Analysis timeline

1. All pH samples are obtained in the field as grab samples.
2. Samples must be obtained in fresh glass or plastic bottles or beaker.
3. Sample analysis shall be performed on site within 15 minutes of grab time.

Technique

1. Remove device from the field storage solution. Do not remove from storage solution until water sample is ready for analysis.
2. Pre-rinse the sample bottle or beaker with sample water prior to obtaining the actual sample.
3. Collect a 200-milliliter (mL) sample (minimum).
4. Thoroughly rinse the device tip with DI water, pat dry with clean paper towel, and put the device into the sample.
5. Once the device is immersed in the sample, slowly rotate in a circular pattern until the reading stabilizes (30 seconds).
6. Record the pH (to nearest 0.1 unit).
7. Enter the pH data on the Monitoring Field Data Sheet.
8. Remove the device from the sample and rinse with DI water prior to storage or analysis of the next sample.

QA/QC

1. Monitoring Field Data Sheets are completed in the field as the samples are collected.
2. After the completion of each day's sampling, device calibration(s) must be verified and checked for accuracy. The verified pH readings shall be recorded in the pH Calibration Log Book. Devices should be cleaned with DI water and stored in the correct storage solution.
3. A low ionic strength pH probe and an automatic temperature compensation (ATC) probe should be used (e.g., pH probe Orion 815600 and ATC probe 917005).

Field Conductivity Procedure

Meter preparation

1. Set up the field conductivity meter.
2. Check the device for damage.
3. Calibrate the device according to current manufacturer's calibration instructions.
4. Check and replenish the field supply of DI water for rinsing the device following sampling.

Analysis timeline

1. All conductivity samples are obtained in the field as grab samples.
2. Samples must be obtained in fresh glass or plastic bottles or beaker.
3. Sample analysis is performed on site within 15 minutes of grab time.

Technique

1. Pre-rinse the sample bottle with sample water prior to obtaining the actual sample.
2. Collect 200 mL sample (minimum).
3. Ensure that the meter is reading in conductivity mode, if necessary.
4. Rinse device with DI water and pat dry with clean paper towel.
5. Immerse the device in the sample and do not allow the device to touch the bottom of the container or any solid object.
6. Enter the conductivity data on the Monitoring Field Data Sheet.
7. Remove the device from the sample and rinse with DI water prior to storage or the next analysis.

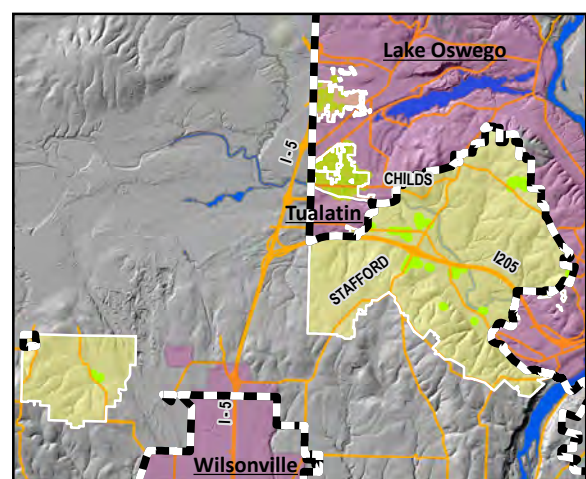
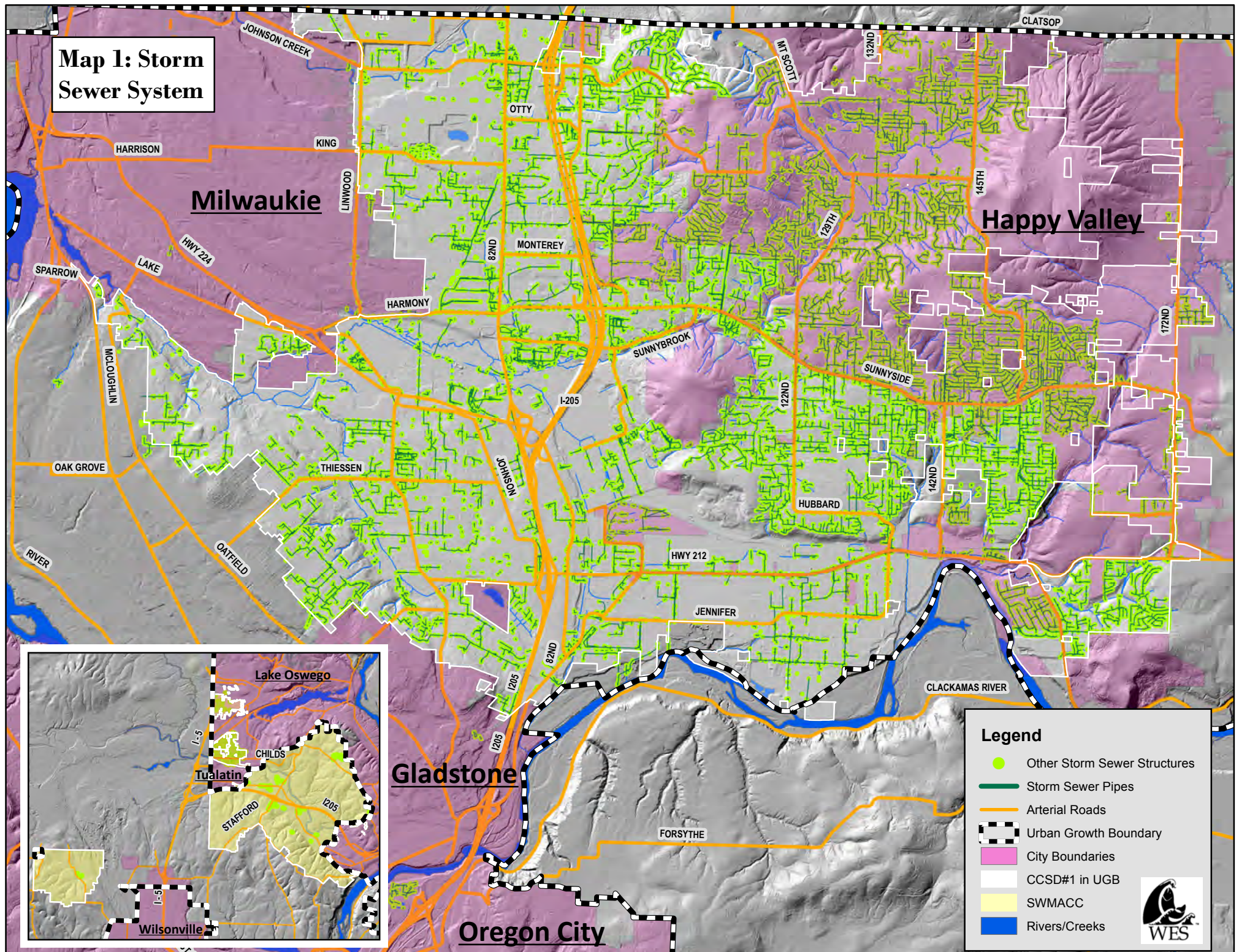
QA/QC

1. Monitoring Field Data Sheets are completed in the field as the samples are collected.
2. After the completion of each day's sampling, device calibration(s) must be verified, checked for accuracy, and recorded.
3. Devices should then be cleaned with DI water and stored appropriately.

Appendix G

Maps

Map 1: Storm Sewer System

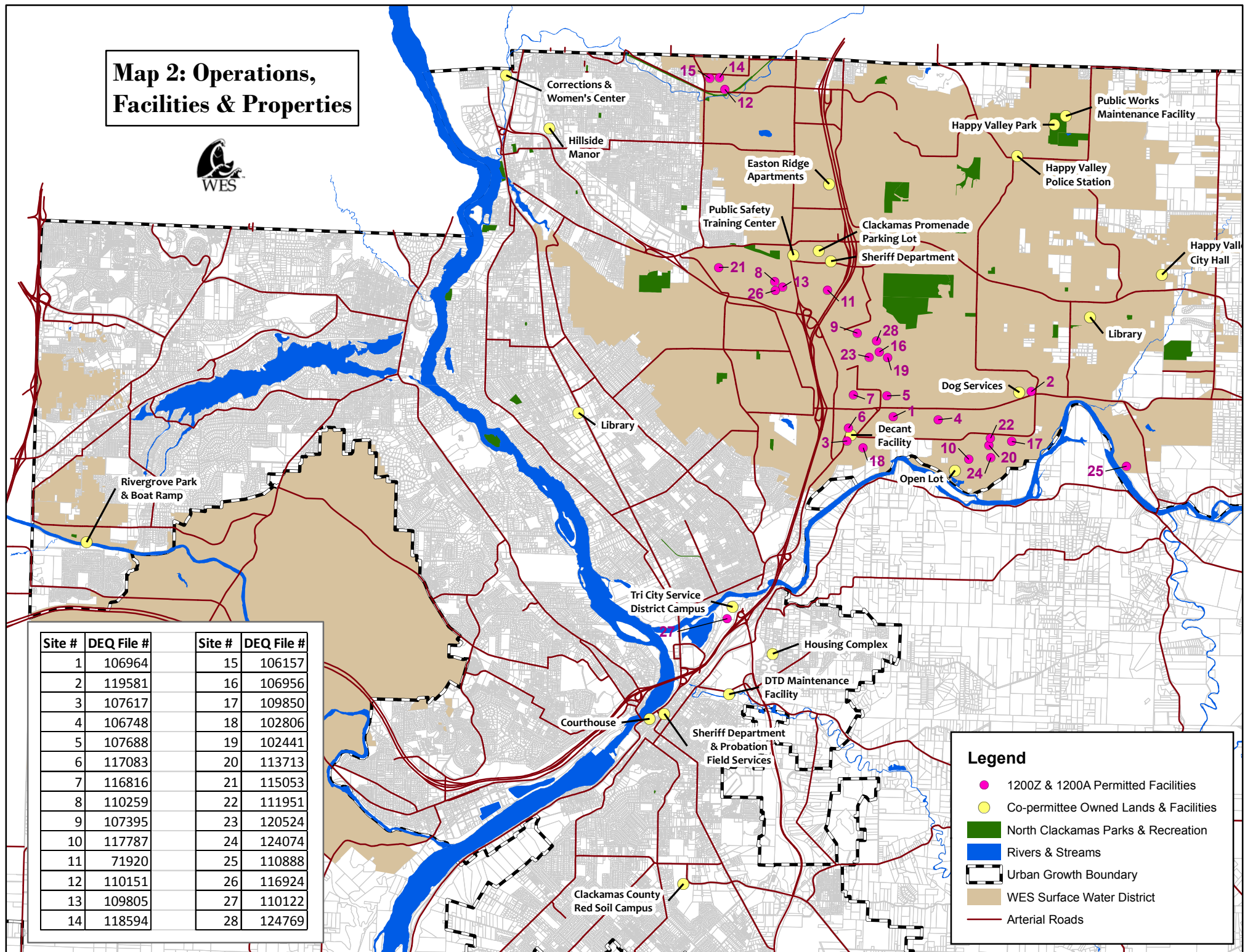


Legend

- Other Storm Sewer Structures
- Storm Sewer Pipes
- Arterial Roads
- Urban Growth Boundary
- City Boundaries
- CCSD#1 in UGB
- SWMACC
- Rivers/Creeks



Map 2: Operations, Facilities & Properties



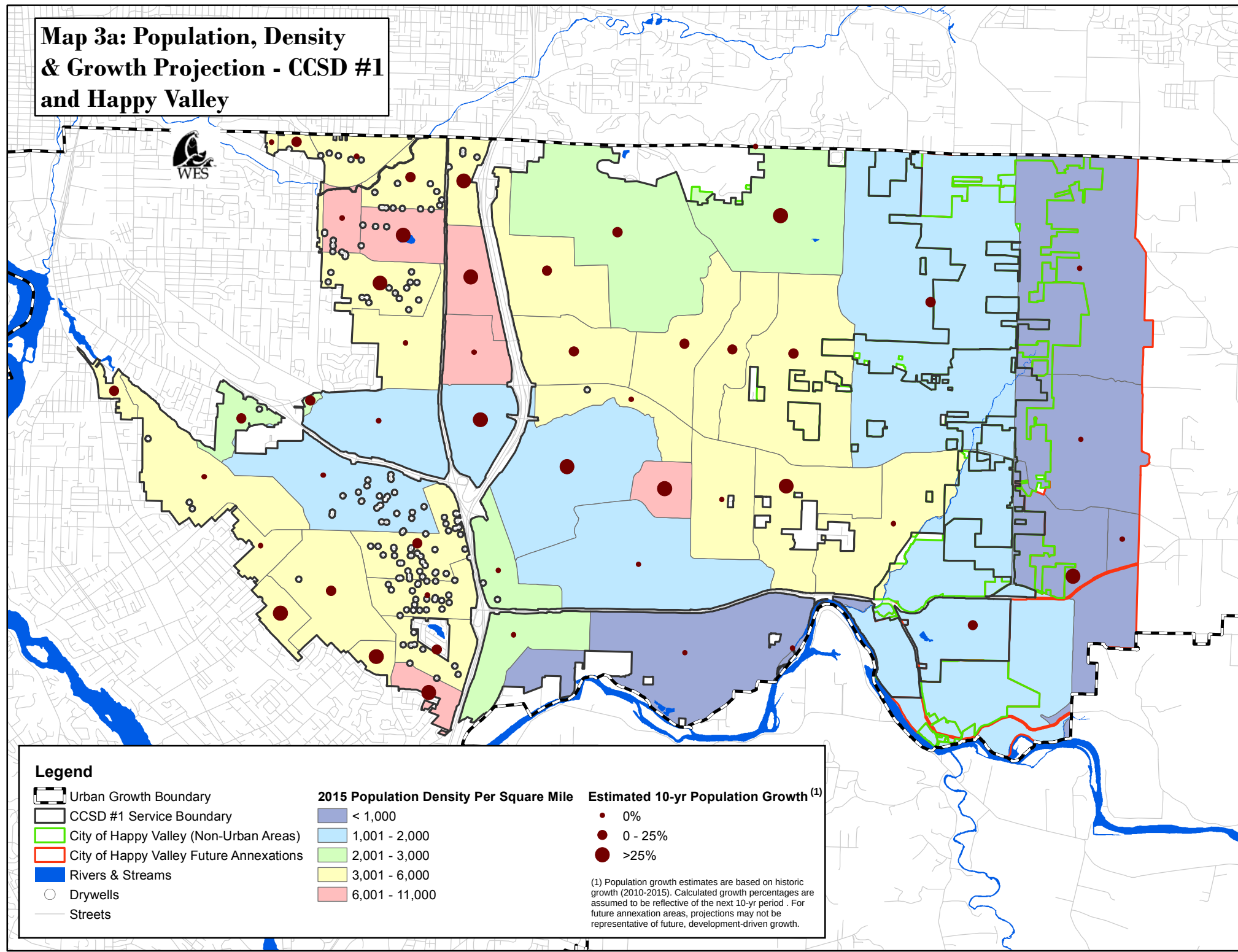
Site #	DEQ File #
1	106964
2	119581
3	107617
4	106748
5	107688
6	117083
7	116816
8	110259
9	107395
10	117787
11	71920
12	110151
13	109805
14	118594

Site #	DEQ File #
15	106157
16	106956
17	109850
18	102806
19	102441
20	113713
21	115053
22	111951
23	120524
24	124074
25	110888
26	116924
27	110122
28	124769

Legend

- 1200Z & 1200A Permitted Facilities
- Co-permittee Owned Lands & Facilities
- North Clackamas Parks & Recreation
- Rivers & Streams
- Urban Growth Boundary
- WES Surface Water District
- Arterial Roads

Map 3a: Population, Density & Growth Projection - CCSD #1 and Happy Valley



Legend

- Urban Growth Boundary
- CCSD #1 Service Boundary
- City of Happy Valley (Non-Urban Areas)
- City of Happy Valley Future Annexations
- Rivers & Streams
- Drywells
- Streets

2015 Population Density Per Square Mile

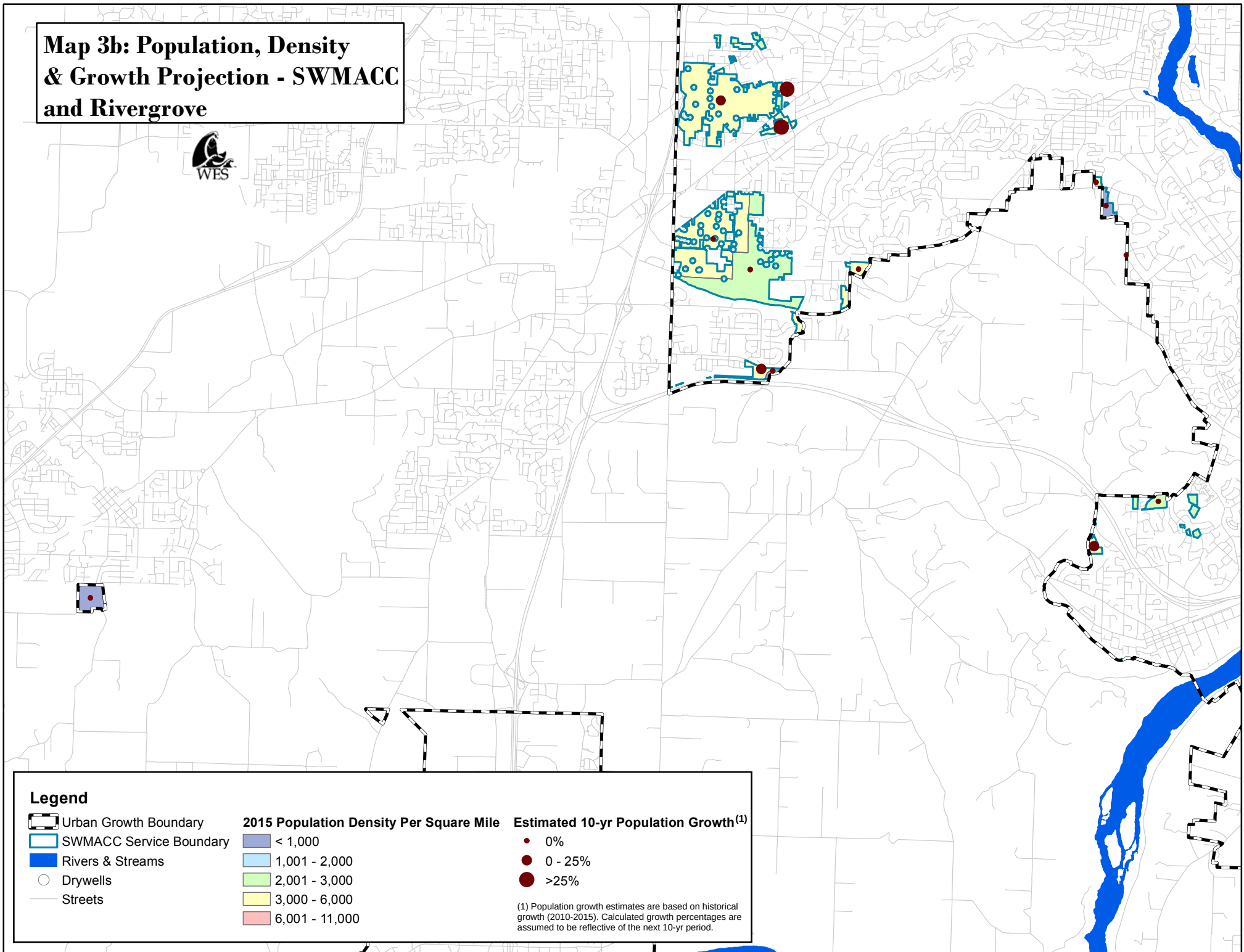
- < 1,000
- 1,001 - 2,000
- 2,001 - 3,000
- 3,001 - 6,000
- 6,001 - 11,000

Estimated 10-yr Population Growth ⁽¹⁾

- 0%
- 0 - 25%
- >25%

(1) Population growth estimates are based on historic growth (2010-2015). Calculated growth percentages are assumed to be reflective of the next 10-yr period. For future annexation areas, projections may not be representative of future, development-driven growth.

Map 3b: Population, Density & Growth Projection - SWMACC and Rivergrove



Appendix H

TMDL Pollutant Load Reduction Evaluation and Benchmarks



TMDL Pollutant Load Reduction Evaluation and Benchmark Development

Prepared for
Clackamas County Service District #1,
the Surface Water Management Agency of Clackamas County,
the City of Happy Valley, Oregon, and
the City of Rivergrove, Oregon

November 1, 2015
Amended: January 2017



6500 SW Macadam Avenue, Suite 200
Portland, OR 97239
Phone: 503.244.7005
Fax: 503.244.9095

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List of Abbreviations

ac	acre(s)	SWMACC	Surface Water Management Agency of Clackamas County
ACWA	(Oregon) Association of Clean Water Agencies	TMDL	total maximum daily load
AGR	agricultural	TSS	total suspended solids
ASCE	American Society of Civil Engineers	UCL	upper confidence limit
BMP	best management practice	UGB	urban growth boundary
CCSD #1	Clackamas County Service District #1	UIC	underground injection control
CFU	colony forming unit(s)	USGS	U.S. Geological Survey
City	City of Happy Valley	VAC	vacant
COM	commercial	WES	Water Environment Services
DDT	dichlorodiphenyltrichloroethane	WLA	waste load allocation
DEQ	(Oregon) Department of Environmental Quality	WPCF	water pollution control facility
Districts	CCSD #1 and SWMACC (including Rivergrove)	WTM	Watershed Treatment Model
DO	dissolved oxygen	WWTP	wastewater treatment plant
EHV	East Happy Valley		
EMC	event mean concentration		
EPA	U.S. Environmental Protection Agency		
GIS	geographic information system		
HUC	hydrologic unit code		
IND	industrial		
LA	load allocation		
LCL	lower confidence limit		
MFR	multifamily residential		
mg/L	milligram(s) per liter		
mL	milliliter(s)		
MS4	Municipal Separate Storm Sewer System		
ng/L	nanogram(s) per liter		
NPDES	National Pollutant Discharge Elimination System		
ODOT	Oregon Department of Transportation		
PLRE	pollutant load reduction evaluation		
POS	parks and open space		
RUR	rural residential		
SFR	single-family residential		
SOD	sediment oxygen demand		
SVS	settleable volatile solids		

Definitions

Load allocation	The amount of pollutant allocated to existing nonpoint sources and natural background in a total maximum daily load (TMDL). (EPA, 2010, http://toxics.usgs.gov/definitions/tmdl.html)
Pollutant load reduction benchmark	A future pollutant load reduction estimate for a parameter or surrogate, where applicable, for which a waste load allocation (WLA) is established. The benchmark is used to establish progress toward achieving the WLA over an implementation period (typically 5 years).
Pollutant load reduction evaluation	An evaluation of current pollutant load generation for a parameter or surrogate, where applicable, for which a WLA is established. The pollutant load reduction evaluation (PLRE) is used to measure progress toward achieving a WLA or previously established benchmark.
Waste load allocation	The amount of pollutant load allocated to a specified point source (e.g., sewage treatment plant; industrial facility; stormwater) in a TMDL. (EPA, 2010, http://toxics.usgs.gov/definitions/tmdl.html)

Section 1

Introduction

This report presents: 1) the 2015 total maximum daily load (TMDL) pollutant load reduction evaluation (PLRE), and 2) the 2017 TMDL pollutant load reduction benchmarks for Clackamas County Service District #1 (CCSD #1), the Surface Water Management Agency of Clackamas County (SWMACC), and the City of Happy Valley (City). Throughout this document, CCSD#1 and SWMACC, which includes the City of Rivergrove, are collectively referred to as the Districts.

TMDLs relevant to stormwater discharges from the Districts and the City are contained in the Willamette Basin TMDL, approved on September 29, 2006, by the U.S. Environmental Protection Agency (EPA). In addition, TMDLs relevant to stormwater discharges from select areas of SWMACC are also contained in the Tualatin Subbasin TMDL, approved on August 7, 2001, by the EPA and amended on August 28, 2012.

PLRE: As required by the National Pollutant Discharge Elimination System (NPDES) Phase I Municipal Separate Storm Sewer System (MS4) permit, the PLRE includes:

- An evaluation of the estimated pollutant loading based on current land use from all MS4 permitted areas
- An evaluation of the pollutant load reduction based on current use of structural water quality controls or best management practices (BMPs)
- A comparison of the current pollutant load reduction to benchmarks established as part of the Districts and City's permit renewal application in 2008

The PLRE results are presented in Section 5 and show that the wasteload allocations (WLAs) are estimated to be achieved for bacteria in SWMACC. Thus, no additional evaluation or new TMDL benchmarks are required for bacteria in SWMACC. However, benchmarks are required in the Districts and City for other parameters and TMDL watersheds.

Benchmarks: As part of the Districts and the City's NPDES MS4 permit renewal application, both are required to establish new pollutant load reduction benchmarks for TMDL parameters where WLAs are not currently being achieved. The benchmark development includes:

- Identification of additional or modified BMPs anticipated over the next permit term
- An evaluation of the estimated pollutant loading and pollutant load reduction (i.e., benchmarks) based on current and anticipated future use of BMPs

Updated benchmarks for the Districts and the City are presented in Section 6.

This report outlines the data assumptions, methods, and results of the PLRE and updated benchmarks for the Districts and the City. This report also includes an analysis of long-term trends in receiving water quality based on in-stream monitoring data, as documented in Appendix A and a summary of loads related to the PLRE and benchmarks, as documented in Appendix B.

1.1 Permit Requirements

The Districts and City are co-permittees on the Clackamas County NPDES MS4 permit 101348, issued on March 16, 2012. The requirements to evaluate pollutant load reductions apply as listed in Schedule D.3 as follows:

- a. *Applicability: The requirements of this section apply to the co-permittee's MS4 discharges to receiving waters with established TMDLs or to receiving waters with new or modified TMDLs approved by EPA within three years of the issuance date of this permit. Established TMDLs are noted on page 1 of this permit. Pollutant discharges for those parameters listed in the TMDL with applicable WLAs must be reduced to the maximum extent practicable through implementation of BMPs and an adaptive management process.*

The following two subsections provide more detail regarding the TMDL pollutant evaluation requirements from the permit, specifically for the PLRE and benchmarks. Detail related to interpretation and application of the Willamette Basin TMDL and Tualatin Subbasin TMDL for purposes of this report is provided in Section 2.

1.1.1 PLRE Requirements

Per Schedule D.3.c (i–ix) of the Clackamas County NPDES MS4 permit, the Districts and the City must complete a PLRE by November 1, 2015. The PLRE must include the following:

- (i) *The rationale and methodology used to evaluate progress towards reducing TMDL pollutant loads.*
- (ii) *An estimate of current pollutant loadings without considering BMP implementation, and an estimate of current pollutant loadings considering BMP implementation for each TMDL parameter with an established WLA.*
- (iii) *A comparison of the estimated pollutant loading with and without BMP implementation to the applicable TMDL WLA.*
- (iv) *A comparison of the estimated pollutant load reduction to the estimated TMDL pollutant load reduction benchmark established for the permit term, if applicable.*
- (v) *A description of the estimated effectiveness of structural BMPs.*
- (vi) *A description of the estimated effectiveness of non-structural BMPs, if applicable, and the rationale for the selected approach.*
- (vii) *A water quality trend analysis, as sufficient data are available, and the relationship to stormwater discharges for receiving water bodies within the co-permittees jurisdictional area with an approved TMDL.*
- (viii) *A narrative summarizing progress towards applicable TMDL WLAs and existing TMDL benchmarks, if applicable.*
- (ix) *If the permittee estimates that TMDL WLAs are achieved with existing BMP implementation, the co-permittee must provide a statement supporting this conclusion.*

With respect to item iv above, the Districts established TMDL pollutant load reduction benchmarks in 2008 for the Willamette River, Tualatin River, and specified tributaries. The pollutant load reduction benchmarks projected development conditions and associated pollutant load reduction in 2013 and are compared with estimated, current pollutant load reductions as part of the PLRE.

1.1.2 Benchmark Requirements

Per Schedule D.3.d of the Clackamas County NPDES MS4 permit, the Districts and the City must develop pollutant load reduction benchmarks for the next permit term for each applicable TMDL parameter where existing BMP implementation is not shown to be achieving WLAs. Benchmarks must be submitted with the permit renewal application, which is due March 1, 2017. Per subsection D.3.d.ii, the benchmark submittal must include the following:

1. *An explanation of the relationship between the TMDL WLAs and the TMDL benchmark for each applicable TMDL parameter;*
2. *A description of how SWMP implementation contributes to the overall reduction of the TMDL pollutants during the next permit term;*
3. *Identification of additional or modified BMPs that will result in further reductions in the discharge of the applicable TMDL pollutants, including the rationale for proposing the BMPs; and*
4. *An estimate of current pollutant loadings that reflect the implementation of the current BMPs and the BMPs proposed to be implemented during the next permit term.*

1.2 Document Organization

Following this introductory section, this report is organized according to the following sections:

- Section 2 Review of the Willamette Basin TMDL, Tualatin Subbasin TMDL, and applicable pollutant wasteload allocations.
- Section 3 Description of the Districts' and the City's process for conducting the PLRE and benchmarks.
- Section 4 Pollutant load modeling methods and assumptions.
- Section 5 PLRE, including comparison of results to WLAs and comparison of results to the 2013 pollutant load reduction benchmarks.
- Section 6 TMDL Pollutant Load Reduction Benchmarks for the upcoming permit term.
- Section 7 References.

Section 2

TMDL Applicability

TMDLs are developed to document the projected maximum pollutant load capacity of a water body that should be met so as not to exceed water quality standards. They may be developed for pollutants with direct links to stormwater runoff (e.g., metals, nutrients) and also for pollutants not typically associated with urban stormwater runoff in the Willamette Valley (temperature).

To translate a TMDL into guidelines for NPDES-permitted entities (municipalities, industries, wastewater treatment plants [WWTPs]), WLAs are developed as a means to regulate discharges from defined point sources of pollution that operate under an NPDES discharge permit (e.g., permitted municipalities, industries, and WWTPs). Load allocations (LAs) are developed to allocate pollutant discharges from nonpoint sources that do not generally operate under an NPDES discharge permit (e.g., agriculture and forestry).

With the implementation of NPDES MS4 permit requirements (considered to be point source discharge permits), by definition, WLAs should be used to regulate discharges from urban stormwater runoff for areas covered by the permits. However, depending on the language of the TMDL, MS4 sources have sometimes been undefined or excluded from the WLA or instead covered under the LAs. As such, interpretation of TMDL requirements for MS4 sources can be difficult.

The Willamette Basin TMDL uses LAs to define pollutant load discharges from urban land use including from the Districts' and the City's NPDES MS4 permit area. The Tualatin Subbasin TMDL uses WLAs to define pollutant load discharges from designated jurisdictions (including SWMACC) with an NPDES MS4 permit. Because the pollutant load discharges in CCSD #1, Happy Valley, and the urbanized area of SWMACC are managed through implementation of the NPDES MS4 permit, for purposes of this report, it is assumed that the LAs referenced in the Willamette Basin TMDL are WLAs. The term WLA is used in this report.

2.1 Service Area Summary

CCSD #1 is a stormwater and sanitary service district located east of the Willamette River. It is predominantly composed of unincorporated Clackamas County area within the urban growth boundary (UGB).

The city of Happy Valley is located along the eastern CCSD #1 service boundary. Happy Valley is an incorporated city, but CCSD #1 provides stormwater and sanitary services for the more developed areas of the city. The portion of Happy Valley not included within CCSD #1's service boundary is referred to as East Happy Valley (EHV) and for purposes of the PLRE and benchmarks, pollutant loads are calculated for this area separately from CCSD#1.

SWMACC is a stormwater and sanitary service district located west of the Willamette River also composed of unincorporated Clackamas County area. Only the portion of SWMACC that is within the UGB is covered under the Clackamas County NPDES MS4 permit and subject to this PLRE and benchmark requirement. The portion of the City of Rivergrove located in Clackamas County is considered part of SWMACC. It should be noted that SWMACC's NPDES MS4 permit area is continually fluctuating in conjunction with annexations to neighboring cities (e.g., Lake Oswego, Tualatin). Internal review of the SWMACC boundary indicates that the SWMACC permit area may be less than the area reflected

in current GIS and included in the model; thus, the model areas are conservative. Additional review and update of the District boundary will be necessary with future submittals.

2.2 Willamette Basin TMDL

The Willamette Basin TMDL document covers the following tributary water bodies applicable to the Districts and the City: the Clackamas River, Johnson Creek, unspecified tributary discharges to the Lower Willamette River, and unspecified tributary discharges to the Middle Willamette River. The Willamette Basin TMDL includes water-body-specific allocations for urban stormwater sources of bacteria. For Johnson Creek, a WLA is also provided for toxics (i.e., dichlorodiphenyltrichloroethane [DDT] and dieldrin).

The Districts and EHV submitted a PLRE and (for the Districts) TMDL pollutant load reduction benchmarks as part of their Phase I NPDES MS4 permit renewal submittal in September 2008.

2.2.1 TMDL Overview

The Willamette Basin TMDL addresses elevated in-stream temperatures, bacteria (*E. coli*), and mercury for the Willamette River and tributaries. Additional pollutant parameters are included in the Willamette Basin TMDL for select tributaries. Applicable for CCSD #1 and EHV, a TMDL is also in place for toxics for Johnson Creek.

Temperature can be considered both a point and nonpoint source pollutant, but the Oregon Department of Environmental Quality (DEQ) does not typically consider it to be a pollutant parameter associated with urban stormwater runoff in the Willamette Valley. Temperature is regulated by DEQ and addressed by individual NPDES Wastewater Discharge permits and TMDL Implementation Plans, but not under the NPDES MS4 permit.

Mercury is identified as a pollutant with direct ties to stormwater runoff, but currently DEQ has not completed its analysis and establishment of source-specific WLAs for mercury. No pollutant load analyses or pollutant load reduction benchmarks were calculated for mercury in 2008. Therefore, no pollutant load reduction estimates or benchmarks are required, as there is not an established WLA for MS4 sources.

Bacteria are considered to be a pollutant with direct ties to stormwater runoff; thus, bacteria are regulated under the NPDES MS4 permits as a point source pollutant. Therefore, the Districts and the City are required to conduct a PLRE and, as necessary, develop new benchmarks for bacteria.

In Johnson Creek, a TMDL was developed for toxics because of measured high levels of the pesticides DDT and dieldrin. Johnson Creek was listed on the 1998 303(d) list for both compounds. DDT and dieldrin are both legacy pollutants, used historically as agricultural insecticides, and use of the compounds was banned in 1972 (DDT) and 1983 (dieldrin). However, the historical use of the compounds still results in exceedances of the aquatic and human-health water quality standards because of their persistence in the environment and low solubility (i.e., tendency to bind to soil particles). Stormwater collection systems provide a transport mechanism for contaminated soils, so a WLA was established for MS4 discharges and a pollutant load reduction estimate is required. Because DDT and dieldrin are legacy pollutants and ongoing degradation is occurring, new benchmarks have not been developed for toxics.

2.2.2 Application for CCSD #1, SWMACC, and EHV

Stormwater runoff from all of CCSD #1 and EHV discharges to the Lower Willamette River via tributaries (i.e., Johnson Creek, the Clackamas River [including the Rock Creek tributary], and Kellogg-Mt. Scott Creek [including other smaller tributaries]). Stormwater runoff from a portion (approximately

30 percent) of the total SWMACC NPDES MS4 area discharges to the Lower Willamette River via tributaries. Of the roughly 15,000 acres (ac) of combined Districts and EHV area discharging to the Lower Willamette River, approximately half of the total drainage area is located in the Clackamas River and Johnson Creek subbasins. The remainder discharges to the Lower Willamette River via unspecified, smaller tributaries.

Only 1.7 acres of area (i.e., one tax lot) in SWMACC is located in the Middle Willamette Subbasin and discharges to the Middle Willamette River via Tanner Creek (an unspecified tributary in the TMDL).

Pollutant load estimates have been calculated separately for areas that discharge to tributaries specifically referenced in the Willamette Basin TMDL (i.e., the Clackamas River and Johnson Creek) versus areas that discharge to the Willamette River via unspecified tributaries, because of the way WLAs have been assigned.

The Willamette Basin TMDL was reviewed for this report to verify the appropriate WLAs for MS4 contributions from the Districts and EHV. The TMDL was previously reviewed in 2008 in conjunction with the permit renewal submittals and TMDL benchmarks. Identified WLAs by service area and TMDL water body are listed in Table 2-1.

Table 2-1. Willamette River WLAs			
Service area	Water body	Parameter	WLA
CCSD #1	Clackamas River	Bacteria (<i>E. coli</i>)	78% (annual reduction)
	Lower Willamette (via tributaries)	Bacteria (<i>E. coli</i>)	78% (annual reduction)
	Johnson Creek	Bacteria (<i>E. coli</i>)	78% (annual reduction)
		DDT	77% (annual reduction)
EHV	Clackamas River	Bacteria (<i>E. coli</i>)	78% (annual reduction)
	Lower Willamette (via tributaries)	Bacteria (<i>E. coli</i>)	78% (annual reduction)
	Johnson Creek	Bacteria (<i>E. coli</i>)	78% (annual reduction)
		DDT	77% (annual reduction)
SWMACC	Lower Willamette (via tributaries)	Bacteria (<i>E. coli</i>)	78% (annual reduction)
	Middle Willamette (via tributaries)	Bacteria (<i>E. coli</i>)	88% (summer seasonal reduction) 75% (fall, winter, spring seasonal reduction)

The WLAs for bacteria (*E. coli*) and DDT are calculated as a percent load reduction for each water body and applied to the contributing watershed area based on land use (e.g., urban, agricultural, etc.). The MS4 contribution is assumed to equate to the urban land use (when not otherwise specified). As described in the Willamette Basin TMDL, the water quality criterion for bacteria (monthly log mean concentration of 126 *E. coli* per 100 milliliters [mL]) was used to establish the required bacteria WLAs. For DDT, a WLA of 77 percent (annual reduction) was established for urban stormwater, based on the 90th percentile concentration of DDT in stormwater versus instream samples. It should be noted that stormwater samples used to establish the WLA were based on a limited number of samples (10 samples) collected from two locations in 2002.

2.3 Tualatin Subbasin TMDL

The Tualatin Subbasin TMDL includes WLAs for urban stormwater runoff to Fanno Creek and direct and unspecified tributary discharges to the Tualatin River. The TMDLs include bacteria, total phosphorus (as a surrogate for pH and chlorophyll a), and settleable volatile solids (SVS) (as a surrogate for dissolved oxygen [DO]). Given the lack of data for SVS, the Tualatin Subbasin TMDL references TSS as a common parameter that may be evaluated instead of SVS¹.

SWMACC submitted a PLRE and TMDL pollutant load reduction benchmarks as part of its Phase I NPDES MS4 permit renewal submittal in September 2008. It should be noted that the Tualatin Subbasin TMDL was amended in 2012 for total phosphorus and ammonia. However, this amendment did not affect the previously established WLAs for urban stormwater or change the results of the PLRE and benchmarks submitted in 2008.

2.3.1 TMDL Overview

The Tualatin Subbasin TMDL addresses elevated in-stream temperatures, bacteria (*E. coli*), chlorophyll a and pH (total phosphorus as a surrogate measure), and DO (ammonia and SVS as a surrogate measure) for the Tualatin River and tributaries.

As described for the Willamette Basin TMDL, DEQ does not typically consider temperature to be a pollutant parameter associated with urban stormwater runoff in the Willamette Valley. Therefore, no WLA was established for temperature, and temperature is not evaluated in this PLRE.

Bacteria are considered to be a pollutant with direct ties to stormwater runoff, so bacteria are regulated under the NPDES MS4 permits as a point source pollutant. Therefore, SWMACC is required to conduct a PLRE and, as necessary, develop new benchmarks for bacteria.

pH, chlorophyll a, and DO are not independently considered to be pollutants, but rather an effect of elevated temperature, low flows, excessive algal growth, and the discharge of pollutants such as nutrients that exacerbate the growth of algae and other autotrophs. This can result in changes to pH levels and DO concentrations. Low DO concentrations and variable pH levels can impact aquatic health. DO and pH levels have a direct tie to stormwater runoff when considering impacts of the discharge of pollutants such as nutrients (i.e., total phosphorus) and sediment. Total phosphorus and SVS (or TSS due to data limitations) are often used as surrogates for DO and pH, and SWMACC is required to conduct a PLRE and, as necessary develop new benchmarks for these parameters.

2.3.2 Application for SWMACC

The Tualatin River is a major tributary to the Willamette River. Approximately 500 acres (or 70 percent) of SWMACC's total NPDES MS4 permit area is located in the Tualatin Subbasin. Of the 500 acres, approximately 75 acres discharge to Fanno Creek, one of the major tributaries specified in the Tualatin Subbasin TMDL. The remainder of the SWMACC NPDES MS4 permit area in the Tualatin Subbasin discharges to the Tualatin River via unspecified tributaries (i.e., Chicken Creek, Saum Creek).

The Tualatin Subbasin TMDL was reviewed for this report to verify the appropriate WLAs for MS4 contributions from SWMACC. The TMDL was previously reviewed in 2008 in conjunction with the permit renewal submittals and TMDL benchmarks. Identified WLAs for SWMACC by TMDL water body are listed in Table 2-2.

¹ In the Tualatin Subbasin TMDL, page 124, sediment oxygen demand (SOD) is caused in great part by the discharges of SVS. Load reduction to improve the DO concentration is referred to as the reduction of SVS in the TMDL.

Table 2-2. Tualatin River WLAs

Service area	Water body	Parameter	WLA
SWMACC	Fanno Creek	Bacteria (<i>E. coli</i>)	12,000 count/ 100 mL (summer storm event)
			5,000 count/ 100 mL (winter storm event)
		TSS (surrogate measure for SVS and DO)	50% (summer seasonal reduction)
		Total phosphorus (surrogate measure for pH and chlorophyll a)	0.13 mg/L (summer seasonal)
	Tualatin River (via unspecified tributaries)	Bacteria (<i>E. coli</i>)	12,000 count/ 100 mL (summer storm event)
			5,000 count/ 100 mL (winter storm event)
		TSS (surrogate measure for SVS and SOD)	20% (summer seasonal reduction)
		Total phosphorus (surrogate measure for pH and chlorophyll a)	0.14 mg/L (summer seasonal)

WLAs for bacteria were established as a general (not water-body-specific) WLA for urban runoff. The WLAs are presented as an event mean concentration (EMC) of stormwater runoff and are calculated separately for a summer storm event of 0.11 inch/24 hours and a winter storm event of 1.96 inches/96 hours. The WLAs were established based on a calibrated loadings model and the ability to achieve a target in-stream *E. coli* concentration of 126 counts/100 mL.

The WLAs for total phosphorus (as a surrogate for pH and chlorophyll a) were established as a median concentration of stormwater runoff for the summer season (May to October). The TMDL assigns WLAs for point source discharges (excluding WWTPs) according to the location of discharges along the Tualatin River. Dischargers to tributaries have lower WLAs than dischargers to the mainstem Tualatin River. Point source WLAs for total phosphorus were based on maintaining an in-stream total phosphorus concentration below 0.15 mg/L, which is considered natural background conditions.

The WLA for TSS (as a surrogate for SVS) was calculated based on the necessary reduction in sediment oxygen demand (SOD) required in order to meet various DO criteria along the mainstem and tributaries of the Tualatin River. SOD reduction for runoff sources (i.e., MS4 runoff) is addressed through the allocation of SVS and total phosphorus (see pH and chlorophyll a TMDL). Because the current (or background) SVS load is unknown, the WLA is presented as a percent reduction from current conditions and management efforts are expected to incorporate TSS (as opposed to SVS) as a target parameter.

Section 3

PLRE and Benchmark Development Process

Conducting a PLRE and developing benchmarks relies on the use of a pollutant loading model to calculate pollutant loads for select parameters and select scenarios, under select development conditions.

In accordance with Schedule D.3.c of the District's and City's NPDES MS4 permit, jurisdictions are required to conduct a PLRE for all applicable TMDL parameters. The PLRE must reflect current (2015) development conditions. The PLRE must include estimates of current pollutant loading both without and with BMP implementation. Results of the PLRE must be compared to previously established pollutant load reduction benchmarks and applicable WLAs. The PLRE is used to estimate the effectiveness of stormwater management facilities and show how BMPs are making progress toward achieving pollutant load reductions.

For TMDL parameters where the PLRE indicates that a WLA is not being met, development of a new pollutant load reduction benchmark is required. A benchmark is an estimate of pollutant load reduction for an applicable TMDL pollutant at the end of the next 5-year NPDES MS4 permit term. Benchmarks account for current BMP implementation and additional BMP implementation anticipated during the course of the next five year permit term.

Figure 3-1 below identifies the overall process for conducting the PLRE and the relationship to the pollutant load reduction benchmarks. Steps 1 through 6 are associated with the PLRE and include review of TMDL assumptions, data compilation, pollutant load calculations, and comparison of pollutant loads with WLAs and benchmarks previously established for the current permit period. Step 7 includes development of new pollutant load reduction benchmarks for the upcoming permit period. This process was followed for TMDL watersheds and pollutant parameters listed in Table 2-1 and 2-2. Modeling assumptions and input data are described in Section 4.

This overall process is loosely based on the process collectively developed through the Oregon Association of Clean Water Agencies (ACWA) in 2005 (updated in 2008) to conduct pollutant loads modeling for TMDL compliance.

If benchmarks were previously established, Figure 3-1 identifies the points at which the current model assumptions and model results are reviewed in conjunction with previous efforts. If benchmarks were not previously established, such activities are not required. For the Districts and EHV, a few modeling assumptions changed between 2008 and 2015. Therefore, documentation of changes is necessary in order to accurately review and interpret model results.

As shown on Figure 3-1, three general categories of BMPs are considered in the process:

1. Structural BMP systems for which pollutant removal can be reported quantitatively and are based on the results of scientific research (i.e., effluent concentrations). These BMPs include traditional ponds, swales, infiltration facilities, proprietary treatment systems, and wetlands.
2. Structural and/or source control BMP applications or practices where pollutant removal potentially could be reported in objective, quantitative terms, but effectiveness information is generally limited or unavailable. These BMPs (particularly source control BMPs) may be reflected in the

modeling effort by simulating their specific coverage area with adjusted model assumptions (impervious area, land use EMCs, etc.). These BMPs include downspout disconnection programs, street sweeping, and catch basin cleaning.

3. Non-structural/source control BMP applications where pollutant removals are not likely to be reported in objective, quantitative terms. These BMPs include public education, illicit discharge detection programs, and spill prevention.

This process results in a conservative estimate of pollutant removal because it does not directly estimate pollutant load removal achieved by BMPs with limited or no quantifiable effectiveness information. Instead, pollutant loads are generated after applying structural BMPs (Category 1) and any selected structural/source control BMPs under Category 2 in order to provide a relative picture as to how close or how far off the stormwater program is with regard to meeting the WLAs and previous benchmarks. It is acknowledged that implementation of non-structural or non-quantifiable BMPs (Category 3) has the potential to reduce pollutant loads further; however, utilization of such BMPs in the PLRE and benchmarks is qualitative in nature, and not reflected in any quantitative (numeric) reduction in pollutant loads.

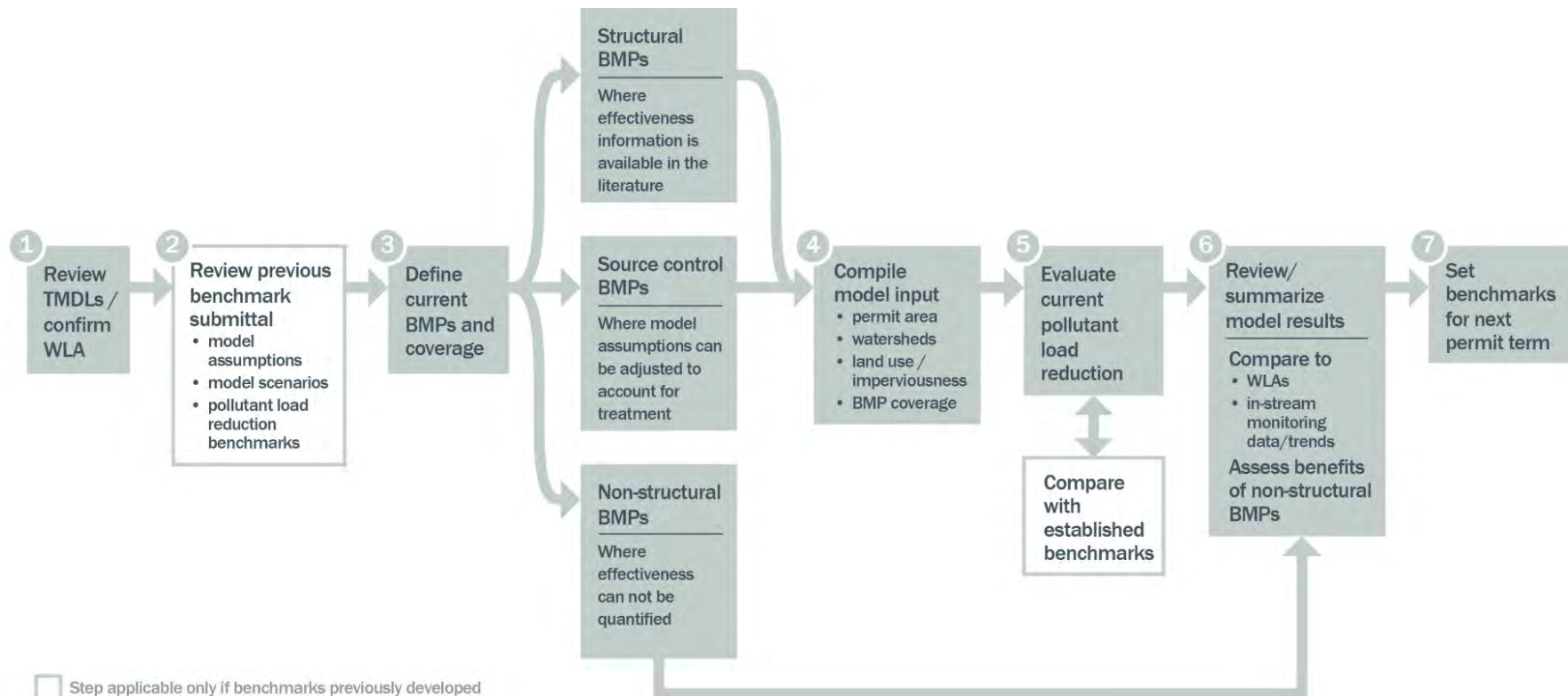


Figure 3-1. Pollutant load reduction evaluation and benchmark development

Section 4

Modeling Methods and Assumptions

To conduct the PLRE and develop new benchmarks, the Districts and EHV used a spreadsheet loads model that is based on the EPA simple method for pollutant load calculations. The model was used to calculate bacteria, total phosphorus, and TSS loads within the Districts and EHV service area boundaries in conjunction with the Willamette Basin and Tualatin Subbasin TMDLs. A modified version of the model was used to estimate DDT loadings, accounting for natural degradation and removal via BMPs.

This section describes the modeling methods and assumptions associated with developing the spreadsheet loads model for development of the PLRE and benchmarks. The subsections below include information regarding model development, model areas, model scenarios, model input, and model assumptions related to land use and BMP effectiveness. As applicable, modeling assumptions associated with the previous (2008) PLRE and benchmark effort are provided for comparison.

4.1 Model Description and Methodology

In 2008, the Districts and EHV used a pollutant load model developed as part of their Stormwater Master Plan Project in 2006. The Clackamas County pollutant load model was a spreadsheet model with a geographic information system (GIS) interface that used the EPA simple method for calculation of pollutant loadings based on rainfall and concentration information.

An alternative spreadsheet loads model (without a GIS interface) was also developed in 2008 for multiple Oregon Phase I NPDES MS4 jurisdictions. This alternative spreadsheet loads model also uses the EPA simple method to calculate pollutant loads. In accordance with discussion among Phase I jurisdictions in 2014, the spreadsheet model was updated with the following modifications:

- New BMP categories were added to account for the following BMP facility types not modeled in 2008: porous pavement, lined planters/filtration rain gardens, and eco roofs.
- BMP effluent concentration data were refined based on a collective effort among ACWA jurisdictions to update BMP effectiveness information with new literature information.

Because the underlying data calculation methods are the same and the spreadsheet model had been updated with new concentration data, the Districts and EHV opted to use the updated spreadsheet loads model for this PLRE. Results are expected to be comparable with the 2008 effort and modeling approach.

Rainfall, land use, and BMP coverage information is entered into the spreadsheet loads model; the model is configured with average pollutant concentration information for various land uses and BMP categories. Pollutant loads are automatically calculated for each TMDL watershed and TMDL parameter, reflective of modeled development conditions and structural BMP implementation. Quantitative data are not currently available to assess the effectiveness of source control or non-structural BMPs for the Districts. Therefore, effectiveness of source control and non-structural BMPs is not included in the model but is qualitatively incorporated in the PLRE and new benchmarks based on best professional judgment and as summarized in Sections 5 and 6.

Model simulations are conducted for each PLRE scenario (a current no-BMP scenario and a current with-BMP scenario). Pollutant loads and pollutant load removals are calculated for the upper confidence limit (UCL), mean (or geometric mean for bacteria), and lower confidence limit (LCL), to yield a

range in the resulting loads. The UCL and LCL represent the 95 percent confidence limits for the data used in establishing the land use EMCs.

For TMDL parameters that require the development of benchmarks, an additional simulation (future with-BMP scenario) is conducted. The future with-BMP scenario assumes all current (as of 2015) BMPs are still in place and functioning, and it includes the addition of new BMPs anticipated to be constructed by the end of the next 5-year permit term (i.e., by 2022). Pollutant loads and pollutant load reductions were calculated using the current no-BMP and the future with-BMP scenarios consistent with the PLRE methodology.

4.2 Model Area

The Districts' NPDES MS4 permit covers existing and new discharges of stormwater "within the service areas of CCSD #1....and the portion of SWMACC in the urban growth boundary (UGB)". Specific for Happy Valley, the NPDES MS4 permit covers existing and new discharges of stormwater from the MS4 "within the service boundaries of incorporated cities". As a result, the CCSD #1 NPDES MS4 permit area is its service district boundary. SWMACC's NPDES MS4 permit area is its service district boundary within the UGB. The EHV service area reflects the portion of incorporated Happy Valley not included in CCSD #1.

The service area boundaries used in the PLRE and benchmark modeling effort reflect annexations through March 2015. Annexations continuously occur within unincorporated Clackamas County; therefore, significant discrepancies exist between the modeled areas in 2008 and 2015. Additionally, as portions of Happy Valley develop, they are incorporated into CCSD #1, which results in an increase in the CCSD #1 modeled area and a decrease in EHV's modeled area.

As described in Section 2, individual WLAs are defined for six TMDL watersheds; therefore, each TMDL watershed is modeled separately and pollutant load generation is compared to the respective WLAs. In addition, each service area is separately modeled within each applicable TMDL watershed. GIS was used to define and delineate the service areas within each TMDL watershed. Updated (2015) U.S. Geological Survey (USGS) hydrologic unit code (HUC) 6 watershed boundaries were used for this PLRE, which accounts for some additional discrepancies between 2008 and 2015 modeled areas.

Areas within the Districts that are the responsibility of the Oregon Department of Transportation (ODOT) were omitted from the modeled area, as ODOT has a separate NPDES MS4 permit for discharges from these areas. For CCSD #1 and EHV, this includes the Interstate 205 corridor, the Oregon Highway 212/224 corridor, the Oregon Highway 213 corridor (including SE 82nd Avenue), and Oregon Highway 99E. No ODOT areas are applicable to the SWMACC NPDES MS4 permit area.

Large water bodies and areas that discharge to public underground injection controls (UICs) that are regulated under CCSD #1's or SWMACC's water pollution control facility (WPCF) permit for UIC systems were also excluded from the modeled area. Such exclusions were also considered in 2008. For UICs, the Districts have limited information about the actual drainage area that discharges to an individual, public UIC. Therefore, a 1-acre drainage area per UIC was assumed and in turn excluded from the modeled area.

Table 4-1 compares the 2015 total modeled area by District and TMDL watershed to the 2008 total modeled area by District and TMDL watershed. It should be noted that the total modeled area includes land that drains directly into the MS4 system, but also includes a substantial amount of land which is served by privately owned storm sewer systems or that not connected to the MS4, so this modeling exercise may overestimate the amount of pollution which is discharged from the MS4.

Table 4-1. Modeled Areas

TMDL/subbasin	TMDL watersheds	2015 total modeled area (ac) ^a				2008 total modeled area (ac) ^a			
		CCSD #1	EHV	SWMACC	Total	CCSD #1	EHV	SWMACC	Total
Willamette Basin/ Lower Willamette River	Clackamas River	4,031	1,371	N/A	5,402	3,426	2,168	N/A	5,594
	Johnson Creek	1,478	387	N/A	1,865	529	2	N/A	531
	Lower Willamette (direct or via unspecified tributaries)	7,584	9	197	7,790	8,274	154	97	8,525
Willamette Basin/ Middle Willamette River	Middle Willamette (via unspecified tributaries)	N/A	N/A	2	2	N/A	N/A	2	2
Tualatin Subbasin/ Tualatin River	Fanno Creek	N/A	N/A	76	76	N/A	N/A	139	139
	Tualatin River (direct or via unspecified tributaries)	N/A	N/A	429	429	N/A	N/A	500	500

a. The total modeled area reflects the NPDES MS4 permit area boundary (by service District or service area) minus ODOT right-of-way, UIC drainage area, and water bodies.

4.3 Model Assumptions and Input Data

To generate pollutant loads, a number of assumptions were made with regard to the acquisition, processing, and utilization of land use concentration data and BMP effluent concentration data. Assumptions were also made with respect to land use categories, BMP categories, and modeling methods. These assumptions are described below.

4.3.1 Land Use and BMP Effluent Data

Compilation of land use pollutant load concentration data and BMP effluent data for use by Oregon Phase I NPDES MS4 permittees for pollutant load modeling began in 2004. In anticipation of future pollutant load reduction benchmark requirements in their NPDES MS4 permits, select Phase I jurisdictions coordinated efforts to maintain consistency with respect to interpretation and implementation of the benchmark requirement. The statewide coordination process was facilitated through the Oregon ACWA Stormwater Committee. One item that ACWA coordinated was the determination of appropriate, typical land use-based pollutant load concentrations and BMP effluent concentrations for use in pollutant loads modeling.

Tables of pollutant concentrations by land use, referred to in this report as “event mean concentrations” (EMCs), and BMP effluent concentrations were originally developed in 2005 for Phase I jurisdictions required to develop pollutant load reduction benchmarks as part of their Interim Evaluation Report submittals (in 2006). The tables of original concentration data were developed using published, statistically verified national data and data obtained by local jurisdictions.

For the 2008 pollutant load reduction benchmark submittals, the original land use EMC and BMP effluent concentrations developed in 2005 were revisited. The original land use concentration data were adjusted to include additional data reflective of the open space land use category and revisions to the statistical method of dealing with non-detects and outliers. As was done in 2005, the data were *bootstrapped*, a statistical method to estimate upper and lower confidence intervals. The original BMP effluent values were reviewed for inconsistencies and questionable values (e.g., data points where the dissolved concentration is greater than the total concentration, and data points where the BMP effluent concentration is greater than local land use EMCs).

For the 2015 PLRE and 2017 benchmark effort, Phase I jurisdictions coordinated in 2014 to revisit and refine BMP categories and BMP effluent data per updated information contained in the American Society of Civil Engineers (ASCE) BMP database and locally obtained data. No changes were made to the 2008 land use EMC data. BMP updates were made and focused on inclusion of refined flow reduction values for infiltration-related BMPs. New BMP categories and effluent concentration data reflecting lined planters/filtration rain gardens, eco roofs, and porous pavement were also added.

Land use concentration data, including the upper and lower confidence intervals, are provided in Table 4-2. These values are consistent with the Districts' and EHV's 2008 data assumptions. The mean and median BMP effluent concentration values are provided in Table 4-3. As described previously, these values were collectively developed and reviewed by the ACWA Stormwater Committee in 2014. Analysis of *E. coli* is conducted via use of a geomean land use EMC. Analysis of total phosphorus is conducted via use of the median land use EMC and BMP effluent concentrations, because the Tualatin Subbasin TMDL load capacity analysis and calculation of WLAs for total phosphorus is based on median concentration data.

Table 4-2. Land Use-Based Pollutant Load Concentration Values Used in the PLRE and Benchmark Analysis

Parameter	Land use	Count ^d	Bootstrapped mean		
			95% lower confidence level	Mean	95% upper confidence level
Total suspended solids (mg/L)	Commercial ^c	72	64	82	103
	Industrial	48	117	184	284
	Open space ^a	10	16	31	50
	Residential ^b	65	44	66	99
Parameter	Land use	Count ^c	Bootstrapped median		
			95% lower confidence level	Median	95% upper confidence level
Total phosphorus (mg/L)	Commercial ^c	26	0.230	0.280	0.310
	Industrial	25	0.360	0.470	0.650
	Open space ^a	9	0.079	0.086	0.089
	Residential ^b	36	0.160	0.210	0.230
Parameter	Land use	Count	Bootstrapped geomean		
			95% lower confidence level	Geomean	95% upper confidence level
<i>E. coli</i> , CFU/100 mL (geomean)	Commercial ^c	52	573	1,247	2,409
	Industrial	58	154	438	1,004
	Open space ^a	9	57	87	124
	Residential ^b	65	970	1,656	2,651

Data range (+/- 95%) provided by the City of Portland. Based on modified ACWA data set (2008).

- a. Land use EMCs for open space are used to simulate vacant land use.
- b. Land use EMCs for residential are used to simulate rural residential, single-family residential and multifamily residential land use.
- c. Land use EMCs for commercial are used to simulate agricultural land use.
- d. Reflects the sample size for the source land use concentration data.

Table 4-3. BMP Effluent Concentration Values Used in the PLRE and Benchmark Analysis

Parameter	Units	Centrifugal separator hydrodynamic devices	Filters (leaf/sand/other)	Ponds: dry vegetated detention ponds	Ponds: wet retention basin	Swales: vegetated filter strips	Water quality wetlands	Sedimentation manhole	Green roofs	Porous pavement/UIC	Soakage trenches/infiltration rain gardens	Lined planters/filtration rain gardens
		Mean										
TSS	mg/L	115	42	44	41	24	25	66	5.4	N/A	N/A	42
<i>E. coli</i>	CFU/100 mL	5,587	91	1,922	499	1,922	499	5,587	20	N/A	N/A	91
Flow reduction	decimal %	0.00	0.00	0.23	0.05	0.29	0.00	0.00	0.50	1.00	1.00	0.30
		Median										
Total phosphorus	mg/L	0.14	0.12	0.29	0.14	0.22	0.08	0.14	0.35	N/A	N/A	0.12

Most values are consistent with the ACWA data set (2008) and consistent with 2008 data assumptions. Underlined values reflect an increase from 2008 values.

Shaded values are updated values per the 2014 ACWA Stormwater Committee reanalysis of BMP effectiveness.

Values in **black background** are new values per the 2014 ACWA Stormwater Committee reanalysis of BMP effectiveness.

Effluent concentrations shown as N/A represent BMP facilities that achieve 100% flow reduction, as no effluent is generated with which to analyze.

4.3.2 Land Use and BMP Categories

As stated in Section 4.2, the Districts and EHV created an updated land use coverage GIS layer in 2015 to align land use conditions with land use categories available in the pollutant loads model. Land use coverage incorporated the current (2015) zoning coverage, the Districts parks and open space inventory, and Metro's vacant lands inventory. The land use EMCs listed in Table 4-2 do not include all of the Districts' or EHV's land use and zoning categories. Therefore, some land use categories were modeled using concentration data from a comparable land use category. The Districts and City maintained consistent land use categories and a consistent process to consolidate zoning categories with the 2008 PLRE and benchmark effort assumptions.

The breakdown of modeled area by land use is outlined in Table 4-4 for the Districts and EHV.

A more robust GIS BMP inventory was developed for this modeling effort. Clackamas County Water Environment Services (WES) maintains an inventory of public and private stormwater treatment facility installations, which is continually being improved to ensure accurate representation of facilities and associated treatment areas. The 2015 PLRE modeling effort included public and private structural BMPs with a designated drainage area in GIS. Some additional drainage area delineation efforts were conducted as part of the data compilation efforts. Additionally, some facility and drainage area designations were updated from 2008 assumptions. Specifically, upon further review of facility characteristics, stormwater wetlands modeled in 2008 were actually natural wetlands (which should not be included as a designated stormwater facility) or were incorrectly designated instead of a wet retention pond. As such, no stormwater wetlands are included in this modeling effort.

Table 4-4. Summary of Model Input Parameters (2015 Land Use)

Service area or service district	TMDL/subbasin	TMDL water body	Total modeled area (ac)	Land use breakdown (ac)							
				Agriculture	Commercial	Industrial	Single-family residential	Rural residential	Multifamily residential	Vacant	Parks and open space
CCSD #1	Willamette Basin/ Lower Willamette River	Clackamas River	4,031.0	119.6	282.5	795.6	1375.2	7.6	357.6	1,036.4	56.6
		Johnson Creek	1,478.1	0.1	131.2	107.6	825.6	0.0	189.6	218.0	5.9
		Lower Willamette River (direct or via unspecified tributaries)	7,584.4	0.4	1,153.1	440.6	4,248.9	0.3	407.3	1,056.4	277.5
EHV	Willamette Basin/ Lower Willamette River	Clackamas River	1,370.5	3.6	15.9	12.6	288.6	22.6	57.5	969.8	0.0
		Johnson Creek	386.7	1.2	0.0	0.0	75.9	0.0	8.1	301.5	0.0
		Lower Willamette River (direct or via unspecified tributaries)	8.5	0.0	0.0	0.0	3.5	4.3	0.0	0.7	0.0
SWMACC	Willamette Basin/ Lower Willamette River	Lower Willamette River (direct or via unspecified tributaries)	196.9	0.2	4.0	0.0	180.6	0.0	0.5	11.7	0.0
	Willamette Basin/ Middle Willamette River	Middle Willamette River (via unspecified tributaries)	1.7	0.7	0.0	0.0	0.1	0.0	0.0	0.9	0.0
	Tualatin Subbasin/ Tualatin River	Fanno Creek	75.7	0.0	0.0	0.0	72.3	0.0	0.0	3.3	0.0
		Tualatin River (direct or via unspecified tributaries)	428.8	11.3	0.0	0.0	292.8	15.8	0.0	108.8	0.0

It is assumed that there are structural BMP facilities in the Districts that have not been captured in GIS. These BMPs were therefore not included in the model. Not accounting for these BMPs is a conservative assumption as these BMPs are also providing some level of pollutant load reduction.

Table 4-5 summarizes the structural BMP categories included in the modeling effort. Available BMP effluent concentrations listed in Table 4-3 do not include all of the Districts' BMP categories. Therefore, on a case-by-case basis, some BMP categories were modeled using concentration data from a comparable BMP category. Table 4-5 identifies the BMP category from Table 4-3 that was used to represent each of the Districts' BMP categories. Table 4-6 shows the breakdown of 2015 BMP coverage in each modeled TMDL watershed used to develop the PLRE.

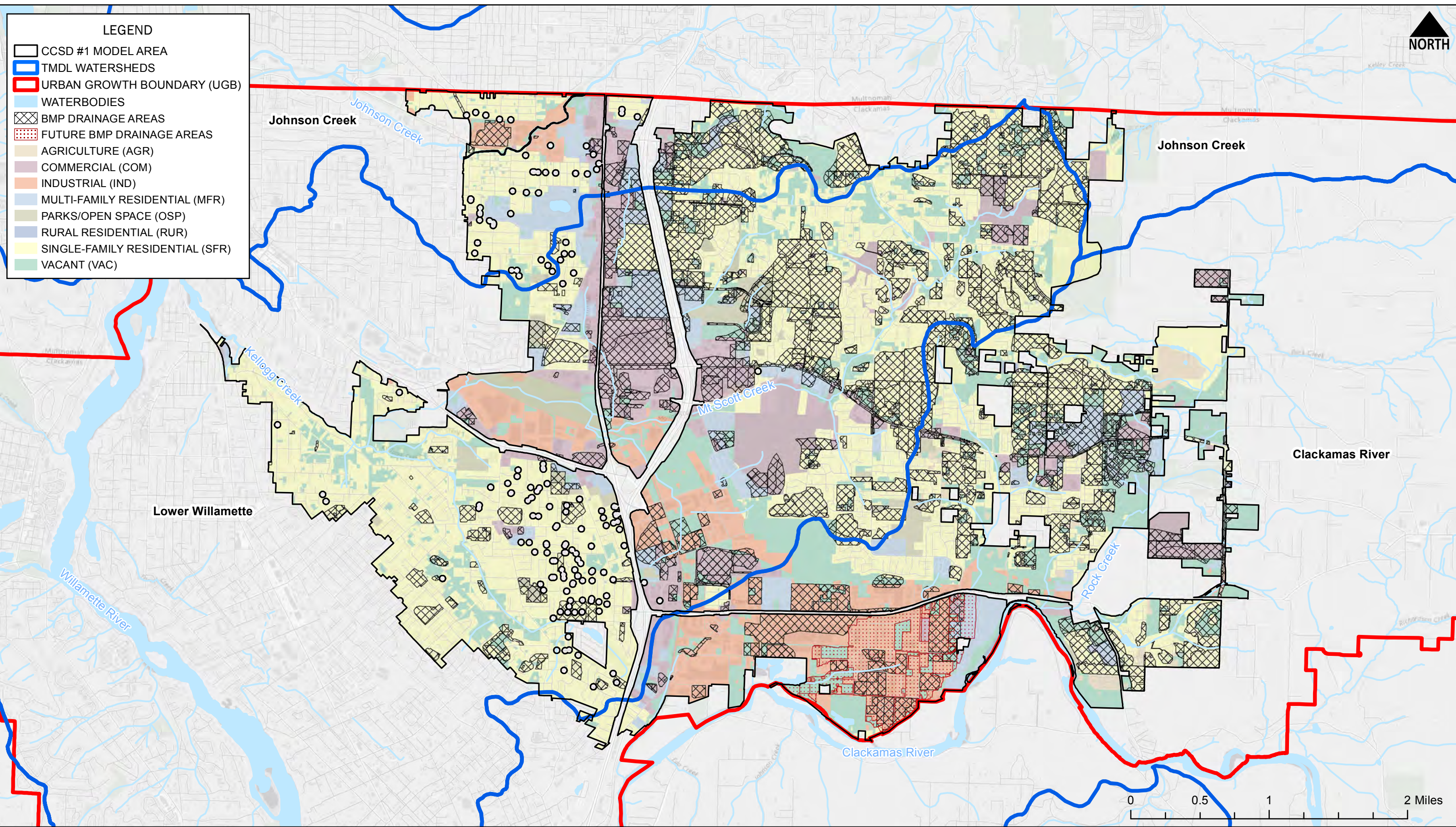
Table 4-5. Structural BMP Categories Used in CCSD #1, SWMACC, and EHV's Pollutant Loads Model

Structural BMP category	2015 BMP category available for modeling
Detention pond	Ponds: dry vegetated detention ponds
Water quality pond	Ponds: wet retention basins
Swales	Swales: vegetated filter strips
Vortech separators	Centrifugal separator hydrodynamic devices

Table 4-6. Summary of Model Input Parameters (2015 BMP Coverage)

Service area or service district	TMDL/subbasin	TMDL water body	BMP coverage area (% model area)	BMP coverage (ac)			
				Hydro-dynamic devices	Dry, detention ponds	Wet, retention ponds	Swale/ filter strip
CCSD #1	Willamette Basin/ Lower Willamette River	Clackamas River	35.7%	349.3	368.1	506.5	215.7
		Johnson Creek	28.7%	43.6	319.4	52.8	8.0
		Lower Willamette River (direct or via unspecified tributaries)	31.1%	208.6	1,430.9	386.0	333.6
EHV	Willamette Basin/ Lower Willamette River	Clackamas River	4.6%	13.8	0.5	39.2	10.2
		Johnson Creek	0.2%	0.0	0.5	0.2	0.0
		Lower Willamette River (direct or via unspecified tributaries)	5.9%	0.0	0.1	0.1	0.2
SWMACC	Willamette Basin/ Lower Willamette River	Lower Willamette River (direct or via unspecified tributaries)	0.0%	0.0	0.0	0.0	0.0
	Willamette Basin/ Middle Willamette River	Middle Willamette River (via unspecified tributaries)	0.0%	0.0	0.0	0.0	0.0
	Tualatin Subbasin/ Tualatin River	Fanno Creek	0.0%	0.0	0.0	0.0	0.0
		Tualatin River (direct or via unspecified tributaries)	5.1%	0.0	0.0	9.5	12.4

Figures 4-1, 4-2, and 4-3 show the land use and structural BMP coverage for CCSD #1, SWMACC, and EHV, respectively. Anticipated future BMP coverage used to develop benchmarks is also shown in Figure 4-1 and discussed in further detail in Section 6.



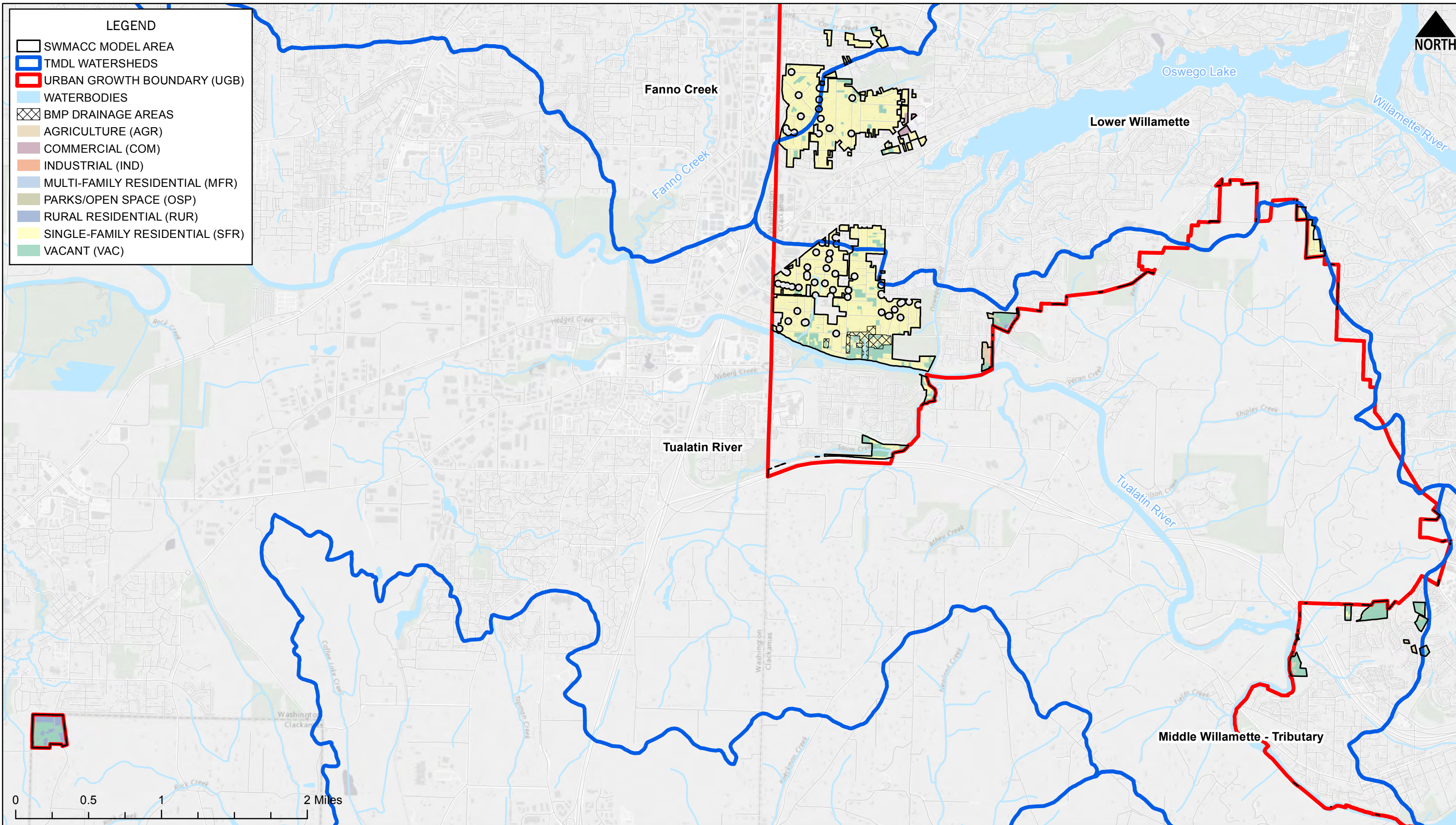
WATER ENVIRONMENT SERVICES

FIGURE 4-1. TMDL POLLUTANT LOAD REDUCTION EVALUATION AND BENCHMARKS: CCSD #1

CLACKAMAS COUNTY, OREGON



JANUARY 2017



4.3.3 Impervious Values

Impervious percentages by land use that were used in 2008 were also used for this pollutant load modeling effort. The impervious percentages are based on Table A-2 of the Clackamas County Master Plan (2005).

The EPA formula was used to translate between percent impervious and a runoff coefficient, for use in the pollutant loads model:

$$\text{Runoff coefficient} = 0.05 + 0.009 (\text{percent impervious})$$

Table 4-7 summarizes the percent impervious values used to calculate runoff coefficients by modeled land use category.

Table 4-7. Land Use Categories Used in CCSD #1, SWMACC, and EHV's Pollutant Loads Model	
Modeled land use classification	2015 modeled impervious percentage
Single-family residential (SFR)	42
Multifamily residential (MFR)	61
Rural residential (RUR)	10
Agricultural (AGR)	5
Commercial (COM)	72
Industrial (IND)	70
Vacant (VAC)	5
Parks and open space (POS)	7

4.3.4 Modeling BMPs

For the PLRE, current (2015) public and private structural BMP information (BMP types and drainage areas) was compiled into one GIS shapefile. As mentioned previously, a qualitative review of facilities was then conducted to ensure that they were categorized correctly.

Throughout the Districts, a number of structural BMPs work together in series to achieve pollutant removal. Generally, these applications consist of a sedimentation-type device upstream of a pond or bioswale. When BMP drainage areas overlapped, the structural BMP that appeared to be farthest downstream and provide better overall treatment was generally selected as the representative BMP for the drainage area. This method does not give credit for additional load removal likely achieved with BMPs that perform in series.

For the benchmarks, future projected public, structural BMP information (BMP type and drainage area) through 2022 was added to the current shapefile. Only one large regional facility in CCSD #1 was identified for inclusion with the new benchmarks. Due to the size of its drainage area, some overlap did occur with current (2015) BMP drainage areas. Consistent with the process defined above for current BMPs, overlapping areas were assigned to the structural BMP furthest downstream that provides the better overall treatment.

Most structural BMPs are not designed to treat all runoff that enters a facility in any given year. Generally, BMPs are designed to treat a proportion of the total annual rainfall/runoff that occurs. Clackamas County WES's stormwater design standards call for treatment of 80 percent of the average annual runoff volume. Thus, structural BMPs included in the model were assumed to capture and treat 80 percent of the average annual rainfall and bypass additional runoff. This was the assumption for

TMDLs that are based on a reduction of the annual pollutant load. As an exception, the Tualatin Subbasin TMDL was established based on reducing bacteria loads from a summer and winter design storm event. The identified summer and winter design storm event is, on average, smaller than the District's design storm event. As a result, it was assumed that total treatment of the summer and winter design storms would occur and BMP bypass was not accounted for in the pollutant load modeling for bacteria in the Tualatin Subbasin.

Clackamas County WES's stormwater design requirements also currently require that the first 0.5 inch of rainfall depth is infiltrated on site. This is a source control activity that would result in significant and additional pollutant load reduction due to volume reduction beyond water is represented in the BMP effluent concentrations used in the model. However, representing this infiltration in the model would require review of all development applications and as-builts to determine if this standard was met in conjunction with each structural BMP installation. Therefore, it is likely that more infiltration and pollutant load reduction is being achieved within the Districts and EHV than is represented by structural BMPs alone in this evaluation.

4.4 Model Input Files

Clackamas County WES generated GIS shapefiles to populate the pollutant loads model with areal information reflecting modeled areas, modeled land uses, and BMP coverage. WES provided source GIS shapefiles specific for each service area or district and TMDL watershed. CCSD #1 is used to show an example of the shapefiles provided below:

- CCSD1_Zoning: Reflects the total NPDES MS4 permit area.
- CCSD1_Parks_Vacant_Zoning_noDW_wWatersheds: Reflects the total modeled area by land use. Includes removal of drywells and inclusion of vacant and parks and open space with the zoning coverage.
- BMPs2015_April_QC: Reflects the 2015 BMP drainage areas.
- BMPs_Benchmark2016_CCSD1.shp

4.5 Annual and Seasonal Rainfall

WLAs calculated for the Willamette Basin and Tualatin Subbasin TMDLs reflect varying assumptions related to rainfall depths. Consistent rainfall depths were used for the PLRE and benchmark assessments to project pollutant loads and pollutant load reductions for purposes of comparing with documented WLAs and previously established TMDL benchmarks.

In the Lower Willamette Subbasin, tributary-specific WLAs for bacteria and, for Johnson Creek, toxics (DDT) are identified as a single percent load reduction and, for purposes of this evaluation, are evaluated on an annual basis. An annual rainfall of 40 inches was used in the model to simulate annual pollutant loading, consistent with assumptions from the 2008 PLRE and benchmark development.

In the Middle Willamette Subbasin, varying WLAs for bacteria are identified depending on whether the discharge is to a tributary or direct to the Willamette River. Only SWMACC has a contributing drainage area within the Middle Willamette Subbasin, and SWMACC discharges to Tanner Creek (a tributary) prior to discharging to the Willamette River. As such, the bacteria WLA is identified as a seasonal percent reduction. A summer seasonal rainfall depth of 6.82 inches (reflecting rainfall between May 1 and October 31) and a winter seasonal rainfall depth of 33.18 inches (reflecting rainfall between November 1 and April 30) was used in the model to simulate seasonal pollutant loading, consistent with assumptions from the 2008 PLRE and benchmark development.

The Tualatin Subbasin TMDL includes tributary-specific WLAs for bacteria, total phosphorus (as a surrogate for pH and chlorophyll a), and TSS (as a surrogate for SVS and SOD, associated with reduced

DO). Only SWMACC has contributing area within the Tualatin Subbasin, and SWMACC discharges runoff to Fanno Creek (a specified tributary with separate WLAs) and unspecified tributaries to the Tualatin River. The bacteria WLAs are identified as a concentration applicable for a specified (in the TMDL) seasonal design storm. The summer seasonal design storm is 0.11 inch/24 hours and the winter seasonal storm event is 1.96 inches/96 hours. The total phosphorus WLA is identified as a summer seasonal concentration, and was evaluated based on a summer seasonal rainfall of 6.82 inches (consistent with the Middle Willamette assumptions). The TSS WLA is identified as a summer seasonal percent reduction and used the summer seasonal rainfall. Rainfall depths used are consistent with 2008 assumptions.

4.6 Model Output and Comparison to WLAs

Pollutant loads were calculated in the spreadsheet loads model based on annual, seasonal, and design storm-specific WLAs established for each parameter in the TMDL.

Specific for the PLRE and development of pollutant load reduction benchmarks, the current no-BMP pollutant load range (LCL to UCL) was first documented for each service area and TMDL watershed. This current no-BMP load was the starting point for PLRE calculations, WLA comparisons, and benchmark development.

Where the WLA is reflected as a percent reduction, the WLA (as a load) was calculated as the specified percent load reduction from the mean, no-BMP pollutant load. Where the WLA is reflected as a concentration, the WLA (as a load) was calculated based on the current no-BMP total runoff volume and the required concentration.

4.6.1 Comparing Pollutant Loads to WLAs and Previous Benchmarks

For graphic representation, the current no-BMP and current with-BMP loads are both shown as a range. The WLA is shown as a single value, based on the mean value calculations.

The estimated pollutant load reduction reflective of the PLRE was calculated as the difference between the current no-BMP and current with-BMP pollutant loads. This pollutant load reduction is identified as a range, using the results from the LCL and UCL calculations. The pollutant load reduction (as a percent or concentration) was directly compared with the WLA. Resulting graphs and discussion related to the PLRE and comparison with WLAs are included in Section 5.

As part of the PLRE effort, pollutant load reduction estimates must also be compared to previously established benchmarks (Schedule D.3.c.iv). The Districts previously developed TMDL benchmarks as part of their Phase I NPDES MS4 permit renewal submittal in September 2008. The 2008 benchmarks are presented in Section 5 as a pollutant load reduction range and are directly comparable with the PLRE results.

For DDT, because it is a legacy pollutant with no new pollutant sources, the estimated pollutant load reduction is calculated based on a combination of natural degradation and projected removal associated with structural BMP implementation. In 2008, a methodology was developed to assess DDT loading, given a lack of land use EMC and BMP effluent concentration data. Using local stormwater data collected around 2008, all land use categories were estimated to contribute a consistent DDT concentration of 2.96 nanograms per liter (ng/L). Literature values suggest a natural attenuation rate equivalent to a 10-year half-life. Therefore, to reflect current loading conditions, the 2008 baseline concentration and a 10-year half-life was used to calculate a revised 2015 concentration and develop a current no-BMP load (in pounds). Current structural BMP implementation was accounted for using the relative reduction (as a percentage) of TSS as a surrogate parameter. Because DDT is a legacy pollutant, pollutant load reduction was evaluated based on 2008 (baseline), no-BMP conditions and the current with-BMP conditions.

4.6.2 Calculating New Benchmarks

New benchmarks were calculated as the difference between the current no-BMP and future with-BMP pollutant loads. As with the PLRE, the benchmarks are identified as a range, using the results from the LCL and UCL calculations. Results and discussion related to development of TMDL benchmarks are included in Section 6.

Pollutant loads are tabulated in Appendix B for all modeled scenarios.

Section 5

Pollutant Load Reduction Evaluation Results

PLRE results, including comparison of model results to WLAs and comparison of model results to the benchmarks established in 2008, are described below. Sections 5.1 to 5.3 present the model results by TMDL watershed. Section 5.4 provides a comparison of model results to 2008 benchmarks. Section 5.5 provides an evaluation of model results with respect to non-structural BMP effectiveness and results from the water quality trends analysis.

It should be emphasized that the pollutant load model results portray the incremental improvements that are estimated with the implementation of structural BMPs. As mentioned in Section 4.3, the pollutant load model results are not reflective of full implementation of the Districts stormwater design standards and infiltration requirements. Therefore, model results are assumed to be conservative. Additionally, the Districts and the City implement a significant number of non-structural BMP activities that are required under the current NPDES MS4 permit but that are not directly reflected in the model results. These measures include public education, illicit discharges elimination, spill prevention, catch basin cleaning, erosion control, etc. Discussion related to the conservative nature of the pollutant load modeling results with respect to non-structural BMP activities is also provided in Section 5.5.

5.1 Lower Willamette Subbasin

Pollutant loads were calculated for the three TMDL watersheds within the Lower Willamette Subbasin with specified WLAs. The TMDL watersheds are the Clackamas River, Johnson Creek, and the Lower Willamette River (via unspecified tributaries).

Pollutant loads are calculated on an annual basis. Model results, provided by TMDL watershed in the subsections below, reflect model assumptions and simulations as described in Section 4. Model results include a numeric estimate of the current pollutant load reduction range (Schedule D.3.c.ii), a comparison of the current pollutant loading to the WLA (Schedule D.3.c.iii), and a narrative summarizing progress toward existing WLAs (Schedules D.3.c.viii and D.3.c.ix).

The WLA is shown for each model simulation. As described in Section 4.6, the WLA is calculated based on the required load reduction applied to the no-BMP pollutant load range. Each service area is evaluated separately with a separate figure showing results of the PLRE.

5.1.1 Clackamas River

Figure 5-1 shows the CCSD #1 bacteria pollutant load estimates for the Clackamas River TMDL watershed. Figure 5-2 shows the EHV bacteria pollutant load estimates for the Clackamas River TMDL watershed. Both the no-BMP and with-BMP load estimates are shown. The pollutant load reduction estimate is highlighted.

The bacteria WLA for the Clackamas River is a 78 percent reduction.

CCSD #1 shows a mean load decrease of approximately 8.27×10^{12} counts (approximately a 12.2 percent reduction) when comparing conditions with and without BMPs. EHV shows a mean load decrease of approximately 2.56×10^{11} counts (approximately a 2.4 percent reduction).

For CCSD #1, structural BMP implementation is fairly widespread (structural BMP coverage is approximately 36 percent), which is greater than 2008 estimates. For EHV, structural BMP implementation is more limited in this watershed (structural BMP coverage of about 4.6 percent), but it reflects an increase from 2008 estimates where no BMP coverage was reported. As a whole, the structural BMPs implemented in this TMDL watershed (swales, dry detention ponds) generally show limited effectiveness for bacteria removal. In CCSD #1, a number of wet retention ponds are also installed, which show better removal for bacteria. Generally, bacteria reduction associated with structural BMPs is due to volume reduction achieved through the structural BMP (i.e., infiltration) rather than actual removal of the bacteria itself.

Figures 5-1 and 5-2 indicate that CCSD #1 and EHV are not currently estimated to be meeting the WLA for bacteria in the Clackamas River watershed. Significant additional load reduction would be needed beyond the current structural BMP implementation reflected in the range of loading. Although source control and non-structural BMPs are implemented in this watershed (and not directly considered in the pollutant load reduction estimate), it is unlikely that the additional pollutant removal achieved would result in meeting the WLA. The WLA is considered to be an ultimate discharge goal.

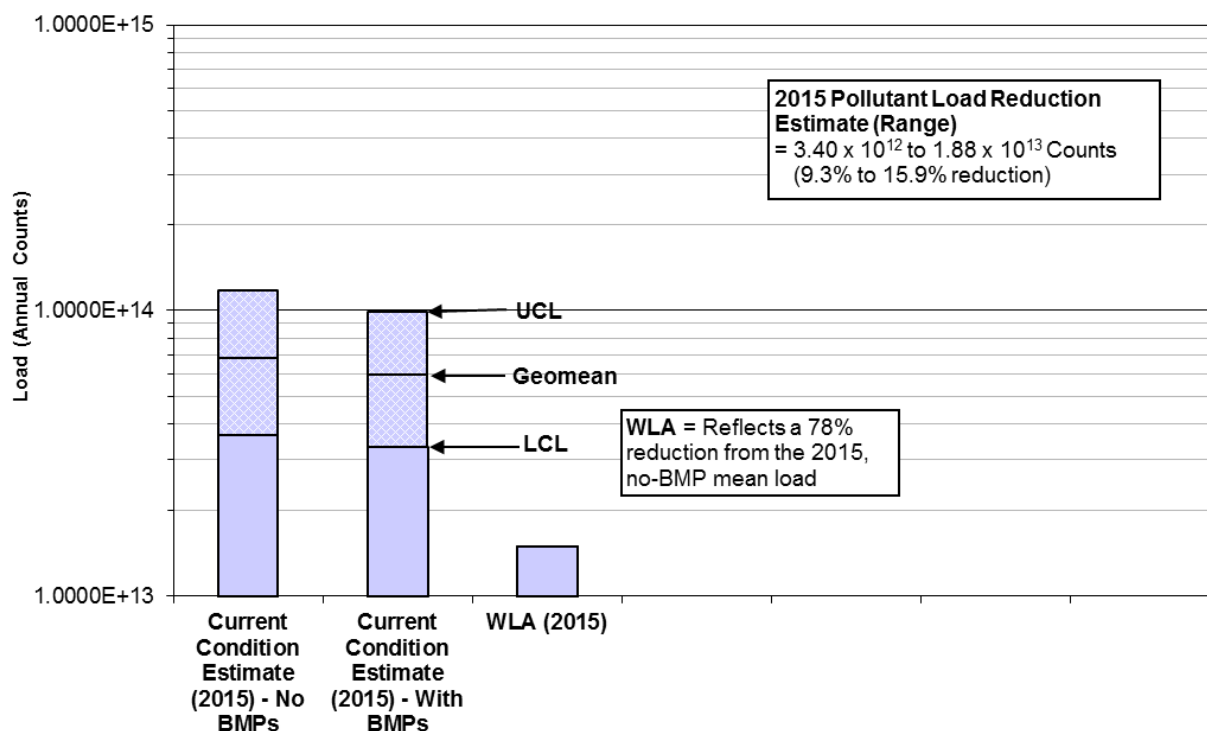


Figure 5-1. CCSD #1: *E. coli* PLRE results—Clackamas River TMDL watershed

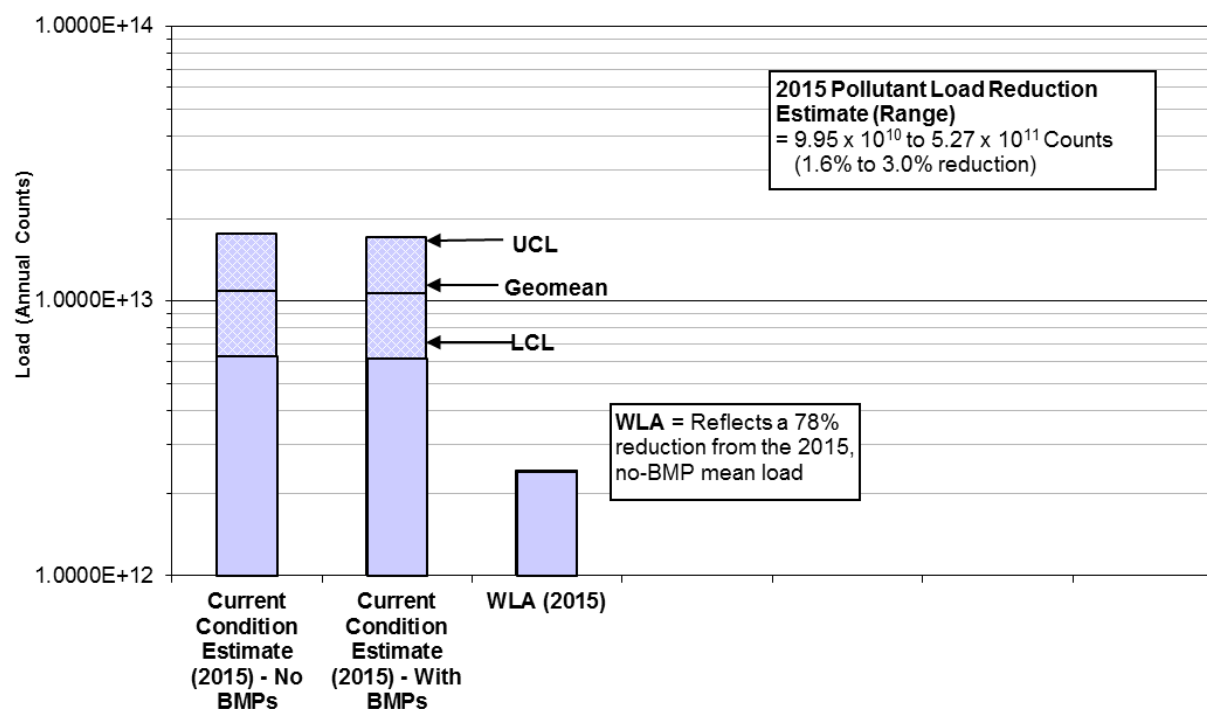


Figure 5-2. EHV: *E. coli* PLRE results—Clackamas River TMDL watershed

5.1.2 Johnson Creek

Figures 5-3 and 5-4 show bacteria pollutant load estimates for the Johnson Creek TMDL watershed for CCSD #1 and EHV, respectively. Figures 5-5 and 5-6 show DDT pollutant load estimates for CCSD #1 and EHV, respectively. Both the no-BMP and with-BMP load estimates are shown. The pollutant load reduction estimate is highlighted.

The bacteria WLA for Johnson Creek is a 78 percent load reduction. The DDT WLA for Johnson Creek is a 77 percent load reduction, using a baseline date of 2008 in accordance with the methodology described in Section 4.6.

For bacteria, CCSD #1 shows a mean load decrease of approximately 2.07×10^{12} counts (approximately a 6.1 percent reduction) when comparing conditions with and without BMPs. EHV shows a mean load decrease of approximately 2.50×10^9 counts (approximately a 0.1 percent reduction).

For DDT, CCSD #1 shows a mean load decrease of approximately 0.007 pound (approximately a 44.4 percent reduction). EHV shows a mean load decrease of approximately 0.00062 pound (approximately a 38.6 percent reduction). This pollutant load reduction accounts for natural degradation and additional pollutant removal with structural BMPs (using TSS as a surrogate parameter).

Structural BMP implementation is slightly less prevalent in this watershed, as compared with the Clackamas River watershed. This watershed also experienced a change in regulated permit area by CCSD #1 and EHV due to annexations and adjusted watershed boundaries. For CCSD #1, structural BMP implementation is fairly widespread (structural BMP coverage is approximately 29 percent), which is greater than 2008 estimates. For EHV, structural BMP implementation is more limited in this watershed (structural BMP coverage of about 0.2 percent), but it does reflect an increase from 2008 estimates where no BMP coverage was reported. The structural BMP categories implemented in this watershed are consistent with those in the Clackamas River watershed.

Figures 5-3 and 5-4 indicate that CCSD #1 and EHV are not estimated to be meeting the WLA for bacteria in the Johnson Creek TMDL watershed, when comparing the mean pollutant load estimate with BMPs to the mean WLA. Significant additional load reduction would be needed beyond the current structural BMP implementation reflected in the range of loading.

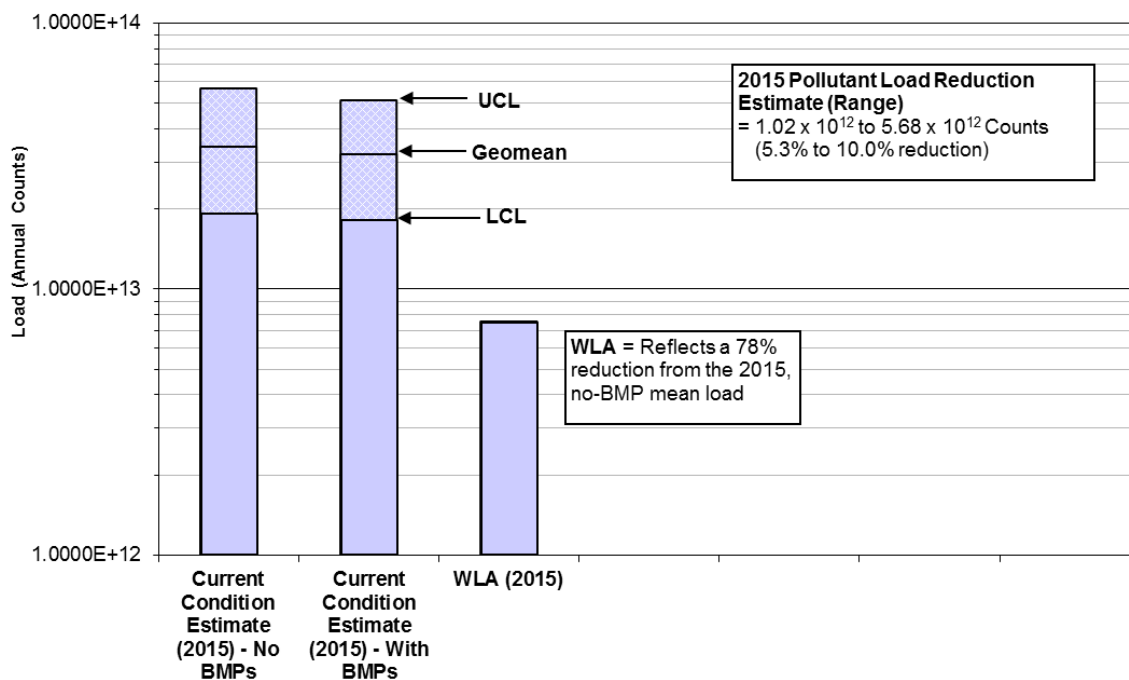


Figure 5-3. CCSD #1: *E. coli* PLRE results—Johnson Creek TMDL watershed

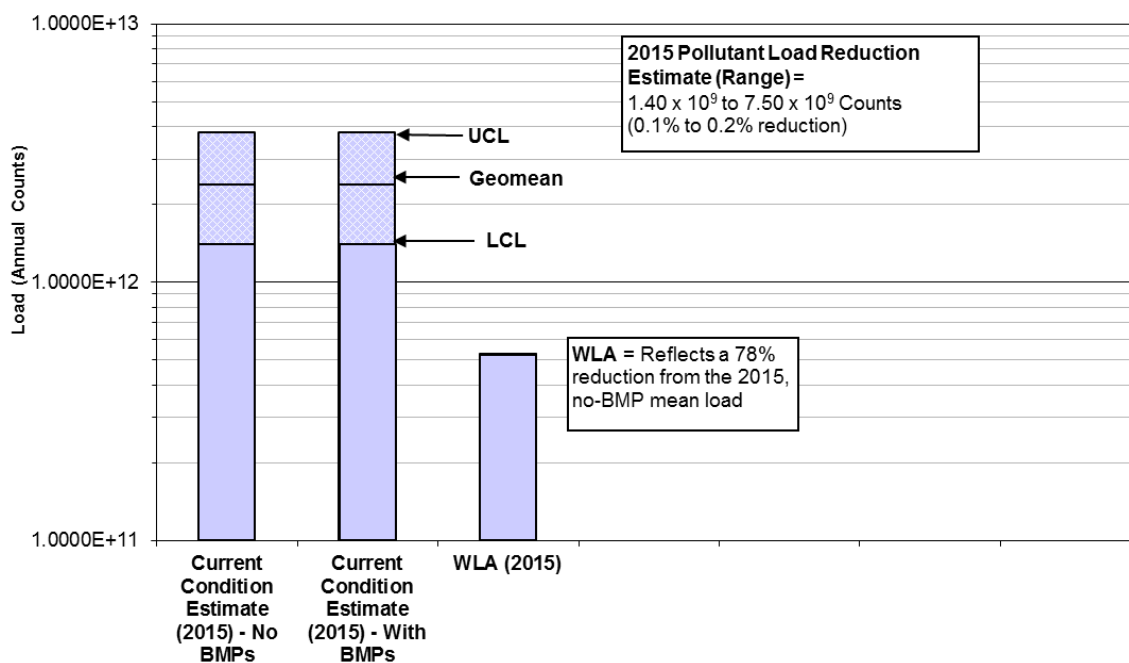
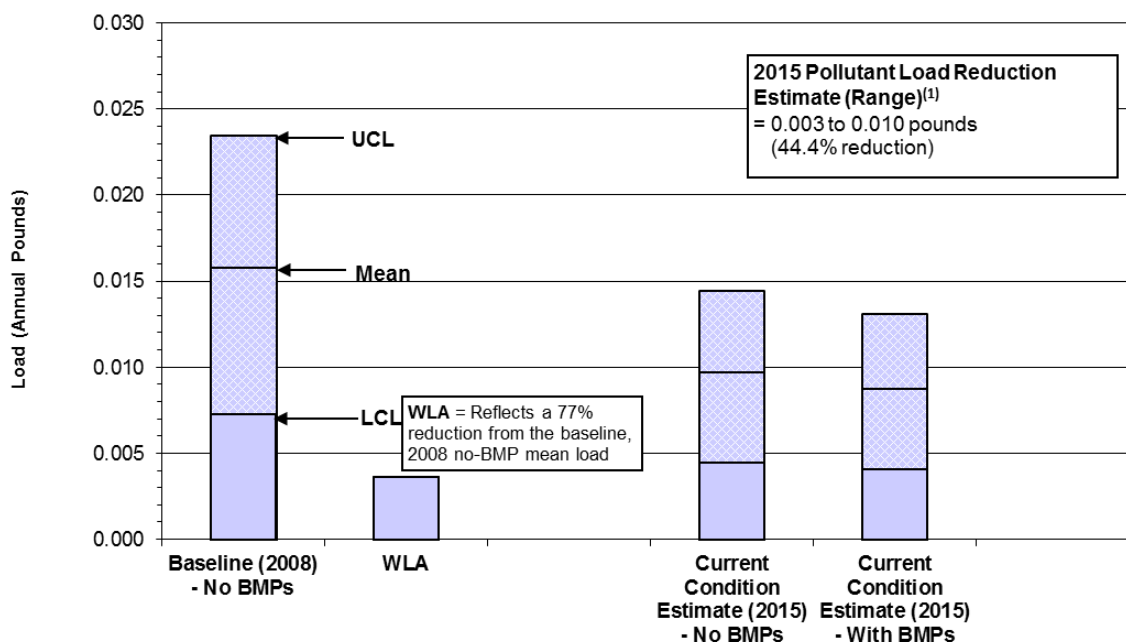


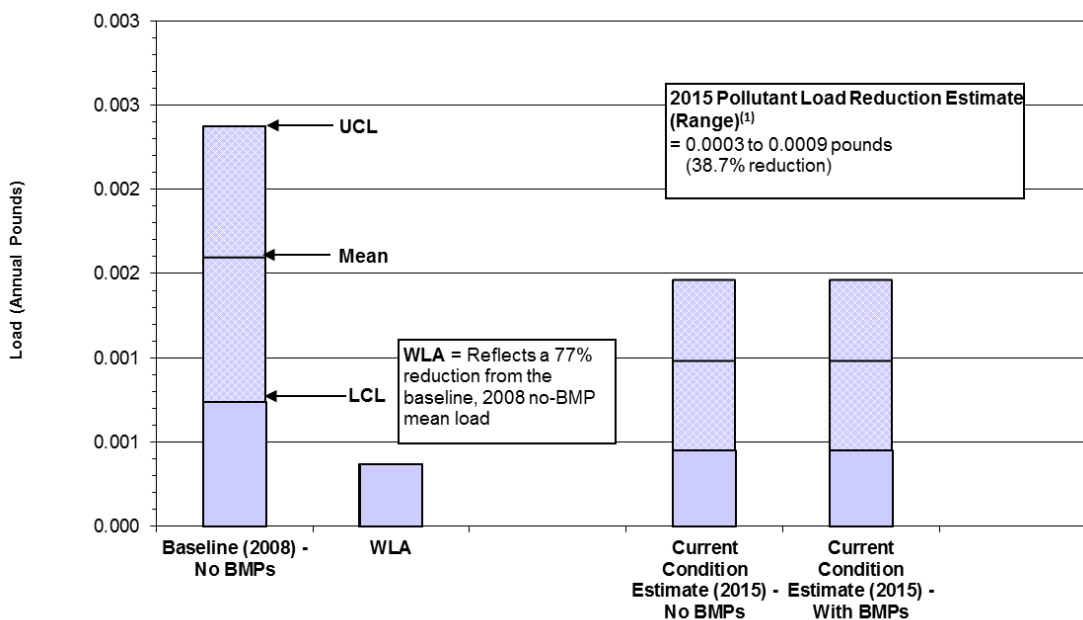
Figure 5-4. EHV: *E. coli* PLRE results—Johnson Creek TMDL watershed

Figures 5-5 and 5-6 indicate that CCSD #1 and EHV, respectively, are not estimated to be meeting the WLA for DDT in the Johnson Creek TMDL watershed. However, the PLRE does indicate significant progress toward the WLA. From the model results (and comparing CCSD #1 and EHV results), it appears that a majority of pollutant load reduction is achieved through the natural degradation process as opposed to BMP implementation. Based on a 10-year half-life, it is assumed that the WLA will be achieved by 2024. Accounting for structural BMP implementation, this time frame is expected to be shorter. Because the pollutant load reduction estimate reflects structural BMP implementation alone, non-structural and source control BMP implementation (as implied by the range in pollutant loading) may further reduce pollutant loads to meet the WLA.



(1) This pollutant load reduction estimate is based on the difference between the baseline load assumed for the contributing area at the time data was collected for the TMDL and the 2015 with BMP load. Pollutant reduction from BMPs is based on projected percent reduction in TSS removed by BMPs.

Figure 5-5. CCSD #1: DDT PLRE results—Johnson Creek TMDL watershed



(1) This pollutant load reduction estimate is based on the difference between the baseline load assumed for the contributing area at the time data was collected for the TMDL (i.e., 2008) and the 2015 with BMP load. Pollutant reduction from BMPs is based on projected percent reduction in TSS removed by BMPs.

Figure 5-6. EHV: DDT PLRE results—Johnson Creek TMDL watershed

5.1.3 Lower Willamette River

Figures 5-7, 5-8, and 5-9 show the bacteria pollutant load estimates for the Lower Willamette River TMDL watershed for CCSD #1, EHV, and SWMACC, respectively. Both no-BMP and with-BMP load estimates are shown. The pollutant load reduction estimate is highlighted.

The bacteria WLA for the Lower Willamette River (direct and via unspecified tributaries) is a 78 percent load reduction.

CCSD #1 shows a mean load decrease of approximately 1.34×10^{13} counts (approximately an 8.0 percent reduction) when comparing conditions with and without BMPs. EHV shows a mean load decrease of 1.37×10^9 counts (approximately a 1.1 percent reduction) when comparing conditions with and without BMPs. SWMACC shows no anticipated load reduction, because no BMPs are currently identified and tracked in SWMACC.

Structural BMP implementation in CCSD #1 is prevalent in this watershed (31 percent coverage), with dry detention ponds being the dominant BMP category. EHV's area within this TMDL watershed is only 8.5 acres, of which 0.5 acre reflects structural BMP implementation. As mentioned, no structural BMPs are currently identified and tracked in SWMACC. Of the structural BMPs, sedimentation-based systems like dry detention ponds and hydrodynamic systems show limited effectiveness for bacteria removal, so although the percent coverage of structural BMPs is significant, the relative bacteria load reduction may not be optimal.

Figures 5-7, 5-8, and 5-9 indicate that CCSD #1, EHV, and SWMACC, respectively, are not estimated to be meeting the WLA for bacteria in the Lower Willamette River watershed, when comparing the mean pollutant load estimate with BMPs to the mean WLA. Significant additional load reduction would be needed beyond the current structural BMP implementation reflected in the range of loading. Although source control and non-structural BMPs are implemented in this watershed (and not

directly considered in the pollutant load reduction estimate), it is unlikely that the additional pollutant removal achieved would result in meeting the WLA. The WLA is considered to be an ultimate discharge goal.

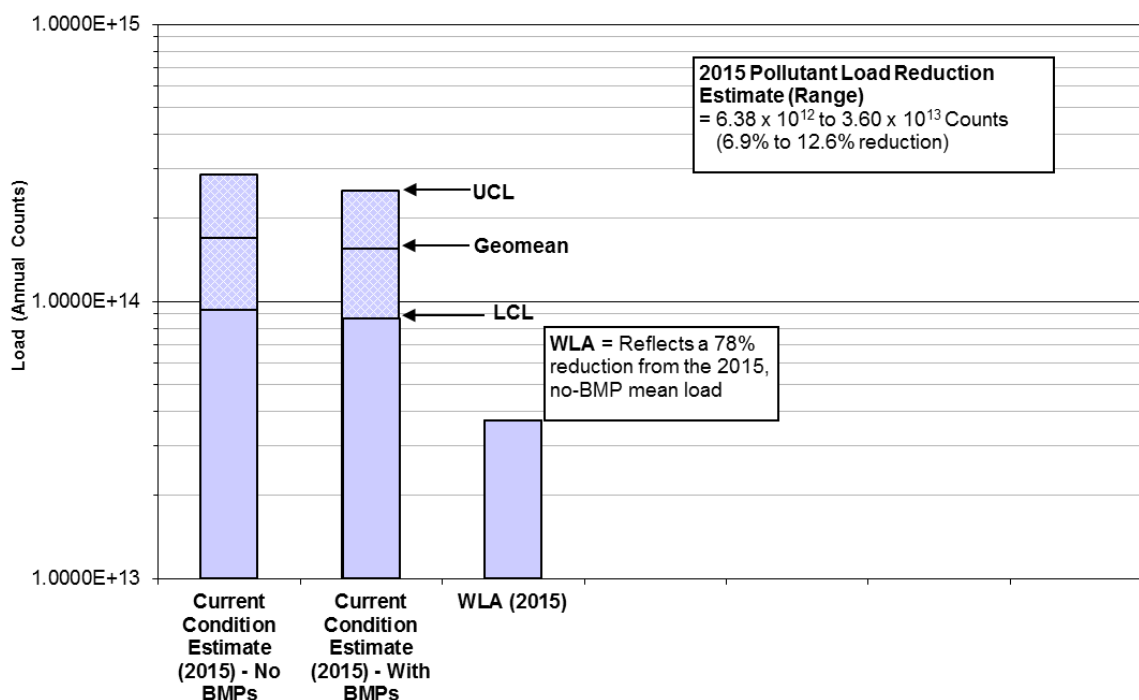


Figure 5-7. CCSD #1: *E. coli* PLRE results—Lower Willamette River TMDL watershed

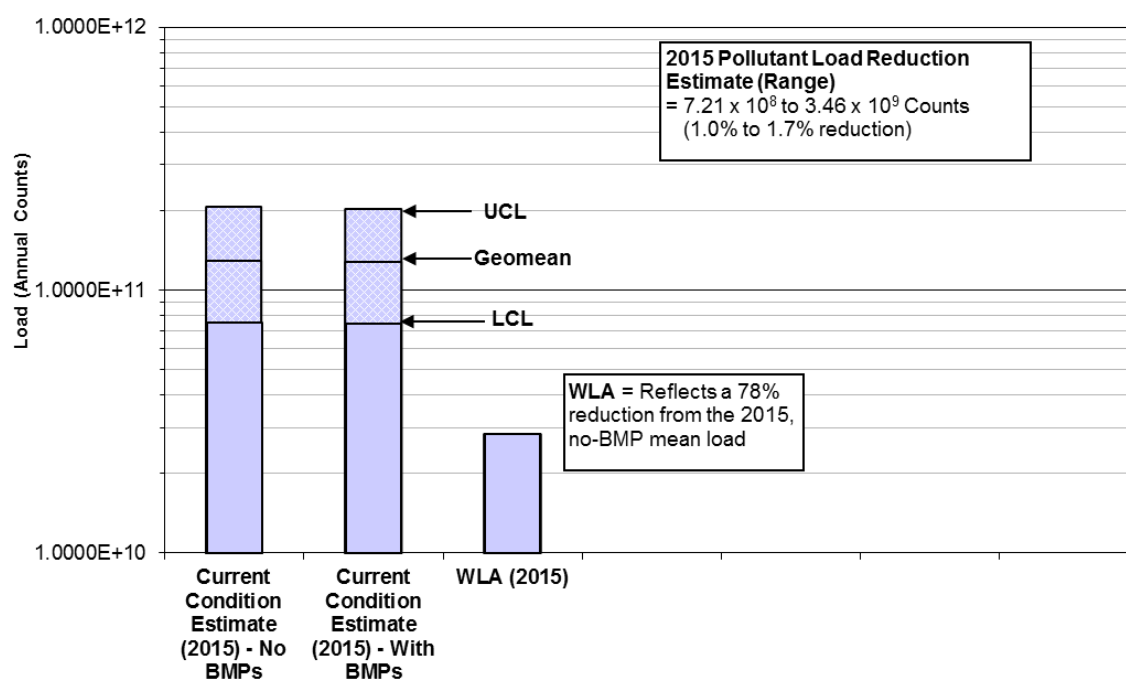


Figure 5-8. EHV: *E. coli* PLRE results—Lower Willamette River TMDL watershed

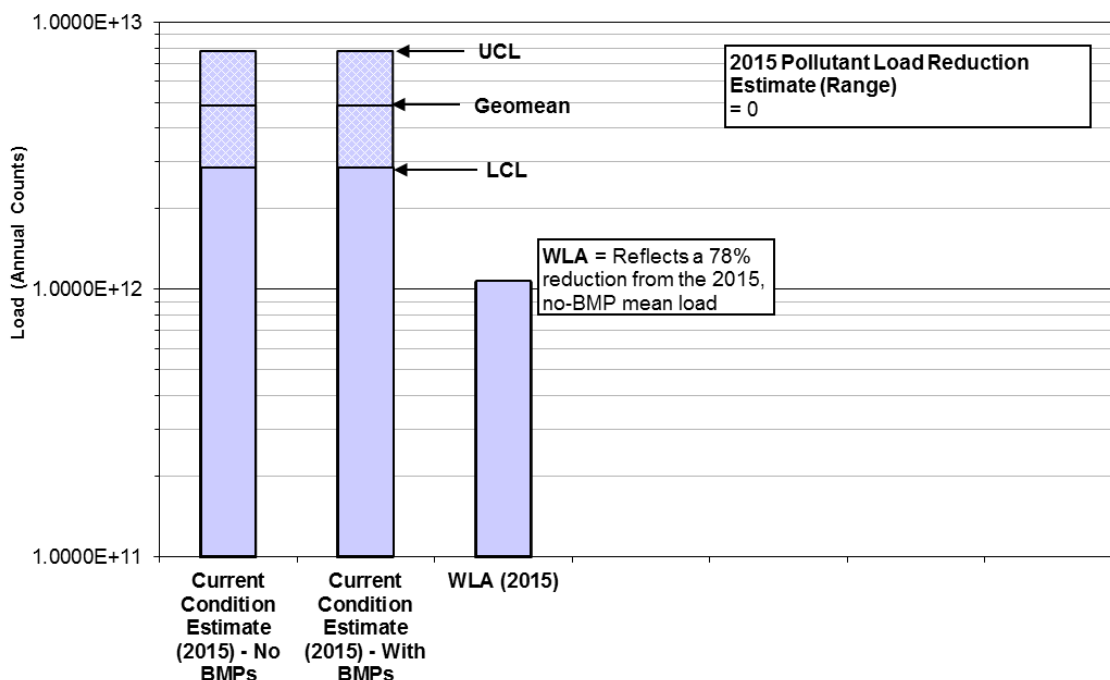


Figure 5-9. SWMACC: *E. coli* PLRE results—Lower Willamette River TMDL watershed

5.2 Middle Willamette Subbasin

Pollutant loads were calculated for the relatively small (1.7 acres total) SWMACC NPDES MS4 area within the Middle Willamette Subbasin. The area discharges to Tanner Creek, a tributary to the Willamette River within the Middle Willamette Subbasin. Because the area discharges to a tributary as opposed to the Willamette River directly, the TMDL specifies separate seasonal WLAs.

Pollutant loads are calculated for the summer season and the winter season, based on rainfall depths described in Section 4.5. As with the Lower Willamette Subbasin, model results include a numeric estimate of the current pollutant load reduction range (Schedule D.3.c.ii), a comparison of the current pollutant loading to the WLA (Schedule D.3.c.iii), and a narrative summarizing progress toward existing WLAs (Schedules D.3.c.viii and D.3.c.ix).

The WLA is shown for each model simulation. For the fall, winter, and spring seasons, the WLA is a 75 percent load reduction. For the summer season, the WLA is an 88 percent load reduction. The WLA is calculated as a load, based on the required load reduction applied to the no-BMP pollutant load range.

Figures 5-10 and 5-11 show SWMACC's bacteria pollutant load estimates for the Middle Willamette River TMDL watershed. Both no-BMP and with-BMP load estimates are shown, although no structural BMPs are currently inventoried or tracked in this area. Therefore, no pollutant load reduction estimate is provided.

Per Figures 5-10 and 5-11, SWMACC is not currently estimated to be meeting the WLA for bacteria in the Middle Willamette Subbasin when comparing the mean pollutant load estimate with BMPs to the mean WLA. However, given the small (single tax lot) area within this watershed, the inability of SWMACC to meet its WLAs would be based on retrofit potential. Source control and non-structural BMPs are implemented in this watershed (and not directly considered in the pollutant load reduction estimate), so additional load reduction not specifically observed through the pollutant load modeling is likely achieved.

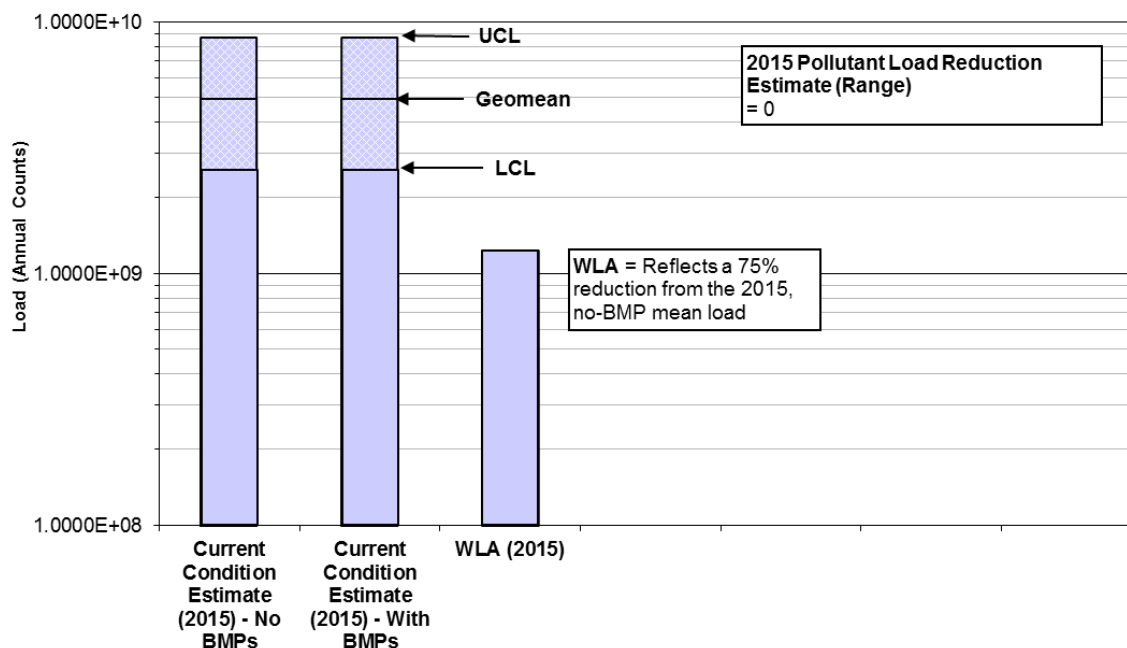


Figure 5-10. SWMACC: *E. coli* PLRE results—Middle Willamette River TMDL watershed (fall, winter, spring seasons)

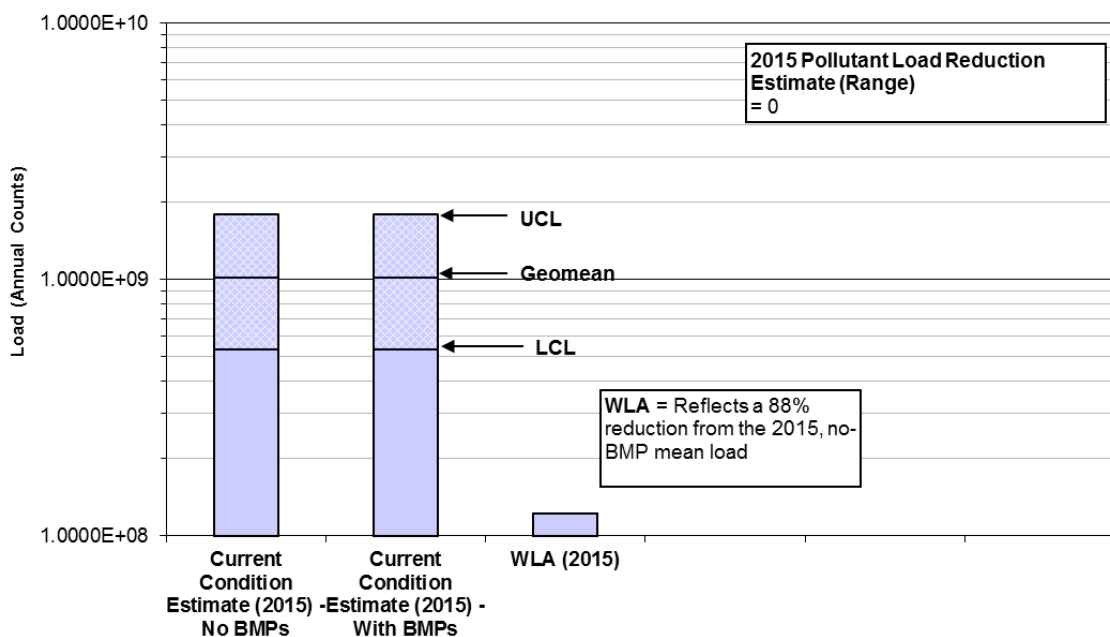


Figure 5-11. SWMACC: *E. coli* PLRE results—Middle Willamette River TMDL watershed (summer season)

5.3 Tualatin Subbasin

Pollutant loads were calculated for two TMDL watersheds within the Tualatin Subbasin with specified WLAs. The TMDL watersheds are Fanno Creek and the Tualatin River (direct or via unspecified tributaries). SWMACC is the only applicable service area in the Tualatin Subbasin.

Depending on the pollutant parameter, pollutant loads are calculated either on a seasonal basis or for a specific storm event. Model results, provided by TMDL watershed in the subsections below, reflect model assumptions and simulations as described in Section 4. Model results include a numeric estimate of the current pollutant load reduction range (Schedule D.3.c.ii), a comparison of the current pollutant loading to the WLA (Schedule D.3.c.iii), and a narrative summarizing progress toward existing WLAs (Schedules D.3.c.viii and D.3.c.ix).

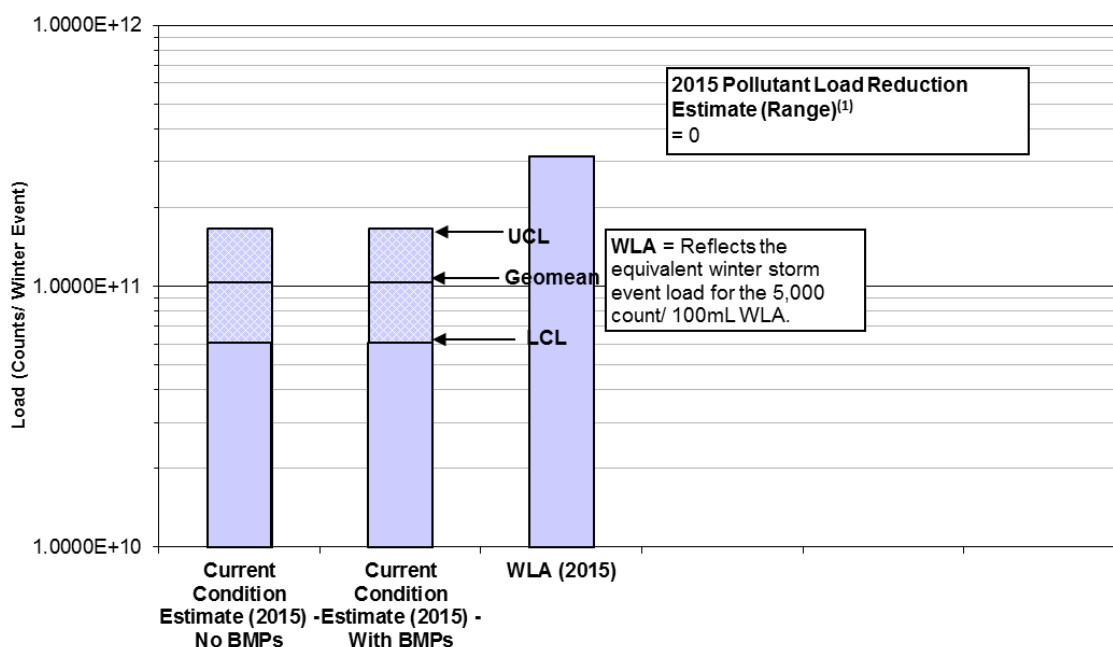
The WLA is shown for each model simulation. As described in Section 4.6, the WLA (as a load) is either calculated based on the required load reduction applied to the no-BMP pollutant load range (for TSS) or based on the required concentration and associated runoff volume for the no-BMP model simulation (for bacteria and total phosphorus).

5.3.1 Fanno Creek

Figures 5-12, 5-13, 5-14, and 5-15 show SWMACC's pollutant load estimates in the Fanno Creek TMDL watershed.

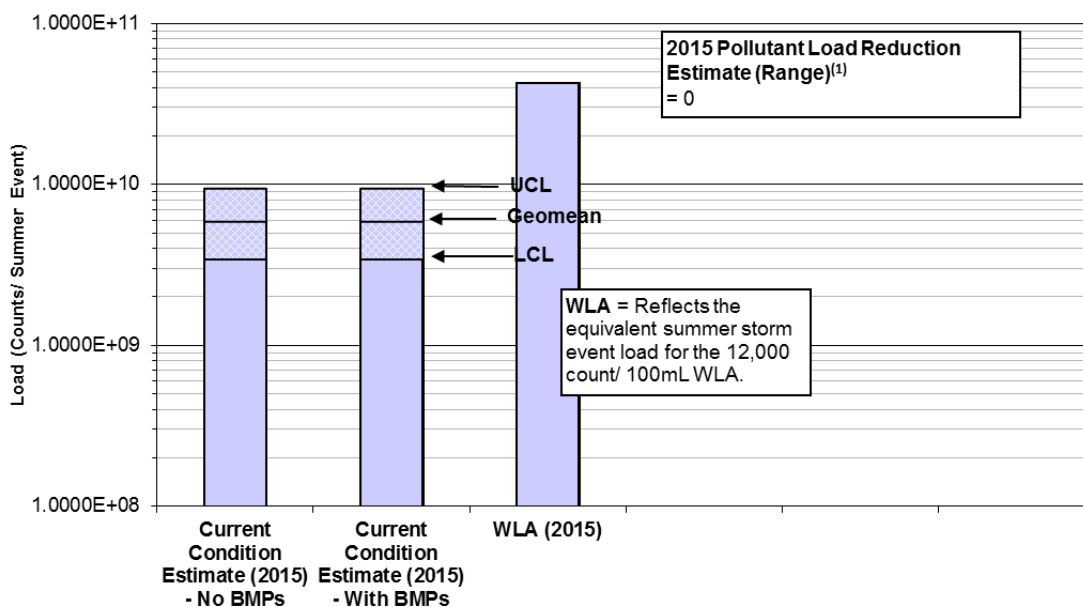
The bacteria WLAs for Fanno Creek are a concentration of 12,000 counts per 100 mL during a summer storm event and 5,000 counts per 100 mL during a winter storm event. The TSS (as a surrogate for SVS) WLA is a 50 percent load reduction. The total phosphorus (as a surrogate for pH and chlorophyll a) WLA is a concentration of 0.13 mg/L.

Figures 5-12 and 5-13 show SWMACC's bacteria pollutant load estimates for the Fanno Creek TMDL watershed. Both no-BMP and with-BMP load estimates are shown, although no structural BMPs are currently inventoried or tracked in this area. Therefore, no pollutant load reduction estimate is provided. However, the pollutant load estimates reflect a discharge concentration range between 96 and 263 counts per 100 mL, which is lower than the WLAs. Therefore, in the Fanno Creek TMDL watershed, SWMACC appears to be meeting its WLA.



(1) The 2015 pollutant load estimates reflect a discharge concentration range of 96 to 263 counts/ 100mL. This loading range meets the WLA.

Figure 5-12. SWMACC: *E. coli* PLRE results—Fanno Creek TMDL watershed (winter storm event)



(1) The 2015 pollutant load estimates reflects a discharge concentration range of 96 to 263 counts/ 100mL. This loading range meets the WLA.

Figure 5-13. SWMACC: *E. coli* PLRE results—Fanno Creek TMDL watershed (summer storm event)

Figures 5-14 and 5-15 show SWMACC's TSS and total phosphorus pollutant load estimates, respectively, for the Fanno Creek TMDL watershed. As with bacteria, both no-BMP and with-BMP load estimates are shown, although no structural BMPs are currently inventoried or tracked in this area. Therefore, no pollutant load reduction estimate is provided. SWMACC is not currently estimated to be meeting the WLA for TSS or total phosphorus in the Fanno Creek TMDL watershed when comparing the mean (for TSS) or median (for total phosphorus) pollutant load estimate to the WLAs. The SWMACC NPDES MS4 permit area is relatively small in this watershed (approximately 75 acres), and composed primarily of older single-family residential development. Therefore, the opportunity for retroactive structural BMP implementation is limited. Source control and non-structural BMPs are implemented in this watershed (and not directly considered in the pollutant load reduction estimate), so some load reduction not specifically observed through the pollutant load modeling is likely achieved.

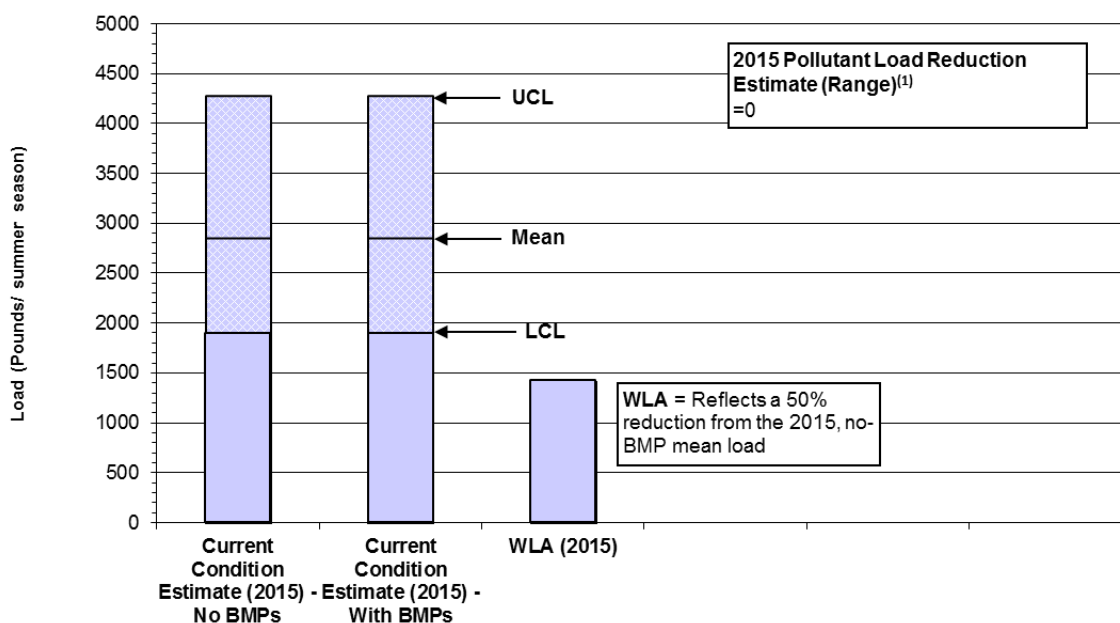
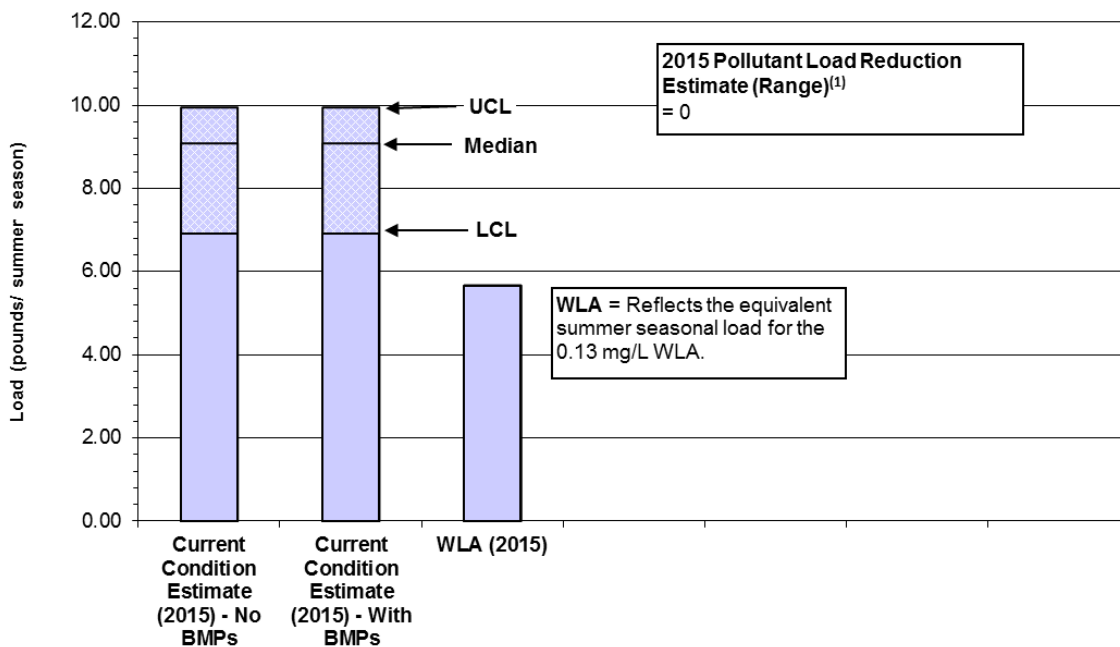


Figure 5-14. SWMACC: TSS PLRE results—Fanno Creek TMDL watershed (summer season)



(1) The 2015 pollutant load estimates reflect a discharge concentration range of 0.16 to 0.23 mg/L

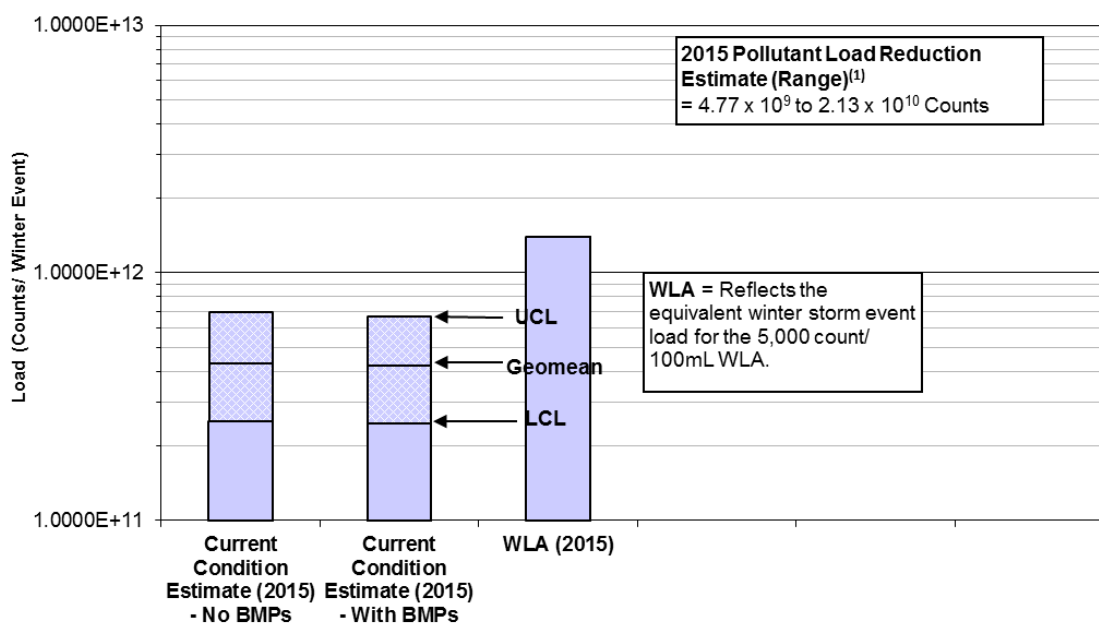
Figure 5-15. SWMACC: total phosphorus PLRE results—Fanno Creek TMDL watershed (summer season)

5.3.2 Tualatin River (direct and via unspecified tributaries)

Figures 5-16, 5-17, 5-18, and 5-19 show SWMACC's pollutant load estimates in the Tualatin River TMDL watershed. Both no-BMP and with-BMP load estimates are shown for each pollutant parameter. The pollutant load reduction estimate is highlighted.

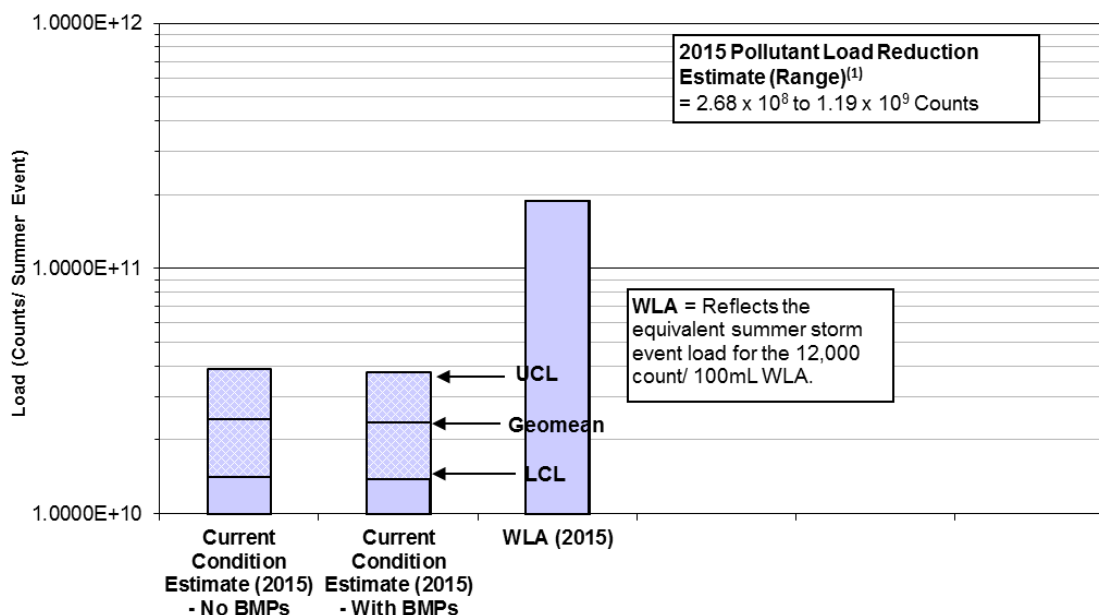
As in the Fanno Creek TMDL watershed, the bacteria WLAs for the Tualatin River (via direct or unspecified tributary) are a concentration of 12,000 counts per 100 mL during a summer storm event and 5,000 counts per 100 mL during a winter storm event. Specific to the Tualatin River TMDL watershed, the TSS (as a surrogate for SVS) WLA is a 20 percent load reduction. The total phosphorus (as a surrogate for pH and chlorophyll a) WLA is a concentration of 0.14 mg/L.

Figures 5-16 and 5-17 show SWMACC's bacteria pollutant load estimates for the Tualatin River TMDL watershed. SWMACC shows a mean load decrease of approximately 9.96×10^9 counts for the winter storm event when comparing conditions with and without BMPs. SWMACC shows a mean load decrease of approximately 5.59×10^8 counts for the summer storm event when comparing conditions with and without BMPs. The pollutant load estimates reflect a discharge concentration range between 88 and 239 counts per 100 mL, which is lower than the WLAs. Therefore, in the Tualatin River TMDL watershed, SWMACC appears to be meeting its WLA.



(1) The 2015 - with BMP pollutant load estimate reflects a discharge concentration range of 88 to 239 counts/ 100mL. This loading range meets the WLA.

Figure 5-16. SWMACC: *E. coli* PLRE results—Tualatin River TMDL watershed (winter storm event)



(1) The 2015 - with BMP pollutant load estimate reflects a discharge concentration range of 88 to 239 counts/ 100mL. This loading range meets the WLA.

Figure 5-17. SWMACC: *E. coli* PLRE results—Tualatin River TMDL watershed (summer storm event)

Figure 5-18 shows SWMACC's TSS pollutant load estimates for the Tualatin River TMDL watershed. For TSS, SWMACC shows a mean load reduction of 286 pounds (approximately a 2.3 percent reduction) when comparing conditions with and without BMPs.

Figure 5-19 shows SWMACC's total phosphorus pollutant load estimates. For total phosphorus, SWMACC shows a median load reduction of 0.49 pound. The pollutant load estimates with BMPs reflect a discharge concentration range between 0.15 and 0.22 mg/L, which is slightly above the WLA.

Structural BMP implementation is observed but not widespread in this watershed. Structural BMP coverage is currently estimated at 5.1 percent, which is less than 2008 estimates for 2013 development conditions. This difference is likely due to the fact that less development than projected ended up occurring in this watershed. Of the inventoried and mapped structural BMPs, bioswales were the most common category. Source control and non-structural BMPs are implemented in this watershed (and not directly considered in the pollutant load reduction estimate), so additional load reduction not specifically observed through the pollutant load modeling is likely achieved.

Figures 5-18 and 5-19 indicate that SWMACC is not estimated to be meeting the WLAs for TSS or total phosphorus, respectively, in the Tualatin River TMDL watershed, when comparing the mean pollutant load reduction estimate with BMPs to the mean WLA (for TSS) or when comparing the equivalent, with BMP pollutant concentration to the WLA (for total phosphorus). Additional load reduction would be needed beyond the current structural BMP implementation that is reflected in the current model results. However, particularly for total phosphorus, the pollutant load ranges are not significantly greater than the WLA.

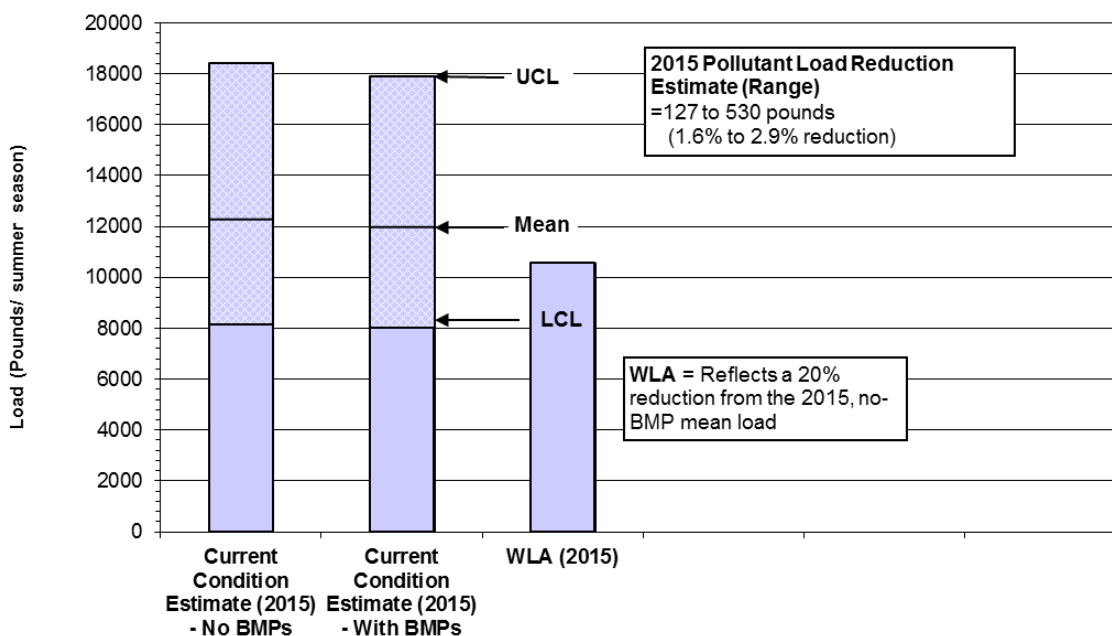
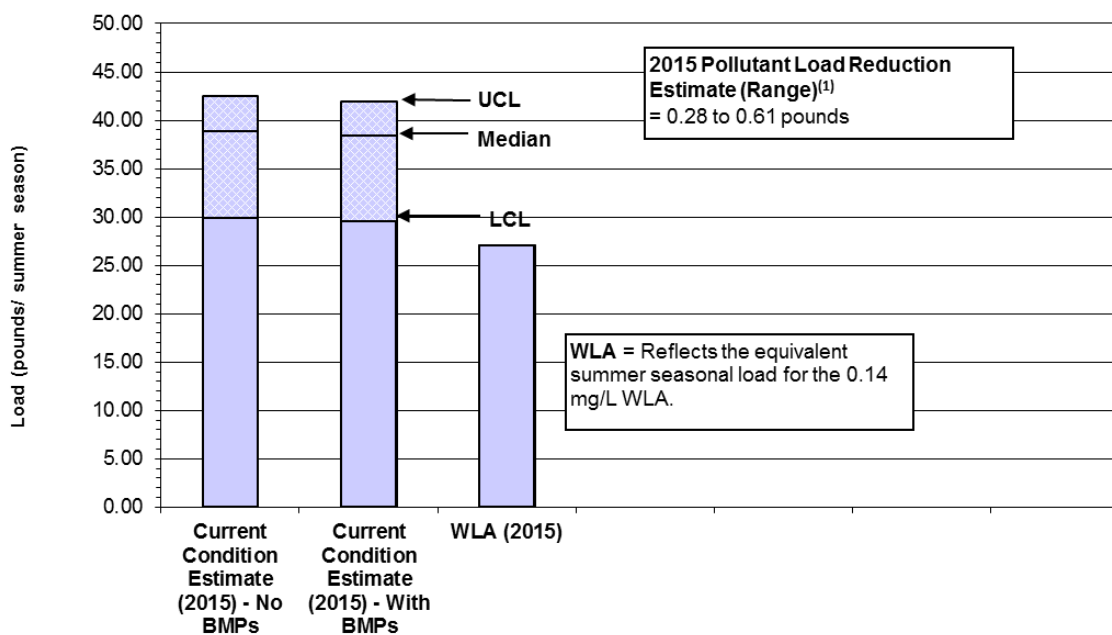


Figure 5-18. SWMACC: TSS PLRE results—Tualatin River TMDL watershed (summer season)



(1) The 2015 - with BMP pollutant load estimate reflects a discharge concentration range of 0.15 to 0.22 mg/L

Figure 5-19. SWMACC: total phosphorus PLRE results—Tualatin River TMDL watershed (summer season)

5.4 Benchmark Comparison

As part of the PLRE effort, pollutant load reduction estimates must be compared to previously established pollutant load reduction benchmarks as applicable (Schedule D.3.c.iv). The Districts established pollutant load reduction benchmarks for select TMDL watersheds within the Lower Willamette, Middle Willamette, and Tualatin subbasins in 2008. Because of the fluctuating nature and relatively limited anticipated development in EHV, no BMP implementation projections were established in 2008. Therefore, no TMDL benchmarks were developed for EHV.

The pollutant load reduction benchmarks were intended to represent development and BMP implementation conditions 5 years in the future, or 2013. Pollutant load reduction benchmarks for bacteria were established for the Clackamas River, Johnson Creek, Lower Willamette River, Tualatin River, and Fanno Creek TMDL watersheds. Pollutant load reduction benchmarks were not established for bacteria for the Middle Willamette TMDL watershed, as the SWMACC NPDES MS4 area is only 1.7 acres and composed of a couple of single tax lots. Pollutant load reduction benchmarks were established for total phosphorus and TSS for the Fanno Creek and Tualatin River TMDL watersheds.

Calculation of pollutant load reduction benchmarks in 2008 required the Districts to project where annexations would occur (change in permit coverage area), where development would occur (change in land use conditions), and where future BMPs would be implemented (based on projected development and retrofit activities). With the recession in 2008, such activities did not occur as estimated.

Changes in modeling assumptions (see Section 4) resulted in differences in the model area and land use coverage by TMDL watershed from 2008 assumptions. As a result, the 2008 model assumptions for permit area, land use area, and BMP coverage area are not directly reflected in this modeling effort.

Tables 5-1 and 5-2 show the difference in model area and BMP coverage areas between the 2008 modeling effort and the 2015 PLRE. Such differences in assumptions directly affected the 2015 PLRE results and comparison to the 2008 benchmarks.

Table 5-1. Benchmark Assumptions Comparison (Model Area)				
Service area	TMDL watershed	2008 benchmark effort (ac)		2015 PLRE effort (ac)
		2008 (actual)	2013 (projected)	
CCSD #1	Clackamas River	3,426	3,426	4,031
	Johnson Creek	529	861	1,478
	Lower Willamette (direct and via unspecified tributaries)	8,274	8,276	7,584
SWMACC	Fanno Creek	139	139	76
	Tualatin River (direct and via unspecified tributaries)	500	500	429
	Lower Willamette (direct and via unspecified tributaries)	97	97	197
	Middle Willamette (via unspecified tributaries)	2	2	2
EHV	Clackamas River	2,168	2,168	1,371
	Johnson Creek	2	2	387
	Lower Willamette (direct and via unspecified tributaries)	154	154	9

Table 5-2. Benchmark Assumptions Comparison (BMP Coverage)

Service area	TMDL watershed	2008 benchmark effort (%)		2015 PLRE effort (%)
		2008 (actual)	2013 (projected)	
CCSD #1	Clackamas River	24%	34%	36%
	Johnson Creek	14%	10% ^a	29%
	Lower Willamette (direct and via unspecified tributaries) ^b	20%	28%	31%
SWMACC	Fanno Creek	0%	6%	0%
	Tualatin River (direct and via unspecified tributaries)	0%	15%	5%
	Lower Willamette (direct and via unspecified tributaries) ^b	--	--	0%
	Middle Willamette (via unspecified tributaries)	0%	0%	0%
EHV	Clackamas River	0%	0%	5%
	Johnson Creek	0%	0%	>1%
	Lower Willamette (direct and via unspecified tributaries)	0%	0%	6%

a. For the 2008 benchmark effort, 333 acres were projected to be annexed into the Johnson Creek TMDL watershed for CCSD #1, but no projected development or treatment was estimated to occur in the permit term for this area. As a result, the BMP coverage percentage was reduced from 2008 to 2013.

b. For the 2008 benchmark effort, the Lower Willamette River TMDL watershed was modeled for the combined CCSD #1 and SWMACC contributing area instead of separated by service area. As such, BMP coverage was reflective of the combined service area.

Based on changes in modeling assumptions and methods (described above), direct comparison of the 2015 pollutant load reduction estimates to the pollutant load reduction benchmarks established in 2008 is not possible. However, results of the benchmark comparison effort have been provided in Table 5-3 in order for the Districts to specifically meet permit requirements outlined in Schedule D.3.c.iv. In accordance with the discussion in Sections 5.3.1 and 5.3.2, it is assumed that the WLA is achieved for bacteria in the Fanno Creek and Tualatin River TMDL watersheds. Thus, no comparison to benchmarks is provided.

Because of the statistical variability of the underlying data, the current pollutant load reduction estimates and 2008 benchmarks are presented as ranges in loading. For purposes of this benchmark comparison effort, the mean or median 2015 pollutant load reduction estimate was compared to the 2008 benchmark range. Where the mean or median 2015 pollutant load reduction estimate falls within the benchmark range, the benchmarks are interpreted to likely be met.

Table 5-3. CCSD #1 and SWMACC Benchmark Comparison

Service area	TMDL watershed	Parameter (units)	2015 pollutant load reduction estimate ^a			2008 benchmarks (counts or pounds), depicted as a range based on projected 2013 conditions	Met benchmarks ^b
			UCL	Mean or median	LCL		
CCSD #1	Clackamas River	Bacteria (counts)	1.88 x 10 ¹³	8.27 x 10 ¹²	3.40 x 10 ¹²	1.90 x 10 ¹² to 2.50 x 10 ¹³	Likely met
	Johnson Creek	Bacteria (counts)	5.68 x 10 ¹²	2.07 x 10 ¹²	1.02 x 10 ¹²	2.40 x 10 ¹¹ to 2.80 x 10 ¹²	Likely met
		DDT (pounds)	0.010	0.007	0.003	0.00013 to 0.00043	Met
	Lower Willamette River	Bacteria (counts)	3.60 x 10 ¹³	1.34 x 10 ¹³	6.38 x 10 ¹²	5.70 x 10 ¹² to 6.10 x 10 ¹³	Likely met
SWMACC	Lower Willamette River ^c	Bacteria (counts)	0	0	0	N/A	N/A
	Fanno Creek	Total phosphorus (pounds)	0	0	0	0.06 to 0.08 pounds	N/A
		TSS (pounds)	0	0	0	34 to 102 pounds	N/A
	Tualatin River	Total phosphorus (pounds)	0.61	0.49	0.28	0.40 to 0.57 pounds	Likely met
		TSS (pounds)	530	286	127	232 to 704 pounds	Likely met

a. The pollutant load reduction estimate is based on the difference between the no-BMP and with-BMP pollutant loads. The UCL pollutant load reduction range is the difference between the no-BMP and with-BMP pollutant loads for the UCL; the mean pollutant load reduction range is the difference between the no-BMP and with-BMP pollutant loads for the mean load; the LCL pollutant load reduction range is the difference between the no-BMP and with-BMP pollutant loads for the LCL.

b. This column is provided to comply with a permit requirement. However, the Districts believe that refined GIS files and changes in development projections have a significant impact on the ability to simulate pollutant reductions representative of the benchmarks.

c. No benchmarks for the Lower Willamette River TMDL watershed in SWMACC were specifically developed. The 2008 benchmarks, reflecting 2013 development conditions, for the Lower Willamette TMDL watershed in CCSD #1 reflect combined CCSD #1 and SWMACC areas.

Because benchmarks are pollutant load reduction estimates for estimated future conditions, they are used as a tool and a goal for guiding adaptive management activities and are not considered a numeric effluent limit.

5.5 Pollutant Load Reduction Evaluation Discussion

Because of the variable nature of stormwater runoff and the variety of undefined sources contributing to stormwater pollutant discharges, there are inherent difficulties in applying WLAs to MS4 discharges and quantitatively tracking pollutant load discharges to ensure that progress toward the WLA is being made.

In conducting a quantitative PLRE, the Districts and the City have chosen a conservative approach to avoid overestimating the effectiveness of the programs. The pollutant load reduction estimates reflect the maximum extent practicable standard defined by the service areas or Districts and implemented with structural BMPs. With adaptive management efforts, implementation of stormwater retrofits, ongoing implementation of stormwater development standards for new development and redevelopment that promote infiltration, and the potential for new information and/or new, more cost-effective technologies in the future, it is expected that pollutant load reductions will continue to increase.

The pollutant load reduction estimates, as detailed in Sections 5.1, 5.2, and 5.3, are conservative (i.e., greater reductions are likely achieved) for several reasons, as described below.

5.5.1 Non-Structural BMP Effectiveness

While numeric values for non-structural or source control BMP effectiveness were not specifically accounted for in the pollutant loads models, pollutant loads are presented as a range, and this range likely reflects the variable nature of stormwater runoff and select source control practices (i.e., street sweeping and catch basin cleaning conducted at the time the baseline land use data was collected) implemented upstream.

The estimated range of pollutant load reductions in this report may be interpreted to reflect the Districts' and the City's implementation of their overall stormwater management program. Structural BMP implementation (as directly accounted for in pollutant modeling) composes a small component of the overall program. However, measuring the effectiveness of source control and non-structural practices requires significant assumptions in order to determine how to reflect pollutant reduction associated with a behavioral or conditional practice and how to translate that interim practice into reduction of a singular pollutant over the course of a season or year. Thus, the Districts and the City have opted to account for the effectiveness of source control and non-structural BMPs in narrative form only.

On behalf of the Districts and service areas, Clackamas County WES conducts a variety of programmatic and source control activities that are directly attributable to bacteria, nutrient, and TSS reduction. Such activities include erosion control, illicit discharge detection and elimination, street sweeping, catch basin cleaning, facility maintenance, operations and maintenance, pet waste programs, and public education. One specific example is the recent and ongoing installation of sanitary sewer service to homes and businesses in the Johnson Creek watershed. Such installation allows for connection of residences on septic systems or cesspools to the wastewater treatment plant, and presumably removal of bacteria sources from the MS4 due to failed/failing septic systems.

Research has been conducted related to literature values for non-structural BMP effectiveness. One such data source is the Watershed Treatment Model (WTM) (Caraco, 2010), a planning-level model developed by the Center for Watershed Protection. The model is a simple spreadsheet used to estimate pollutant loading and evaluate effects of proposed structural and non-structural management practices and future development on pollutant loads.

The WTM provides default values for the effectiveness of certain non-structural BMPs while it encourages the user to input values for others. In each case, the model provides guidance to select appropriate values. Although not used in this pollutant loads modeling effort, the efficiencies of non-structural practices, including street sweeping, riparian buffer protection, catch basin cleanouts, and erosion and sediment control, are provided in the form of percent removals in Tables 5-4 and 5-5 for additional background.

Table 5-4. Example Pollutant Load Removal Efficiencies of Street Sweeping				
Sweeper type	Efficiency (%)			
	Residential		Other roads	
	Nutrients	TSS	Nutrients	TSS
Mechanical	24	30	4	5
Regenerative air	51	64	18	22
Vacuum assisted	62	78	63	79

Source: WTM.

Table 5-5. Example Pollutant Load Removal Efficiencies of Non-Structural BMPs (Other)

BMP	Efficiency (%)			
	TSS	Nutrients (general)	Total phosphorus	Total nitrogen
Erosion and sediment control	70			
Catch basin cleanouts (monthly cleaning)	25	15	Not reported	Not reported
Catch basin cleanouts (semiannual cleaning)	13	8	Not reported	Not reported
Riparian buffers	70	Not reported	10	30

Source: WTM.

For other non-structural practices, removal efficiencies are included in the WTM based on treatability and discount factors that the user inputs into the model. Treatability is defined as the fraction of the population that can be reached for educational programs. Discount factors account for imperfect practice application and upkeep, inability of educational programs to reach all citizens, and inadequate funding to implement all practices, for example. The pollutant removal efficiencies associated with the non-structural stormwater management practices used in the WTM are based on existing research and studies by the Center for Watershed Protection (1999) and Winer (2000) and are not locally based.

The WTM makes many simplifying assumptions, and it is not calibrated. Therefore, the results of the model simulations should be compared on a relative basis rather than used as absolute values. Per results of the WTM, up to 79 percent removal efficiency was estimated depending on the parameter and the non-structural practice implemented. It should be noted that for bacteria the efficiency is more limited than for other parameters (e.g., TSS) and was thus not presented. Also, any non-structural BMP effectiveness estimate needs to be qualified based on best professional judgment and continued ability to update and refine the effectiveness numbers based on improved non-structural practices. This information is presented to show the potential significance and additional load reduction that may be achieved through the Districts' non-structural practices. These additional load reductions are not reflected in the quantitative analysis.

5.5.2 Water Quality Trends Analysis

In accordance with Schedule D.3.c.vii of the NPDES MS4 permit, this PLRE includes a water quality trends analysis. Clackamas County Water Environment Services (WES) conducts water quality monitoring on behalf of the Districts, and the City's monitoring obligation is fulfilled via an intergovernmental agreement with CCSD #1. Therefore, the trends analysis is relevant to the pollutant loads modeling conducted for the Districts and EHV.

The Districts' overall monitoring program includes in-stream (ambient) water quality monitoring, MS4 (stormwater) monitoring, biological monitoring, and physical condition monitoring. For this PLRE and water quality trends analysis, the Districts evaluated their instream monitoring data collected to assess long-term trends in receiving stream water quality. Up to 22 years' worth of instream water quality data were available for analysis. Ambient water quality data was sorted into dry weather and wet weather conditions to help assess the potential influence of MS4 discharges on receiving water quality.

Ambient water quality trends were calculated for the current eight CCSD #1 instream monitoring locations and 1 SWMACC instream monitoring location, based on the monitoring locations identified in the Comprehensive Clackamas County Stormwater Monitoring Plan (2013). The following pollutant parameters were included in the analysis:

- total suspended solids
- *E. coli*

- total phosphorus
- total and dissolved copper
- total and dissolved zinc

The Mann-Kendall test was used to analyze the pre-screened data sets. Each data set reflects data compiled for one monitoring location, for one parameter, and for one weather condition, so 126 data sets were included in this analysis.

Table 5-6 summarizes results of the 2015 ambient water quality trends evaluation for water bodies and parameters where observed trends were noted. No statistically significant trends were identified for approximately half (64) of the data sets that were evaluated. Full documentation of the water quality trends is included in Appendix A of this report.

Table 5-6. Summary of Seasonal Kendall Water Quality Trends Analysis				
Monitoring location	Improving trends (decreasing concentration trends)		Deteriorating trends (increasing concentration trends)	
	No rain	Rain	No rain	Rain
CCSD #1 monitoring locations				
Carli Creek (CC-05)	Total phosphorus Copper (dissolved)	Total phosphorus	None	None
Sieben Creek (CC-07)	Total phosphorus Copper (dissolved)	Total phosphorus	Zinc (total and dissolved)	<i>E. coli</i> Copper (total) Zinc (total and dissolved)
Cow Creek (CC-24)	None	None	TSS Total phosphorus Copper (total and dissolved) Zinc (total and dissolved)	TSS Total phosphorus Copper (dissolved) Zinc (dissolved)
Phillips Creek (CC-11)	Total phosphorus Copper (dissolved)	None	Zinc (total)	Zinc (total and dissolved)
Mt Scott Creek (CC-15)	Total phosphorus Copper (dissolved)	None	Zinc (total)	Copper (total) Zinc (total and dissolved)
Rock Creek (CC-16)	Total phosphorus Copper (dissolved)	None	Zinc (total and dissolved)	<i>E. coli</i> Copper (total) Zinc (total and dissolved)
Kellogg Creek (CC-14)	Total phosphorus Copper (dissolved)	None	Zinc (total)	Zinc (total and dissolved)
Kellogg Creek (CC-27)	Zinc (dissolved)	None	None	None
SWMACC monitoring location				
Pecan Creek (SW-11)	Total phosphorus Copper (dissolved)	Total phosphorus	TSS <i>E. coli</i> Zinc (total and dissolved)	Zinc (dissolved)

Note: Based on a significance level of 5 percent.

Results from the trends analysis indicate a mixture of improving and deteriorating trends with most deteriorating trends observed during wet weather events. The majority of deteriorating trends (for dry or wet weather) occurred for total and dissolved zinc. The majority of improving trends (for dry or wet weather) occurred for total phosphorus.

As mentioned previously, no trend was observed for approximately half of the data sets evaluated. These trends reflect a period of time when Clackamas County grew in population by approximately 80,000. Given that level of population growth and the potential impacts associated with the resulting development, seeing no trend in water quality is a positive result. Correlating data from instream and outfall water quality sampling with stormwater management activities is a challenging task because of the myriad other influences in water quality. The results of this trends analysis are not a definitive statement of the overall quality of sampled streams, but rather one piece of information to be considered within the larger watershed context. Ongoing instream water quality sampling will continue in compliance with the NPDES MS4 permit.

Section 6

Benchmarks

Based on results of the pollutant load reduction evaluation (Section 5), the Districts and the City are required to establish new pollutant load reduction benchmarks for bacteria, total phosphorus and TSS. The proposed benchmarks presented in this section are based on projected structural BMP implementation at the end of the next NPDES MS4 permit term (anticipated to be 2022).

6.1 Benchmark Development

Benchmarks are required for TMDL parameters where current BMP implementation does not meet WLAs established in the permit. For the Districts and City, benchmarks are required for bacteria in the Clackamas River, Johnson Creek, Lower Willamette, and Middle Willamette tributary TMDL watersheds. Benchmarks are required for total phosphorus and TSS in the Tualatin River and Fanno Creek TMDL watersheds. In accordance with Schedule D.3.d.i of the Districts and City's NPDES MS4 permit, each benchmark must reflect the pollutant load reduction necessary to achieve the previously established benchmarks for the current permit term (2008 benchmark) and additional progress toward the TMDL WLA during the next permit term.

The current NPDES MS4 permit expires March 1, 2017, the next 5-year permit term is anticipated to be 2017 to 2022.

Benchmarks are developed by identifying stormwater BMPs that are likely to be installed before the end of the next permit term. Given uncertainties with the timing and types of stormwater BMPs to be installed with private development activities, benchmark development is focused on public facility installations only. Clackamas WES staff identified one large (400+ acre drainage area) regional stormwater facility, the Carli Creek regional water quality facility, for installation by 2022. This proposed facility is located in the Clackamas River TMDL watershed within CCSD #1. The drainage area for this future stormwater BMP is shown in Figure 4-1.

Table 6-1 summarizes the District's status in meeting the WLAs and 2008 benchmarks (as repeated from Table 5-3). Table 6-1 also identifies the Carli Creek regional water quality facility as the projected BMP installation for the future.

Additional public and private facility installations beyond those shown in Figure 4-1 are likely but have not been projected. This conservative assumption is again due to the variable schedules of private development activities and the unknown content and issuance date for the reissued NPDES MS4 permit.

Table 6-1. TMDL Benchmark Status and Projected Stormwater Facility Installation

Service area	TMDL watershed	Model time frame	Parameter (units)	2015 pollutant load reduction estimate results		2017 TMDL benchmark development	
				Met TMDL WLA? (Y/N)	Met (2008) benchmark? (Y/N)	Projected BMP installations	Estimated future BMP drainage area (ac) ^d
CCSD #1	Clackamas River	Annual	Bacteria (counts)	N	Y	Carli Creek regional water quality facility (wet retention pond)	427.3
	Johnson Creek	Annual	Bacteria (counts)	N	Y		
		Annual	DDT (pounds)	N	Y		
	Lower Willamette River	Annual	Bacteria (counts)	N	Y		
EHV	Clackamas River	Annual	Bacteria (counts)	N	N/A ^a		
	Johnson Creek	Annual	Bacteria (counts)	N	N/A ^a		
		Annual	DDT (pounds)	N	N/A ^a		
	Lower Willamette River	Annual	Bacteria (counts)	N	N/A ^a		
SWMACC	Middle Willamette tributary	Summer and Winter Season	Bacteria (counts)	N	N/A ^b		
	Lower Willamette River	Annual	Bacteria (counts)	N	N/A ^b		
	Fanno Creek	Summer/Winter Design Storm	Bacteria (concentration)	Y	Y	N/A	N/A
		Summer Season	Total phosphorus (pounds)	N	N/A ^c		
		Summer Season	TSS (pounds)	N	N/A ^c		
	Tualatin River	Summer/ Winter Design Storm	Bacteria (concentration)	Y	Y	N/A	N/A
		Summer Season	Total phosphorus (pounds)	N	Y		
		Summer Season	TSS (pounds)	N	Y		

a. Benchmarks were not established for EHV in 2008.

b. No benchmarks for the Lower Willamette River and Middle Willamette tributary TMDL watersheds in SWMACC were specifically developed. The 2008 benchmarks for the Lower Willamette TMDL watershed in CCSD #1 reflect combined CCSD #1 and SWMACC service area. The limited SWMACC service area within the Middle Willamette TMDL watershed limits the ability to retrofit existing area.

c. Changes in modeling assumptions resulted in a reduction of the SWMACC service area and BMP coverage in the Fanno Creek TMDL watershed.

d. The future BMP drainage area includes 1) potential areas to be treated by new BMPs, and 2) area currently being treated by structural BMP, but expected to receive treatment by a more effective BMP (through retrofit of existing systems or installation of downstream BMPs).

6.2 TMDL Benchmark Results

The spreadsheet loads model used for the PLRE was used to simulate future BMP implementation in accordance with modeling methods and assumptions described in Section 4 and as reflected in Table 6-1.

As shown in Table 6-1, the Clackamas River TMDL watershed is the only watershed with a future BMP installation proposed. This regional facility is large and will collectively reduce pollutant loading to the Willamette River. Future public BMP installations are not currently anticipated within the Johnson Creek or Lower Willamette TMDL watersheds.

Future public BMP installations are also not currently proposed or anticipated in the EHV or SWMACC service areas. In conjunction with new, private development activities stormwater BMPs will be installed within the Districts and City. However, the schedule, location, and facility type is unknown and development driven. SWMACC is comprised of pocket areas of unincorporated Clackamas County, often within or adjacent to incorporated cities. Given the limited area within the Clackamas NPDES MS4 permit coverage and the potential for new and redevelopment, large regional or capital projects are not proposed for installation within SWMACC.

The benchmarks are calculated as the difference between the modeled loads associated with the current no-BMP scenario and the future with-BMP scenario. Due to the variability in stormwater quality data, pollutant loads themselves are typically calculated and presented as a range. Pollutant load estimates reflecting the current no-BMP, current with-BMP, and future with-BMP scenarios are provided in Appendix B. Pollutant load reduction estimates associated with the current scenario (PLRE) and future scenario (benchmarks) are also provided in Appendix B. For TMDL watersheds without future BMPs proposed, the benchmarks are set as the current pollutant load reduction estimate.

Table 6-2 shows the new bacteria TMDL benchmark for CCSD #1 in the Clackamas River TMDL watershed as both a load reduction and percentage load reduction.

Table 6-2. TMDL Benchmarks for CCSD #1 for Bacteria (2017-2022)					
TMDL watershed	Time frame	Pollutant (units)	WLA (% reduction)	TMDL benchmarks (load reduction) ^a , range	TMDL benchmarks (% load reduction) ^a , range
Clackamas River	Annual	Bacteria (counts)	78%	3.62×10^{12} to 2.27×10^{13}	9.9 to 19.2

^a. The TMDL benchmarks are a load reduction, calculated as the difference between the current no-BMP scenario load and the future with-BMP scenario load. The benchmarks have also been calculated as a percent reduction for direct comparison with the WLA.

6.3 Discussion and Application of SWMP Implementation

CCSD #1's benchmarks reflect the projected installation of the Carli Creek regional water quality facility, a new regional stormwater facility covering approximately 427 acres of drainage area. Approximately 272 acres will be new treatment for drainage areas that are not currently treated. Approximately 120 acres will be enhanced treatment for drainage area that is currently treated by a less effective structural BMP. The remaining 35 acres reflect drainage area that is currently treated by retention ponds and will continue to be treated by a retention pond with installation of the Carli Creek facility.

While the projected BMP coverage area and resulting bacteria load reductions are significant, the resulting pollutant load reduction falls short of achieving the WLAs. Large areas of the Districts and City have already developed without structural BMPs and structural stormwater BMPs are not

100 percent effective in removing bacteria or other TMDL parameters. The Districts and City prepared a WLA attainment assessment for DEQ in October 2015, which indicated that achieving the WLAs would require construction of facilities and associated maintenance costs that far exceed either the Districts or City's definition of maximum extent practicable. Progress toward the WLA, and not achievement of the WLA, is the goal in setting benchmarks. Such progress is reflected in Table 6-2 and Appendix B.

The proposed benchmarks are conservative estimates of the pollutant load reduction anticipated during the next permit term with the use of structural BMPs alone. The load reduction estimates do not account for:

- 1) Non-structural BMPs, as described in Section 5.5.
- 2) Additional structural BMPs installed in conjunction with future development and redevelopment projects that have not yet submitted land use applications to the Districts or City.
- 3) Targeted capital improvement projects and retrofit applications not yet reflected in current District and City budget estimates.

Each of these efforts is expected to further reduce the TMDL pollutant loads in runoff to below the levels indicated in these benchmark projections. Specific to number 3 above, additional retrofit opportunities are being researched and identified in SWMACC

Section 7

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Section 8

Limitations

This document was prepared solely for CCSD #1 in accordance with professional standards at the time the services were performed and in accordance with the contract between CCSD #1 and Brown and Caldwell dated September 1, 2015. This document is governed by the specific scope of work authorized by CCSD #1; it is not intended to be relied upon by any other party except for regulatory authorities contemplated by the scope of work. We have relied on information or instructions provided by CCSD #1 and other parties and, unless otherwise expressly indicated, have made no independent investigation as to the validity, completeness, or accuracy of such information.

Appendix A: Water Quality Trends Analysis



Technical Memorandum

6500 SW Macadam Avenue, Suite 200
Portland, OR 97239

T: 503.244.7005
F: 503.244.9095

Prepared for: Clackamas County Water Environment Services

Project Title: Regulatory On-Call Support (TO 1-2015)

Project No.: 148335.007

Technical Memorandum

Subject: Instream Water Quality Trends Analyses

Date: October 26, 2015

To: Leah Johanson

From: Valerie Fuchs, Angela Wieland, and Krista Reininga, Brown and Caldwell

Prepared by: Valerie Fuchs, Ph.D., P.E., WA 52615

Reviewed by: Krista Reininga, P.E., and Angela Wieland, P.E.

Limitations:

This document was prepared solely for Clackamas County Service District No. 1 (District) in accordance with professional standards at the time the services were performed and in accordance with the contract between the District and Brown and Caldwell dated September 1, 2015. This document is governed by the specific scope of work authorized by the District; it is not intended to be relied upon by any other party except for regulatory authorities contemplated by the scope of work. We have relied on information or instructions provided by the District and other parties and, unless otherwise expressly indicated, have made no independent investigation as to the validity, completeness, or accuracy of such information.

Summary

The purpose of this technical memorandum (TM) is to summarize the review and analysis of instream water quality monitoring data for the Stormwater Management Agency of Clackamas County (SWMACC), Clackamas County Service District #1 (CCSD #1), and the cities of Rivergrove and Happy Valley. For purposes of this TM, CCSD #1 and SWMACC are collectively referred to as the Districts. The cities of Happy Valley and Rivergrove are collectively referred to as Cities.

Clackamas County Water Environment Services (WES) conducts water quality monitoring on behalf of the Districts and cities. This data review and trends analysis was completed to comply with the District's and City's National Pollutant Discharge Elimination System (NPDES) municipal separate storm sewer system (MS4) permit requirements.

The Districts and cities are Phase 1 co-permittees on the Clackamas County NPDES MS4 permit, along with several other local governments and service districts in Clackamas County, Oregon. As part of the NPDES MS4 permit requirements, the permittees must evaluate the overall effectiveness of its stormwater management program by conducting a pollutant load reduction evaluation (Schedule D.3 of the permit). This evaluation includes a requirement to conduct an instream water quality trends analysis including a summary of the relationship of identified trends to stormwater discharges.

WES has been collecting instream water quality monitoring data since 1994 from nine creek sites. Brown and Caldwell (BC) was retained to review these instream environmental monitoring data and develop the trends analysis that is provided in this TM. This TM includes a summary of the review and processing of the data, a summary of the Mann-Kendall statistical analysis, and a summary of the results.

Data Review and Pre-Processing

BC reviewed the instream data collected within the District's and Cities watersheds in order to summarize and pre-process the data sets. Pre-processing of data was conducted to determine which data sets were sufficient to perform a statistically valid water quality trends analysis. Each record in the data to be analyzed represents a measurement recorded for one parameter at one site, and each data set represents all of the data collected for one parameter at one site during either a wet or dry day. The original criteria for determining which data sets would be used for the trends analysis were that only data sets with at least 5 years of data and 30 or more data points would be used, and that data sets for wet days and dry days would be analyzed separately (or wet season and dry season where daily rainfall records were not available).

These criteria were recommended in a draft guidance document developed in 2007 by the Oregon Association of Clean Water Agencies (ACWA) Phase I stormwater committee. However, not all data sets reviewed included 30 or more observations; some of the data sets had 10 or more observations. Based on the review of WES's data, BC completed the analysis based on the following refined/updated ACWA criteria:

- Data were analyzed separately for wet days and dry days given that information regarding the occurrence of rainfall in association with data collection was readily available.
- The threshold for the trends analysis was reduced to data sets with 10 or more observations in order to allow for a trends analysis to be performed for copper and zinc and to be able to separate the data into wet-day and dry-day data sets when that resulted in fewer than 30 observations.
- Data sets were analyzed only when 50 percent or more of the data were reported as above the detection limit to provide more rigorous and statistically valid trends analyses.

The NPDES MS4 permit does not specify the parameters required for the trends analysis. The ACWA Committee draft guidance recommends that trends analyses be performed for total suspended solids (TSS), total phosphorus (TP) or other relevant nutrient, copper (total recoverable and soluble), zinc (total recoverable



and soluble), and *E. coli* if adequate data are available to perform a rigorous Mann-Kendall trends analysis. BC performed the Mann-Kendall trends analysis on wet- and dry-day data sets for these seven parameters.

Based on the criteria described above for conducting the trends analyses, pre-processing of the data included a review of the following for each monitoring site and parameter:

- Total number of data points (where a single data point is one measurement recorded for one parameter at one site)
- Number of data points associated with wet-day conditions (record marked “Y” for rainfall greater than or equal to 0.1 inch during the sampling event) or dry-day conditions (record marked “N” for no rainfall);
- Number of non-detects
- Summary of monitoring frequency
- Summary of the monitoring sites and parameters with adequate data for a trends analysis

For this analysis, BC assumed that the quality assurance/quality control (QA/QC) review of stormwater data was already completed by WES.

Eight of the nine instream monitoring sites had data sets with 30 or more observations. However, the data sets for all parameters for site CC-27 at Kellogg Creek did not have 30 or more observations. In order to perform a trends analysis for these data sets, as mentioned above, BC elected to reduce the threshold for the trends analysis to data sets with 10 or more observations.

Table 1 shows a check mark (✓) for each data set that met the project criteria for conducting a Mann-Kendall trends analysis. As a result of the data review and pre-processing of instream water quality monitoring data, a total of 126 trends analyses were completed, including 63 trends analyses for dry weather (i.e., 9 sites x 7 parameters), and 63 trends analyses for wet weather (i.e., 9 sites x 7 parameters). Fourteen of the 126 trends analyses had data sets with 10 to 30 observations.

Table 1. Summary of Monitoring Sites and Data Review Statistics							
Carli Creek (CC-05)							
Statistic/parameter	TSS	<i>E. coli</i>	TP	Copper	Copper (diss.)	Zinc	Zinc (diss.)
Monitoring date range	1999-2015	1994-2015	1994-2015	1994-2015	2007-2015	1994-2015	2007-2015
Number of observations	175	210	218	136	76	138	76
Wet-day detects	57	63	64	44	40	47	40
Wet-day non-detects	0	2	2	3	0	0	0
Wet-day data set 10+ records and 50% or more detects	✓	✓	✓	✓	✓	✓	✓
Dry-day detects	114	136	148	72	36	88	36
Dry-day non-detects	4	9	4	17	0	3	0
Dry-day data set 10+ records and 50% or more detects	✓	✓	✓	✓	✓	✓	✓
Sieben Creek (CC-07)							
Statistic/parameter	TSS	<i>E. coli</i>	TP	Copper	Copper (diss.)	Zinc	Zinc (diss.)
Monitoring date range	1999-2015	1994-2015	1994-2015	1994-2015	2007-2015	1994-2015	2007-2015
Number of observations	172	210	213	134	74	134	74
Wet-day detects	53	60	58	38	36	43	36
Wet-day non-detects	0	2	1	5	0	0	0
Wet-day data set 10+ records and 50% or more detects	✓	✓	✓	✓	✓	✓	✓
Dry-day detects	106	142	151	68	38	76	38
Dry-day non-detects	13	6	3	23	0	15	0
Dry-day data set 10+ records and 50% or more detects	✓	✓	✓	✓	✓	✓	✓

Table 1. Summary of Monitoring Sites and Data Review Statistics

Cow Creek (CC-24)							
Statistic/parameter	TSS	<i>E. coli</i>	TP	Copper	Copper (diss.)	Zinc	Zinc (diss.)
Monitoring date range	2002-2015	2002-2015	2002-2015	2002-2015	2007-2015	2002-2015	2007-2015
Number of observations	118	109	114	88	74	88	74
Wet-day detects	23	22	23	12	12	12	12
Wet-day non-detects	0	0	0	0	0	0	0
Wet-day data set 10+ records and 50% or more detects	✓	✓	✓	✓	✓	✓	✓
Dry-day detects	56	52	54	42	42	45	42
Dry-day non-detects	0	2	0	3	0	0	0
Dry-day data set 10+ records and 50% or more detects	✓	✓	✓	✓	✓	✓	✓
Phillips Creek (CC-11)							
Statistic/parameter	TSS	<i>E. coli</i>	TP	Copper	Copper (diss.)	Zinc	Zinc (diss.)
Monitoring date range	1999-2015	1994-2015	1994-2015	1994-2015	2007-2015	1994-2015	2007-2015
Number of observations	174	209	214	133	74	134	74
Wet-day detects	59	64	65	42	38	46	38
Wet-day non-detects	0	2	1	4	0	0	0
Wet-day data set 10+ records and 50% or more detects	✓	✓	✓	✓	✓	✓	✓
Dry-day detects	112	137	138	66	36	85	36
Dry-day non-detects	3	6	10	21	0	3	0
Dry-day data set 10+ records and 50% or more detects	✓	✓	✓	✓	✓	✓	✓
Mt Scott Creek (CC-15)							
Statistic/parameter	TSS	<i>E. coli</i>	TP	Copper	Copper (diss.)	Zinc	Zinc (diss.)
Monitoring date range	1999-2015	1994-2015	1994-2015	1994-2015	2007-2015	1994-2015	2007-2015
Number of observations	175	210	217	135	76	134	76
Wet-day detects	58	65	66	41	37	45	37
Wet-day non-detects	0	2	1	5	0	0	0
Wet-day data set 10+ records and 50% or more detects	✓	✓	✓	✓	✓	✓	✓
Dry-day detects	116	137	145	68	39	80	39
Dry-day non-detects	1	6	5	21	0	9	0
Dry-day data set 10+ records and 50% or more detects	✓	✓	✓	✓	✓	✓	✓
Rock Creek (CC-16)							
Statistic/parameter	TSS	<i>E. coli</i>	TP	Copper	Copper (diss.)	Zinc	Zinc (diss.)
Monitoring date range	1999-2015	1998-2015	1998-2015	1998-2015	2007-2015	1998-2015	2007-2015
Number of observations	175	167	185	119	77	119	77
Wet-day detects	53	52	53	36	36	38	36
Wet-day non-detects	0	2	2	5	0	3	0
Wet-day data set 10+ records and 50% or more detects	✓	✓	✓	✓	✓	✓	✓
Dry-day detects	116	108	118	54	41	61	41
Dry-day non-detects	6	5	12	24	0	17	0
Dry-day data set 10+ records and 50% or more detects	✓	✓	✓	✓	✓	✓	✓

Table 1. Summary of Monitoring Sites and Data Review Statistics

Kellogg Creek (CC-14)							
Statistic/parameter	TSS	<i>E. coli</i>	TP	Copper	Copper (diss.)	Zinc	Zinc (diss.)
Monitoring date range	1999-2015	1994-2015	1994-2015	1994-2015	2007-2015	1994-2015	2007-2015
Number of observations	176	210	222	135	77	135	77
Wet-day detects	57	62	64	41	36	45	36
Wet-day non-detects	0	2	2	4	0	0	0
Wet-day data set 10+ records and 50% or more detects	✓	✓	✓	✓	✓	✓	✓
Dry-day detects	117	139	156	69	41	79	41
Dry-day non-detects	2	7	0	21	0	11	0
Dry-day data set 10+ records and 50% or more detects	✓	✓	✓	✓	✓	✓	✓
Kellogg Creek (CC-27)							
Statistic/parameter	TSS	<i>E. coli</i>	TP	Copper	Copper (diss.)	Zinc	Zinc (diss.)
Monitoring date range	2012-2015	2012-2015	2012-2015	2012-2015	2012-2015	2012-2015	2012-2015
Number of observations	29	29	29	29	29	29	29
Wet-day detects	11	11	11	11	11	11	11
Wet-day non-detects	0	0	0	0	0	0	0
Wet-day data set 10+ records and 50% or more detects	✓	✓	✓	✓	✓	✓	✓
Dry-day detects	18	18	18	18	18	18	18
Dry-day non-detects	0	0	0	0	0	0	0
Dry-day data set 10+ records and 50% or more detects	✓	✓	✓	✓	✓	✓	✓
Pecan Creek (SW-11)							
Statistic/parameter	TSS	<i>E. coli</i>	TP	Copper	Copper (diss.)	Zinc	Zinc (diss.)
Monitoring date range	1996-2015	1996-2015	1996-2015	2007-2015	2007-2015	2007-2015	2007-2015
Number of observations	256	255	251	119	118	119	118
Wet-day detects	95	95	92	74	73	74	73
Wet-day non-detects	1	0	0	0	0	0	0
Wet-day data set 10+ records and 50% or more detects	✓	✓	✓	✓	✓	✓	✓
Dry-day detects	152	160	152	45	45	45	45
Dry-day non-detects	8	0	7	0	0	0	0
Dry-day data set 10+ records and 50% or more detects	✓	✓	✓	✓	✓	✓	✓

Mann-Kendall Trends Analysis

Temporal trends in water quality were evaluated using the Mann-Kendall test, a non-parametric method that is used for identifying monotonic (though not necessarily linear) trends. The Mann-Kendall test is particularly well-suited for analyzing environmental data because (1) it allows for missing values and unevenly spaced measurements, (2) there are no distributional assumptions, (3) outliers have minimal effect, and (4) some non-detects can be present in the data. The Mann-Kendall test is described in a number of references including Gibbons (1994), Gilbert (1987), Hollander and Wolfe (1973), and U.S. EPA (2006).

The null and alternative hypotheses for this analysis are:

H_0 : slope = 0 (null)

H_a : slope $\neq$ 0 (alternative)

The null hypothesis (H_0) of “no trend” was rejected if the absolute value of the test statistic (p-value) exceeded the critical value. The critical value depends on the number of observations and the desired significance level of the results. A significance level of 5 percent was selected for this analysis (i.e., there is at most a 5 percent chance that the trend observed is not actually a trend but due to variability of the data). P values less than 5 percent were assumed to demonstrate a statistically significant trend. P-values between 5 and 10 percent were assumed to demonstrate a marginally significant trend. P-values corresponded to a two-sided analysis where there is interest in both upward and downward trends.

A rejection of the null hypothesis, H_0 , indicates a high likelihood of a temporal trend in the data. If H_0 is not rejected, it cannot be concluded that there is a temporal trend in the data. The Mann-Kendall trend test compares each observation in a time series with all previous observations, tallying a point when the observation is larger than a previous observation, and subtracting a point when the observation is smaller than a previous observation. The total tally is the Kendall Score, and its sign determines the direction of the trend. A negative value indicates a downward trend with time and a positive value indicates an upward trend. When the null hypothesis is rejected, the conclusion is that the Kendall score (and the temporal trend) is not significantly different from zero.

Mann-Kendall tests for trends were conducted using the package “Kendall” in the programming language R. R is an open-source language and integrated suite of software applications for statistical computing, for which statistical packages are developed and scientifically peer-reviewed (available through the Comprehensive R Archive Network from the R Core Team [2013]). The Kendall package is the program developed to run the Mann-Kendall trends analysis (McLeod, 2011). Results of the Mann-Kendall trends analysis in R are produced in a table of values including two-sided p-value and Kendall Score. BC processed all data sets for each monitoring site using R, resulting in a table of Mann-Kendall trends analysis values for each of the parameters for the site.

To provide quality assurance on the automated processing of the site data, the Mann-Kendall test was also conducted in ProUCL for selected data sets. ProUCL is a statistical software package developed by the U.S. Environmental Protection Agency (EPA) for analysis of environmental data (U.S. EPA, 2013). Because of the large number of WES data sets (nine sites, seven parameters, two weather conditions) and the inability to automate the processing of data sets in ProUCL, ProUCL was used solely to spot-check selected results from the R package. The Kendall Score and p-value from the ProUCL Mann-Kendall trend analysis were compared with the Kendall Score and p-value from R. In all spot-checked cases, the results of the two software packages were in agreement, providing confidence in the results from all data sets processed through R.

Statistical Test Results

Trends analyses were conducted on all wet-day and dry-day data sets that had at least 50 percent detected values and at least 10 observations. Of the 126 trends analyses completed, 112 were on data sets with 30 or more observations, and 14 were on data sets with 10 to 29 observations. Of the 126 trends analyses completed, 63 were conducted for wet-day data and 63 were conducted for dry-day data.

A legend for the results is shown in Table 2, and results of the trends analyses are summarized in Table 3. Based on the selected data criteria for performing the trends analysis, trends were evaluated for both the 5 and 10 significance levels (i.e., alpha of 0.05 and 0.10).

Table 2. Legend for Summary of Trends

No rain	< 0.1 inch of rainfall in the 24 hours prior to sampling
Rain	>= 0.1 inch of rainfall in the 24 hours prior to sampling
↑	Significant upward trend ($p \leq 0.05$)
↓	Significant downward trend ($p \leq 0.05$)
↗	Somewhat significant upward trend ($0.05 < p \leq 0.1$)
↘	Somewhat significant downward trend ($0.05 < p \leq 0.1$)
	Improvement in water quality indicator parameter
	Deterioration in water quality indicator parameter
	Not enough data for analysis
NA	Not enough uncensored values for analysis (<10)
	No trend was detected

Table 3. Summary of Trends

TMDL watershed	L Willamette (Clackamas R)														
Water body	Carli Creek					Sieben Creek					Cow Creek				
Site/Station ID	CC-05					CC-07					CC-24				
2015 instream monitoring site	SE 120th and Carpenter					Hwy. 212 and SE 135th					At SE Last Rd.				
WQ parameter	Date range	No rain		Rain		Date range	No rain		Rain		Date range	No rain		Rain	
		N	Trend	N	Trend		N	Trend	N	Trend		N	Trend	N	Trend
TSS	1999-2015	118		57		1999-2015	119	↑	53		2002-2015	62	↑	56	↑
<i>E. coli</i>	1994-2015	145		65	↑	1994-2015	148		62	↑	2002-2015	55		54	
TP	1994-2015	152	↓	66	↓	1994-2015	154	↓	59	↓	2002-2015	60	↑	54	↑
Total copper	1994-2015	89	↓	47		1994-2015	91		43	↑	2002-2015	43	↑	45	
Copper (diss.)	2007-2015	36	↓	40		2007-2015	38	↓	36		2007-2015	32	↑	42	↑
Total zinc	1994-2015	91		47		1994-2015	91	↑	43	↑	2002-2015	43	↑	45	
Zinc (diss.)	2007-2015	36		40		2007-2015	38	↑	36	↑	2007-2015	32	↑	42	↑

TMDL watershed	L Willamette (Mt Scott Creek)										L Willamette (Rock Creek)				
Water body	Phillips Creek					Mt. Scott Creek					Rock Creek				
Site/Station ID	CC-11					CC-15					CC-16				
2015 instream monitoring site	SE 84th Ave. and SE Sunnybrook					Hwy. 224					Hwy. 212 and SE 142nd				
WQ parameter	Date range	No rain		Rain		Date range	No rain		Rain		Date range	No rain		Rain	
		N	Trend	N	Trend		N	Trend	N	Trend		N	Trend	N	Trend
TSS	1999-2015	115		59		1999-2015	117		58		1999-2015	122		53	
<i>E. coli</i>	1994-2015	143		66	↑	1994-2015	143		67		1998-2015	113		54	↑
TP	1994-2015	148	↓	66		1994-2015	150	↓	67		1998-2015	130	↓	55	
Total copper	1994-2015	87		46		1994-2015	89		46	↑	1998-2015	78		41	↑
Copper (diss.)	2007-2015	36	↓	38		2007-2015	39	↓	37		2007-2015	41	↓	36	↑
Total zinc	1994-2015	88	↑	46	↑	1994-2015	89	↑	45	↑	1998-2015	78	↑	41	↑
Zinc (diss.)	2007-2015	36		38	↑	2007-2015	39		37	↑	2007-2015	41	↑	36	↑

TMDL watershed	L Willamette (Kellogg Creek)										Tualatin R				
Water body	Kellogg Creek					Kellogg Creek					Pecan Creek				
Site/Station ID	CC-14					CC-27					SW-11				
2015 instream monitoring site	SE Rusk and SE Aldercrest					Rowe Middle School					SW Mossy Brae Rd.				
WQ parameter	Date range	No rain		Rain		Date range	No rain		Rain		Date range	No rain		Rain	
		N	Trend	N	Trend		N	Trend	N	Trend		N	Trend	N	Trend
TSS	1999-2015	119		57		2012-2015	18		11		1996-2015	160	↑	96	
<i>E. coli</i>	1994-2015	146		64		2012-2015	18		11	↓	1996-2015	160	↑	95	
TP	1994-2015	156	↓	66		2012-2015	18		11		1996-2015	159	↓	92	↓
Total copper	1994-2015	90		45		2012-2015	18		11		2007-2015	45		74	
Copper (diss.)	2007-2015	41	↓	36		2012-2015	18		11		2007-2015	45	↓	73	↓
Total zinc	1994-2015	90	↑	45	↑	2012-2015	18		11		2007-2015	45	↑	74	
Zinc (diss.)	2007-2015	41		36	↑	2012-2015	18	↓	11		2007-2015	45	↑	73	↑

Summary/Conclusions

A summary of results based on Table 3 is as follows:

- Given a significance level of 10 percent, more declining water quality trends (i.e., increasing pollutant concentrations) were observed during wet weather (23 declining trends) than during dry weather (18 declining trends).
- Given a significance level of 10 percent, more improving water quality trends (i.e., decreasing pollutant concentrations) occurred during dry weather (16 improving trends) than during wet weather (5 improving trends).
- The majority of all of the trends analyses (64 out of 126, or 51 percent) showed no trend given a significance level of 10 percent.
- The majority (i.e., 56 percent) of the 41 declining water quality trends occurred for total and dissolved zinc (23 declining trends).
- Seven declining water quality trends occurred for copper, five for bacteria, four for TSS, and two for phosphorus.
- The majority (i.e., 48 percent) of the improving water quality trends occurred for phosphorus.
- Nine improving water quality trends occurred for copper, one for zinc, and one for bacteria.
- Kellogg Creek (CC-27) had the fewest data sets showing trends out of all the sites, with two improving water quality trends. This site also had the shortest monitoring period and the fewest data points.
- Cow Creek (CC-24) had the most data sets showing trends out of all the sites with 10 of the 14 trends analyses showing declining water quality trends.

These trends results should be evaluated in the context of where samples are collected and what watershed influences may be affecting water quality at each sampling site, while also considering the data available for the trends analysis such as the length of the measurement period and the number of data points in the data sets evaluated. In addition, these trends reflect a period when Clackamas County grew in population by approximately 80,000. Given that level of population growth and the potential impacts associated with the resulting development, seeing no trend in water quality is a positive result.

It should be noted that water quality data from grab samples represent conditions during a specific snapshot in time and the results can be influenced by many factors. Although there is evidence that stormwater management activities can have a measurable impact on reducing pollutants in stormwater, correlating data from instream and outfall water quality sampling with stormwater management activities is a challenging task because of the myriad of other influences on water quality. The results of the trends analyses presented here are not a definitive statement of the overall quality of the sampled streams, but rather one piece of information to be considered within the larger watershed context. Both the number of data points in a data set and the scatter of the data affect the results of the Mann-Kendall trends analysis. Data sets with more data may be more likely to exhibit a trend (if the data are not widely scattered) than data sets with fewer data points (McBride et al., 1993). In addition, a statistically significant result is not necessarily practically significant.

Other factors such as the magnitude and range of reported values compared to various water quality criteria can also be more practically significant, as well as longer-term indicators of watershed health such as benthic macroinvertebrate survey results. The results of the trends analysis are one piece of an overall evaluation of water quality.

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Appendix B: Summary of Loads

Table B-1. CCSD #1 Pollutant Load Summary (for use with the PLRE and TMDL Benchmarks)																				
Waterbody	Season	WLA (% reduction or concentration)	Pollutant Loading Estimate									Pollutant Load Reduction Estimate ^c								
			Current, no BMPs (counts or pounds) ^a			Current, with BMPs (counts or pounds) ^a			Future, with BMPs (counts or pounds) ^b			Current conditions (counts or pounds) ^{d, f}			Future conditions (counts or pounds) ^e			Future conditions (% reduction or concentration) ^e		
			Upper confidence limit (UCL)	Mean	Lower confidence limit (LCL)	Upper confidence limit (UCL)	Mean	Lower confidence limit (LCL)	Upper confidence limit (UCL)	Mean	Lower confidence limit (LCL)	Upper confidence limit (UCL)	Mean	Lower confidence limit (LCL)	Upper confidence limit (UCL)	Mean	Lower confidence limit (LCL)	Upper confidence limit (UCL)	Mean	Lower confidence limit (LCL)
Bacteria (counts)																				
Clackamas River	annual	78%	1.18 x 10 ¹⁴	6.80 x 10 ¹³	3.66 x 10 ¹³	9.92 x 10 ¹³	5.97 x 10 ¹³	3.32 x 10 ¹³	9.53 x 10 ¹³	5.90 x 10 ¹³	3.29 x 10 ¹³	1.88 x 10 ¹³	8.27 x 10 ¹²	3.40 x 10 ¹²	2.27 x 10 ¹³	9.00 x 10 ¹²	3.62 x 10 ¹²	19.2%	13.2%	9.9%
Lower Willamette (via tributaries)	annual	78%	2.86 x 10 ¹⁴	1.69 x 10 ¹⁴	9.30 x 10 ¹³	2.50 x 10 ¹⁴	1.55 x 10 ¹⁴	8.67 x 10 ¹³	Same as Current, with BMPs.			3.60 x 10 ¹³	1.34 x 10 ¹³	6.38 x 10 ¹²	3.60 x 10 ¹³	1.34 x 10 ¹³	6.38 x 10 ¹²	12.6%	8.0%	6.9%
Johnson Creek	annual	78%	5.68 x 10 ¹³	3.41 x 10 ¹³	1.92 x 10 ¹³	5.11 x 10 ¹³	3.20 x 10 ¹³	1.81 x 10 ¹³	Same as Current, with BMPs.			5.68 x 10 ¹²	2.07 x 10 ¹²	1.02 x 10 ¹²	5.68 x 10 ¹²	2.07 x 10 ¹²	1.02 x 10 ¹²	10.0%	6.1%	5.3%
DDT (pounds) ^g																				
Johnson Creek	annual	77%	0.014	0.010	0.004	0.013	0.009	0.004	To be determined, based on natural degradation and BMP implementation			0.010	0.007	0.003	To be determined, based on natural degradation and BMP implementation			To be determined, based on natural degradation and BMP implementation		

a. The current (2015) no-BMP and with-BMP load estimates are presented in graphical form in Figures 5-1, 5-3, 5-5, and 5-7.

b. The future (2022) with-BMP load estimate is required per Schedule D.3.d.ii.4 of the NPDES MS4 permit. This load estimate provides the basis for development of the TMDL Benchmarks.

c. The pollutant load reduction estimate is calculated as the difference between the no-BMP and the with-BMP loads. The pollutant load reduction estimate is presented as a range, consistent with the pollutant loading estimate.

d. The current condition pollutant load reduction estimate (PLRE) is reflected in Section 5 in graphical and tabular form.

e. The future condition pollutant load reduction estimate is considered to be the TMDL Benchmark, as described in Section 6. The TMDL Benchmarks have been calculated as a load reduction and also as a percentage load reduction or concentration, to allow for comparison to the WLA (defined as a percent load reduction or a concentration) and future PLREs (defined as a load reduction).

f. For DDT, the current condition pollutant load reduction estimate is based on the difference between the baseline condition (2008) no-BMP load and the current with-BMP load. This accounts for natural degradation and removal via BMPs.

g. For DDT, due to the fact that it is a legacy pollutant and the majority of load reduction is associated with natural degradation, benchmarks have not been established.

Table B-2. SWMACC Pollutant Load Summary (for use with the PLRE and TMDL Benchmarks)																				
Waterbody	Season	WLA (% reduction or concentration)	Pollutant Loading Estimate									Pollutant Load Reduction Estimate ^c								
			Current, no BMPs (counts or pounds) ^a			Current, with BMPs (counts or pounds) ^a			Future, with BMPs (counts or pounds) ^b			Current conditions (counts or pounds) ^d			Future conditions (counts or pounds) ^e			Future conditions (% reduction or concentration) ^e		
			Upper confidence limit (UCL)	Mean	Lower confidence limit (LCL)	Upper confidence limit (UCL)	Mean	Lower confidence limit (LCL)	Upper confidence limit (UCL)	Mean	Lower confidence limit (LCL)	Upper confidence limit (UCL)	Mean	Lower confidence limit (LCL)	Upper confidence limit (UCL)	Mean	Lower confidence limit (LCL)	Upper confidence limit (UCL)	Mean	Lower confidence limit (LCL)
Bacteria (counts)																				
Lower Willamette ^f	annual	78%	7.87 x 10 ¹²	4.89 x 10 ¹²	2.85 x 10 ¹²	Same as current, no BMPs			Same as Current, with BMPs.			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Middle Willamette Tributary ^f	Summer season	88%	1.79 x 10 ⁹	1.02 x 10 ⁹	5.33 x 10 ⁸	Same as current, no BMPs			Same as Current, with BMPs.			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Fall, winter, spring season	75%	8.73 x 10 ⁹	4.95 x 10 ⁹	2.59 x 10 ⁹	Same as current, no BMPs			Same as Current, with BMPs.			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tualatin	Summer event	12,000 counts/100mL	3.87 x 10 ¹⁰	2.41 x 10 ¹⁰	1.41 x 10 ¹⁰	3.75 x 10 ¹⁰	2.36 x 10 ¹⁰	1.38 x 10 ¹⁰	Future conditions analysis not required. WLA is estimated as being met under current conditions.			1.19 x 10 ⁹	5.59 x 10 ⁸	2.68 x 10 ⁸	N/A			N/A		
	Winter event	5,000 counts/100mL	6.89 x 10 ¹¹	4.30 x 10 ¹¹	2.52 x 10 ¹¹	6.68 x 10 ¹¹	4.20 x 10 ¹¹	2.47 x 10 ¹¹	Future conditions analysis not required. WLA is estimated as being met under current conditions.			2.13 x 10 ¹⁰	9.96 x 10 ⁹	4.77 x 10 ⁹	N/A			N/A		
Fanno ^f	Summer event	12,000 counts/100mL	9.28 x 10 ⁹	5.80 x 10 ⁹	3.39 x 10 ⁹	9.28 x 10 ⁹	5.80 x 10 ⁹	3.39 x 10 ⁹	Future conditions analysis not required. WLA is estimated as being met under current conditions.			0.00	0.00	0.00	N/A			N/A		
	Winter event	5,000 counts/100mL	1.65 x 10 ¹¹	1.03 x 10 ¹¹	6.05 x 10 ¹⁰	1.65 x 10 ¹¹	1.03 x 10 ¹¹	6.05 x 10 ¹⁰	Future conditions analysis not required. WLA is estimated as being met under current conditions.			0.00	0.00	0.00	N/A			N/A		
Total Phosphorus (pounds)																				
Tualatin	Summer season	0.14 mg/L	42.56	38.92	29.87	41.95	38.43	29.59	Same as Current, with BMPs.			0.61	0.49	0.28	0.61	0.49	0.28	0.22 mg/L	0.20 mg/L	0.15 mg/L
Fanno ^f	Summer season	0.13 mg/L	9.94	9.08	6.92	Same as Current, no BMPs			Same as Current, with BMPs.			0.00	0.00	0.00	0.00	0.00	0.00	0.23 mg/L	0.21 mg/L	0.16 mg/L
TSS (pounds)																				
Tualatin	Summer season	20%	18,439	12,279	8,133	17,909	11,993	8,006	Same as Current, with BMPs.			530	286	127	530	286	127	2.9%	2.3%	1.6%
Fanno ^f	Summer season	50%	4,284	2,855	1,901	Same as current, no BMPs			Same as Current, with BMPs.			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

- a. The current (2015) no-BMP and with-BMP load estimates are presented in graphical form in Figures 4-1 to 4-8.
- b. The future (2022) with-BMP load estimate is required per Schedule D.3.d.ii.4 of the NPDES MS4 permit. This load estimate provides the basis for development of the TMDL Benchmarks.
- c. The pollutant load reduction estimate is calculated as the difference between the no-BMP and the with-BMP loads. The pollutant load reduction estimate is presented as a range, consistent with the pollutant loading estimate.
- d. The current condition pollutant load reduction estimate (PLRE) is reflected in Section 4 in graphical and tabular form.
- e. The future condition pollutant load reduction estimate is considered to be the TMDL Benchmark, as described in Section 5. The TMDL Benchmarks have been calculated as a load reduction and also as a percentage load reduction or concentration, to allow for comparison to the WLA (defined as a percent load reduction or a concentration) and future PLREs (defined as a load reduction).
- f. SWMACC has limited area within the Lower Willamette, Middle Willamette tributary, and Fanno Creek TMDL watersheds. Area is already development with no existing structural BMPs and little opportunity for retrofit and new BMP installation. No load reduction associated with structural BMPs is anticipated, although non-structural controls are expected to achieve some load reduction.



Table B-3. EHV Pollutant Load Summary (for use with the PLRE and TMDL Benchmarks)																				
Waterbody	Season	WLA (% reduction or concentration)	Pollutant Loading Estimate									Pollutant Load Reduction Estimate ^c								
			Current, no BMPs (counts or pounds) ^a			Current, with BMPs (counts or pounds) ^a			Future, with BMPs (counts or pounds) ^b			Current conditions (counts or pounds) ^{d, f}			Future conditions (counts or pounds) ^e			Future conditions (% reduction or concentration) ^e		
			Upper confidence limit (UCL)	Mean	Lower confidence limit (LCL)	Upper confidence limit (UCL)	Mean	Lower confidence limit (LCL)	Upper confidence limit (UCL)	Mean	Lower confidence limit (LCL)	Upper confidence limit (UCL)	Mean	Lower confidence limit (LCL)	Upper confidence limit (UCL)	Mean	Lower confidence limit (LCL)	Upper confidence limit (UCL)	Mean	Lower confidence limit (LCL)
Bacteria (counts)																				
Clackamas River	annual	78%	1.76 x 10 ¹³	1.08 x 10 ¹³	6.27 x 10 ¹²	1.70 x 10 ¹³	1.06 x 10 ¹³	6.17 x 10 ¹²	Same as Current, with BMPs.			5.27 x 10 ¹¹	2.56 x 10 ¹¹	9.95 x 10 ¹⁰	5.27 x 10 ¹¹	2.56 x 10 ¹¹	9.95 x 10 ¹⁰	3.0%	2.4%	1.6%
Lower Willamette (via tributaries)	annual	78%	2.06 x 10 ¹¹	1.29 x 10 ¹¹	7.55 x 10 ¹⁰	2.03 x 10 ¹¹	1.28 x 10 ¹¹	7.48 x 10 ¹⁰	Same as Current, with BMPs.			3.46 x 10 ⁹	1.37 x 10 ⁹	7.21 x 10 ⁸	3.46 x 10 ⁹	1.37 x 10 ⁹	7.21 x 10 ⁸	1.7%	1.1%	1.0%
Johnson Creek	annual	78%	3.80 x 10 ¹²	2.39 x 10 ¹²	1.40 x 10 ¹²	3.80 x 10 ¹²	2.38 x 10 ¹²	1.40 x 10 ¹²	Same as Current, with BMPs.			7.50 x 10 ⁹	2.50 x 10 ⁹	1.40 x 10 ⁹	7.50 x 10 ⁹	2.50 x 10 ⁹	1.40 x 10 ⁹	0.2%	0.1%	0.1%
DDT (pounds) ^g																				
Johnson Creek	annual	77%	0.0015	0.0010	0.0005	0.0015	0.0010	0.0005	To be determined, based on natural degradation and BMP implementation			0.0009	0.0006	0.0003	To be determined, based on natural degradation and BMP implementation			To be determined, based on natural degradation and BMP implementation		

a. The current (2015) no-BMP and with-BMP load estimates are presented in graphical form in Figures 5-2, 5-4, 5-6, and 5-8.

b. The future (2022) with-BMP load estimate is required per Schedule D.3.d.ii.4 of the NPDES MS4 permit. This load estimate provides the basis for development of the TMDL Benchmarks.

c. The pollutant load reduction estimate is calculated as the difference between the no-BMP and the with-BMP loads. The pollutant load reduction estimate is presented as a range, consistent with the pollutant loading estimate.

d. The current condition pollutant load reduction estimate (PLRE) is reflected in Section 5 in graphical and tabular form.

e. The future condition pollutant load reduction estimate is considered to be the TMDL Benchmark, as described in Section 6. The TMDL Benchmarks have been calculated as a load reduction and also as a percentage load reduction or concentration, to allow for comparison to the WLA (defined as a percent load reduction or a concentration) and future PLREs (defined as a load reduction).

f. For DDT, the current condition pollutant load reduction estimate is based on the difference between the baseline condition (2008) no-BMP load and the current with-BMP load. This accounts for natural degradation and removal via BMPs.

g. For DDT, due to the fact that it is a legacy pollutant and the majority of load reduction is associated with natural degradation, benchmarks have not been established.