MS4 Permit Renewal Submittal
Application Package

CITY OF GRESHAM

National Pollutant Discharge Elimination System

Permit #101315 | Expiration December 29, 2015

for Municipal Stormwater Discharges to Surface Waters

CITY OF GRESHAM

1333 N.W. Eastman Parkway | Gresham, OR 97030

December 15, 2015

Mark Riedel, MS4 Program Coordinator
Oregon DEQ, Environmental Solutions Division
811 Southwest Sixth Avenue
Portland, OR 97204

RE: City of Gresham Permit Renewal Application Package, NPDES MS4 Permit #101315

Dear Mr. Riedel:

On behalf of the City of Gresham, I am enclosing the National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) discharge permit renewal application package with regard to our permit #101315, expiration date December 29, 2015.

As per Schedule B 6 a. – h., the package contains the following:

1. An updated Stormwater Management Plan and summary of changes.
2. A Maximum Extent Practical general evaluation
3. Updated annual total pollutant loads for Total Maximum Daily Load (TMDL) pollutants or parameters
4. A proposed monitoring program objectives matrix and updated Monitoring Plan for Gresham and Fairview
5. Service Area Expansion discussion
6. A Fiscal Evaluation
7. Updated MS4 Maps
8. TMDL Pollutant Load Reduction Benchmarks

As required by Schedule A 4. e., elements 1, 4, and 8 were released for public comment using the City's website, an advertisement in the Oregonian, direct email to stakeholders and a press release. No comments were received.

If you have questions about the contents of this package, please contact Keri M. Handaly, MS4 Permit Coordinator at: keri.handaly@GreshamOregon.gov or 503-618-2657.

Sincerely,

Torrey Lindbo, Water Sciences Program Manager

National Pollutant Discharge Elimination System
Permit No. 101315
EPA Reference No. ORS108013
December 2015 MS4 Permit Renewal Application Package
City of Gresham

"We the undersigned, 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 inquiry of the 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 from knowing violations."

Steve Fancher
Director, Department of Environmental Services
City of Gresham

For additional information regarding this report, please contact:

Torrey Lindbo
Manager, Water Sciences Program
City of Gresham
1333 NW Eastman Parkway
Gresham, OR 97030
(503) 618-2405
www.greshamoregon.gov

City of Gresham Permit Renewal Submittal Application Package

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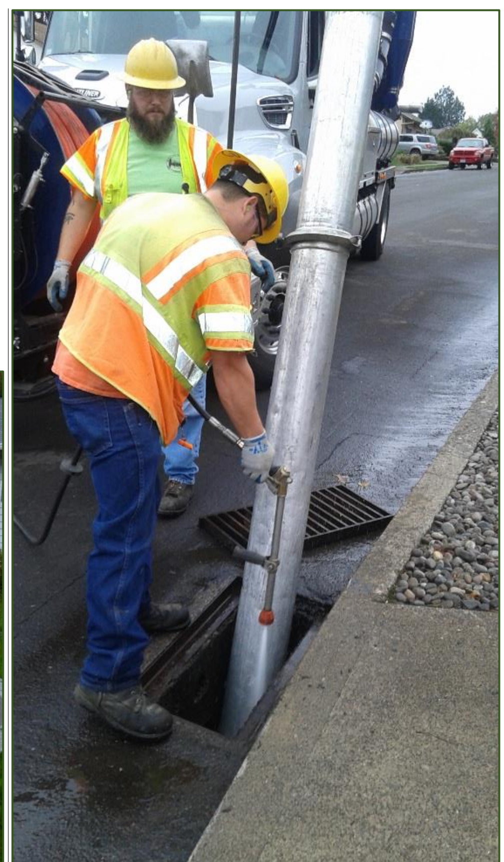
B. 2014 TMDL Pollutant Load Reduction Evaluation
C. Maps of the service boundary and required elements (Schedule B. 6. g.)

CITY OF GRESHAM

Stormwater Management Plan

Updated December 2015



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CITY OF GRESHAM STORMWATER MANAGEMENT PLAN (SWMP)

1.0 EXECUTIVE SUMMARY

Under the federal Clean Water Act and Oregon Revised Statute 468B.050, DEQ has issued the City of Gresham a National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) Discharge Permit. The City of Gresham is required to develop a Stormwater Management Plan (SWMP) as described in the Clean Water Act (CWA) 40 CFR 122.26 (d) (2) (iv) (A) through (D) and in Schedule A of the 2010 NPDES MS4 Permit #101315. The primary component of the SWMP is a management program comprised of Best Management Practices (BMPs) and other management activities developed to address the elements as detailed in the CWA and in Schedule A 1. through 4., Schedule B 5. and 6. and Schedule D 1., 4, and 7. of the permit. These are actions Gresham will take to minimize pollutant discharge into surface waters to the maximum extent practicable (MEP) in order to protect water quality and satisfy requirements of the NPDES MS4 Permit and the CWA.

The contents of this Stormwater Management Plan reflect the requirements as described in the permit issued by the Oregon Department of Environmental Quality (DEQ) dated December 30, 2010. At time of revision, DEQ has not issued a draft reissued permit and therefore, the City has no major proposed changes. A summary of the rationale for the revisions made for the 20011 SWMP update is described in **Section 6.0.**

As described in Schedule A 3 of the permit, "*Each co-permittee is responsible for compliance within its jurisdiction as identified in this permit, and is not responsible for compliance outside of its jurisdiction.*" Therefore, the contents of this SWMP are specific to the City of Gresham and do not apply to its co-permittee, City of Fairview and vice versa.

The content of the SWMP is organized into sections as briefly described below.
Section 2.0 includes the Introduction to the SWMP
Section 3.0 includes a description of the permit area and co-permittees and a map of the permit boundary.
Section 4.0 includes a summary of the City's organization with respect to managing stormwater.
Section 5.0 includes a summary of the City's Maximum Extent Practicable determination.
Section 6.0 includes a summary of the City's SWMP revisions and the rationale for those revisions.
Section 7.0 provides the SWMP BMPs with specific details. The BMPs are divided into Components 1-6.

Introduction
Section 2.0 describes the history of the City's permit.
A SWMP was first developed by Gresham to meet the first NPDES MS4 permit issued by DEQ in 1995. Ongoing implementation of the SWMP was conducted during the five-year permit period from 1995 to 2000.

In February 2000, the City submitted a renewal package to DEQ as required. However, DEQ postponed issuance of the second 5-year permit until it was determined how other CWA programs would be integrated into permit requirements. During this time, the City was legally operating under the 1995-2000 permit, but submitted a more detailed SWMP dated December 2001, as part of its adaptive management process.

In March, 2004, DEQ issued the renewed NPDES MS4 permit, which was later reconsidered, modified, and reissued in July 2005 and was set to expire on January 31, 2009. The permit required the City to prepare

> *…an evaluation of, and proposed revisions to, the SWMP that address the requirements of Schedules D(2)(b) and B(1)(b), including the rationale supporting the proposed revisions.*

Schedules D(2)(b) and B(1)(b) include details related to conducting a SWMP evaluation and preparation of a Monitoring Plan, respectively. This update was referred to as the Interim Evaluation Report (IER) and was submitted to DEQ on May 1, 2006. The IER documents, including the updated SWMP and Monitoring Plan, were approved on July 31, 2006. The City submitted its Permit Renewal Submittal (PRS) on August 1, 2008 and continued to implement the 2006 SWMP until DEQ reissued the City's permit on December 30, 2010. The City updated the revised SWMP submitted with the PRS to reflect the final permit language on April 1, 2011.

This SWMP is a draft with minor changes for the permit renewal submittal due on Dec 29, 2015. A summary of the rationale for the revisions made for the 2015 SWMP update is described in **Section 6.0.**

The detail of the SWMP is included in **Section 7.0** which includes tables of the City's BMPs.

Description of the Permit Area and Coordination with Co-Permittees

Section 3.0 provides a description of Gresham's portion of the permit area, watershed boundaries within the permit area, and co-permittees. The permit area for Gresham includes the incorporated areas (the city limits) of the City of Gresham.

The NPDES MS4 permit area for Gresham includes the incorporated areas (the city limits) of the City of Gresham except the portions of the City's stormwater system that drain to Underground Injection Control (UIC) systems. UICs drain to groundwater and are subject to a Water Pollution Control Facility (WPCF) permit. The Best Management Practices (BMPs) described within this Stormwater Management Plan (SWMP) are applied throughout the entire City's urban services boundary.

The City of Gresham area *excluding* Pleasant Valley and Springwater is about 15,002 acres or 23.4. square miles. The area *including* the urban growth boundary of Pleasant Valley, Kelley Creek Headwaters and Springwater represents approximately 17,000 acres or approximately 26.5 square miles. Gresham is comprised of four watersheds: Fairview Creek, Johnson Creek, Kelly Creek, and the Columbia Slough. All of these watersheds cross multiple jurisdictions. **Figure 1.0** illustrates the total area and the representative watersheds within the City of Gresham as well as surrounding jurisdictions.

With respect to NPDES MS4 co-permittees, the City of Gresham acted as the lead permit applicant for the Gresham NPDES MS4 submittal in 1993, 1995, 2000, 2006, 2008 and 2015. A complete overview of the permit history may be found in **Section I.** Introduction to the permit renewal submittal.

Gresham's Stormwater Management Program Organization

Section 4.0 describes the City's organization structure and responsible groups relative to the SWMP implementation and includes organization charts as **Figures 2.0 and 3.0**.

Maximum Extent Practicable Determination

Section 5.0 details the City's process for determining that its stormwater management program will reduce discharge of pollutants to the maximum extent practicable (MEP). The City has reviewed available data regarding the impact of urban runoff, and performed the required reviews of its practices and benchmark evaluation. The proposed changes are expected to improve water quality protection, while still meeting other important legal mandates and City goals such as flood control and groundwater protection. The detailed descriptions of the best management practices and their implementation schedule are listed in **Section 7.0.**

SWMP Revisions and Rationale for those Revisions

Section 6.0 contains the purpose of the proposed revisions, a short description in **Table 1.0** of the proposed BMP revisions and the rationale for those changes, and the focus of the SWMP. The majority of the proposed changes are insignificant in that their purpose is for clarity in language, grammar, formatting, etc., or the changes are deletion of information that is no longer accurate or were formerly listed as program goals and have now been incorporated into the Implementation Activity description. *Because Gresham's stormwater program is mature, has an adequate budget and reflects industry best practices, current science and best professional judgement, no major enhancements are deemed necessary to continue achieving water quality improvements over time.*

During the next permit cycle, the City plans to continue requiring and/or incentivizing low impact development (i.e., surface infiltration techniques) where appropriate soils exist because of its regional and national recognition as a sustainable approach to stormwater management and benefits to flow/volume reduction that lead to less stream modification.

The City will continue to focus on the importance of trees and riparian buffers as a stormwater management tool in conjunction with its next stormwater manual update. Finally, the City will continue ensuring the proper function of both Public and Private Water Quality Facilities.

The SWMP is organized to mirror Section 40 of the Code of Federal Regulations 122.26, from which the permit is derived, in order to make it simple for any reviewer to see how the City is meeting all of its legal requirements. There are now six major components. The first four mirror the stormwater management plan requirements described in 40 CFR 122.26 (d) (2) (iv) (A) through (D) and Schedule A 4. through 7 in the permit. Because some of the requirements in components 1-4 are addressed by public education BMPs, these are grouped into a fifth component. Finally, a sixth component of management activities, Program Management & Monitoring, has been created in order to capture other important elements of the permit requirements that require a significant amount of time to implement, but are not BMPs in and of themselves.

Gresham's Proposed SWMP

Section 7.0 contains an explanation of the contents of the six major components of organization as described above that make up the SWMP and a description of each BMP, the purpose, program commitment (measurable goals) and reporting elements.

2.0 INTRODUCTION

Under the federal Clean Water Act and Oregon Revised Statute 468B.050, DEQ has issued the City of Gresham a National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) Discharge Permit. The City of Gresham is required to develop a Stormwater Management Plan (SWMP) as described in the Clean Water Act (CWA) 40 CFR 122.26 (d) (2) (iv) (A) through (D) and in Schedule A of the 2010 NPDES MS4 Permit #101315. The primary component of the SWMP is a management program comprised of Best Management Practices (BMPs) and other management activities developed to address the elements as detailed in the CWA and in Schedule A 1. through 4., Schedule B 5. and 6. and Schedule D 1., 4, and 7. of the permit. These are actions Gresham will take to minimize pollutant discharge into surface waters to the maximum extent practicable (MEP) in order to protect water quality and satisfy requirements of the NPDES MS4 Permit and the CWA.

This SWMP draft proposes only minor changes to the one previously adopted in 2011 and is being released for public comment prior to the Permit Renewal Submittal in December 2015. Given that the previous SWMP went through an extensive public review process and maximum extent practicable determination from Gresham City Council, the City considers this an administrative extension of the SWMP and Council Resolution 2829 of MEP.

Water Resources Division

Stormwater Management Plan History and Updates
A SWMP was developed by Gresham to meet NPDES MS4 permit requirements in 1995. Ongoing implementation of the SWMP was conducted during the five-year permit period from 1995 to 2000.

In February 2000, the City submitted a renewal package to DEQ as required. However, DEQ postponed issuance of the second 5-year permit until 2005. During this time, the City was legally operating under the 1995-2000 permit, but submitted a more detailed SWMP dated December 2001, as part of its adaptive management process.

In March, 2004, DEQ issued the renewed NPDES MS4 permit, which was later reconsidered, modified, and reissued in July 2005 and was set to expire on January 31, 2009. The permit required the City to prepare

> *…an evaluation of, and proposed revisions to, the SWMP that address the requirements of Schedules D(2)(b) and B(1)(b), including the rationale supporting the proposed revisions.*

Schedules D(2)(b) and B(1)(b) of the 2005 permit included details related to conducting a SWMP evaluation and preparation of a Monitoring Plan, respectively. This update was referred to as the Interim Evaluation Report (IER) and was submitted to DEQ on May 1, 2006. The IER documents, including the updated SWMP and Monitoring Plan, were approved on July 31, 2006. An updated SWMP was prepared and submitted in the City's permit renewal package on August 1, 2008. The City continued to implement the 2006 SWMP until DEQ reissued the permit on December 30, 2010 and approved the corresponding updated SWMP. The 2010 permit required the City to make further changes to some of the measureable goals within the SWMP as described in Schedule D 7. Furthermore, the permit authorized the City to make administrative changes necessary to make the SWMP references and language consistent with the final permit and submit the final SWMP to DEQ by April 1, 2011.

A summary of the rationale for the revisions made for the 2015 SWMP update is described in **Section 6.0.**

The detail of the SWMP is included in **Section 7.0** which includes tables of the City's BMPs.

3.0 DESCRIPTION OF THE PERMIT AREA, CO-PERMITTEES, AND SERVICE AREA EXPANSION

This section provides a description of Gresham's portion of the permit area and changes that have occurred since the first NPDES MS4 permit was issued in 1995, watershed boundaries within the permit area, and the history of the co-permittees.

A. Gresham Permit Area & Watersheds

The NPDES MS4 permit area for Gresham includes the incorporated areas (the city limits) of the City of Gresham except the portions of the City's stormwater system that drain to Underground Injection Control (UIC) systems. UICs drain to groundwater and are subject to a Water Pollution Control Facility (WPCF) permit. The Best Management Practices (BMPs) described within this Stormwater Management Plan (SWMP) are applied throughout the entire city urban services boundary, including the areas draining to groundwater.

Metro's urban growth boundary in the Gresham area was adjusted in 1998 and 2002 to include the areas known as Pleasant Valley, Kelley Creek Headwaters and Springwater Plan Areas. Gresham's city limits were adjusted in 2003 to exclude area that was de-annexed to the City of Troutdale within the Beaver Creek watershed. Gresham has entered into agreement with other local jurisdictions that describe which entity will be responsible for providing urban services to the areas within the urban growth boundary. Development of area within the urban growth boundary will likely proceed over the course of the next 20 years depending on economic forces and population pressure.

Approximately 541 acres in Pleasant Valley were permitted for development in June 2006 and 161 acres in Springwater were permitted for development in November 2007. The development of these areas are reported annually to DEQ. (See Appendix B of the City's NPDES Stormwater Annual Report available on the City's website). The Stormwater Management Plan is applied within the UGB as development occurs, which includes enforcement of the Erosion Prevention and Sediment Control and Stormwater Manual for new and redevelopment, as well as the public and private stormwater facility maintenance programs.

Another change occurred related to jurisdiction of roads within the permit boundary. Effective January 1, 2006, the jurisdiction of Multnomah County's arterial roads within Gresham were transferred to Gresham. The County continues to maintain these roads pursuant to an agreement with the City of Gresham.

The City of Gresham area *excluding* Pleasant Valley and Springwater is about 15,002 acres or 23.4 square miles. The area *including* the urban growth boundary of Pleasant Valley and Springwater represents approximately 17,000 acres or approximately 26.5 square miles. Just over 2,200 acres and 150 acres lie within the permit boundary and are managed by the City of Fairview and Multnomah County, respectively and are subject to their individual Stormwater Management Plans.

Gresham is comprised of four watersheds: Fairview Creek, Johnson Creek, Kelly Creek, and the Columbia Slough. All of these watersheds cross multiple jurisdictions. **Figure 1.0** illustrates the total area and the representative watersheds within the City of Gresham as well as surrounding jurisdictions. In addition to these surface water bodies, Gresham has water bearing underground strata that vary in depth across the city.

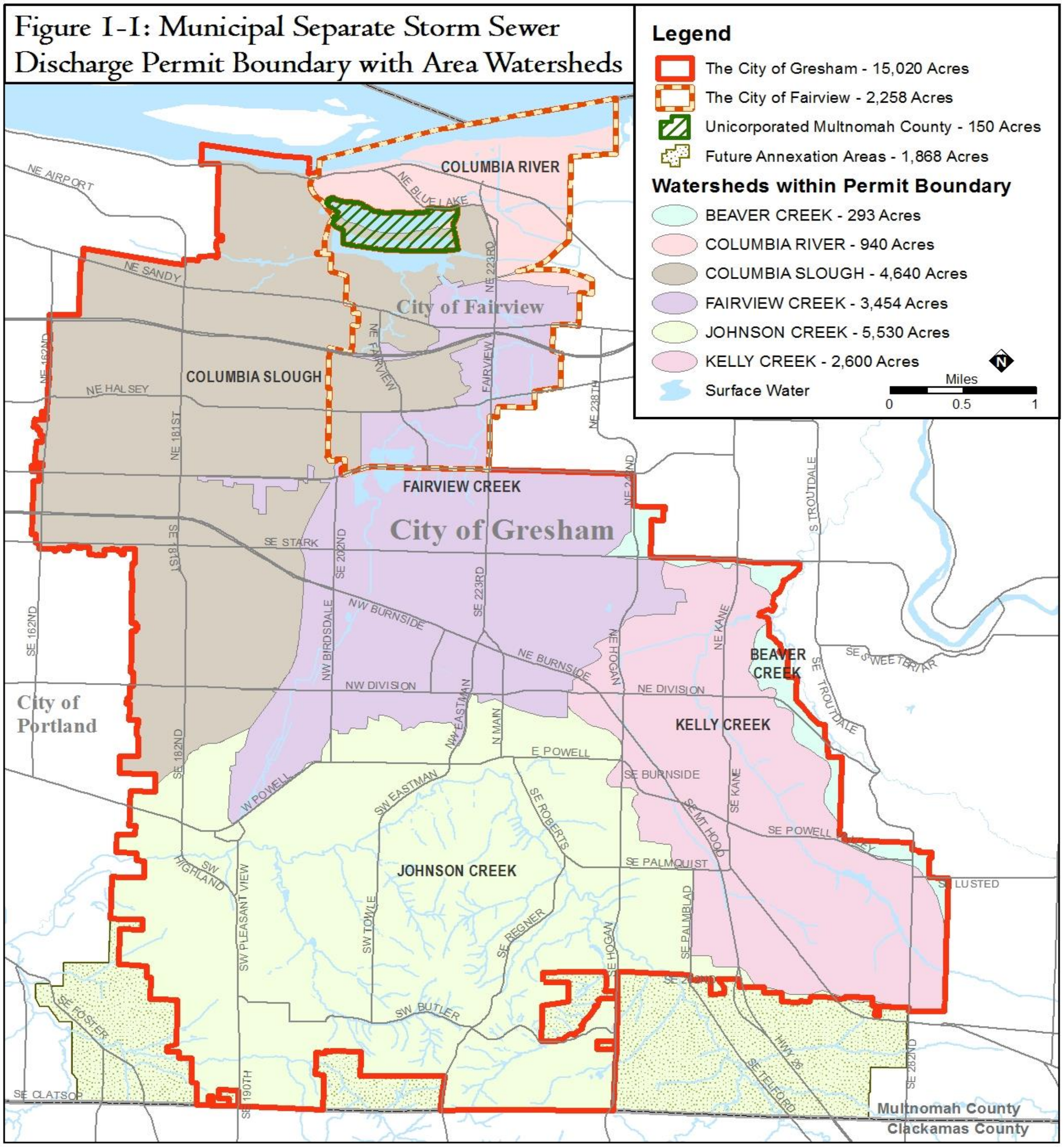
Kelly Creek & Beaver Creek

The Kelly Creek watershed within Gresham encompasses about 2,597 acres (4.1 square miles) and is tributary to the Beaver Creek watershed and ultimately to the Sandy River. The Beaver Creek watershed comprises about 293 acres (0.5 square miles) within Gresham. As described above, the urban service boundary was adjusted in 2003 to exclude a 48-acre parcel of protected Metro open space within the Beaver Creek canyon area at Mount Hood Community College. Kelly Creek originates east of Gresham and enters the city limits just a few hundred yards east of SE 282 Avenue and north of SE Dodge Park Boulevard. It flows in a northwesterly direction until its confluence with Burlingame Creek; its main tributary which lies just northwest of NE Kane Road and NE 18th Court. Most of east Gresham drains to Kelly Creek.

Johnson Creek

The entire Johnson Creek watershed encompasses 54 square miles and is a tributary of the Willamette River in the Milwaukie/Portland area. About 5,483 acres (8.6 square miles) lie within Gresham's permit area. Although Johnson Creek does not originate in Gresham, some of the upper reaches of the creek flow through the City of Gresham. Presently, Johnson Creek enters the Gresham city limits at approximately SE 252 Avenue and SE Telford Road, flows in a northwesterly direction to Powell Boulevard and Main Avenue, then generally westward until it leaves the city limits near its intersection with SE 174 Avenue. Butler Creek, a significant tributary of Johnson Creek in Gresham, enters Johnson Creek a few hundred yards east of SW Pleasant View Drive. Much of south Gresham, including the downtown area, is located in the Johnson Creek watershed.

Figure 1. Note: This map includes both the portions of the City of Gresham that drain to surface waters subject to the NPDES MS4 permit and the Underground Injection Control Facility areas draining to groundwater that will be subject to the requirements of a WPCF Permit.



Fairview Creek

The entire Fairview Creek watershed encompasses approximately 3,454 acres (5.4 square miles) and is a tributary to Fairview Lake. About 4.3 sq. miles lie within Gresham's permit areas. Fairview Creek is also recognized as the headwaters of the Columbia Slough. The creek originates within Gresham city limits near West Powell Boulevard and SE 182 Avenue. The creek flows in a northeasterly direction though Gresham and enters Fairview just west of 223 at NE Glisan Street, and remains within the City of Fairview's jurisdiction for its remaining length. The Fairview Creek watershed encompasses most of the City of Fairview and the north-central part of Gresham.

Columbia Slough

The entire Columbia Slough watershed encompasses approximately 62 square miles, of which about 4,640 acres lie within the Cities of Gresham and Fairview. About 6 sq. miles are within Gresham's permit area. The headwaters of the slough begin with Fairview Creek in the City of Gresham, flowing north to Fairview Lake in the City of Fairview, then paralleling the Columbia River west from the lake to its confluence with the Willamette River. While there are several major piped stormwater outfalls within west Gresham that drain and discharge directly to the slough, the majority of the west Gresham's drainage is served by drywells, also known as underground injection controls that drain to groundwater. For mapping purposes the northwest Gresham area is demarcated as the Columbia Slough.

Groundwater

Discharges to groundwater are not subject to the requirements of the NPDES MS4 permit. However the BMPs described within the SWMP at the time of this submittal have historically been applied in the same manner irrespective of the above or below-ground nature of the receiving water body. The City's Water Pollution Control Facilities (WPCF) Permit was issued on December 10, 2012. The City's approach to BMP implementation did not change as a result of the permit issuance, but rather continues to administer the SWMP and Stormwater Monitoring Plan throughout the city boundary. Maps showing depth to groundwater based on a recent study by the US Geological Survey are available upon request, and are shown in the City's submittal to DEQ titled, "December 31, 2008 Update to WPCF Permit Application."

B. Description of Co-permittee Coordination Efforts

With respect to NPDES MS4 permit co-permittees, the City of Gresham acted as the lead permit applicant for the Gresham NPDES MS4 submittal in 1993, 1995, 2000, 2006, 2008 and 2015. A complete overview of the permit history may be found in **Section I.** Introduction. Although Gresham is the lead permit applicant, the co-permittees are responsible for development, implementation, and tracking of their jurisdictions' BMPs as well as submitting their respective annual reports to be collated with Gresham's annual compliance report and then submitted to DEQ. Gresham's responsibility is coordination of the program, communication with DEQ, and submittal of the annual report from each co-permittee. Costs associated with these activities have been partially reimbursed by the other co-permittees according to intergovernmental agreements (IGAs) or MOAs developed by the jurisdictions. However, as of the 2010 NPDES MS4 permit reissuance, Multnomah County was issued its own permit and is no longer be a co-permittee of the City of Gresham or the City of Fairview. Multnomah County has an intergovernmental agreement with Gresham to conduct elements of their environmental monitoring, and an IGA also exists with the City of Fairview to implement the monitoring requirements of the permit on their behalf, as well as other coordinated permit compliance work.

During the first permit application, Gresham, Fairview, and Multnomah County employed the same 35 BMPs. However, during subsequent permit renewals, all of the co-permittees modified their respective BMPs to best suit the needs, goals, and requirements of their respective jurisdictions.

C. Service Area Expansion

I. Background

As acknowledged by the 2010 renewal of the City's original 1995 stormwater permit #101315, the urban service boundary has been expanded from its original approximately 15,000 acres to become 17,000 acres including the area within the urban growth boundary (UGB)[1]. The UGB includes three planned areas known as Pleasant Valley, Springwater and Kelley Creek Headwaters.

The City's permit states the following:

> SOURCES COVERED BY THIS PERMIT:
> *This permit covers all existing and new discharges of stormwater from the Municipal Separate Storm Sewer System (MS4) within the incorporated areas of the City of Gresham and City of Fairview including, upon annexation into the City of Gresham, the Pleasant Valley Plan District, Springwater Plan District, and the Kelley Creek Headwaters Plan Area, which are located south and east of current city limits of the City of Gresham and within the approved Metro Urban Growth Boundary.*

In 2008, the Oregon Department of Environmental Quality (DEQ) requested a Land Use Compatibility Statement from the City because of the physical expansion of the City's Urban Service Boundary to include the three planned areas. (See Appendix A) Based upon the LUCS, DEQ found that the City of Gresham has acknowledged Comprehensive Plan provisions and land use regulations that are compatible with the 2010 permit provisions.

The Land Conservation and Development Commission (LCDC) has concluded that a determination of compliance with the statewide planning goals and compatibility with acknowledged comprehensive plans is not needed for the renewal of an existing permit except in certain circumstances. A LUCS is required for the *renewal* or *modification* of a permit if DEQ "determines the permit involves a substantial modification or intensification of the permitted activity." OAR 660-031-0040

OAR 340-018-0050(2)(b)(B) sets out three relevant circumstances in which "[m]odification permits" require a LUCS: where the activity (1) relates to use of additional property or a physical expansion on the existing property, (2) involves a significant increase in discharge to state waters or into the ground, or (3) involves the relocation of an outfall outside of the source property.

Because the prior permit included consideration of the area within the urban growth boundary, Gresham's MS4 permit renewal application does not constitute a substantial modification or intensification of currently permitted activity. Therefore, a LUCS is not required.

In addition to its Comprehensive Plan the City has other adopted code, manuals and plans that govern the management of stormwater impacts from development or redevelopment within the existing city

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[1] City of Gresham and City of Fairview National Pollutant Discharge Elimination System Permit Municipal Separate Storm Sewer System Proposed Permit Evaluation Report and Fact Sheet December 30, 2010.

boundary and the future development of planned areas within the UGB. These documents are also available on the City's website at GreshamOregon.gov and include:

- Basin Master Plans
- New Community Master Plans
- Green Development Practices Manual
- Stormwater Manual
- Public Works Standards

II. Findings
During the years of 2006 to 2008, approximately 718 acres (36%) of the planned area were permitted for development. Since the issuance of the 2010 permit, the City has issued permits for the development of an additional 40 acres (2%) of the planned area. The permit applications received by the City are reported in the City's Annual Reports to DEQ.

While it is unknown precisely how many acres will develop during the next permit cycle, it is anticipated to be a fraction of the remaining total acres. No additional physical expansions of the urban service boundary are expected. As such, this permit renewal package and updated Stormwater Management Plan and above referenced City code, manuals and plans will continue to limit the impacts of stormwater intensity and its associated pollutant loads on local streams. Furthermore, the permit renewal package includes a summary of the Total Maximum Daily Load (TMDL) Pollutant Load Benchmarks that set forth projections of the City's combined work to result in a net decrease in stormwater pollution discharges during the next permit cycle.

4.0 GRESHAM'S STORMWATER MANAGEMENT PROGRAM ORGANIZATION

Gresham's Department of Environmental Services' (DES) Water Resources Division (formerly called the Watershed Division) undertakes a majority of the responsibilities for development and implementation of the City's SWMP. There are, however, required components of the program where implementation and tracking must occur in other City divisions, departments, and groups. The divisions within Gresham that are responsible for implementation of the NPDES program are described below. DES is comprised of the city utilities, providing services such as delivery of drinking water, collection and treatment of wastewater, recycling & solid waste disposal, maintenance of streets, stormwater management, and parks and recreation activities. The City recently reorganized its water utilities into one Division called the Water Resources Division which includes the functions as described below, along with the other DES functions.

- The **~~Watershed Division~~Water Resources Division (WD)**, formerly called the **Stormwater Division,** works to improve flood protection and water quality through the construction and maintenance of the public stormwater system and protection of local waterways. This division is responsible for management of Gresham's programs that address all stormwater water quality regulatory requirements listed above, monitoring of storm and surface water; erosion control inspection and enforcement; stormwater capital improvements; stormwater operations and maintenance, engineering and flood control and stormwater public involvement and education of staff, as applicable and the general public. The Water Resources Division is also tasked with supporting and providing guidance to other divisions within the city regarding the NPDES MS4 permit. There are groups within WD that play very specific roles in implementation of the NPDES MS4 program and, ultimately in implementing the SWMP.

- **Stormwater Operations and Maintenance Group** is responsible for maintaining all public conveyance and water quality components of Gresham's stormwater drainage system including surface water quality facilities and the structural conveyance system, identifying illicit connections, responding to accidental spills, and assisting in mapping updates.
- **Stormwater Engineering Group** is responsible for planning, designing, and constructing capital improvement projects within the Water Resources Division.
- **Water Sciences~~Resources~~ Group** within WD is responsible for meeting regulatory requirements including NPDES MS4, UIC, Endangered Species Act, Oregon Planning Goal 5, and TMDL programs. This group handles~~e~~ **Public Involvement and Education, Water Quality Monitoring, TMDL and UIC Compliance, Natural Resource Program, Land Acquisition, Public and Private Water Quality Facility Program, Illicit Connection and Spill Enforcement and Program science and data analysis.** ~~staff currently comprise the Water Science and Policy Group.~~
- **Water Regulatory Group** is responsible for assisting with the business compliance and inspection program for wastewater and stormwater.

Other DES groups include:

- The **Transportation Division** is responsible for street improvements, maintenance, and repair, street cleaning, street lighting, and some signs and signals within city limits. NPDES MS4 components that include the Transportation Division are road maintenance, street sweeping, limiting and tracking their Division's use of pesticides and herbicides, and de-icing material management.
  - The **Public Works Inspection Group** (housed within the Transportation Division) implements the commercial/industrial erosion prevention and sediment control inspections during construction.
  - **Development Engineering** is responsible for the review and permit approval of development and re-development including implementation of the stormwater *Water Quality Manual, as well as the Green Development Practices Manual.*
- The **Water Division** provides planning, design, construction, operation, and maintenance of the public drinking water systems. The flushing of water lines, emergency system repairs and limiting and tracking of their Division's use of pesticides and herbicides are activities the Water Division undertakes that fall within the NPDES MS4 permit.
- The **Parks and Recreation Division** operates, maintains, plans, and acquires Gresham's parks. Of the parks within Gresham, eight are directly adjacent to open waterways. The Parks Division is responsible for limiting and tracking of their Division's use of pesticides and herbicides, maintenance of litter receptacles, using native vegetation where appropriate, reporting dumpsites, and reporting unusual discharges in the waterways.
- The **Wastewater Services Division** is responsible for sanitary sewer master planning, design, review, and contract administration of new infrastructure projects; compliance with the City's wastewater NPDES permit; maintaining the public system to help prevent sanitary leaks or infiltration into the stormwater system; limiting and tracking of their Division's use of pesticides and herbicides; and implementing the Pre-Treatment Industrial Inspection program to monitor industrial point source discharges to the sanitary system and, where applicable, impacts to the stormwater system. Wastewater Services also manages the 1200COLS stormwater permit for the wastewater treatment plant.
- **The Recycling & Solid Waste Program** is responsible for managing curbside garbage, yard debris, used oil, & recycling collection and implements programs that foster waste prevention and all public education efforts related to these activities for businesses and residents. This group also assists Metro Regional Services with delivery of household hazardous waste collection events.

Other city offices having a role in the stormwater NPDES-MS4 program include:

- **The Mapping Program** is responsible for supporting various program monitoring efforts such as mapping the public infrastructure, mapping streams, watersheds, maintenance schedules, etc.
- **The Community Relations Program** is responsible for supporting all public involvement and education efforts for DES.
- **Code Compliance** is responsible for enforcement of city code and ordinance violations.
- **Facilities Maintenance** is responsible for maintaining various city-owned properties and utilizing stormwater best management practices to limit pollutant sources.
- **Community & Economic Development Department** assists with short and long range planning for city development that is codified in the Community Development Plan (Vol 1-3).
- **City Attorney's Office** assists with review of the Legal Authority element of the NPDES permit as well as regular updates to city code.
- **Fire & Emergency Services** assists with spill response (HAZMAT team) and wellhead protection area inspections related to hazardous chemical storage.

See **Figures 2.0 and 3.0** which are organization charts for the Department of Environmental Services and the Water Resources Division, respectively.

Figure 2.0 Department of Environmental Services Organization Chart

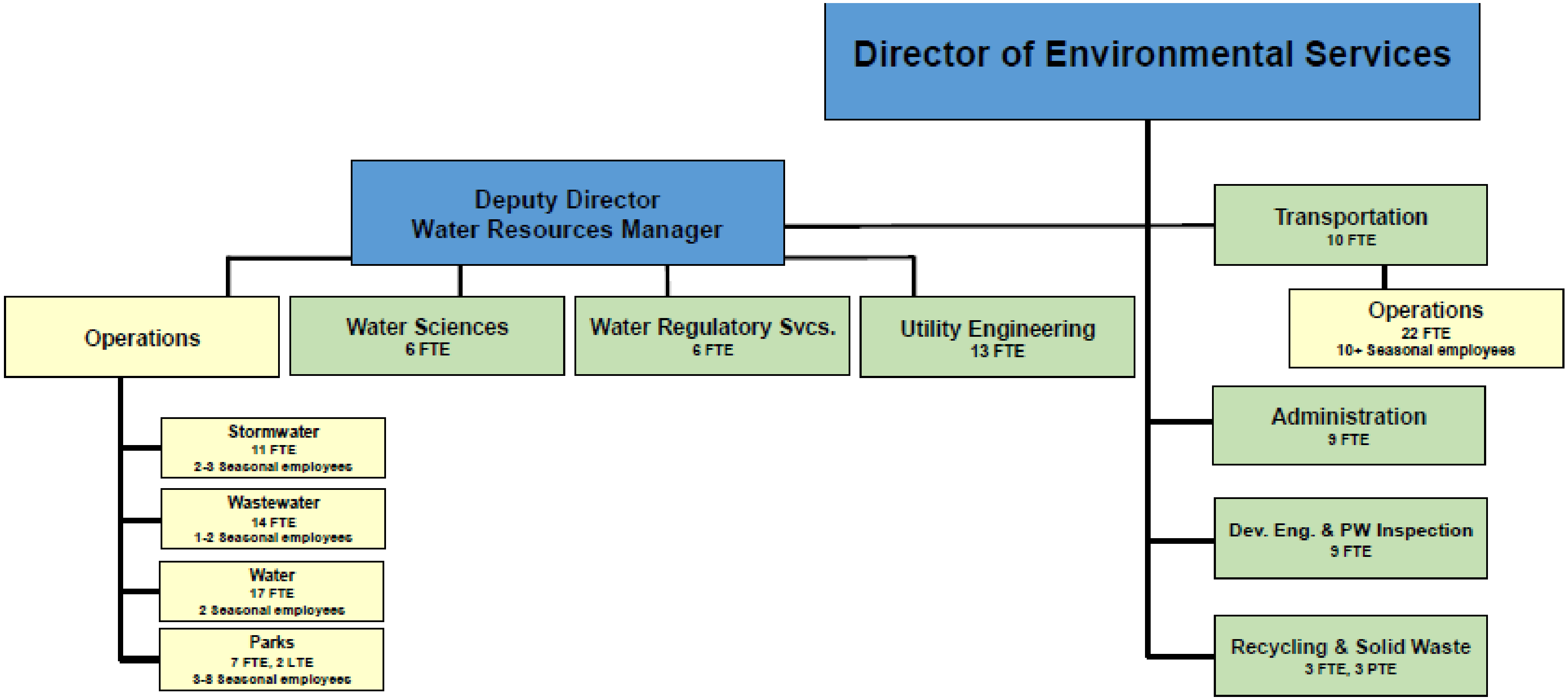

Figure 3.0 WATER RESOURCES DIVISION ORGANIZATION CHART
Brian R. Stahl, Manager

Utility Engineering

WATER – Mike Whiteley
John Aho
Jason Branstetter
Rick Lillie

WASTEWATER/STORMWATER COLLECTION – Jim Montgomery
Jeff Loftin
A.J. Thorne
Jeremy Provenzola
- Rob Stahle
- Chris Chambers

WASTEWATER TREATMENT – Alan Johnston
Mike Nacrelli
Jeff Maag

Water Regulatory Services	**Water Sciences**
Keely Thompson – Environmental Program Manager	**Torrey Lindbo – Environmental Program Manager**
Clay Walker	Keri Handaly
Jesse Engum	Kathy Majidi
Paul Kramer	Katie Holzer
Diana Lindoff	Karen Bromley
Robin Pederson	Mike Wallace

5.0 Maximum Extent Practicable Determination Process

NPDES MS4 permittees must develop and implement a stormwater management program to reduce the discharge of pollutants to the maximum extent practicable (MEP). This program must address the elements as required by 40 CFR 122.26 (d)(2), Section iv, Proposed Management Program and the City's NPDES MS4 Permit No: 101315. The program elements and implementation goals are described in the Stormwater Management Plan (SWMP), and other procedures and policies are described within a variety of city documents and plans as referenced within the SWMP, where applicable. These program elements vary by permitted municipality because they take into consideration site-specific conditions.

The City of Gresham developed and established the program that met MEP as part of their original 1993 permit application, which has become the foundation of the City's program since the Phase 1 NPDES MS4 permit was issued in 1995. **The overall program has been continuously evaluated and adaptively managed based upon new data, technology, and/or program evaluation of individual best management practices with on-going oversight and approval from the Oregon Department of Environmental Quality. As such, this updated SWMP reflects the City's best professional judgment regarding resource allocation and optimization to reduce or eliminate the discharge of stormwater pollutants from the MS4 system based upon site-specific conditions and other factors as described further below.**

The City of Gresham has used the following sequential processes to ensure its SWMP meets the MEP standard:

I. The original development of the SWMP submitted with the 1993 permit application.
II. The continual adaptive management process reported in annual reports and the following updates to the SWMP:
  a. The SWMP review conducted for the 2000 permit renewal application.
  b. The SWMP review conducted for the 2006 Interim Evaluation Report.
  c. The SWMP review conducted for the 2008 permit renewal application.
  d. The SWMP review conducted for the 2015 permit renewal application.

These processes are described below.

I. PERMIT APPLICATION (1993)

To comply with requirements set forth by the 1987 amendments to the Clean Water Act, the City of Gresham and its co-permittees (City of Fairview, Multnomah County, and the Oregon Department of Transportation) submitted Part 1 of the NPDES MS4 permit application in May 1992, which contained a brief description of existing management programs implemented by the co-applicants. No comments were received from DEQ on this section of the Part 1 application; therefore, no adjustments were made.

The Part 2 application contained a SWMP that was designed to address the most critical existing storm water quality problems, as identified within the permit area. Gresham and co-permittees participated in workshops to define the problems and develop strategies to address them. Pollutants of concern were identified using a national literature search and from data collected locally by the City of Portland.

A public process was held to elicit the public's concerns, understanding, priorities and willingness to support a stormwater management program that included stormwater consultants, watershed committee representatives, developers, and a neighborhood association representative. One hundred and twenty candidate BMPs were identified and selection criteria were developed in order to prioritize the BMPs based upon available and future projected resources to support their implementation. The factors included:

a. Lifecycle costs
b. Meets a regulatory requirement
c. Addresses a pollutant of concern
d. Ability to implement (included public acceptability and willingness to pay)
e. Reliability/Sustainability

Based upon scoring criteria applied by committee representatives, the BMPs were narrowed to 45. Using professional feedback, detailed BMP fact sheets and another complete review by City staff and its co-permittees, the BMPs were narrowed to the 35 that were submitted and accepted in 1993.

II. ADAPTIVE MANAGEMENT

As described in the NPDES MS4 permit in Schedule B 2. b. and Schedule D 4. Adaptive Management, the City follows an annual adaptive management process to assess and modify, as necessary, program elements to achieve reductions in stormwater pollutants to the maximum extent practicable. This includes consideration of available technologies and practices; review of monitoring data generated by the implementation of this Plan and corresponding analysis of the data; review of SWMP measurable goals and tracking measures; and evaluation of City resources available to implement the technologies and practices.

To ensure the on-going effectiveness of the City's SWMP, the BMPs are evaluated annually during the preparation of the NPDES Annual Report to DEQ. The Annual Reports include the following:

a. The status of implementing the components of the SWMP.
b. Proposed changes to the SWMP components and/or newly proposed BMPs.

III. PERMIT RENEWAL SUBMITTAL (2000)

The City's NPDES MS4 Permit requires a permit renewal submittal to be completed 180 days prior to the permit's expiration. As such, the City's renewal submittal consisted of an updated SWMP with the rationale for the proposed changes. At this time, the Oregon Department of Transportation was removed as a co-permittee in order to receive its own permit.

During the permit renewal process, third party environmental groups expressed concern that the DEQ permit was not protective enough to ensure that creeks, streams and rivers would eventually meet water quality standards. As a result, DEQ convened an advisory group to help determine what water quality goals would be included in the new permits; a process that lasted over three years. In March 2004, the City's new permit was issued and later reconsidered as a result of a third party appeal. The permit was reissued in 2005 and contained more specific requirements relating to the SWMP including:

a. The establishment of performance measures aimed at assisting with SWMP evaluation,
b. Estimates of pollutant load reductions based upon what is known about BMP effectiveness,
c. The evaluation of progress towards meeting those estimates,
d. The application of an adaptive management process until the estimates are projected to be achieved, and
e. An overall evaluation of the SWMP.

IV. INTERIM EVALUATION REPORT (2006)

Because of the five year delay between the 2000 permit renewal submittal and the reissuance of the next permit, DEQ required that the City and its co-permittees prepare an "Interim Evaluation Report" that included:

a. A review of the City's estimated progress towards meeting the established Total Maximum Daily Loads for permitted streams,
b. An analysis of the SWMPs ability to help reduce pollutants on the 303(d) List for permitted streams,
c. A review of sources of non-stormwater discharges, and
d. A review of the previously submitted SWMP and Monitoring Plan with proposed updates.

Related to this effort, the City hired a consultant team with a national reputation for expertise in stormwater to assist in the review of its programs and the preparation of some of the documents listed above. Additionally, the City prepared BMP fact sheets and related cost and staffing estimates in order to conduct a formal review process. The City convened a SWMP advisory subcommittee to the standing Environmental Services Council Advisory Committee (ESCAC). Known as the "SWMP Working Group," this committee was comprised of a variety of stakeholders including citizens, developers, local Watershed Councils and business owners that met eight times, including a half-day workshop that resulted in the final recommended package of potential BMP enhancements. Two package options were provided to City Council for consideration, both required additional resources, but one was significantly more costly than the other.

In order to assist City Council in the decision making process, the City conducted a statistically representative survey of Gresham utility rate payers to assess willingness to pay for the proposed enhancements. The results were interpreted by the City's survey consultant to mean that if the stormwater fee increase necessary to pay for the more costly package were put to a vote, the measure would fail. Thus, while City Council did consider the merits of the full package enhancements, they determined that the lower cost option was the appropriate level of effort, given the many demands on City resources. A complete description of the MEP determination process may be found in Section 2.4 of the 2006 SWMP.

V. PERMIT RENEWAL SUBMITTAL (2008)

As with the 2000 Permit Renewal Submittal, the City's 2008 submittal package is due 180 days prior (August 1, 2008) to the expiration of the NPDES MS4 permit (January 31, 2009). Prior to this renewal submittal, the City worked with DEQ and other Phase I NPDES municipalities to develop a standardized template for a process to make an MEP determination that included the following three factors:

- **Program Effectiveness**: Describe how your program continues to address pollutants of concern in MS4 discharges to local receiving waters.
- **Local Applicability**: Describe how your program continues to be appropriate for local conditions (climate, geology, hydrology, MS4 size, etc.).
- **Program Resources:** Describe how you continue to allocate program resources appropriately (e.g., current ability to finance the program, capacity to perform operation and maintenance, tax base, public acceptability).

The City's overall process to arrive at the proposed SWMP and Monitoring Plan is as follows:

- Internal reviews to optimize BMPs
- Review of technical information from external sources and monitoring data, including a formal literature search
- Review data collected by staff and knowledge of program effectiveness
- Discussion with other jurisdictions concerning best practices
- Consideration of fiscal constraints
- Input from the general public
- Deliberation by Council

Steps that led up to revising the SWMP submitted to City Council included:

- Discussion with other Phase I permitted municipalities regarding commonalities and technical issues. The group also asked about what issues DEQ would like to see addressed in the next updated SWMP.
- A review of the following technical documents: *MS4 Program Evaluation Guidance*, US EPA, January 2007; *Protocol for Conducting Environmental Compliance Audits under the Stormwater Program*, US EPA, January 2005; *Measurable Goals Guidance for Phase II Small MS4s*, US EPA, http://cfpub.epa.gov/npdes/stormwater/measurablegoals/index.cfm; and *Stormwater Solutions*, Oregon Environmental Council, December 2007.
- A review of the 2008 permit renewal submittal documents including:
    - Stormwater Pollutant Load Estimates and Benchmarks for TMDL Parameters,
    - 303(d) Listed Pollutant Evaluation,
    - Trend Analysis/Overall Program Effectiveness Evaluation
    - non-stormwater discharge evaluation.
- An internal review of BMPs administered by the Watershed Division using an evaluation process that included the factors listed above, as well as additional factors such as:
    - Base Program (Possible to remove the BMP if deemed less useful)
    - Ability to address other regulatory goals/mandates (ESA, Goal 5, UIC, public safety, asset management, etc.)
    - Flood Control
    - Flow Reduction (Infiltration)
    - Cost consideration
    - Universality (application treats only a small portion of pollutant sources or has a broad effect)
- A public comment period that included:
    - Advertising before the public comment period to solicit names for the City's interested person's list (*Oregonian* and the *Outlook—total of five ads)*
    - Release of the draft documents to the general public via the City's website, a press release to the local newspapers, and ads in the *Oregonian* and the *Outlook* (notices ran on ten days total)
    - Direct mail and email to persons who are on the City's interested person's list

IV. PERMIT RENEWAL SUBMITTAL (2015)

The following process was conducted for the 2015 SWMP update:

- Internal reviews to optimize BMPs
- Review of technical information from external sources and monitoring data and a literature search
- Review data collected by staff and knowledge of program effectiveness
- Discussion with other jurisdictions concerning best practices
- Consideration of fiscal constraints
- Input from the general public and specific stakeholders such as Watershed Councils and the City's Natural Resource Sustainability Committee

This SWMP draft proposes only minor changes to the one previously adopted in 2011 and is being released for public comment prior to the Permit Renewal Submittal in December 2015. Given that the previous SWMP went through an extensive public review process and maximum extent practicable determination from Gresham City Council, the City considers this an administrative extension of the SWMP and Council Resolution 2829 of MEP.

6.0 SWMP REVISIONS AND RATIONALE FOR THOSE REVISIONS

I. Purpose

The purpose of this section is to summarize the 2015 updated SWMP as compared to the 2011 SWMP and to explain the rationale for the proposed changes.

Because Gresham's SWMP is established and mature and its permit has not yet been reissued by DEQ, the plan edits primarily reflect updates for accuracy of nomenclature and program details as they have evolved since the program was written. Some language has been deleted because the tasks are complete or have been absorbed into other BMPs, where noted. To update the document, the Water Resources Division (WD) notified each group or division responsible for BMPs that were not directly implemented by WD. Each person in charge of reporting and monitoring the particular BMP was asked to review the existing commitments and suggest any changes. **No enhancements are currently proposed.** The Water Resources Division conducted an internal review process of the BMPs that are directly implemented using the stormwater fees from ratepayers. The review and consideration of each of the BMPs effectiveness at the current rate of implementation consisted of the process described in **Section 5.0**.

II. Focus of the Stormwater Management Plan (2011 & 2015)

During the 2006/08 update, additional emphasis was placed primarily on the following BMPs: Erosion Prevention and Sediment Control, Business Inspection Program, and Monitoring Program. Since then, a 1 FTE staff position for the Business Inspection Program was created and filled, and the .75FTE position for erosion control was increased to 1 FTE. Therefore, in the 2011 update to the SWMP, additional pollution reduction is expected to be gained from each of these BMPs via program implementation and enhancements.

During the next permit cycle, the City plans to continue its programs as previously described in the 2011 SWMP with minor updates to make the document current. During the last permit cycle, the City has developed and implemented efforts that now reflect mature public and private water quality facility inspection and maintenance, stormwater facility monitoring to collect performance data, business inspections and also enhanced its erosion program standard operating procedures based upon an EPA audit and feedback. The BMPs within the 2015 SWMP are running smoothly and are considered current technology, scientifically relevant, industry accepted, and reflect best professional judgement as to what level of effort is a priority for making the biggest contribution towards water quality protection and enhancement. **Therefore, no programmatic additions are proposed at this time.**

III. Proposed Changes (2015)

General changes to the SWMP include the following:

- Some of the BMPs and their respective Program Goals in the 2011 plan were related to short-term planning activities or studies that were completed during the last permit cycle and were therefore removed or combined with other activities and reporting statements for simplicity and brevity.

- Language has been clarified to reflect basic administrative changes within the City and over time as programs have evolved. Measurable Goals were updated, if applicable.

Table 1.0 Rationale for Changes to Gresham's Stormwater Management Plan

BMP or Task Name	Explanation of the Proposed Change
RC 1 Operations and Maintenance Program • Pipe cleaning • Catch basin cleaning • Public Water Quality Facility Program Ensure Proper Disposal Master Plan Update	Updated the numbers of facilities and level of effort based on historical averages, infrastructure growth by type and available staffing resources for cleaning rates. Updated text for accuracy* and clarity. Updated text for accuracy* and clarity.
RC 2 Planning Procedures Water Quality Manual Deleted Promote Low Impact Development Practices BMP Updated BMP task called "Private Water Quality Facility Maintenance Program" Urban Tree Canopy	Updated text for accuracy* and clarity. The City has integrated low impact development into its code and manuals for new and redevelopment. It is now a common practice and does not require a separate BMP. This concept is reported with the Water Quality Manual BMP commitment to track and report all facilities installed across the city. Reflects mature program. Updated text for accuracy* and clarity.

RC 3 Maintain Public Streets RC 4 Retrofit & Restore System for Water Quality RC 5 Monitor Pollutant Sources from Closed or Operating Municipal Waste Facilities RC 6 Reduce Pollutants from Pesticides, Herbicides and Fertilizers ILL 1 Non-Stormwater Discharge Controls ILL 2 & 3 Illicit Discharges Elimination Program • Field Screening and Investigation ILL 4 Spill Response Program	Updated text for accuracy* and clarity. Deleted completed tasks.
ILL 5 Facilitate Public Reporting ILL 6 Facilitate Proper Management & Disposal of Used Oil & Toxics	Updated text to maintain accuracy* and clarity.
ILL 7 Limit Sanitary Sewer Discharges	Updated text to maintain accuracy* and clarity.
IND 1 & 2 Industrial Inspection & Monitoring • Business Inspection Program	Reflects mature program.
Con 1 & 2 Construction Site Planning & Controls	Updated text to maintain accuracy* and clarity.
Con 3 Construction Site Inspection & Enforcement	Updated text to maintain accuracy* and clarity.
EDU 1 Stormwater Education Program	Updated text to maintain accuracy* and clarity.
MON 1-5 Program Management & Monitoring	Updated text to maintain accuracy* and clarity.

*Use of the word “accuracy” does not mean the previous BMP description was incorrect; rather the procedures for BMPs may change slightly over time because of technology or other procedural policies.

7.0 GRESHAM’S SWMP

As described above, this stormwater management plan is organized into the six major components listed below.

Component #1. Structural and Source Control BMPs to Reduce Pollutants from Commercial and Residential Areas (see Table 2.0)

Component #2. A Program to Detect and Remove Illicit Discharges and Improper Disposal into the Storm Sewer System (see Table 3.0)

Component #3. A Program to Monitor and Control Pollutants from Industrial Facilities (see Table 4.0)

Component #4. A Program to Reduce Pollutants in Stormwater Discharges from Construction Sites (see Table 5.0)

Component #5. Public Education BMPs (see Table 6.0)

Component #6. Program Management and Monitoring (see Table 7.0)

For each component, the SWMP includes an overview that lists the CFR citation and DEQ issued permit requirements and a BMP to satisfy those requirements.

Each BMP contains the following information:

- Purpose
- Targeted Pollutants that are addressed by that BMP
- Individual tasks that will be carried out as a result of that BMP including:
  - The responsible group
  - A description of implementation activities
  - Program commitment*
  - Permit year of commitment
  - Program goals (if any)**
  - Measurable Goals***

*Program Commitment includes the timeline for which the BMP will be initiated, implemented, or completed. "Ongoing" refers to an annual commitment to continue the BMP for the duration of the permit term.

**Program Goals are activities that the City has identified as potential program enhancements, should additional resources (staff time and budget) become available. The program commitments as stated presume that no additional resources will become available other than what is currently allocated. Moreover, in some cases, initiatives are planned for discussion and recommendation, but most are subject to legal review and City Council approval and are therefore not commitments at this time.

***Measurable Goals include the reportable outcome that will be tracked, recorded and reported in the annual report, such as street miles swept, debris removed, number of trees planted, number of persons reached, etc. Location is city-wide, unless otherwise noted.

7.1 Component #1 (RC 1-7)
Structural and Source Control BMPs to Reduce Pollutants from Commercial and Residential Areas

Requirements listed below are from 40 CFR § 122.26 (d)(2)(iv)(A) and are further described in the NPDES MS4 permit as cited. The Gresham BMP activity titles are listed below each requirement. The details of the BMPs are listed in **Table 2.0**.

(1) Maintenance activities and a maintenance schedule for structural controls to reduce pollutants (including floatables) in discharges from municipal separate storm sewers. NPDES MS4 permit Schedule A. g. Pollution Prevention for Municipal Operations i. and h. Structural Stormwater Controls Operations and Maintenance Activities

RC 1 Stormwater System Maintenance Program:

- Pipe Cleaning
- Catch basin Cleaning
- Maintain Public Water Quality Facilities
- System Repair and Maintenance
- Manhole (Sedimentation & Control Release types) and Detention Line Cleaning
- Ensure Proper Disposal
- Underground Injection Control Maintenance and Cleaning

(2) Planning procedures including a comprehensive master plan to develop, implement and enforce controls to reduce the discharge of pollutants from municipal separate storm sewers that receive discharges from areas of new development and significant redevelopment. Such a plan must address controls to reduce pollutants in discharges from municipal separate storm sewers after construction is completed. NPDES MS4 Permit Schedule A. f. Post-Construction Site Runoff , g. Pollution Prevention for Municipal Operations vi., h. Structural Stormwater Controls Operations and Maintenance Activities and Schedule A 4 d. Education and Outreach iv.

RC 2 Planning Procedures:

- Water Quality Manual for New and Re-development
- ~~Promote Low Impact Development (LID) Practices~~
- Private Water Quality Facility Maintenance Program
- Master Plan Update
- Urban Canopy Initiatives

(3) Practices for operating and maintaining public streets, roads and highways and procedures for reducing the impact on receiving waters of discharges from municipal storm sewer systems, including pollutants discharged as a result of deicing activities. NPDES MS4 Permit Schedule A g.

RC 3 Maintain Public Streets:

- Street Sweeping
- Deicing
- Standard Operating Procedures for Road Maintenance Activities

(4) Procedures to ensure that flood management projects assess the impacts on the water quality of receiving water bodies and that existing structural flood control devices have been evaluated to determine if retrofitting the device to provide additional pollutant removal from storm water is feasible. NPDES MS4 Permit Schedule A g. Pollution Prevention for Municipal Operations and Schedule A 6. Stormwater Retrofit Strategy Development

RC 4 Retrofit & Restore System for Water Quality:

- Water Quality Retrofits
- Enhance Riparian Areas

(5) A program to monitor pollutants in runoff from operating or closed municipal landfills or other treatment, storage or disposal facilities for municipal waste. The description must identify priorities and procedures for inspections and establishing and implementing control measures for such discharges. *NPDES MS4 Permit Schedule A g. Pollution Prevention for Municipal Operations*

Monitor Pollutant Sources from Closed or Operating Municipal Waste Facilities:

- Pollutant Source Evaluation

(6) A program to reduce to the maximum extent practicable, pollutants in discharges from municipal separate storm sewers associated with the application of pesticides, herbicides and fertilizer that will include, as appropriate, controls such as educational activities, permits, certifications and other measures for commercial applicators and distributors, and controls for application in public right-of-ways and at municipal facilities. NPDES MS4 Permit Schedule A d. Education and Outreach vii. and g. Pollution Prevention for Municipal Operations

(Note: See also component #5 and Table 6.0 for educational BMPs associated with this requirement).

RC 6 Reduce Pollutants from Pesticides, Herbicides and Fertilizers:

- Integrated Pest Management Program

EDU 1 Stormwater Education Program

- Educate Businesses
- Educate Residents

TABLE 2.0 - Structural and Source Control BMPs to Reduce Pollutants from Residential and Commercial Areas (RC 1-6)

BMP Descriptions	BMP Implementation	Measurable Goals	Reporting Elements
NPDES Permit Requirement – *40 CFR § 122.26 (d)(2)(iv)(A) (1) Maintenance activities and a maintenance schedule for structural controls to reduce pollutants (including floatables) in discharges from municipal separate storm sewers.* *NPDES MS4 permit Schedule A. g. Pollution Prevention for Municipal Operations and h Structural Stormwater Controls Operations and Maintenance Activities.*			
Purpose: To promote efficient and effective maintenance of the stormwater system that will lead to the removal of targeted pollutants and optimize the function and lifespan of the MS4 system.			
Targeted Pollutants: Primarily anything that adsorbs to sediment such as: phosphorus, bacteria, metals, and organic compounds, and litter, as well as pollutants that dissolve readily in water and/or carry a negative charge (e.g. soaps and surfactants, chloride, nitrate, and phosphate).			
Introductory Note With Respect to Addressing this Requirement: The City performs maintenance as needed to ensure the proper functioning of the stormwater system with respect to both flow and water quality. Over the permit term, the City will optimize the effectiveness of its maintenance activities by shifting resources among the BMPs listed below to respond to on-the-ground needs, as necessary and as part of the City's annual adaptive management process to ensure efficient and effective implementation of BMPs and notify DEQ as required by the NPDES MS4 permit. Measurable goals are provided for each BMP, but as the size of the public system continues to grow, the City may not always have proportional maintenance budget growth or staff allocations. Therefore, the level of effort on a specific BMP may vary over the permit term, but the City will endeavor to ensure that the total amount of resources does not fall below current levels.			
RC 1 Stormwater System Maintenance Program			
A. Pipe Cleaning	**BMP Owner**: Stormwater Operations & Maintenance **Implementation Activities:** The City's stormwater system currently consists of approximately 220 miles of pipes that drain to both surface and groundwater. Cleaned lines are mapped and new sections of pipe are identified for cleaning each year. When crews conduct the cleaning, they can detect off-set joints and collapsed pipe which leads to repairs that will limit pollutants from being introduced into stormwater and protects the City's investment over the long term.	**Program Commitment:** ~~Clean & I~~inspect 5-10~~15-20 (7% to 9%)~~ miles of pipe per year and clean as needed. **Permit Year of Commitment:** ongoing	- Report number of pipe miles cleaned per year and volume of materials collected per year. - ~~Track volume of materials collected per year.~~
B. Catch basin Cleaning	**BMP Owner:** Water Resources Division Operations & Maintenance group	**Program Commitment:**	- Report number of

Table 4.3.2 (continued)

BMP Descriptions	BMP Implementation	Measurable Goals	Reporting Elements
	Implementation Activities: The City currently owns approximately ~~6,200~~ 8,400 catch basins that drain to both surface and groundwater. This number grows by about 50 to 100 per year. When cleaning is complete, the catch basin lateral pipes are inspected and deficiencies are noted for repair. Maps of the maintenance areas are made annually to ensure efficient routes and scheduling.	Clean or inspect 90 to 100% ~~all (100%)~~ of publicly-owned catch basins that drain to surface water once per year. **Permit Year of Commitment:** ongoing	catch basins cleaned ~~per year.~~ and ~~- Track~~ volume of materials collected per year.
C. Public Water Quality Facility Program	**BMP Owner:** Water Resources Division Operations & Maintenance group **Implementation Activities:** The City currently owns and operates almost 350~~bout 170~~ water quality facilities and 15 miles of ditches, some of which drain to groundwater. The City maintains a database to manage the inventory, maintenance, and cleaning details of the publicly-owned water quality facilities. ~~From 2002-2007, the City prioritized the inspection and major cleaning of ponds, swales and proprietary devices. Based on these efforts, staff estimate that an average of 20-25 facilities per year will be cleaned to optimize performance.~~ During certain years, major pond rehabilitation efforts and large regional water quality facility maintenance will be necessary. Therefore, during these years, the stated goal in terms of overall quantity may not be met, but an average will be met over the permit cycle. Facility Maintenance Goals: Inspect functional condition annually: all facilities (for inlet/outlet blockage, noxious weeds) Rate sediment condition once every three-four years: all facilities Manage vegetation/remove litter annually: all facilities, if resources allow Rehabilitation of facilities (interplanting/sediment removal/design enhancement): 10-20 facilities per permit cycle* *if standard operating procedure criteria is met for criticality Regional Facilities: (4~~3~~ total)	**Program Commitment:** ~~On average, clean 20-25 (11% to 15%) facilities per year over the permit cycle. Annual cleaning totals may vary because of the intensive labor efforts needed to maintain the larger regional facilities in a particular year.~~ Inspect all facilities annually to ensure proper function Rate sediment condition of all every three to four years Annually maintenance 50% of all facilities for noxious weeds, access, blockages, litter, interplanting. Rehabilitate 10-20 facilities per permit cycle	- ~~Track number of and type of facilities inspected per year.~~ ~~- Track type of cleaning activities performed on each facility type each year.~~ - Report volume of materials removed and total cartridges replaced by cleaning each year.

Table 4.3.2 (continued)

BMP Descriptions	BMP Implementation	Measurable Goals	Reporting Elements
	• Kelly Creek Pond and Swale—drains 480 acres • Columbia Slough Water Quality Facility—drains 709 acres • Fairview Creek Water Quality Facility—drains 959 acres • Brookside Regional Water Quality Facility—drains 31 acres Activities that may be conducted during annual cleaning include the following: Ponds: (32 total) Litter pickup, mowing, weeding, invasive species removal, planting enhancements, and vegetation management to ensure adequate access to the appropriate structures of the pond, periodic excavation of sediments in the basin to ensure pollutant removal and periodic removal of woody debris buildup that clogs the inlet structure. ~~Occasionally, rehabilitation of maintenance access roads is also necessary to support large equipment, resulting in considerable cost in a budget cycle and limiting the amount of facilities that can be addressed in a given year.~~ Swales/Ditches/Rain Gardens: (210, plus 15 miles of ditches~~20~~ total) Litter pickup, mowing, weeding, pruning, invasive species removal (infrequently), replanting, and occasional removal of sediment at the inlet. ~~build-up and reconstruction as needed to maintain performance. The City is currently constructing two large road improvement projects that will substantially increase the total number of publicly maintained rain gardens within the first few years of the permit cycle that may cause future maintenance regimens to change.~~ Proprietary Devices: (113 total) (i.e., underground vaults with stormwater filters or vortechnic settling devices, currently over 500 cartridges to maintain) Maintenance of these devices includes sediment/debris removal by cleaning and filter cartridge replacement. Devices that have been installed for typically 4 years or less are inspected annually. Devices that are older than four years tend to require less frequent cleaning because of the presence of mature landscaping and fully developed neighborhoods and are therefore inspected every 2-3 years. ~~Staff have typically replaced one to fifteen filters on each device inspected each year.~~	Replace proprietary filter cartridges according to SOP. **Permit Year of Commitment:** ongoing	

Table 4.3.2 (continued)

BMP Descriptions	BMP Implementation	Measurable Goals	Reporting Elements
D. System Repair and Maintenance	**BMP Owner:** Water Resources Division Operations & Maintenance group **Implementation Activities:** This includes repair of the pipe system and minor maintenance to ditches, culverts, inlets, off-road systems, etc. that helps reduce the incidence of flooding and helps protect the City's investments. Records of repairs and locations are kept for long-term asset management and resource planning.	**Program Commitment:** Repair and maintain the publicly-owned system to enhance function and limit water quality pollutants. **Permit Year of Commitment:** ongoing **Program Goal:** Implement capital improvement projects as staff time and resources allow to retrofit off-road water quality facilities in order to provide ease of access for maintenance equipment.	-Report the number of hours dedicated to repair & maintenance activities.
E. Manhole/ Detention line Cleaning	**BMP Owner:** Water Resources Division Operations & Maintenance group **Implementation Activities:** The City currently has approximately 165 sedimentation manholes and 137 flow control release manholes (FCMH) that are connected to detention lines that drain to both surface water and groundwater.	**Program Commitment:** Inspect 75% of manhole structures annually.~~, as appropriate; clean detention lines only as needed, based on a visual inspection while cleaning the CRMH.~~ Clean sedimentation manholes at 50% of capacity. Clean FCMH at 25% of capacity. Clean detention lines if more than 4 inches of	- Report number of structures cleaned/repaired and the volume of debris removed.

Table 4.3.2 (continued)

BMP Descriptions	BMP Implementation	Measurable Goals	Reporting Elements
		sediment have accumulated. **Permit Year of Commitment:** ongoing	
F. Ensure Proper Debris Disposal	**BMP Owner:** City-wide Operations and Maintenance groups **Implementation Activities:** Debris from public infrastructure maintenance is taken to the City's dewatering station where it is dumped and dried. The City's dewatering station is plumbed to the wastewater system. The dried debris is hauled to a DEQ approved disposal site. The debris is tested as needed ~~on an annual basis~~ to verify that it does not meet the definition of hazardous waste. Often, the disposal site conducts the testing per their own permit requirements. In such cases, the city does not maintain these records. To date, the debris from these activities has never required special disposal due to contamination.	**Program Commitment:** Ensure that the City utilizes environmentally sound disposal practices and services. Keep debris testing data performed by the City, as applicable.	-Keep records on annual disposal services utilized. ~~-Keep annual debris testing data.~~
G. Underground Injection Controls (UICs) Maintenance and Cleaning	**BMP Owner:** Water Resources Division Operations & Maintenance groups **Implementation activities:** The City currently owns approximately 1,100 UICs. The City has mapped the locations of the UICs in GIS. A list has been developed that includes UICs that were acquired during the Multnomah County road transfer and were built without access. The City will be adding access so that these UICs can be cleaned. The City's inventory of accessible UICs is on a maintenance and cleaning cycle. ~~Future~~ UIC maintenance and cleaning is ~~will be~~ managed in accordance with the WPCF permit.	**Program Commitment:** Under the City's UIC WPCF permit, report all maintenance and cleaning activities as required.	-Keep records of annual maintenance locations and cleaning activities.

Table 4.3.2 (continued)

BMP Descriptions	BMP Implementation	Measurable Goals	Reporting Elements
NPDES Permit Requirement - *(2) Planning procedures including a comprehensive master plan to develop, implement and enforce controls to reduce the discharge of pollutants from municipal separate storm sewers that receive discharges from areas of new development and significant redevelopment. Such a plan must address controls to reduce pollutants in discharges from municipal separate storm sewers after construction is completed. NPDES MS4 permit Schedule A. f. Post-Construction Site Runoff, g. Pollution Prevention for Municipal Operations, and h. Structural Controls Operations and Maintenance Activities*			
Purpose: To promote effective development and implementation of City code and policies that will help limit stormwater pollutants.			
Targeted Pollutants: Primarily anything that adsorbs to sediment such as: phosphorus, bacteria, metals, and organic compounds, as well as pollutants that dissolve readily in water and/or carry a negative charge (e.g. soaps and surfactants, chloride, nitrate, and phosphate).			

Table 4.3.2 (continued)

RC 2 Planning Procedures			
A. Water Quality Manual for New and Re-Development	**BMP Owner:** Water Resources Division, Development Engineering, Building Division **Implementation Activities:** The City's current *Water Quality Manual/Green Development Practices Manual* provides guidance to developers that is needed for meeting the stormwater quality treatment requirements as prescribed in the *Gresham Community Development Code*, *Gresham Revised Code*, and the *Gresham Public Works Standards*. These *Manuals* illustrate and describe, the disturbance threshold for compliance, storm derivation for design standards, stormwater management principles and techniques that are aimed at preventing stormwater pollutants from entering local streams and making progress towards the City's TMDL benchmarks ~~achieving water quality goals~~, with a focus on preserving or mimicking the natural hydrologic cycle (use low impact development/green infrastructure techniques), whenever possible. These *Manuals* provide developers and design professionals with specific requirements for reducing the impacts of stormwater runoff (water quantity) and pollution (water quality) resulting from new development and redevelopment within the City of Gresham and is available on the City's website.	**Program Commitment:** 1) Implement the *Water Quality Manual* standards and biennially determine whether updates to the document are necessary. Update the document, at a minimum, once during the permit cycle. 2) Provide training opportunities to *Manual* users whenever the *Manual* is significantly updated. **Permit Year of Commitment:** ongoing	- Report the number, location, acreage and land use of new and re-development projects and type of facility installed. - ~~Track the number and type of private water quality facilities installed to comply with new development standards.~~ - Delineate and GIS map the drainage areas of the private facilities installed to comply with new development standards. - Report training activities.

Table 4.3.2 (continued)

~~**B. Promote Low Impact Development (LID) Practices**~~	~~**BMP Owner:** Watershed DivisionWater Resources~~Division~~, Development Engineering, Building Department~~ ~~**Implementation Activities:** The City has two manuals that set the policy for the use of Low Impact Development (LID) for development. (Also referred to as Green Infrastructure in the City's NPDES MS4 permit). The *Water Quality Manual* describes methods available to developers for reducing stormwater runoff volumes and delaying the peak stormwater runoff flows from developed sites.~~ ~~The City also has the *Green Development Practices for Stormwater Management Manual*, which was originally designed for development in the Pleasant Valley & Springwater plan areas. This manual contains a simplified approach that streamlines sizing, design and maintenance submissions which acts as an incentive to the development community to use LID. Since the manual's inception, it has commonly been utilized for stormwater management for development throughout the city, where LID is appropriate.~~ ~~While the water quality treatment standards are required, developers are afforded flexibility in BMP selection based on their various site considerations such as cost, topography, safety, drainage, full build out intent, etc. However, the primary factor they are required to consider includes surface infiltration to mimic the natural hydrologic cycle. If on-site stormwater management methods are not feasible, the City's options for determining alternative options are described in the *Gresham Community Development Code*.~~ ~~The City also adopted *Green Street Standards* for the Pleasant Valley & Springwater areas in July 2007 that include standard details for rain gardens and stormwater planters in the street right-of-way. Standard cross-sections, plan views, and details make it easy for developers and City design staff to incorporate into new projects across the city, in addition to the Pleasant Valley and Springwater area.~~ ~~The City will continue to evaluate the *Water Quality Manual*, the *Green Streets Standards*, and *Green Development Practices Manual* to further refine and incorporate LID BMPs where appropriate.~~	~~**Program Commitment:**~~ ~~Implement practices or programs that promote the use of low impact development techniques and report on activities annually.~~ ~~**Permit Year of Commitment:** ongoing~~ ~~**Program Goal:**~~ ~~Add Low Impact Development requirements to the Water Quality Manual such that at least 90% of new development projects are utilizing LID practices to manage stormwater in portions of the city appropriate for this BMP*.~~ ~~*Subject to approval by City Council.~~	~~- Track the location, drainage area and type of LID practices that are implemented.~~

Table 4.3.2 (continued)

C. Private Water Quality Facility Maintenance Program	**BMP Owner:** Development Engineering, Water ~~Resourcess~~Resources~~hed~~ Division **Implementation Activities:** The City either collects a~~n~~ maintenance agreement for private stormwater facilities or uses Gresham Revised Code 3.20 to ensure that private facilities are maintained post construction. ~~between the developer and the City regarding how any water quality treatment facilities associated with private property will be maintained. These maintenance agreements note the type of water quality treatment facility constructed, type and frequency of maintenance to be conducted and the frequency of inspection by the owner necessary to ensure proper functioning. The agreements are reviewed by Development Engineering staff and/or WD Engineering staff for completeness. Requested changes, if any, are resubmitted to the developer for correction.~~ ~~A Memorandum of Agreement (MOA) to maintain stormwater facilities is then filed with Multnomah County prior to recordation of the plat. If a plat is not required as part of the development, the MOA is recorded prior to approval of the construction plans. The original copy of the maintenance agreement and a photo copy of the MOA are kept on file at the City.~~ ~~The WD Engineering and the WD Operations & Maintenance groups maintain a tracking database of the status of all requested and finalized agreements. There are currently just over 130 locations with private water quality facilities. Approximately 93 of these facilities have agreements on file, 15 facilities were built before the requirement was implemented, and 25 facilities are without recorded agreements.~~ The City collects data on all newly installed facilities, including an estimate of the treated area. These estimates and associated agreements are mapped in the GIS system for planning and evaluation purposes. **See Also: Stormwater Education Program**	**Program Commitment:** 1) Collect and record maintenance agreements for private water quality facilities per standard operating procedure. Manage agreements in a city database. ~~that legal code allows.~~ **Permit Year of Commitment:** ongoing 2) ~~Develop a program to ensure private facilities are being adequately maintained. The goals for program development include example actions such as the following:~~ ~~Collection of maintenance agreements for those facilities without recorded agreements using technical assistance.~~ ~~Self reporting requirements/Internal auditing of paperwork~~ ~~Inspections of facilities~~ **Permit Year of Commitment:** ~~PY 16 and~~ ongoing	~~- Track the number, type, year installed, and watershed location for all private water quality facilities.~~ - Every three-four years, complete an inspection cycle of all privately owned facilities. -Report inspection activities, outcomes and enforcements, as applicable. ~~-Report progress on program development related to private facility maintenance annually in PY 16 and ongoing.~~

Table 4.3.2 (continued)

	(See Table 6.0) A description of the City's education BMP for privately-owned or operated stormwater quality management facilities is included under Component #5, in Table 6.0.	~~**Program Goals:**~~ - ~~Create an on-line submittal form for maintenance agreements to streamline the submittal process for developers.*~~ - ~~To take advantage of the City's new civil penalty authority, consider changing code to require maintenance according to a maintenance manual. This could make maintenance agreements obsolete.*~~ ~~*This requires financial resources and staff time that is not currently available.~~	
D. Master Plan Update	The City has updated all of its master plans to include water quality as part of the overall planning effort. These plans are expected to be effective for approximately 20 years. ~~Updated Original~~ **Stormwater Master Plans:** Fairview Creek Master Plan (2003) West Gresham (Columbia Slough) (2005) Kelly Creek Master Plan (2007) Springwater Master Plan (2005)	**Program Commitment:** Include water quality goals in the City's master plans.	- Report on updates to Master Plans. - Master plan project implementation with water

Table 4.3.2 (continued)

	Johnson Creek Master Plan Executive Summary including Pleasant Valley and Springwater (2005) Pleasant Valley Stormwater Master Plan (Updated 2007) Natural Resource Master Plan (2011) This document is a database of continually amended GIS layers and is updated at least every other year ~~(expected to be completed 2011-12):~~ ~~This plan will allow for prioritized, phased implementation of floodplain reconnection, bank stability, invasive removal and planting projects for full-function of City's riparian and wetland natural resource areas.~~	**Permit Year of Commitment:** ~~PY 17~~Ongoing	quality benefits are reported in BMP RC4: Water Quality Retrofits

Table 4.3.2 (continued)

E. Urban Canopy Initiatives	**BMP Owners:** Water Resources Division, Urban Design & Planning Department **Implementation Activities:** The City of Gresham recognizes that trees in an urban setting are an integral part of a variety of approaches to offset impervious surface runoff caused by urban development. They intercept rain, infiltrate stormwater, and evapotranspirate water, all of which are effective at slowing and reducing stormwater runoff. Other benefits of trees include urban habitat, improved air quality, noise and wind buffers, reduction of heat island effect, and enhanced real estate values. In recent years the City has adopted additional stream protection overlays known as habitat conservation areas that conform to Metro's Title 13 Urban Growth Functional Plan and afford additional protection to riparian areas, wetlands, and certain upland areas from most types of development.	**Program Commitment:** 1) ~~Create and~~ Implement an Urban Forestry Management Plan ~~by November 1, 2012~~ 2) Utilize fee in-lieu funds and Code Compliance staff to help ensure urban canopy objectives are supported. 3) Collect fee in lieu funds and fines from tree removal violations that may be used for tree replacement efforts. 4) Review code to ensure urban canopy objectives are supported. 5) Conduct community outreach to help achieve	-1) Report on the progress ~~of creating the Urban Forestry Management Plan and annually report on the status~~ of the Plan's implementation -2) Report the number of Code Compliance investigations and outcomes related to tree protection objectives. -3) Report outcomes that result from the collection of tree removal fines and fee in lieu funds. -4) Report code changes, as applicable. See MON 2: Legal Authority and Code Review. -5) Report on incentive and outreach programs. ~~the~~

Table 4.3.2 (continued)

		urban canopy protection goals in accordance with the urban forestry strategic plan. **Permit Year of Commitment:** ~~**PY 16**~~ **ongoing**	~~type/number of outreach activities conducted and estimated persons~~ reached. See EDU 1: Stormwater Education Program.

Table 4.3.2 (continued)

NPDES Permit Requirement - *(3) Practices for operating and maintaining public streets, roads and highways and procedures for reducing the impact on receiving waters of discharges from municipal storm sewer systems, including pollutants discharged as a result of deicing activities. NPDES MS4 permit Schedule A. g. Pollution Prevention for Municipal Operations*
Purpose: To promote efficient and effective maintenance activities related to the management of the City's streets in order to limit pollutants to stormwater.
Targeted Pollutants: Primarily anything that adsorbs to sediment such as: phosphorus, bacteria, metals, and organic compounds, and litter, as well as pollutants that dissolve readily in water and/or carry a negative charge (e.g. soaps and surfactants, chloride, nitrate, and phosphate).

Table 4.3.2 (continued)

RC 3 Maintain Public Streets			
A. Street Sweeping	**BMP Owner:** Transportation Division **Implementation Activities:** The City of Gresham Transportation Division has contracted out for services to provide street sweeping for the majority of the city during the months of March through December. ~~The City entered a new contract in early 2010 that has an option to renew up to four additional years beyond the first year.~~ Additionally, the City owned-sweeper will provide supplemental sweeps, including weekly sweeps of the downtown commercial district and enhanced leaf pickups in the fall for the Water Resources Division. The City's prioritization for using its own sweeper focuses on higher vehicular use areas, higher pedestrian traffic areas downtown, City-owned parking lots, and removal of accumulated leaves in the fall to prevent flooding. The City may also respond, if necessary, to small traffic accident clean up needs and cleanup of excess sediment or landscaping materials on streets and illegal construction debris dumping that sometimes occurs during new development. The City has reviewed national data related to the effects of street sweeping on water quality. To date, study findings are inconclusive or contradictory about what the optimal frequency of sweeping and type of machinery to use in order to maximize water quality effects. Therefore, the City has selected the frequency which can be completed by the contractor based on current road miles, maximum miles per hour of the street sweeper, and weather. (Currently, there is little return for sweeping during the wettest months of January and February because the volume of water collected greatly exceeds the sediment collected, in turn requiring frequent decanting, making the effort very inefficient.) In order to gain extra sweeps during the dry months, an additional truck and driver would have to be employed, which drives up the cost significantly. There are currently no additional resources to conduct enhanced frequencies at this time.	**Program Commitment:** Provide 8-10 sweeps of the city per year. **Permit Year of Commitment:** ongoing	- Report & report the number of sweeps per year, total miles swept and total debris collected.

Table 4.3.2 (continued)

B. Deicing	**BMP Owner:** Transportation Division, Water Resources Division **Implementation Activities:** The City of Gresham road safety and management procedures are described in a winter response standard operating procedure that is designed to maximize public safety and limit negative impacts to the environment. The techniques utilized by the City are planned in order to limit applications of sand and gravel, which are estimated to be 50% to 70% recoverable and to minimize overspray or travel of anti-icing and deicing products. The City's Water Resources Division assists the Transportation Division by evaluating products using performance, cost, environmental impacts, and corrosivity to determine the best options for use. This report is titled, *Anti-icing and Deicing Product Assessment* and is available upon request.	**Program Commitment:** Continue to implement deicing activities in a manner that limits impacts to water quality. At least once per permit cycle, review the *Anti-icing and Deicing Product Assessment*, update if needed to reflect new data or products. **Permit Year of Commitment:** ongoing	- Report an estimate of sand/gravel and deicing product applied to Gresham roads. -Report the miles of road to which sand/gravel or deicing products are applied.

Table 4.3.2 (continued)

C. Standard Operating Procedures for Road Maintenance Activities	**BMP Owner:** Transportation Division, ~~WD~~ Natural Resource program **Implementation Activities:** The City has developed a manual titled "*Standard Operating Procedures for Wetland, Waterway, and Habitat Protection*" to guide City staff and contractors in resource protection efforts when working near jurisdictional resources. This Manual was initially based on ODOT's routine road maintenance manual, which they developed in collaboration with NOAA fisheries to gain limit 10 protection under the endangered species act. Gresham's practices include use of the ODOT standards, plus additional policies/standard operating procedures staff deemed necessary for identification and protection of jurisdictional resources areas, listed species and their habitats, and water quality. The Manual is updated as necessary to reflect any regulatory changes, or to include information on new species/habitat discoveries, new BMPs, or clarifying information. The first training on the Manual was held march 2009, and was provided to all operations, engineering, and planning staff. Staff responsible for permitting projects or overseeing staff or contractors working on tasks with a reasonable potential to impact resources areas, listed species and their habitats, or water quality, are required to attend trainings.	**Program Commitment:** Train staff on proper road maintenance SOPs and i~~I~~mplement a road maintenance program that will limit impacts to water quality. **Permit Year of Commitment:** ongoing ~~Biennially train appropriate staff (PY 16 and ongoing)~~ ~~Monitor Program Implementation (PY 16 and ongoing)~~ ~~Adaptively manage the program based on monitoring feedback & results. (PY 16 and ongoing)~~	- Report and report implementation of training activities. - Report changes to the SOPs annually, if updated.

Table 4.3.2 (continued)

NPDES Permit Requirement - *(4) Procedures to assure that flood management projects assess the impacts on the water quality of receiving water bodies and that existing structural flood control devices have been evaluated to determine if retrofitting the device to provide additional pollutant removal from storm water is feasible. NPDES MS4 permit Schedule A. g. Pollution Prevention for Municipal Operations and Schedule A h. Structural Stormwater Controls Operation and Maintenance Activities and 6. Stormwater Retrofit Strategy Development*			
Purpose: To promote effective implementation of the capital improvement program projects and riparian/wetland restoration projects in order to maximize stormwater water quality benefits and enhance stream channel function and wildlife habitat, whenever possible.			
Targeted Pollutants: Primarily anything that adsorbs to sediment such as: phosphorus, bacteria, metals, and organic compounds, as well as pollutants that dissolve readily in water and/or carry a negative charge (e.g. soaps and surfactants, chloride, nitrate, and phosphate).			
RC 4 Retrofit & Restore System for Water Quality			
A. Water Quality Retrofits	**BMP Owner:** Water Resources Division Engineering group **Implementation Activities:** The City looks for opportunities to retrofit the existing storm system through the development of stormwater master plans, all recently updated for the four major watershed areas in Gresham including: Fairview Creek, Johnson Creek, Kelly Creek, and the Columbia Slough. These master planning efforts result in capital improvement projects (CIPs) that are based on water quality, habitat & riparian buffer restoration, flood control, and conveyance. The CIPs within each Master Plan are ranked and prioritized per watershed for short, medium and long range planning. All projects from all watersheds are then re-ranked in the CIP ranking system to look at city-wide needs, not just the needs within one watershed. Additionally, projects that have more of a regional benefit for the community are given more weight. Other ranking factors include: environmental impact, cost, and public safety. The current CIP list is scheduled for implementation over a 20-year period. The CIP process is based on a rolling 5-year plan, with each year's plan extended to account for the projects that were completed from the previous year and then adding one more year's worth of projects. The City also created a Retrofit Strategy and Plan (Nov 2014) that will guide its capital project installation related to portions of the city without effective stormwater controls.	**Program Commitment:** Implement a CIP program that will prevent flooding and help mimic the natural hydrologic cycle and reduce or treat stormwater pollutants and promote stream protection and enhancement in accordance with the City's Water Quality and Green Development Practices Manuals, Master Plans and Retrofit Plan. **Permit Year of Commitment:** ongoing ~~**Program Commitment:**~~ ~~Document a stormwater retrofit strategy for developed areas that are underserved or lacking stormwater controls in a stormwater retrofit plan.~~ **Permit Year of Commitment:** ~~November 1, 2014~~ ongoing	- Report the number, type, watershed location and total drainage area of CIPs constructed for water quality and flood control. -Report annual activities conducted towards retrofit strategy or hydromodification reduction implementation being planned or built.

Table 4.3.2 (continued)

B. Enhance Riparian Areas	**BMP Owner:** Water Resources Division Natural Resources program **Implementation Activities:** This program is primarily spearheaded by the Natural Resources Program Coordinator, whose position is funded by all DES Divisions, but whose operating budget comes solely from the Water Resources Division. Efforts related to riparian restoration are generally supported through partnerships with various community groups, Watershed Councils, volunteers, and occasional grant funding. Through master planning, watershed Council action plans and riparian inventories, various types of priority projects have been identified for each major watershed including: removal of invasive species, restoring and expanding riparian buffers, planting of multi-story native plant populations, channel stabilization, and support of critical habitat (i.e., placement of large woody debris, and creation of backwater pond areas).	**Program Commitment:** The City will continue to seek collaboration, partnerships and grant funding in order to implement riparian enhancement projects that will help reduce the amount of stormwater pollutant sources. **Permit Year of Commitment:** ongoing	- Track and describe riparian enhancement activities by location - Estimate number of volunteers/partners involved, where applicable - Estimate of acreage enhanced and total plants installed or invasives removed.

Table 4.3.2 (continued)

NPDES Permit Requirement - *(5) A program to monitor pollutants in runoff from operating or closed municipal landfills or other treatment, storage or disposal facilities for municipal waste. The description must identify priorities and procedures for inspections and establishing and implementing control measures for such discharges. NPDES MS4 permit Schedule A. g. Pollution Prevention for Municipal Operations*			
Purpose: To ensure that the City has no stormwater pollutant sources stemming from runoff in closed municipal landfills.			
Targeted Pollutants: Primarily anything that dissolves readily in water and/or carries a negative charge (e.g. soaps and surfactants, chloride, nitrate, and phosphate).			
RC 5 Monitor Pollutant Sources from Closed or Operating Municipal Waste Facilities			
Pollutant Source Evaluation	**BMP Owner:** Water Resources Division **Implementation Activities:** There are currently no operating landfills or other treatment, storage or disposal facilities for municipal waste within the City's jurisdiction. There is an existing closed landfill that was formerly the Multnomah County dump, also sometimes referred to as Vance Pit. WD staff hired a consultant to conduct an evaluation to determine its potential to contribute stormwater pollutants to the publicly-owned system. The consultant found no significant potential for the site to contaminate stormwater. The report is available upon request.	**Program Commitment:** Ensure that any new municipal waste facilities within the City's permitted area are appropriately permitted and designed, in order to limit the potential for pollutants to enter stormwater.	- Report any new facilities and assessment results.
NPDES Permit Requirement - *(6) A program to reduce to the maximum extent practicable, pollutants in discharges from municipal separate storm sewers associated with the application of pesticides, herbicides and fertilizer that will include, as appropriate, controls such as educational activities, permits, certifications and other measures for commercial applicators and distributors, and controls for application in public right-of-ways and at municipal facilities.* *See also Component #5 Stormwater Education BMP. NPDES MS4 permit Schedule A. g. Pollution Prevention for Municipal Operations and Schedule A 4 d. Education and Outreach vii.*			
Purpose: To reduce stormwater pollutant sources from public lands.			
Targeted Pollutants: Primarily anything that dissolves readily in water and/or carry a negative charge (e.g. soaps and surfactants, chloride, nitrate, and phosphate).			
RC 6 Reduce Pollutants from Pesticides, Herbicides and Fertilizers			
Integrated Pest Management Program	**BMP Owner:** City-wide Operations & Maintenance Divisions **Implementation Activities:** The purpose of this BMP is to reduce stormwater pollutants stemming from the use of pesticides, herbicides and fertilizers by addressing the need for, alternatives to, and methods of chemical applications in landscaping, open space management, roadside ditch maintenance, and public facility maintenance. Integrated Pest Management (IPM) is an effective and environmentally sound approach to pest management. Unlike any single method of pest control, IPM programs balance costs, benefits, public health and environmental quality, and avoid unnecessary applications of pesticides, herbicides, and fertilizers. This is accomplished by focusing on correcting conditions that encourage pests and strategically selecting the locations and number of times that pest populations are	**Program Commitment:** 1) Review and evaluate the IPM Plan biennially and, at a minimum, update at least once per permit cycle. 2) Conduct staff training. 3) Annually review the list of City approved pesticides to ensure the most current environmental information is being applied to what is prescribed by staff.	- Report frequency of staff trainings and number of staff trained. - Report updates to the plan. - Report quantities and types of pesticide, herbicides and fertilizer application.

Table 4.3.2 (continued)

	addressed to maximize the effectiveness of chemical treatment while minimizing the number of applications. The City of Gresham updated their Integrated Pest Management Plan (IPMP) in 2007 based on the City of Portland's latest version. During 2008-2011, the WD staff continue to develop and evaluate the policies to ensure their effectiveness and ability to be applied effectively by staff. Notably, staff identified a lack of local or state integrated pest management trainings and/or certifications as one of the challenges to the ease of implementing this BMP. Staff will continue to develop or seek state and regional support for IPM trainings to further hone this program's efficiency and effectiveness. Of further note, reductions in the State's general fund allocations have created extreme public utility worker shortages with regard to park management and natural areas, as well as operating budget funding that would be used to hire subcontractors. This further limits the City's ability to avoid the use of pesticides altogether, due to the fact that organic approaches require more human hours for maintenance. The City is committed to identifying a balance of IPM techniques combined with chemical applications within the resources allocated for this purpose.	**Permit Year of Commitment:** ~~Evaluate and update the IPMP in PY 16.~~ ~~Train all staff: PY 16-17 and ongoing as policies are updated.~~ ongoing **Program Goals:** * 1) Encourage other public agencies within the Gresham city limits such as TriMet and the School Districts to adopt the IPM Plan if resources allow. 2) Create a pesticide-free park to enhance public education if resources allow. 3) Develop a training for municipal employees to supplement the training that occurs during the state of Oregon licensing process, as needed if resources allow. *These are dependent on staff time available to coordinate the project, partnerships and neighborhood commitment due to funding and labor shortages.	
Stormwater Education Program **(See Table 6.0)**	A description of the City's education BMP for construction site operators is included under Component #5, in Table 6.0.		See Table 6.0

7.2 Component #2 (ILL 1-7)
A Program to Detect and Remove Illicit Discharges and Improper Disposal Into the Storm Sewer System

Requirements listed below are from 40 CFR § 122.26 (d)(2)(iv)(A) except where noted and are further described in the NPDES MS4 permit as cited. The Gresham BMP activity titles are listed below each requirement. The details of the BMPs are listed in **Table 2.0**.

NPDES MS4 Permit #101315 Schedule A 4 a. Illicit Discharge Detection and Elimination xii. Unless the following non-stormwater discharges are identified in a particular case as a significant source of pollutants to waters of the State by the permittee or the Department, they are not considered illicit discharges and are authorized by this permit: water line flushing; landscape irrigation; diverted stream flows; rising ground water; uncontaminated ground water infiltration; uncontaminated pumped ground water; discharges from potable water sources, start up flushing of groundwater wells; potable groundwater monitoring wells; draining and flushing of municipal potable water storage reservoirs; foundation drains; air conditioning condensate; irrigation water; springs; water from crawl space pumps; footing drains; lawn watering; individual residential car washing; charity car washing; flows from riparian habitats and wetlands; dechlorinated swimming pool discharges; street wash waters; discharges of treated water from investigation, removal and remedial actions selected or approved by the Department pursuant to Oregon Revised Statute (ORS) Chapter 465;and, discharges or flows from emergency fire fighting activities.

NPDES MS4 Permit Schedule A 4 d. Education and Outreach vii.
ILL 1 Non-Stormwater Discharge Controls

- Control Releases from Fire Training Activities
- Water Line Flushing
- See also Table 6.0 Educate Residents & Educate Businesses

(2) Procedures to conduct on-going field screening activities during the life of the permit, including areas or locations that will be evaluated by such field screens; NPDES MS4 Permit Schedule A 4. a Illicit Discharge Detection and Elimination
(3) Procedures to be followed to investigate portions of the separate storm sewer system that, based on the results of the field screen, or other appropriate information, indicate a reasonable potential of containing illicit discharges or other sources of non-storm water [such procedures may include: sampling procedures for constituents such as fecal coliform, surfactants (MBAS), residual chlorine, fluorides and potassium; testing with fluorometric dyes; or conducting in storm sewer inspections where safety and other considerations allow.] Such a description must include the location of storm sewers that have been identified for such evaluation. NPDES MS4 Permit Schedule A 4. a. Illicit Discharge Detection and Elimination
ILL 2 & 3 Illicit Discharges Elimination Program (IDEP):

- Field Screening and Investigation
- CCTV New Development Stormwater Pipe

(4) Procedures to prevent, contain, and respond to spills that may discharge into the municipal separate storm sewer. NPDES MS4 Permit Schedule A 4. a. Illicit Discharge Detection and Elimination and Schedule A 4 d. Education and Outreach vii.
ILL 4 Spill Response Program:

- Spill Response
- Spill Prevention
- Maintain Public Vehicles

(5) A program to promote, publicize, and facilitate public reporting of the presence of illicit discharges or water quality impacts associated with discharges from municipal separate storm sewers. NPDES Permit Schedule A 4. d. Education and Outreach viii.

ILL 5 Facilitate Public Reporting and Respond to Citizen Concerns

(6) Educational activities, public information activities, and other appropriate activities to facilitate the proper management and disposal of used oil and toxic materials. NPDES MS4 Permit Schedule A 4. d. Education and Outreach iii.

ILL 6 Facilitate Proper Management of Used Oil and Toxics

(7) Controls to limit infiltration of seepage from municipal sanitary sewers to municipal separate storm sewer systems where necessary. NPDES MS4 Permit Schedule A 4. g. Pollution Prevention for Municipal Operations

ILL 7 Limit Sanitary Sewer Discharges

See Table 3.0 for more detailed descriptions of the City's BMPs that address the requirements that are listed above.

TABLE 3.0 - BMPs to Detect and Remove Illicit Discharges and Improper Disposal Into the Storm Sewer System (ILL 1-7)

BMP Descriptions	BMP Implementation	Measurable Goals	Reporting Elements
NPDES Permit Requirement - *NPDES MS4 Permit #101315 Schedule A 4. a. Illicit Discharge Detection and Elimination xii. Unless the following non-stormwater discharges are identified in a particular case as a significant source of pollutants to waters of the State by the permittee or the Department, they are not considered illicit discharges and are authorized by this permit: water line flushing; landscape irrigation; diverted stream flows; rising ground water; uncontaminated ground water infiltration; uncontaminated pumped ground water; discharges from potable water sources, start up flushing of groundwater wells; potable groundwater monitoring wells; draining and flushing of municipal potable water storage reservoirs; foundation drains; air conditioning condensate; irrigation water; springs; water from crawl space pumps; footing drains; lawn watering; individual residential car washing; charity car washing; flows from riparian habitats and wetlands; dechlorinated swimming pool discharges; street wash waters; discharges of treated water from investigation, removal and remedial actions selected or approved by the Department pursuant to Oregon Revised Statute (ORS) Chapter 465;and, discharges or flows from emergency fire fighting activities.* *Schedule A 4 d. Education and Outreach vii.*			
Purpose: To promote effective development and implementation of City code and policies that will help limit stormwater pollutants.			
Targeted Pollutants: Primarily anything that adsorbs to sediment such as: phosphorus, bacteria, metals, and organic compounds, as well as pollutants that dissolve readily in water and/or carry a negative charge (e.g. soaps and surfactants, chloride, nitrate, and phosphate).			
ILL 1 Non-Stormwater Discharge Controls			
A. Control Releases from Fire Training Activities	**BMP Owner:** Fire Department **Implementation Activities:** This BMP includes procedures to limit pollutants to stormwater while conducting fire training activities. • Utilize catch basin filter inserts when conducting activities at the Fire Training Facility using foam. • Conduct off-site fire training activities in vegetated areas that will capture and filter the water & foam releases, whenever possible. • If vegetated areas cannot be utilized for off-site fire training, then install catch basin filter inserts at downstream drain sites.	**Permit Year of Commitment:** ongoing	- Document fire training protocols for stormwater protection and train staff
B. Water Line Flushing	**BMP Owner:** Water Division	**Permit Year of Commitment:** ongoing	-Train employees on standard operating

Table 3.0 (continued)

BMP Descriptions	BMP Implementation	Measurable Goals	Reporting Elements
	Implementation Activities: The Water Division periodically flushes all public water lines to ensure the reliability of all valves and hydrants in addition to removing organic sediments that have collected in the water system. Flow capacity data is also collected from fire hydrants during flushing activities. Flushing typically occurs from October to May. To avoid impacts to sensitive stormwater collection basins, detention ponds and/or swales discharges are flushed into the wastewater collection system on a case by case basis. Other activities to minimize impacts to discharges that enter the storm system include the following: • All large discharges from the water system are dechlorinated with the use of a dechlorinator (injector) and applicable and appropriate treatment chemicals. • Catch basin inserts and bio bags are used to help filter excess sediments from the water before it enters the stormwater system. • Discharges are monitored for chlorine levels, sedimentation removal, and flow rates.		procedure to minimize impacts to local streams. -Annually report gallons flushed.
Stormwater Education Program (See Table 6.0)	A description of the City's public education BMP related to reducing non-stormwater discharges is included under Component #5, in Table 6.0.		See Table 6.0

Table 3.0 (continued)

NPDES Permit Requirement - *(2) Procedures to conduct on-going field screening activities during the life of the permit, including areas or locations that will be evaluated by such field screens; and*

(3) Procedures to be followed to investigate portions of the separate storm sewer system that, based on the results of the field screen, or other appropriate information, indicate a reasonable potential of containing illicit discharges or other sources of non-storm water [such procedures may include: sampling procedures for constituents such as fecal coliform, surfactants (MBAS), residual chlorine, fluorides and potassium; testing with fluorometric dyes; or conducting in storm sewer inspections where safety and other considerations allow.] Such a description must include the location of storm sewers that have been identified for such evaluation. NPDES MS4 Permit Schedule A 4. a. Illicit Discharge Detection and Elimination

Ill 2 & 3 Illicit Discharges Elimination Program

Table 3.0 (continued)

A. Field Screening and Investigation	**BMP Owner**: Water Resources Division **Implementation Activities:** Gresham Revised Code (GRC) Chapter 3 Article 3.23 Discharge Regulations provides the City with the legal authority to implement their illicit discharges elimination program. As required by the permit and described within the Monitoring Plan, conduct dry weather field screening at high priority outfalls, at a minimum of once per calendar year. (See Monitoring Plan for a list of sites that are also mapped using GIS.) Screening consists of documented visual observations, uncharacteristic odors and certain field measurements. If measurements fall above expected pollutant values per City protocol, staff collect samples for laboratory analyses of additional parameters. As appropriate, follow up with additional investigation within the suspect drainage by monitoring additional manholes to assist with source identification, which may include visual inspection, smoke or dye testing and/or use of closed circuit television, and additional laboratory analysis. Work with the source to eliminate the illicit discharge within 15 working days or to develop an action plan within 20 working days or use standardized city procedure for routine/common types of illicit discharges.	**Program Commitment:** The City will continue to conduct dry weather field screening and follow up procedures as described in the Monitoring Plan. **Permit Year of Commitment:** ongoing ~~**Program Commitment:**~~ ~~Document an enforcement response plan for illicit discharges that describes the procedures the City will implement when an illicit discharge investigation identifies a responsible party.~~ ~~**Permit Year of Commitment:** by Nov 1, 2011~~ ~~**Program Commitment:**~~ ~~Document pollutant parameter action levels and rationale.~~	- Report number of and location of the outfalls inspected. - Report number and location of illicit discharges and/or connections identified. - Describe follow-up actions for identified illicit discharges and/or connections. ~~-Include documentation in the 2011 Annual Report.~~ ~~-Submit documentation to DEQ by July 1, 2012.~~

Table 3.0 (continued)

		~~**Permit Year of Commitment:**~~ ~~By July 1, 2012~~ ~~**Program Commitment:**~~ ~~Map priority illicit discharge monitoring locations~~ ~~**Permit Year of Commitment:**~~ ~~By July 1, 2012~~	-~~Include in the Monitoring Plan~~
3. CCTV New Development Stormwater Pipes	**BMP Owner:** Water Resources Division Operations & Maintenance group **Implementation Activities:** Conduct closed-circuit television (CCTV) inspections of new stormwater pipes installed during development projects. This activity is conducted prior to paving in order to identify installation defects and illicit connections that would cause pipe malfunction or introduce stormwater pollutants. Any noted deficiencies or illicit connections are referred to the appropriate Division for follow-up. The pipes are re-inspected during the final inspection for project acceptance by the City of Gresham.	**Program Commitment:** CCTV at least 80% of all the new pipes installed in the City. **Permit Year of Commitment:** ongoing	-Report the number of stormwater pipe miles inspected as a percentage of the total stormwater pipes installed.

Table 3.0 (continued)

NPDES Permit Requirement - *(4) Procedures to prevent, contain, and respond to spills that may discharge into the municipal separate storm sewer. NPDES MS4 Permit Schedule A 4. a. Illicit Discharge Detection and Elimination and Schedule A 4 d. Education and Outreach vii.*			
Purpose: To promote effective development and implementation of City code and policies that will help limit stormwater pollutants.			
Targeted Pollutants: Primarily anything that adsorbs to sediment such as: phosphorus, bacteria, metals, and organic compounds, as well as pollutants that dissolve readily in water and/or carry a negative charge (e.g. soaps and surfactants, chloride, nitrate, and phosphate).			
ILL 4 Spill Response Program			
A. Spill Response	**BMP Owner:** Water Resources Division, Code Compliance **Implementation Activities:** **Hazardous Substances/Threats to the Environment:** When there is a hazardous substance spill or a spill of any other substance that: • Is hazardous in any quantity • Is non-hazardous and greater than 42 gallons on the ground, • Is any quantity that has entered a waterway Gresham staff either notifies the Oregon Emergency Response System (OERS), or tells the responsible party that they must notify OERS. OERS then notifies DEQ and Gresham HazMat (if necessary) and other state and local agencies that may be affected. The responsible party, if identified, is required to contact an environmental clean-up company and pay for clean-up costs. Examples could include a 55 gallon drum of restaurant grease or sanitary sewer overflows on private property resulting in or having the risk of resulting in discharges to the public stormwater system. DEQ typically remains the enforcement authority in these cases. In some cases, DEQ may ask Gresham staff to oversee the clean-up and report back to DEQ. DEQ may choose to enforce against the responsible party under the following conditions: 1) the party has acted maliciously, 2) the party is a repeat offender, or 3) the party has failed to report the incident to DEQ. **Non-Hazardous Substances:** Watershed Management operations staff will investigate and provide emergency containment and cleanup, as necessary for identifiable substances that are labeled and are not hazardous. If the responsible party can be identified, they are directed to provide containment and site cleanup and the City will oversee the process to ensure compliance. If the spill is an imminent threat to waters of the state, the City reserves the right to provide clean-up and bill the responsible party for the work. The responsible party will be invoiced for any response and cleanup provided by the City. Examples include spills or dumping of paint, auto fluids, carpet cleaning wastes or concrete, etc. into catch basins or	**Program Commitment:** 1) Implement the City's Spill Response Protocol and conduct periodic review of the document to ensure efficacy. 2) Ensure proper training of staff responsible for implementing the spill response protocol. **Permit Year of Commitment:** ongoing	- Report the number, type and location of spills* that occur and the approximate quantity of material spilled. - Report the response activities. *Does not include traffic accidents.

Table 3.0 (continued)

	onto the street. Unidentifiable substances will be treated as hazardous and referred to a licensed disposal contractor to reduce risk to City employees responding to spills. In non-emergency situations, such as stockpiling landscaping materials in the street or dumping yard debris on private property near a stream bank, staff will notify the responsible party, verbally and in writing and specify a timeframe for cleanup. Staff will either refer the incident to Code Compliance if the responsible party does not respond within the specified time frame or take enforcement action directly. NPDES staff and Code Compliance have the authority to issue Abatement Procedures, Violations or Civil Actions. Because the state will not assist with cleanup of non-hazardous spills less than 42 gallons, and because the City's equipment is not designed to cleanup spills over 5 gallons, the City will typically utilize private clean-up contractors to deal with spills between 5 and 42 gallons and less than 5 gallons when the substance is unidentifiable, if no responsible party can be found. **Releases from Traffic Accidents:** If there is a spill of automotive fluids resulting from a traffic accident, typically, the Fire Dept will spread an absorbent compound (usually clay) and specialized absorbent pads on automotive fluids and direct the towing company to assist with cleanup, or contact the Water Resources Division if additional assistance is needed. Buckets are placed underneath dripping fluids. The road is swept and cleaned and, when necessary, additional protection is placed around the catch basins. Large leaking spills from commercial vehicles or semi-trucks are captured using a children's plastic pool and are disposed of by the HazMat Team. From a legal standpoint, the generator of the spill is responsible; therefore the waste materials are bagged and placed inside the wrecked vehicle or given to the tow truck driver for disposal.		
3. Spill Prevention (Hazardous Waste Management (City Property)	**BMP Owner:** Fire Department, Facilities Maintenance, All City Operations & Maintenance Divisions **Implementation Activities:** This BMP includes the proper management of hazardous materials to prevent spills on City-owned property from City practices. Hazardous materials are dealt with slightly differently depending on the group that stores or handles the materials. Fire: Hazardous materials that are stored or handled by the Fire Dept are limited to small quantities of solvents used for cleaning, plus occasional unsolicited "gifts" of unlabeled	**Program Commitment:** 1) Ensure safe handling, storage and disposal of hazardous fluids in order to prevent spills and limit pollutant sources to	-Report quantities of hazardous materials disposed annually. -Report number of spill incidents and outcomes annually.

	substances that appear anonymously at the Fire station doorsteps. These substances are handled by trained HazMat personnel. Operations: At the Operations yard, drums of waste paving-related emulsion, diesel oil, and used motor oil, together with small cans of gasoline or cleaning agents are the main sources of hazardous materials. For small spills, the Operations staff use absorbent booms that are mechanically squeezed to release the fluids back into a container. Drums that contain hazardous materials are located on plastic spill basins that have a capacity adequate to contain the materials from the largest drum. Used hazardous materials are disposed of by a private vendor. Lubricants and fluids are stored in OSHA-approved, fire-rated storage cabinets. Safety containers that minimize spillage during pouring are also used. Pesticides are kept in a locked storage area, and only licensed pesticide operators are allowed to access and apply them. Relatively small quantities (2 ½ gallon containers) of pesticides are stored, due to the concentrated nature of the pesticides. Tanks used for diluting and applying pesticides are rinsed with water that is then sprayed on the area to be treated. Spill kits are distributed to all Operations & Maintenance divisions and are kept in the most commonly used vehicles and each dump truck. Facilities Maintenance: Chemicals related to vehicle maintenance are described under that BMP. Other chemicals used by Facilities Maintenance include: those associated with cleaning, and paints, lubricants, hydraulic fluids, and solvents. All fluids are stored in drums inside a contained storage facility and utilize a closed chemical distribution system that minimizes leaks or spills. Fluids are disposed or recycled by an appropriately certified vendor. The City's business inspection program inspector also conducts biennial walk throughs of the city's maintenance, storage, and fleet bays to ensure compliance and employee safety.	stormwater by training staff appropriately. 2) Provide periodic review of City contractor's safety and environmental violations and disposal permits, where applicable to help ensure environmental compliance of contractors handling the City's waste products. **Permit Year of Commitment:** ongoing **Program Goals:** 1) Document safety protocols. 2) Develop a City procedure or policy for contractor disqualification or contract annulment based on permit or other safety & environmental violations.	-Request and review contractors' permits, where applicable, at least annually and biennially review appropriate regulatory agency databases for safety and environmental violations
C. Maintain Public Vehicles	**BMP Owner:** Facilities & Fleet Management Division, All DES Operation & Maintenance Divisions, Fire Dept. **Implementation Activities:** The City owns and maintains approximately 240 vehicles. Most vehicle maintenance is performed at City Hall in the vehicle maintenance bay which drains to the sanitary sewer system. Due to high use of vehicles, and the need for high performance (esp. police cars and fire trucks), routine maintenance is conducted at three-month intervals. Maintenance tasks include ensuring that working parts are fully functional, and that vehicles are clean. A database provides triggers when a vehicle is due for maintenance and information is input regularly that tracks all work done on vehicles.	**Program Commitment:** 1) Maintain City-owned vehicles & equipment and ensure proper handling & disposal of fluids to reduce the likelihood of leaks or spills being released into the MS4	- Report annual disposal quantities of all fluids and vendors utilized.

Table 3.0 (continued)

	Typical BMPs implemented to minimize entry of pollutants into stormwater from these activities include the following: • Vehicles in the fleet that leak fluids are taken out of operation until maintenance has eliminated the leak. • Maintenance work is conducted indoors. The floor is routinely swept, and pans set below the work bays collect anything that falls from vehicles being maintained. Any fluids that drip during maintenance are covered in kitty litter and given to a permitted private company that handles used fluids. • All fluids that are replaced are kept in drums for pickup by a permitted private firm that recycles or otherwise appropriately disposes of the fluids. Used tires are likewise recycled. • Steam cleaning and washing of vehicles is either performed at the wash pad by the decant facility at the Hogan Operations yard, or performed at commercial car washes that recycle the water. The Hogan wash pad drains to a baffled vault, from which any overflow enters the sanitary system. The vault is cleaned twice per year. • Back hoes and dump trucks are washed once per month at the wash bay at the Hogan Operations yard. • Tractors and riding mowers are inspected daily, and are maintained by a private vendor. They are washed as needed at the Hogan wash pad. • Fire trucks are washed at the individual fire stations using a mild detergent; some discharges currently enter the stormwater system.	system or the environment. 2) Keep appropriate documentation of all contractor permits/disposal practices to ensure proper handling & disposal of fluids. 3) Train new personnel on all safety & maintenance & spill cleanup procedures. 3) Keep spill kits stored in all locations where maintenance & operations procedures occur. 4) Keep written documentation of vehicle maintenance schedules and standard operating procedures for review by the NPDES Program Coordinator. **Permit Year of Commitment:** ongoing **Program Commitment:** Meet DEQ Permit 1700 A deminimis	- Report status of deminimis discharges or Vehicle Wash Water permit implementation and/or waiver.

Table 3.0 (continued)

		discharge or seek a permit and/or waiver. **Permit Year of Commitment:** ongoing	

Table 3.0 (continued)

NPDES Permit Requirement *- (5) A program to promote, publicize, and facilitate public reporting of the presence of illicit discharges or water quality impacts associated with discharges from municipal separate storm sewers. NPDES Permit Schedule A 4. d. Education and Outreach viii.*

Purpose: To promote awareness of the effects of human activities on the municipal storm sewer system, area streams and wetlands and wildlife.

Targeted Pollutants: Primarily anything that adsorbs to sediment such as: phosphorus, bacteria, metals, and organic compounds, and litter, as well as pollutants that dissolve readily in water and/or carry a negative charge (e.g. soaps and surfactants, chloride, nitrate, and phosphate).

ILL 5 Facilitate Public Reporting

Facilitate Public Reporting & Respond to Citizen Concerns	**BMP Owner:** Water Resources Division, Code Compliance **Implementation Activities:** The Water Resources Division will respond to requests and/or complaints from citizens regarding observed water quality problems from suspected illicit discharges or other causes and document the investigations and outcomes in a database. To date, typical activities that have caused the City to respond include the following: illegal dumping, spills, erosion control, plugged catch basins, drainage issues (public & private), concerns about mosquito breeding in stormwater water quality structures, riparian enhancement and Code Compliance related issues (e.g., overgrown vegetation in the public right of way, etc.). The City of Gresham currently implements or supports the use of a variety of methods to communicate stormwater related educational information to the public that address the topics listed in the descriptions above and to facilitate public reporting of illicit discharges, as appropriate. **Communication methods that are commonly used include the following:** • Gresham *Outlook* (estimated to reach 12,000 residents & businesses) • *Oregonian* East (estimated to reach 75,000+ readers) • *El Hispanic News* (estimated to reach 15,500 readers) • Gresham *News to Reuse* (residents and GREAT Business editions) (36,000 households & 3,500 businesses) • Chamber of Commerce newsletter (estimated to reach 900 businesses) • Gresham City Newsletter (estimated to reach 39,000 households)	**Program Commitment:** Include information for the public on how to report an illegal discharge to the stormwater system in various types of City publications, where appropriate. **Year of Program Commitment:** ongoing	-Report number of calls/letters received related to spills or stream concern and code compliance related to stormwater issues, the issue of the call, and the response to the call.

Table 3.0 (continued)

	• Utility Bill Stuffers (estimated to reach 39,000 households) • Gresham's Website (approximately 200,000 visits annually) • Johnson Creek Watershed Council *Within Your Reach* newsletter and e-newsletter (reaches about 800 residents & business owners) • Columbia Slough Watershed Council newsletter (reaches 500 residents & business owners) • Gresham area school district newsletters • Door hangars for specific projects, maintenance work, notice of violations (varies) • Direct mail to streamside property owners or specifically targeted neighborhoods. (varies) • Mount Hood Community College Public Access television (20,000) • Televised City Council meetings (20,000) • Public Service Announcements via radio or television (varies) • Educational Videos (varies) • Presentations to the public at events, open houses, meetings, etc. (varies) • Tri-met bus/max advertisements (varies by route) • Educational signs such as in parks, public, or private property (varies) • Educational brochures and posters (varies) • Social Media—4,000+ • Neighborhood E-News—700+		

Table 3.0 (continued)

NPDES Permit Requirement - *(6) Educational activities, public information activities, and other appropriate activities to facilitate the proper management and disposal of used oil and toxic materials. NPDES Permit Schedule A 4. d. Education and Outreach iii.*			
Purpose: To promote public understanding and appropriate actions related to proper management and disposal of used oil and other toxic materials likely to enter stormwater.			
Targeted Pollutants: Primarily hydrocarbons and other toxics such as antifreeze, lawn, garden & household chemicals, products containing mercury, etc.			
ILL 6 Facilitate Proper Management & Disposal of Used Oil & Toxics			
Facilitate the Proper Management & Disposal of Used Oil and Toxics	**BMP Owner:** Solid Waste & Recycling Division, Community Relations **Implementation Activities:** The City of Gresham currently utilizes a variety of approaches to encourage proper solid waste, recycling, waste prevention and hazardous waste management behaviors in the business and residential sectors. Typical City efforts include: • Voluntary GREAT Business Program audits, technical assistance and certification for businesses. • Hazardous and/or Special Collection events for residents. • Curbside recycling of used oil & publication of drop off locations. Public education communication pieces such as: News to Reuse (residential and business), brochures, website, etc.	**Program Commitment:** The City will continue to implement various solid waste, recycling, waste prevention and hazardous waste management & disposal programs. **Permit Year of Commitment:** ongoing	- ~~Track~~Report quantities of used oil and toxics collected. - Estimate the number of persons and/or households reached.
NPDES Permit Requirement - *(7) Controls to limit infiltration of seepage from municipal sanitary sewers to municipal separate storm sewer systems where necessary. NPDES MS4 Permit Schedule A 4. g. Pollution Prevention for Municipal Operations*			
Purpose: To promote best management practices of the municipal wastewater sewer system in order to limit pollutant sources to stormwater.			
Targeted Pollutants: Primarily bacteria, nutrients and heavy metals.			
ILL 7 Limit Sanitary Sewer Discharges			
Limit Sanitary Sewer Discharges	**BMP Owner:** Wastewater Services Division **Implementation Activities:** The City of Gresham Wastewater System operates under an NPDES permit issued by the Oregon Department of Environmental Quality (DEQ). The DEQ regulates the activities related to the operation, management and discharge of wastewater into surface water. The City's wastewater system is defined as a separate sanitary sewer system, unlike a combined sewer system, which contains stormwater directly connected from the stormwater system to the sanitary system. The wastewater treatment plant discharges to the Columbia River. The	**Program Commitment:** Limit infiltration seepage from the wastewater system by implementing best management practices to the maximum extent practicable.	- ~~Track~~Report sanitary discharge to the stormwater system, including estimated volume and location. - ~~Track~~Report follow up responses to the identification of any

Table 3.0 (continued)

	Wastewater Services Division also administers an Industrial Pretreatment Program to ensure that industrial users that discharge to the City's wastewater treatment system pretreat their wastewater to a certain level of quality before it can be discharged. In 2010, the DEQ issued an internal management directive (IMD), which incorporates CMOM provisions from the U.S Environmental Protection Agency (EPA). "CMOM" stands for "Capacity, Management, Operations, and Maintenance". It is a flexible, dynamic framework for municipalities to identify and incorporate widely accepted wastewater industry practices to better manage, operate, and maintain collection systems; investigate capacity constrained areas of the collection system; and respond to sanitary sewer overflow (SSO) events. Although CMOM was not officially adopted by the EPA, it is being used by the DEQ. Therefore, the Wastewater Services Division has taken the following steps to ensure program efficiency and minimization of sanitary releases to the stormwater system: • Completed Wastewater Collection and Conveyance Master Plan (updated in 2005) and Wastewater Treatment Plant (WWTP) Master Plan (2004) Updates to ensure system capacity and efficient implementation of high priority capital improvement projects. A new Treatment Plant Master Plan is currently being prepared and will be completed by 2011. The Division is also planning to hire a consultant to complete a new Collection System Master Plan by 2012. • Implemented best management practices at the wastewater treatment plant such as: routine maintenance and inspection of equipment; installation of covered surfaces and truck washing facilities to prevent releases. • Implemented the Pretreatment Inspection & Enforcement program. • Mapped the entire wastewater pipe system within the City's GIS program that links to "as-built" maps, CCTV video inspection reports and videos as well as	**Year of Program Commitment:** ongoing **Program Goal:*** As resources become available, implement a CIP to construct pipelines to properties within the city that are not served by sanitary sewers, with the goal of eventually connecting all "unsewered" properties to the City's wastewater collection, conveyance and treatment system. There are very few known unsewered properties within Gresham, therefore, this activity is a lower priority among the existing staff's work plans. *(This activity is dependent upon additional monetary resources subject to City Council approval)	sanitary discharges to the stormwater system. - ~~Track~~Report implementation of the CIP to connect currently unsewered properties to the sanitary sewer system.

Table 3.0 (continued)

	provides "at a glance" information including age, length, and material composition of pipes. • Implemented annual flow monitoring, line cleaning, TV inspection and repair, as well as manhole inspections. • Documented standard operating procedures to respond to wastewater system blockages that could potentially result in sanitary releases from manholes and utilizes the City's Spill Response protocol to respond appropriately.		

7.3 Component #3 (IND 1 & 2)
A Program to Monitor and Control Pollutants from Industrial Facilities

Requirements listed below are from 40 CFR § 122.26 (d)(2)(iv)(C) and are further described in the NPDES MS4 permit as cited. The Gresham BMP activity titles are listed below each requirement. The details of the BMPs are listed in **Table 2.0**.

(1) Identify priorities and procedures for inspections and establishing and implementing control measures for such discharges. NPDES MS4 Permit Schedule A 4 b. Industrial and Commercial Facilities

NPDES MS4 Permit Schedule A 4 b. Industrial and Commercial Facilities

IND 1 Industrial Inspection & Monitoring:

- Business Inspection Program

(2),… to be implemented during the term of the permit, including the submission of quantitative data on the following constituents: any pollutants limited in effluent guidelines subcategories, where applicable; any pollutant listed in an existing NPDES permit for a facility; oil and grease, COD, pH, BOD5, TSS, total phosphorus, total Kjeldahl nitrogen, nitrate plus nitrite nitrogen; and any information on discharges required under 40 CFR §122.21(g)(7)(vi) and (vii).

NPDES MS4 Permit Schedule A 4. b. Industrial and Commercial Facilities

IND 2 Industrial Inspection & Monitoring:

- Industrial Monitoring Program

See Table 4.0 for the City BMPs that address the requirements that are listed above.

TABLE 4.0 - A Program to Monitor and Control Pollutants from Industrial Facilities (IND 1 & 2)

BMP Descriptions	BMP Implementation	Measurable Goals	Reporting Elements
NPDES Permit Requirement – *40 CFR § 122.26 (d)(2)(iv)(C) (1) A description of a program to monitor and control pollutants in stormwater discharges to municipal systems from municipal landfills, hazardous waste treatment, disposal and recovery facilities and industrial facilities that are subject to section 313 of title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA) and industrial facilities that the municipal permit applicant determines are contributing as substantial pollutant loading to the municipal storm sewer system. The program shall:* *1)Identify priorities and procedures for inspections and [for] establishing and implementing control measures for such discharges;* *2) Describe a monitoring program… for industrial facilities* *NPDES MS4 Permit Schedule A 4. b. Industrial and Commercial Facilities*			
Purpose: To limit stormwater pollutants from various industrial sources.			
Targeted Pollutants: Primarily anything that adsorbs to sediment such as: phosphorus, bacteria, metals, and organic compounds, as well as pollutants that dissolve readily in water and/or carry a negative charge (e.g. soaps and surfactants, chloride, nitrate, and phosphate).			
IND 1 & 2 Industrial Inspection & Monitoring			
A. Business Inspection Program	**BMP Owner**: Water Resources Division, Wastewater Division, Solid Waste and Recycling **Implementation Activities:** This BMP includes the following three implementation activities: 1) Business License Review—a proactive measure instituted to identify potential sources of stormwater pollutants during the business license application process, and ensure appropriate disposal. The application screens for types of activities conducted, potential need for a 1200C/COLS permit, chemicals stored on site, and potential for washing activities. Those that may effect stormwater are provided additional information and technical assistance, as needed. 2) Stormwater Business Inspections—The City's business inspection program includes those businesses within the Wellfield Protection Area, Wastewater Pretreatment Permitted Industries, 1200Z/COLS permitted industries and any other businesses that utilize hazardous materials, conduct work outside, conduct washing practices outside, or otherwise pose a significant risk to the introduction of stormwater pollutants to the public stormwater system.	**Program Commitment:** 1) Continue to implement business license reviews ~~**Year of Program Commitment:** ongoing~~ ~~2a) Continue to evaluate needs and develop protocols and technical assistance materials for key business sectors~~ ~~**Year of Program Commitment:** ongoing~~ 2a~~b~~) Notify businesses that may need a 1200-Z or 1200COLS permits to apply for one, or obtain a no exposure certificate. ~~**Year of Program Commitment:**~~ ~~PY 16 and ongoing~~	- (1) Report the number of new business licenses and the number needing stormwater follow-up. ~~Track the number and location of stormwater related issues identified during the business license review and the follow-up.~~ - ~~(2a) Report the status of ongoing program development.~~ - (2a~~b~~) Notify DEQ of businesses that may need a 1200-Z or 1200-COLS permit and report actions promised

Table 4.0 (continued)

BMP Descriptions	BMP Implementation	Measurable Goals	Reporting Elements
	~~Over this permit term the City plans to (a) continue development of the business inspection program implementation manual and technical assistance materials. (b) The program will provide technical assistance efforts to businesses that may need an NPDES 1200-Z or 1200-COLS permit from DEQ but that do not already have one. (c) The City will also inspect businesses based upon a review of their activities and NAICS classifications that allows the City to assess their potential to contribute pollutant loads to the MS4 system. The number of annual inspections conducted is expected to vary based on workload and efforts related to resolving code violations. The City's first priority is to utilize technical assistance whenever possible. (d) Wastewater inspection staff will continue to notify the Stormwater Business Inspector of any deficiencies for follow-up resolution.~~ 3) The City has a GREAT business program that includes voluntary stormwater related audits to suggest various best management practices such as sweeping rather than power hosing, keeping non-leaking dumpsters on site and marking all storm drains on site most likely to be misused for dumping wastewater, etc. As this program is voluntary and focused upon education and technical assistance, it is also included under the public education component of this SWMP (see Table 6.0). This program is housed within the Solid Waste & Recycling Division and is reliant on other sources of funding to continue and is therefore subject to change in the future if City resources are reduced.	3~~2c~~) Inspect businesses with potential to contribute significant pollutant loads to the MS4 system and plan workload for the next year. ~~**Year of Program Commitment:**~~ ~~PY 16 and ongoing~~ ~~2d) Continue to implement stormwater inspections at the businesses that are inspected for the wastewater pretreatment program, based on potential to contribute pollutant loads to the MS4 system.~~ **Year of Program Commitment:** ongoing **Program Goal:** 4~~3~~) Contingent on available resources, continue to implement the GREAT business program. **Year of Program Commitment:** ongoing	by businesses with which the City is working - (3~~2c~~) Report business inspections ~~that are~~ conducted, including the business name, watershed location, outcome, and follow-up, if applicable. - (3~~2c~~) Estimate number and type of businesses to be inspected for the next year in each annual report ~~- (2d) Report stormwater concerns identified by the wastewater pretreatment program, and resolution~~ - (4~~3~~) Track/Report GREAT business program inspections and certifications annually. (Reported in the public education component).
B. Industrial Monitoring Program	**BMP Owner:** ~~Watershed Division~~Water Resources Division **Implementation Activities:** The City will coordinate with DEQ regarding oversight of NPDES 1200-Z and 1200COLS permits issued to industries	**Program Commitment:** Review DEQ database and keep a file of 1200-Z/1200COLS facilities within	- Track NPDES 1200Z/1200COLS

Table 4.0 (continued)

BMP Descriptions	BMP Implementation	Measurable Goals	Reporting Elements
	within Gresham's jurisdiction. At a minimum, the City will review a list of facilities with 1200-Z and 1200-COLS permits from DEQ's database each year and update its records, as applicable. If DEQ requests assistance with follow-up inspections related to monitoring data that indicates noncompliance, the City will assist as resources are available.	Gresham for use in the stormwater outfall monitoring program, as applicable. Review the DEQ enforcement action database on the Department website and keep a file of enforcement actions related to 1200Z/COLS permits for facilities within Gresham's jurisdiction. **Permit Year of Commitment:** ongoing	permits issued in Gresham. - Conduct oversight permitted industries with poor housekeeping practices. –Refer concerns to DEQ or conduct Gresham Code Enforcement, as applicable. ~~Track number of violations reported.~~

7.4 Component #4 (CON 1-3)
A Program to Reduce Pollutants in Stormwater Discharges from Construction Sites

Requirements listed below are from 40 CFR § 122.26 (d) (2) (iv) (D) and are further described in the NPDES MS4 permit as cited. The Gresham BMP activity titles are listed below each requirement. The details of the BMPs are listed in **Table 2.0**.

(1) Procedures for site planning which incorporate consideration of potential water quality impacts.
(2) Requirements for nonstructural and structural best management practices.
NPDES MS4 Permit Schedule A 4 c. Construction Site Runoff Control and f. Post-Construction Site Runoff iv.

CON 1 & 2 Construction Site Planning & Controls:

- Erosion Prevention & Sediment Control Manual

(3) Procedures for identifying priorities for inspecting sites and enforcing control measures that considers the nature of the construction activity, topography, and the characteristics of soils and receiving water quality.
NPDES MS4 Permit Schedule A 4 c. Construction Site Runoff Control and f. Post-Construction Site Runoff iv.

CON 3 Construction Site Inspection & Enforcement

- Construction Site Inspection & Enforcement

(4) Appropriate educational and training measures for construction site operators.
NPDES MS4 Permit Schedule A 4 d. Education and Outreach v.
See Component #5 and Table 6.0. *EDU 1* Stormwater Education Program: Ensure Staff/Stakeholder Training

See Table 5.0 for the City BMPs that address the requirements that are listed above.

TABLE 5.0 - A Program to Reduce Pollutants in Stormwater Discharges from Construction Sites

BMP Descriptions	BMP Implementation	Measurable Goals	Reporting Elements
NPDES Permit Requirement – *(1) Procedures for site planning which incorporate consideration of potential water quality impacts.* *(2) Requirements for nonstructural and structural best management practices.* *NPDES MS4 Permit Schedule A 4 c. Construction Site Runoff Control and f. Post-Construction Site Runoff iv.*			
Purpose: To control stormwater pollutant sources from development and redevelopment activities.			
Targeted Pollutants: Primarily anything that adsorbs to sediment such as: phosphorus, bacteria, metals, and organic compounds.			
CON 1 & 2 Construction Site Planning & Controls			
Erosion Prevention & Sediment Control Manual	**BMP Owner:** Water Resources Division, Public Works Inspection, Building Department **Implementation Activities:** The City currently has a permitting process for development that requires developers to follow the erosion control requirements set forth in the City's Erosion Prevention and Sediment Control (EPSC) Manual, including the creation of an erosion control plan for all sites which are inspected and approved by City staff based on the EPSC plan and identification of an erosion control project site manager for sites larger than one acre. (The plan required to obtain a 1200-C permit qualifies.) This Manual provides the inspection threshold, a summary of EPSC requirements, enforcement language, and a menu of BMPs and their appropriate uses, details and/or specifications for installation and maintenance, and guidance for appropriate site planning to protect water quality and is available on the City's website. City staff will continue to maintain and update the EPSC Manual when necessary to reflect current available and accepted technologies and City code.	**Program Commitment:** Implement the EPSC Manual in order to limit stormwater pollutant sources from construction and development & redevelopment activities. Review and evaluate the manual biennially to assess changes needed, if any. At a minimum, update the Manual once during the permit cycle to ensure appropriate best management practices and/or updated City code are included. **Permit Year of Commitment:** ongoing	- Report~~Track~~ updates to the Manual.

Table 5.0 (continued)

NPDES Permit Requirement - *(3) Procedures for identifying priorities for inspecting sites and enforcing control measures that considers the nature of the construction activity, topography, and the characteristics of soils and receiving water quality.*
NPDES MS4 Permit Schedule A 4 c. Construction Site Runoff Control and f. Post-Construction Site Runoff iv.

CON 3 Construction Site Inspection & Enforcement

Construction Site Inspection & Enforcement	**BMP Owner:** Water Resources Division, Public Works Inspection, Development Engineering, Building Department **Implementation Activities:** The City conducts inspections of construction sites using the permitting system database to record the location and status of site development to ensure compliance with the City's Erosion Prevention and Sediment Control (EPSC) Manual and proper implementation of post-construction site plans. The City of Gresham inspects construction sites holding a 1200-C permit utilizing the most practical application of City resources available. A construction site larger than one acre is always a priority due to the potential for soil loss and stormwater impact. If these sites involve improvements to public infrastructure they are assigned a Public Works Inspector (PWI). The PWI's are trained biannually in EPSC best management practices. They work collaboratively with the City's lead EPSC inspector to adaptively manage these sites. The City is not an agent of DEQ and does not review the 1200-C stormwater pollution prevention plan (SWPPP) prior to implementation; however, the City uses the Permittee's SWPPP as a guidance document to adaptively manage the site. Sites with a greater potential for EPSC failure based on type of construction, topography, soil erodibility and receiving water quality are targeted for more frequent inspection. The City's protocol for inspecting all permitted sites: 1) *Pre-Construction Meeting* where a representative from the Water Resources group (lead EPSC inspector) discusses stormwater best management practices. The permittee is asked to call in to the City's Interactive Voice Response (IVR) system for an initial erosion inspection.	**Program Commitment:** 1) Implement the EPSC inspection program to enforce the Erosion Control Manual in order to limit stormwater pollutant sources from development and redevelopment activities. 2) Ensure proper training for staff. 3) Examine tracking parameters such as the types of violations, number of active sites and total associated acreage. **Permit Year of Commitment:** ongoing ~~**Program Goals:**~~ ~~*Create a penalty structure and protocols to add to the existing enforcement tools.~~ ~~*This effort is subject to legal and City Council approval.~~	- ~~Track~~Report the number of sites inspected annually. - ~~Track~~Report staff training. ~~sessions conducted for staff.~~ - Report compliance/noncompliance ratios annually and enforcement actions taken, as applicable. ~~parameters assessed and~~ Report any applied program adaptive management resulting, as applicable. ~~that result, if applicable.~~

Table 5.0 (continued)

	2) Lead EPSC inspector makes *random inspections* of site throughout duration of project, often utilizing Public Works Inspectors to ensure requests and/or modifications to BMPs are made. 3) Workload permitting, Public Works Inspectors *visit sites daily during active construction for routine inspections including EPSC compliance* and report erosion concerns to the lead EPSC inspector. 4) *Final inspection* is called into the IVR system, and requested by Public Works Inspector. The lead EPSC inspector performs inspection and creates a detailed punch list of deficient items. This punch list must be implemented prior to project acceptance to ensure that post-construction standards are met. 5) Should enforcement response become necessary, the City's procedures are described within the EPSC Manual and City code. Additionally, the City of Gresham inspects all non-permitted sites (< 1 acre) regardless of their participation as a larger common plan of development or sale. These sites have required EPSC plans that are reviewed by City staff for compliance with the City's EPSC standards. Sites are prioritized and targeted for more frequent inspections based on topography, soil erodibility, and proximity to sensitive areas including but not limited to receiving waters.		

Table 5.0 (continued)

NPDES Permit Requirement - *(4) Appropriate educational and training measures for construction site operators.* (Note: See Component #5 and Table 6.0 for educational BMPs associated with this requirement). NPDES MS4 Permit Schedule A. 4 d. Education and Outreach v.			
Stormwater Education Program **(See Table 6.0)**	A description of the City's education BMP for construction site operators is included under Component #5, in Table 6.0.		See Table 6.0

7.5 Component #5 (EDU 1)
Stormwater Education Program

Requirements listed below are from 40 CFR § 122.26 (d)(2)(iv)(A) and (D) and are further described in the NPDES MS4 permit as cited. The Gresham BMP activity titles are listed below each requirement. The details of the BMPs are listed in **Table 2.0**. Three of the four major components of the SWMP requirements include public education-related requirements as follows:

Educational Requirement from Component #1 –
A (6) A program to reduce to the maximum extent practicable, pollutants in discharges from municipal separate storm sewers associated with the application of pesticides, herbicides and fertilizer that will include, as appropriate, controls such as educational activities, permits, certifications and other measures for commercial applicators and distributors, and controls for application in public right-of-ways and at municipal facilities.
EDU 1 Stormwater Education Program

- Ensure Staff/Stakeholder Training

Educational Requirement from Component #4 –
D (4) Appropriate educational and training measures for construction site operators.
NPDES MS4 Permit Schedule A 4. d. Education and Outreach: Provide notice to construction site operators concerning where education and training to meet erosion prevention and sediment control requirements can be obtained.

EDU 1 Stormwater Education Program

- Ensure Staff/Stakeholder Training

Educational Requirement from Component #2 – *NPDES MS4 Permit Schedule A 4 a. xii. [shortened and paraphrased]*
[…if any of these non-stormwater discharges under the co-permittee's jurisdiction are identified as a significant source of pollutants to waters of the State, the permittee must develop and require implementation of appropriate BMPs to reduce the discharge of pollutants associated with the source: landscape irrigation; lawn watering; individual residential car washing; charity car washing; dechlorinated swimming pool discharges…]

NPDES MS4 Permit Schedule A 4 d. Education and Outreach i-iv.
EDU 1 Stormwater Education Program

- Educate Residents
- Educate Businesses

See Table 6.0 for the City BMPs that address the requirements that are listed above.

TABLE 6.0 – Public Education

BMP Descriptions	BMP Implementation	Measurable Goals	Reporting Elements
Component #1 – Requirement A (6) – *A program to reduce to the maximum extent practicable, pollutants in discharges from municipal separate storm sewers associated with the application of pesticides, herbicides and fertilizer that will include, as appropriate, controls such as educational activities, permits, certifications and other measures for commercial applicators and distributors, and controls for application in public right-of-ways and at municipal facilities.* NPDES MS4 Permit Schedule A 4 d. Education and Outreach vii. Component #2 – Requirement *NPDES MS4 Permit Schedule A 4 a. xii. [shortened and paraphrased]* *[…if any of these non-stormwater discharges under the co-permittee's jurisdiction are identified as a significant source of pollutants to waters of the State, the permittee must develop and require implementation of appropriate BMPs to reduce the discharge of pollutants associated with the source: landscape irrigation; lawn watering; individual residential car washing; charity car washing; dechlorinated swimming pool discharges…]* Component #4 – Requirement (4) – *D (4) Appropriate educational and training measures for construction site operators.* *NPDES MS4 Permit Schedule A 4. d. Education and Outreach: v. Provide notice to construction site operators concerning where education and training to meet erosion prevention and sediment control requirements can be obtained.*			
Purpose: To plan, deliver and measure public education programs that will help eliminate or reduce stormwater pollutant sources.			
Targeted Pollutants: Primarily anything that adsorbs to sediment such as: phosphorus, bacteria, metals, and organic compounds, and litter, as well as pollutants that dissolve readily in water and/or carry a negative charge (e.g. soaps and surfactants, chloride, nitrate, and phosphate).			
Introductory Note With Respect to Addressing this Requirement: This section lists a few specific programs that are linked to the required elements listed above. The overall approach to public education is to implement programs based on priority of the pollutant types addressed. The highest priority education programs will target TMDL/303(d) pollutants, such as bacteria, as well as pollutants with high toxicity to fish or to people. Additionally, programs that are measurable in terms of implementation & impact on behavior change will be prioritized higher than programs that have unknown outcomes.			
EDU 1 Stormwater Education Program			
A. Ensure Staff/Stakeholder Training	**BMP Owner**: Water Resources Division, Community Relations, Development Engineering, Public Works, & Facilities Maintenance **Implementation Activities:** Conduct training for new employees and whenever there is a significant update to any of the following documents that regulate stormwater pollution control activities including but not limited to:	**Program Commitment:** The City will continue to conduct training for new personnel who utilize the documents described in this section and will conduct trainings for affected stakeholders, when appropriate.	~~Track~~Report the number of personnel & contractors who receive training by topic.

Table 6.0 (continued)

	Integrated Pest Management Plan—staff and workers (subcontractors-commercial applicators) on behalf of the City of Gresham Water Quality Manual—staff and affected stakeholders Stormwater Operations Manual—staff EPSC Manual—staff and affected stakeholders Spill Response Protocol—staff Environmental Compliance and Legal Training (for all project managers)—staff Public Utility Worker Ongoing Education--staff	**Permit Year of Commitment:** ongoing	
B. Educate Residents	**BMP Owner**: Water Resources Division, Community Relations, Solid Waste & Recycling Division, Water Division **Implementation Activities:** The City's program philosophy is to focus primarily on delivery of services that result in behavior change, as opposed to just raising awareness. However, some mix of approaches is necessary in order to move people from awareness to action. Public education approaches that actually track and measure behavior change are not only difficult, but generally, very costly to implement. As such the City often partners with other groups or agencies to deliver programs and services in an effort to leverage the City's budget in a cost effective manner. The City will endeavor to utilize program design and report estimated contacts and, where possible, measurable outcomes but notes that this is simply not possible in all cases. Create & deliver programs and/or messages to educate the public regarding non-point sources of pollutants of concern. There is no known scientific data that definitely demonstrates that the following types of non-stormwater discharges are significant sources of pollution to waters of the State within the Gresham permit boundary, nevertheless, the City's Education and Outreach Program attempts to address the following sources including but not limited to: lawn watering & landscape irrigation and maintenance practices, swimming pool/hot tub decant; and residential and charity car	**Program Commitment:** The City will continue to educate the public regarding their personal contributions to stormwater pollutant sources and impacts on water bodies and the steps or actions the public can take to reduce pollutants in stormwater runoff and evaluate the cost/benefit of various program approaches and adaptively manage levels of effort to redress pollutant reduction priorities.~~.~~ **Permit Year of Commitment:** ongoing ~~**Program Commitment:**~~ ~~Conduct or participate in an effectiveness evaluation that focuses on assessing changes in targeted behaviors in order to measure the success of public education activities and use results to adaptively manage the education and outreach program during the term of this permit.~~	-~~Track~~Report ~~pr~~programs/messages delivered, type of communication piece and, where appropriate/known, the number of people affected and measured behavior changes. -Annually report the Public Education program priorities and plans for the following year.

Table 6.0 (continued)

	washing, onsite stormwater management techniques, and the value of trees and habitat . Some of the primary target audiences include: • Single family home residents who use chemicals for home maintenance and who irrigate their lawn, who own pools and hot tubs • Pet owners • Do it yourself car maintenance residents • Neighborhoods that have joint ownership of private water quality facilities	~~**Permit Year of Commitment:** By November 1, 2014.~~	
C. Educate Businesses	**BMP Owner**: Water Resources Division, Community Relations, Solid Waste & Recycling Division, Water Division **Implementation Activities:** The City's program philosophy is to focus primarily on delivery of services that result in behavior change, as opposed to just raising awareness. However, some mix of approaches is necessary in order to move people from awareness to action. Public education approaches that actually track and measure behavior change are not only difficult, but generally, very costly to implement. As such the City often partners with other groups or agencies to deliver programs and services in an effort to leverage the City's budget in a cost effective manner. The City will endeavor to utilize program design and report estimated contacts and, where possible, measurable outcomes but notes that this is simply not possible in all cases. Create & deliver programs and/or messages to educate businesses regarding non-point source pollutants of concern, including but not limited to: lawn watering & landscape irrigation, private system maintenance, discharges from potable water sources, street washing, garbage/chemical/fluid/process management, control & disposal, and spill kits. Some of the primary target audiences include: • Landscape firms • Businesses that have pools and hot tubs	**Program Commitment:** The City will continue to educate the businesses regarding their personal contributions to stormwater pollutant sources and impacts on water bodies and the steps or actions the public can take to reduce pollutants in stormwater runoff, including but not limited to those with privately owned stormwater quality management facilities. The City will evaluate the cost/benefit of various program activities and adaptively manage levels of efforts to redress pollution reduction priorities. **Permit Year of Commitment:** ongoing	-~~Track~~Report programs/messages delivered, type of communication piece and, where appropriate/known, the number of people affected and measured behavior changes. -Annually report the Public Education program priorities and plans for the year following

Table 6.0 (continued)

	• Businesses with privately-owned water quality facilities • Businesses as prioritized by the Business Inspection Program		

7.6 Component #6 (MON)
Program Management & Monitoring

The following elements and corresponding activities are included in the SWMP to aid the overall permit compliance effort by the City, but these elements are not BMPs in and of themselves. These activities are listed in this section in order to address the following permit elements:

NPDES MS4 Permit 101315:

Schedule A 4. e. Public Involvement and Participation,
Schedule A 5 Hydromodification Assessment
Schedule B 5. Annual Reporting Requirement, and
Schedule D 2. and 3.
MON 1 Annual Report Writing
MON 3 Program Evaluation and Monitoring

Schedule A 4. e. Public Involvement and Participation,
Schedule B 6. MS4 Permit Renewal Application Package
MON 5 Permit Renewal Submittal

Schedule A 4. e. Public Involvement and Participation,
Schedule A 4 f. Post-Construction Site Runoff ii.;
Schedule D 1. Legal Authority
2. 303 (d) Listed Pollutants
MON 2 Legal Authority and Code Review
MON 3 Program Evaluation and Monitoring
MON 4 Public Involvement

See Table 7.0 for the City BMPs that address the requirements that are listed above.

Table 7.0 Program Management & Monitoring

BMP Descriptions	BMP Implementation	Measurable Goals	Reporting Elements
NPDES MS4 Permit 101315 Schedule A 4. e. Public Involvement and Participation, Schedule A 4 f. Post-Construction Site Runoff ii, Schedule B 5. Annual Reporting Requirement, Schedule B 6. MS4 Permit Renewal Application Package, and Schedule D 1. Legal Authority			
Purpose: To involve the public in efforts to reduce stormwater pollutants, implement the SWMP and evaluate the effectiveness of meeting stormwater pollutant reduction goals and adaptively manage the programs, as necessary, while assuring overall NPDES MS4 Permit compliance.			
Targeted Pollutants: With the exception of Legal Authority, these activities do not address specific pollutants of concern because of their administrative nature. The Legal Authority review does, however, expressly prohibit any type of pollutant from being deliberately introduced into the municipal stormwater system.			
Introductory Note With Respect to Addressing this Requirement: This section lists activities that function related to the administrative function of the overall NPDES permit compliance effort. These activities are required elements that utilize a significant amount of staff time and resources but are not BMPs in and of themselves.			
Program Management & Monitoring			
MON 1 Annual Report Writing	**BMP Owner**: Water Resources Division **Implementation Activities:** Coordinate with all City divisions and groups that administer BMPs described within the SWMP to review program commitments, gather tracking data, and where appropriate, assist with program evaluation and additional goal setting or BMP enhancements. Annually provide a copy of the report on the City's website and provide notice to the public about the opportunity to comment.	**Program Commitment:** Submit Annual Report to DEQ on behalf of Gresham and Co-permittee, as required by the permit. **Permit Year of Commitment:** ongoing	-Each year, provide a report that includes the following components: • a description of the public comment notice method • status of the SWMP implementation and SWMP program elements, progress in meeting the measurable goals; • status and/or results of any public education program effectiveness evaluation conducted during the reporting year and a summary of how the results were or will be used for adaptive management; • a summary of the adaptive management process during the reporting year, including any proposed changes to the SWMP identified through implementation of the adaptive management process ;

			• proposed changes to SWMP elements designed to reduce TMDL pollutants to the MEP; • a summary of total stormwater program expenditures and funding sources over the reporting fiscal year and those anticipated in the next fiscal year; • a summary of monitoring program results, including monitoring data that are accumulated throughout the reporting year and/or assessments or evaluations; • any proposed modifications to the monitoring plan that are necessary to ensure that adequate data and information are collected to conduct stormwater program assessments; • a summary describing the number and nature of enforcement actions, inspections & public education programs, including the results of ongoing field screening and follow-up activities related to illicit discharges; • An overview, as related to MS4 discharges, of concept planning, land use changes and new development activities that occurred within the Urban Growth Boundary (UGB) expansion areas during the previous year, and those forecast for the following year, including the number of new post-construction permits issued, and the estimate of total new or replaced impervious surface area related to new development and redevelopment

			projects commenced during the reporting year; • Results of ongoing field screening and follow-up activities related to illicit discharges; • ~~**Annual Report 2014** must also include:~~ ○ ~~TMDL Pollutant Load Reduction Evaluation~~ ○ ~~Wasteload Allocation Attainment Assessment~~ ○ ~~303 (d) Evaluation~~ ○ ~~Hydromodification Assessment~~ ○ ~~Retrofit Plan~~
MON 2 Legal Authority and Code Review	**BMP Owner**: Water Resources Division and City Attorney's Office **Implementation Activities:** Review existing City code to ensure that the Legal Authority and development standard requirements as stated in the NPDES Permit are met and in appropriate code revision years, examine code for opportunities to enhance or improve language that will limit pollutant sources to stormwater.	**Program Commitment:** Maintain Legal Authority, as required by the permit. **Permit Year of Commitment:** ongoing	-Maintain adequate legal authority through ordinance(s), interagency agreements or other means to implement and enforce the provisions of the NPDES MS4 Permit #101315. -~~Track~~Report enhancements or improvements to existing City code.
MON 3 Program Evaluation/ Monitoring	**BMP Owner**: Water Resources Division, with assistance from other City divisions or groups, as appropriate. **Implementation Activities:** As required by the permit, review the appropriate 303(d) list to determine whether there is a reasonable likelihood of stormwater from the MS4 to cause or contribute to water quality degradation of receiving waters. Evaluate whether the BMPs within the SWMP are effective in reducing these relevant pollutants to the MEP. For ongoing annual program evaluation efforts, the City utilizes the GIS Mapping Program to provide mapping support to the Water Resources Division and other divisions or groups in order to support or enhance system infrastructure documentation for BMP program evaluation/monitoring efforts.	**Program Commitment:** Conduct a 303(d) pollutant evaluation as required by the permit. **Permit Year of Commitment:** PY 17 or as otherwise dated in the permit or requested by DEQ.	- Submit a report summarizing the results of the 303(d) list review and evaluation and any proposed SWMP modification or updates necessary to reduce applicable 303(d) pollutants to the MEP; - Submit a Waste Load Attainment Assessment; - Submit a TMDL Pollutant Load Reduction Evaluation; -~~Track~~Report significant mapping efforts that help evaluate, enhance or support the SWMP BMPs.

MON 4 Public Involvement	**BMP Owner:** Water Resources Division, Community Relations & City Manager's Office **Implementation Activities:** Conduct appropriate public involvement efforts related to various NPDES permit elements including but not limited to: SWMP modifications, Annual Reports, Retrofit Strategy, Permit Renewal Submittal elements such as TMDL pollutant load reduction benchmark document development. Typical public involvement activities include: • Presentations to Technical/Citizen Advisory Committees • Public notices via a variety of media outlets (as described in Component #5 Public Education)	**Program Commitment:** Conducted within an appropriate timeline to meet the legal requirements for five year permit renewal submittals; and ongoing, regarding adaptive management of the SWMP. -Summarize public involvement activities and response to public comment related to SWMP updates or proposed changes. **Permit Year of Commitment:** ongoing	-Report the number of people reached during public involvement activities.
MON 5 Permit Renewal Submittal	**BMP Owner:** Water Resources Division • **Implementation Activities:** Prepare the permit renewal submittal package at least 180 days prior to permit expiration that synthesizes the implementation and findings of the current permit cycle to support the proposed SWMP for the renewed permit, including an evaluation of the adequacy of the SWMP in reducing pollutants to the maximum extent practicable (MEP).	**Program Commitment:** Package to contain the elements as required by the permit. Evaluate the overall program effectiveness and progress towards achieving applicable waste load allocations. **Permit Year of Commitment:** Process to prepare the next submittal will begin in	Submittal includes as required by the permit but is not limited to: • Proposed modifications, including additions and removals of BMPS and measureable goals; • Information allowing the Department to make an independent assessment that the SWMP proposed meets the requirements of the permit to the MEP • Updated pollutant loads for TMDL pollutants and BOD5, COD, nitrate, total phosphorus, dissolved phosphorus, cadmium, copper, lead and zinc.

		PY 17-18, or as appropriate to meet stated permit deadlines.	• Establishment of TMDL Pollutant Reduction Benchmarks, if not achieving the WLA • A proposed monitoring program • a description of service area expansions • A fiscal evaluation summarizing expenditures for the current and next permit cycle • Updated MS4 maps

Cities of Gresham and Fairview

Environmental Monitoring Plan

for
National Pollutant Discharge Elimination System (NPDES)
Municipal Separate Storm Sewer System (MS4)
Permit Compliance

Prepared by:
City of Gresham, Department of Environmental Services,
Water Resources Division
for the Cities of Gresham and Fairview

Original: August 2008
Updated: August 2010, November 2011, October 2012, November 2015

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1.0 INTRODUCTION

1.1 Overview

Under the federal Clean Water Act and Oregon Revised Statute 468B.050, the Oregon Department of Environmental Quality (DEQ) has issued the Cities of Gresham and Fairview a National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) Discharge Permit. As such, both cities are required to develop a monitoring program as described in the Clean Water Act (CWA) 40 CFR 122.26 (d) (2) (iii) (A) through (D) and in Schedule B Monitoring and Reporting Requirements of the NPDES MS4 permit #101315 in order to characterize stormwater discharges, assess trends in water quality and aid the adaptive management of the overall stormwater program within the permit boundary.

The City of Gresham is Co-permittee with the City of Fairview and acts as the lead applicant for the permit and has agreed to be responsible for conducting most of the monitoring program elements on behalf of the City of Fairview via an inter-governmental agreement (**See Appendix D**). The City of Gresham, including the urban growth boundary of Pleasant Valley, Kelley Creek Headwaters and Springwater represents approximately 17,000 acres (about 26.5 square miles). Just over 2,200 additional acres are managed by the City of Fairview. A more detailed discussion of the permit boundary and the history of the Co-permittees may be found in **Section 4.3.3** of Gresham's Stormwater Management Plan (SWMP) which includes Figure 4.3.1 Map of the NPDES MS4 Permit #101315 Boundary and Area Watersheds.

The primary goal for the monitoring program is to support evaluation and adaptive management of the stormwater management program in order to reduce the discharge of pollutants from the MS4 to the maximum extent practicable. The Cities of Gresham and Fairview have developed individual Stormwater Management Plans as directed by the CWA 40 CFR 122.26 (d) (2) (iv) (A) through (D) and in Schedules A, B, and D of the NPDES MS4 permit. These documents are available on the Cities' websites at www.greshamoregon.gov and www.ci.fairview.or.us and are also available upon request from each City.

The City of Gresham is also responsible for implementing a groundwater protection program to comply with a December 2012 Water Pollution Control Facility (WPCF) permit. Currently this plan is written to comply with the NPDES MS4 permit, but may be adapted to include the details necessary to comply with the WPCF permit.

In addition to complying with the NPDES MS4 permit requirements, the goal of this Monitoring Plan is to provide the Cities of Gresham and Fairview with a monitoring program that will consider Total Maximum Daily Load (TMDL) compliance objectives for water quality monitoring; provide data to help answer some of the outstanding questions about stormwater-related pollutant sources; help the Co-Permittees assess water quality impacts related to MS4 discharges; and help identify improvements in water quality over time as a result of the Co-Permittees' stormwater quality management efforts.

This Monitoring Plan reflects the requirements of the NPDES MS4 Permit issued on December 30, 2010.

1.2 Monitoring Program History and Updates

Permit Application (1993)
The Cities of Gresham and Fairview's monitoring program was originally designed by the consultant team that drafted the 1993-95 permit application submittal. A discussion of the permit and SWMP development history are included in the Introduction of the City of Gresham's SWMP. A discussion of the changes to the Monitoring Plan since its original design is included here.

Permit Renewal Submittal (2000)
The monitoring program was updated for the 2000 permit renewal submittal. During the permit renewal process, third party groups expressed concern that the DEQ permit was not protective enough to ensure that creeks, streams, and rivers would eventually meet water quality standards. The permit was initially issued in 2004, but was reconsidered by DEQ as a result of a third party appeal. The permit was reissued in 2005 and required the Co-permittees to review the previously submitted Monitoring Plan to ensure that it met final permit goals and requirements, and report findings and proposed revisions in an "Interim Evaluation Report" due in 2006.

Interim Evaluation Report (2006)
Per the 2005 NPDES MS4 Permit requirement, the Co-Permittees' stormwater monitoring program was reviewed and updated with respect to the NPDES MS4 permit objectives and TMDL requirements. Most of the changes made at that time are still incorporated in the current Stormwater Monitoring Plan. The main recommendation was that resources dedicated to monitoring should continue to be limited, due to the high variability of stormwater and the need to focus resources on activities that reduce pollution.
Monitoring program changes included:

- Added two Kelley Creek monitoring sites (Johnson Creek watershed) to the list of instream sites. Gresham began monitoring these sites in fall 2006 in order to characterize the Pleasant Valley annexation area and the Kelley Creek Headwaters annexation area, which will eventually be incorporated into the City's permit boundary when urban services are provided. Future plans may also include new monitoring site(s) to characterize the Springwater annexation area prior to planned future development.
- In order to assess progress toward meeting the TMDL in Johnson Creek for legacy pesticides, DDT monitoring was added at the two instream sampling locations on Johnson Creek and periodically in stormwater.
- PAH and PCB monitoring was implemented in Johnson Creek with a caveat that monitoring would be re-evaluated after two years if sampling failed to produce values above commercially available quantitation limits.

Permit Renewal Submittal (2008)
In preparation for the 2008 NPDES MS4 permit renewal submittal, the Co-Permittees prepared water quality trend analyses, pollutant load reduction estimates (benchmarks) and pollutant load updates. Additionally, the following activities were conducted:

- Internal reviews of all BMPs
- Review of technical information from external sources and monitoring data, including a formal literature search

- Review of data collected by staff, and knowledge of program effectiveness
- Discussion with other jurisdictions concerning best practices
- Consideration of fiscal constraints
- Input from the general public
- Deliberation by Council

Based on the findings as described above, staff recommended the changes to the Monitoring Plan as follows:

- Added annual macroinvertebrate monitoring to provide measurement of biological communities within MS4 receiving waters, in addition to bacteria. Biological monitoring provides an additional means for evaluating long term trends since these benthic organisms are exposed to chemical, biological and physical conditions of the stream that are not well characterized by point-in-time water quality grab samples for bacteria.
- Removed PCBs and PAHs from list of instream and stormwater constituents monitored in Johnson Creek since all samples analyzed over two years (2006-2008) were below the detection limit (100 ng/L). The USGS data upon which the 303(d) listing is based was a 35-day collection using semi-permeable membranes, with a reported value of 52.9 ng/L. More detail on the 303(d) listing is included in the 303(d) Analysis performed for the 2008 Permit Renewal Submittal. Because the available laboratory quantitation limits are twice the level USGS found over 35 days, grab samples are expected to be below the quantitation limit. Since both constituents have also been found in streambed sediment, the Co-Permittees plan to use TSS as a surrogate measurement for these constituents, as is done in the Columbia Slough. Resources will be reallocated to other monitoring activities.
- Removed total and dissolved nickel from list of ambient and stormwater constituents since levels are always significantly lower than chronic and acute toxicity levels and nickel tracks with other heavy metals, which will serve as surrogate measurements.
- Continue and expand monitoring of the effectiveness of large scale BMP projects built over the past few years. Monitoring will continue at the Fairview Creek Water Quality Facility for at least a portion of the permit term, and additional monitoring will be planned to evaluate the performance of the new Columbia Slough Water Quality Facility.

2010 Update

Slight modifications to the Monitoring Plan were made in 2010 based on requirements in draft NPDES MS4 and WPCF permits, and Multnomah County's application to obtain its own permit and no longer be a Co-permittee. Some cooperative monitoring efforts between Multnomah County and Gresham are still planned to occur via an inter-governmental agreement. (**See Appendix J**.) Additionally, the frequency and location of stormwater sampling were modified to ensure compatibility with the anticipated WPCF permit, as described below:

- Added pesticides (2,4-D and pentachlorophenol) to water quality constituents based on findings from a local USGS study which indicated 2,4-D exceeded an aquatic-life benchmark. Gresham also has a targeted educational BMP for 2,4-D use reduction. Pentachlorophenol has exceeded drinking water standards in stormwater. These pesticides will be monitored for all wet weather stormwater monitoring.
- Reduced instream monitoring frequency from six times to four times per year to free up resources for enhanced stormwater monitoring. Three samples per year will be focused in wet season, with one sample per year being collected during low flow in conjunction with

macroinvertebrate monitoring. Analysis of existing data (described further in **Section 2.0**) indicates no significant loss in ability to recognize changes in water quality based on this modification.

- The stormwater monitoring approach will move from sampling outfalls from three large drainage areas to sampling multiple small drainages (0.5 to 5 acres) selected using a probabilistic (random and spatially-balanced over the selected area) sampling design (see Stevens and Olsen 2004). The benefit to using the probabilistic approach is that the small drainage areas will typically be composed of a single land use, versus the mixed use inherent in the past stormwater outfall monitoring approach that focused on drainage areas that were hundreds of acres in size. This will enable the permittees to better characterize the source of various pollutants.

2011 Update

The Monitoring Plan was reorganized and elements were added to more closely follow the requirements contained in the final NPDES MS4 permit issued to Gresham and Fairview on December 30, 2010. DEQ added a new requirement not included in the applicant review draft of the permit to conduct mercury monitoring as described by the DEQ "Mercury Monitoring Requirements for Willamette Basin Permittees" memo dated December 23, 2010. (See **Appendix H**). As such, the plan was amended to include a description of the effort to monitor for mercury, which includes continued monitoring for total mercury in all stormwater and surface water sampling and adding total and dissolved mercury and methyl mercury at 4 stormwater monitoring locations annually. Additionally, requirements in the draft Water Pollution Control Facility (WPCF) permit for municipal Underground Injection Control Systems (UICs) inspired stratification of the probabilistic sampling design for stormwater based on vehicle trips per day.

The Plan was released for public comment on April 11-25, 2011 and submitted to DEQ on May 1, 2011 for implementation on July 1, 2011. On June 27, 2011, the Co-Permittees received conditional approval of the Monitoring Plan and included comments for the Co-Permittees to address as summarized below:

DEQ Request	Gresham Response
Please submit any Hg monitoring the City of Gresham has collected to date.	Emailed spreadsheet of data to DEQ on June 27, 2011
An updated description of the process for conducting adaptive management should be included in the Monitoring Plan by November 1, 2011. A more specific link between using monitoring data/tracking measures and evaluation efforts within the adaptive management process is necessary.	Additional text was added to Section 1.4 (Adaptive Management).
The study design for instream monitoring should be clarified/refined for purposes of examining the instream water quality improvements associated with BMP implementation.	Added additional language to 3.4.1. The instream monitoring program was not designed to explicitly determine whether or not BMPs improve water quality between the upstream and downstream

	monitoring stations. Rather, long-term instream monitoring trends have been evaluated to determine whether they are consistent with improvements noted with Structural BMP Monitoring (as noted in Section 3.2.4 "Relationship to Long-term Program Strategy," on page 18).
The Monitoring Plan or supporting documentation does not describe how important elements of the study design will be addressed. For example, a description of the calibration or treatment sample collection period for the upstream/downstream study, the timing of upstream/downstream sample collection and evaluation of lag time has not been addressed.	Clarification was added to the Study Design (Section 2.4.1) to describe the rationale used for sample collection timing for upstream/downstream locations.
For NPDES MS4 permit compliance purposes, samples must be analyzed in accordance with EPA approved methods listed in 40 CFR 136. The methods identified for several of the pollutant parameters (e.g., TKN, Hg, DDT, Dieldrin) are not 40 CFR 136 methods. The plan should be revised accordingly.	**TKN**: The listed method (PAI-DK03) is a 40 CFR 136 method (flow injection gas method, see footnote 41, Table 1B, 40 CFR Part 136.3). **Total Hg**: The WPCLSOP M-10.02 method cited for total Hg is EPA 200.8 w/CEM digestion (footnote 4, Table 1B, 40 CFR Part 136.3)~~– this is a method Portland's WPCL received ATP approval for about 5 years ago, but cite as WPCLSOP M-10.02~~. **DDT/Dieldrin**: From DEQ response dated 7/27/2011: EPA Method 608 is listed as an approved method for analyzing organochlorine pesticides, including DDT, DDD, DDE and Dieldrin. EPA SW846 Method 8081 is nearly identical and is often used interchangeably with EPA Method 608. Because of the similarities between the methods, method 8081 meets the criteria of a modified version of 608 under the description outlined in 40 CFR Part 136.6 "Method Modifications and Analytical Requirements". As a result, DEQ will accept the use of EPA Method 8081 for use by the City of Gresham to meet the Gresham MS4 Group permit monitoring and analytical requirements for in-stream monitoring for legacy pesticides (DDT,

	Dieldrin) within the Johnson Creek sub-watershed
The analytical method and Method Reporting Limit (MRL) identified for total Hg for instream and BMP effectiveness monitoring does not meet the intent of DEQ's Mercury Monitoring Requirements for Willamette Basin Permittees memo. Although this monitoring is not specifically required by the MS4 permit, use of this data may be limited if the method and MRL for total Hg are not in accordance with those identified in the referenced memo.	The City has been monitoring total Hg using WPCLSOP M-10.02 for all 1) instream, 2) stormwater, and 3) BMP effectiveness samples since 2004. An evaluation of monitoring results indicates that >60% of instream and >90% of stormwater samples are above the MRL, and therefore the method is deemed to be appropriate for the intended use of the data. The City plans to use the higher resolution data from the low level mercury and methyl mercury study to correlate with the same total mercury monitoring method used since 2004.
Table 6 on page 27 refers to DEQ's guidance for accuracy and precision of field measurements. The table should be revised to reflect the following: Dissolved Oxygen – Precision ± 0.3 mg/L, Accuracy ± 0.2 mg/L Conductivity – Precision ± 10% of Std. Value, Accuracy ± 7% of Std. Value (in this case, the values included in the document are more strict than the DEQ criteria provided here. The permittee may always use more stringent criteria, however, this is the criteria used by DEQ). Turbidity – Precision – include ± 1 NTU if NTU < 20	Changes made to Table 6 and Table 13 to reflect the accuracy and precision targets noted by DEQ.
Instrumentation Calibration should be calibrated to bracket the values expected in the field. Since there is the possibility to record a pH of less than 7 in stormwater, pH meters should be calibrated using 3pt calibration (4, 7, 10). – see pages 28, 52, and 70.	Changed calibration details in Monitoring Plan to reflect 3-point calibration (pH 4, 7 and 10). Began using 3-point calibration for all pH monitoring activities conducted on and after July 1, 2011.
Clarify how the Hg monitoring requirements will be addressed. It is unclear how the sample collection strategy described will result in one wet & one dry sample collection at each of two sites each year during the 1st 2 years.	Mercury monitoring approach outlined in Monitoring Plan was altered to reflect one summer and one winter event being collected at the same 2 sites for the first 2 years of permit. Low level mercury monitoring has been moved from Section

	6.0 (wet weather stormwater monitoring) to Section 8.0 (structural BMP monitoring), since incorporating the Hg monitoring into this task should better meet the comments provided by DEQ.
Mercury (total & dissolved) monitoring should use EPA 1631E analytical method with the appropriate MRL.	Monitoring Plan has been updated to reflect that the special study low level mercury uses EPA 1631E and methyl mercury is EPA 1630
The wet weather stormwater monitoring for mercury and methyl mercury appear to only include samples from residential land use. This monitoring should include commercial and industrial land use types.	The sites selected to meet the mercury monitoring memo requirements were moved from the smaller UIC drainages described in the wet weather stormwater monitoring Section (6.0) to the larger commercial and industrial land uses draining to the BMP evaluation locations described in Section 8.0
Describe the cleaning procedure or reference a certification that the lab supplying the containers for Hg and methyl Hg monitoring are pre-cleaned.	Test America provides water sample bottle kits that follow the procedures outlined in EPA method 1669. Every bottle kit lot is confirmed to produce methyl mercury bottle blanks <0.05 ng/L.
The Monitoring Plan indicates that small drainage catchments will be monitored as a result of using the probabilistic study design for wet weather stormwater monitoring. DEQ is interested in the site selection procedures and other supporting information. Please provide additional supporting documents related to the use of this site selection and monitoring approach by November 1, 2011. Some of the specific questions are as follows:	Responses next to each item below:
How was the range of areal extent for these smaller drainage catchments (0.5-5 acres) determined?	The City's UICs exist within an area deemed to be representative of the land uses and traffic within the entire city. Sites were selected according to the GRTS procedure (see Section 6.4.1) and the area draining to each UIC varies based upon factors such as infiltration rate and amount of impervious area in the drainage area. ~~As stated in Section 6.4.1 (wet weather stormwater sampling study design), the area of the permit area from~~

	~~which the sites were selected is the designated sump area UIC~~
Are larger drainage catchments eliminated from the site selection protocol?	Yes. A few historical large drainage area outfalls will still be monitored as part of BMP Effectiveness Study, but the historic land use based outfalls monitored in the past will no longer be monitored.
Is it possible to use a portion of a larger drainage catchment in delineating a smaller drainage catchment for purposes of site selection?	Yes. But for the study design presented in section 6.0, the discharge point to a UIC was selected as a representative, accessible, and easy to delineate drainage area.
Will all the land use types be captured using the smaller drainage catchment approach?	Yes
What scientific literature was used to support the assumptions related to shifting to small drainage catchments (e.g., Stevens Jr. & Olsen)?	The study design section (6.4.1) discusses the rationale for the switch based on a comparison of monitoring results conducted by Portland and Gresham (analyzed and reported in ACWA 2009), as well as the scientific rationale outlined by Stevens and Olsen (discussed and cited in that section).
The timeframe for evaluating and submitting a report related to considering additional current use pesticides to be monitored was not identified. The evaluation and report should be submitted to DEQ as soon as possible, but no later than November 1, 2011. In addition, the pesticide monitoring should consider when there may be pesticide analyte detection of high frequency, but at a low detection level.	The pesticide assessment conducted to date is being submitted with this annual report. Included in Appendix K.
On page b-5, SOP A-8, the bottle list does not match the needed bottle lists in the tables identified in the plan. Please update the list as appropriate.	The bottle list in SOP A-8 contains the actual bottles and volumes collected. The volumes listed in the Monitoring Plan are minimum volumes required for each analysis. For some analyses, the lab splits the required volume from a larger container (e.g. 1 L plastic bottle collected for nutrients), while for others a larger volume is collected than what is required for analysis (e.g. 250 mL collected for E. coli, but only 1000 mL used).

Verify that equipment blanks are collected prior to sampling to verify equipment is clean and free of contamination. Equipment blanks should be collected 10% of the locations for equipment that is repeatedly used throughout the sample collections.	Field blank collection at 10% of sites was added to in-stream, wet weather stormwater and BMP monitoring sections.
Verify the following information is adequately addressed in the Monitoring Plan:	
Mercury (total and dissolved) and Methyl Mercury (total and dissolved),TSS, flow and Field Constituents are collected at the same time and reported using the MRL and analytical methods specified in the DEQ's Hg memo.	TSS, field constituents, and rainfall (as a surrogate for flow) will be measured at the same time as sample collection for the special mercury monitoring, as well as the total mercury monitoring which will be conducted at all stormwater monitoring locations.
Mercury (total and dissolved) and Methyl Mercury (total and dissolved) should be analyzed with the methods stated DEQ's Hg memo.	This was the original intent, but language was added to explicitly state this.
Collect Mercury (total and dissolved) and Methyl Mercury (total and dissolved) simultaneously. This will allow DEQ to calculate the ratio needed to develop the Bio-Accumulation Factor for the TMDL. This will also allow DEQ to compare ambient monitoring datasets collected by DEQ to the Hg data collected by permittees.	This was the original intent, but language was added to explicitly state this.
Monitoring of Hg should use environmentally relevant and sensitive MRLs to characterize effluent, as specified in DEQ's Hg memo. This is in accordance with a USEPA April 2010 document "Guidance for Implementing the January 2001 Methyl Mercury Water Quality Criterion".	This was the original intent, but language was added to explicitly state this.
Additional Changes – Adaptive Management of Monitoring Plan	
Wet Weather Stormwater Monitoring (Monitoring Plan Section 6.0)	Added additional detail about GRTS site selection procedure, including use of stratification by vehicle trips per day (<1000 and >1000). Strategy for over-sampling high traffic areas is explained. The sampling locations were updated to reflect additional sites being considered (Gresham gained access to all UICs, since 130 of those obtained from

	Multnomah County were paved over until early 2011.
Dry Weather Field Screening (Monitoring Plan Section 7.0)	Updated list of sites in Table 14 (Priority Outfalls for Illicit Discharge Monitoring/Dry weather Screening) to accurately reflect sites screened annually. Three locations were eliminated (D6B, F2A and F4) since the pipe system they are part of is still captured by downstream screening locations, and one site that has been screened annually, but was somehow omitted from the list submitted to DEQ in April 2011, was added to the list (D2B). Additional clarification was also added to some of the sampling locations to more accurately reflect location visited annually.
Appendices J, K, and L	Added IGAs between Gresham and Multnomah County for monitoring (Appendix J) and between Gresham and City of Portland for Columbia Slough monitoring (Appendix F). Also added the pesticide assessment requested in Table B-1 as Appendix K.

Updates During Permit Term

Date	Monitoring Plan Section	Change or Update
11/1/2011	Tables 11 and 12	Deleted chlorophyll-*a* from both tables, since this constituent is not monitored as part of wet weather stormwater monitoring.
11/1/2011	Table 14	Updated list of priority outfalls where dry weather screening occurs to add one major outfall that has been screened annually, but was omitted in July 2011 plan, as well as deleting a couple historic manholes upstream of outfalls already on screening list.
10/26/2012	Entire Document	Changed name of document from "Stormwater Monitoring Plan" to "Environmental Monitoring Plan." Change was made to align with language in MS4 permit and allow wet weather monitoring to be specifically outlined in separate referenced Stormwater

		Monitoring Plan created to comply with WPCF permit, in addition to wet weather requirements of MS4 permit.
10/26/2012	Section 6.0 "Wet Weather Stormwater Monitoring"	Removed specifics for wet weather stormwater monitoring to a separate Stormwater Monitoring Plan submitted to DEQ for compliance with WPCF permit, while also meeting goals, objectives and requirements of NPDES MS4 permit.
10/26/2012	Section 7.6.2 Illicit Discharge Investigation	Added additional language about level of effort City staff will spend investigating sources deemed to be *de minimus*.
10/26/2012	Table 20	The list of rotating panel locations for UIC sampling sites was deleted from the Environmental Monitoring Plan, since this information is contained and updated in the separate Stormwater Management Plan.

Permit Renewal Submittal Proposed Changes (2015)

Updates to be implemented July 2, 2016. There are several proposed minor changes to the Monitoring Plan for the 2015 Permit Renewal Submittal. These changes do not reduce the number of data points sampled or the sampling effort. The proposed changes reduce sampling in well-characterized areas to allow for increased sampling in areas that are more likely to inform stormwater design and management in the future to improve water quality. We plan to adopt these changes on July 1, 2016 as permitted in Schedule B.2.e. of the 2010 NPDES MS4 Permit. After incorporating these changes, the monitoring program will continue to meet or exceed all requirements listed in Table B-1 of the 2010 NPDES MS4 Permit.

Low Level Mercury Monitoring. The City of Gresham conducted low-level mercury monitoring for 2 years in response to DEQ's "Mercury Monitoring Requirements for Willamette Basin Permittees" Memo (Appendix H). Two years of data did not yield environmentally relevant mercury levels, and the city requested in 2013 to eliminate low-level mercury monitoring from the wet weather stormwater monitoring program.

Wet Weather Stormwater Monitoring. Over the past 6 years, Gresham has collected 180 stormwater samples. All sites were selected probabilistically, with the monitoring strategy used over the past 4 years including monitoring of 5 static or "fixed" locations (monitored each year) and 25 rotating sites for a total of 30 underground injection control (UIC) sites monitored annually. Data analysis shows consistent patterns that generally differentiates sites on streets with >1,000 trips/day from those with <1,000 trips/day. We are proposing a decrease in this sampling from 30 sites/year to 10 sites/year (5 fixed and 5 rotating sites). This reduction will allow for an increase in best management practice (BMP) monitoring.

BMP Effectiveness Monitoring. We currently monitor the inlet and outlet of one structural BMP during 2 storms/year. The information from BMP sampling is valuable to inform future design and management of BMPs. The City has recently constructed several BMPs with varying structural design and is interested in understanding the effectiveness of each at removing pollutants. We propose to increase BMP sampling to a total of 4 "facility events"/year; for example, two facilities may be sampled for each of two storms, or four facilities may be sampled during one storm each.

During BMP sampling we currently collect time- or flow-weighted 5-12 part composite samples at the inlets and outlets. Although this is an effective method for characterizing stormwater constituents in some situations, we have found that it is difficult to accurately weight the samples due to the lack of reliable storm forecasts. We propose moving to collecting a minimum of 3 individual grab samples at each inlet and outlet during each storm sampling event so that averages and maxima can be examined for each pollutant.

Dry Weather Field Screening. The City of Gresham currently monitors 30 fixed sites/year for Dry Weather Field Screening. We propose to continue to monitor 8 of these high-priority fixed sites/year while sampling 22 additional sites/year that will be randomly selected based on risk from drainage area and land use. This will allow us to expand our search for illicit connections to the stormwater system.

The sections that follow incorporate the proposed changes, and comprise the commitments of the Monitoring Plan.

1.3 Permit Requirements and Goals of the Monitoring Program

As listed in Schedule B.1.a., the monitoring program must incorporate the following six objectives:

i. Evaluate the source(s) of the 2004-06 303(d) listed pollutants applicable to the co-permittees' permit area;
ii. Evaluate the effectiveness of Best Management Practices (BMPs) in order to help determine BMP implementation priorities;
iii. Characterize stormwater based on land use type, seasonality, geography or other catchment priorities;
iv. Evaluate status and long-term trends in receiving waters associated with MS4 stormwater discharges;
v. Assess the chemical, biological and physical effects of MS4 stormwater discharges on receiving waters; and,
vi. Assess progress towards meeting TMDL pollutant load reduction benchmarks.

The permit also states that:

> *The co-permittees may use Stormwater Management Plan measurable goals, environmental monitoring activities, historical monitoring data, stormwater modeling,*

national stormwater monitoring data, stormwater research or other applicable information to address the monitoring objectives.

With the exception of the SWMP and measurable goals, the Co-permittees approach for the monitoring program utilizing the tools and data as listed above are contained within this document.

The plan is required to include the following information for each monitoring project/task:

i. Project task/organization;
ii. Monitoring objectives, including monitoring questions and background, data analysis methodology and quality criteria, and assumptions and rationale;
iii. Documentation and record-keeping procedures;
iv. Monitoring process/study design, including monitoring location, monitoring frequency and duration, and responsible sampling coordinator;
v. Sample collection methods and handling/custody procedures;
vi. Analytical methods for each water quality parameter to be analyzed;
vii. Quality control procedures, including quality assurance, the testing, inspection, maintenance, calibration of instrumentation and equipment; and
viii. Data management, review, validation and verification.

The Co-permittees have used this as an outline for the structure of the information included for each activity/task described within this document.

1.4 Adaptive Management

As required in the NPDES MS4 permit, Schedule B 2.b. and Schedule D 4. Adaptive Management, the City follows an annual adaptive management process to assess and modify, as necessary, program elements to achieve reductions in stormwater pollutants to the maximum extent practicable. This includes consideration of available technologies and practices; review of monitoring data generated by the implementation of this Plan and corresponding analysis of the data; review of SWMP measurable goals and tracking measures; and evaluation of Co-permittee resources available to implement the technologies and practices. The Adaptive Management Process for annual review and the Permit Renewal Submittal are further described in Section 2 B of the City of Gresham and Fairview's NPDES MS4 Annual Report. The history and process of the stormwater program adaptive management, maximum extent practicable determination and update process for the permit renewal submittals may be found in Gresham and Fairview's respective SWMPs.

The role of the monitoring program is to provide a scientifically based feedback loop to the Co-permittees that enables them to develop and implement programs to address pollutants that are identified as a result of environmental monitoring. Additionally, the Co-permittees utilize the monitoring program, as applicable and as resources allow to assist with BMP evaluation related to performance and effectiveness estimates.

Annual implementation of the monitoring program elements as described within this Monitoring Plan, include but are not limited to: instream monitoring, macroinvertebrate monitoring, wet weather stormwater monitoring, BMP effectiveness monitoring, and dry weather screening. These elements also provide a variety of opportunities to act as an adaptive management tool for the stormwater program. Opportunities are not limited to the evaluation of the data itself, but also include the visual observation of winter weather stormwater system function, dry and wet weather stream conditions, and land use conditions such as development activities, new business openings, etc. Examples of how monitoring data will be used to adaptively manage the stormwater program include:

- Macroinvertebrate monitoring can indicate areas of the City that might be given special protection; for example recent macroinvertebrate study results indicate that the Kelley Creek subbasin of Johnson Creek could potentially serve as a relatively-undisturbed reference site. ~~If further study validates these results,~~ Several years of study have supported this finding, and City staff have~~will~~ provided this~~at~~ information to planners to try to protect the subbasin from avoidable human impacts.
- Sampling of the Fairview Creek Water Quality Facility has shown that the facility causes a significant decrease in *E. coli* between influent and effluent. Further study has shown that the detention pond is the portion of the treatment train that is most effective, followed by the wetland.~~is planned to determine which portion of the treatment train is most effective, and that~~ This information will influence the design and retrofit of future regional facilities.
- Long-term instream water quality data obtained at sites located at approximately the upstream and downstream boundaries of the City allow for trend analysis to validate (or invalidate) the benchmarks and load calculations submitted with each permit renewal application.
- Analysis of existing, statewide stormwater data has revealed that vehicle trips per day are highly correlated with pollutant concentrations. This suggests that retrofitting streets with stormwater treatment (especially through surface infiltration or evapotranspiration facilities) is the most effective way to meet benchmarks, and eventually, water quality standards. For this reason, future retrofits are likely to emphasize streets.

As described in Schedule B 2.e. the Monitoring Plan may be modified without prior Department approval if the following conditions are met:

i. *The co-permittee is unable to collect or analyze any sample, pollutant parameter, or information due to circumstances beyond the permittee's control. These circumstances may include, but are not limited to, abnormal climatic conditions, unsafe or impracticable sampling conditions, equipment vandalism or equipment failures that occur despite proper operations and maintenance; or,*

ii. *The modification does not reduce the minimum number of data points, which are a product of monitoring location, frequency, and length of the permit term, or eliminate pollutant parameters identified in Table B-I [of the NPDES MS4 Permit]*

iii. *The modification is a result of including elements of the City of Gresham's WPCF UIC Permit.*

The City of Gresham's process for updating the SWMP and Monitoring Plan for the permit renewal submittal is more involved than the annual review process and is described in detail in the SWMP **Section 5**.

1.5 Annual Reporting

The Co-Permittees will submit by November 1, of each year, an annual report of the previous year from July 1-June 30 of the same year which has been released for public comment. As stated in Schedule B 5 of the NPDES MS4 Permit, the annual report will contain the following elements related to the implementation of this Monitoring Plan:

f. A summary of monitoring program results, including monitoring data that are accumulated throughout the reporting year and/or assessments or evaluations.

g. Any proposed modifications to the monitoring plan that are necessary to ensure that adequate data and information are collected to conduct stormwater program assessments.

j. Results of [dry weather] screening and follow up activities related to illicit discharges.

As described in 1.4 Adaptive Management above, certain modifications may be made without prior Department approval. When such changes to the Monitoring Plan are made, Schedule B 2. e. requires the annual report to contain:

f. Modifications to the monitoring plan [that describe] the rationale for the modification, and how the modification will allow the monitoring program to remain compliant with the permit conditions.

1.6 Monitoring Program Objectives Summary

The permit objectives are designed to elicit answers to questions that stormwater system managers must answer in order to optimally allocate resources to efficiently and effectively protect beneficial uses and water quality. **Table 1** is a summary of management questions posed by permittees, together with the elements of the Monitoring Plan relate to these objectives. **Appendix A** provides more detail on how the elements address the permit objectives, and describes the source of information to be used to meet each of the objectives.

Table 1: Relationship of Stormwater Management Questions, Monitoring Plan Elements, and Permit Objectives

Stormwater Management-related question	**Monitoring activities proposed to answer this question***	**Objectives addressed by monitoring activities****					
		1	2	3	4	5	6
What is the impact that Gresham and Fairview's stormwater discharges are having on exceedances of instream water quality standards?	Sort and analyze existing instream water quality data by wet/dry weather periods and examine trends in water quality as water enters and exits the permit area (**Section 2.0**). Continue instream sampling in each of the major creeks to examine water quality trends over time, as described in **Sections 3.0 and 4.0**	☒	☒	☒	☒	☒	☒

Stormwater Management-related question	Monitoring activities proposed to answer this question*	Objectives addressed by monitoring activities**					
		1	2	3	4	5	6
To what degree and where are stormwater flows affecting water quality and/or aquatic life?	The City of Gresham has a cost-share agreement with the USGS to collect continuous flow and temperature data at a couple fixed locations, as described in **Section 4.0**.	☒	☒	☒	☒	☒	☒
Is stormwater affecting the biological community of the receiving waters?	Macroinvertebrates will be monitored at instream monitoring locations as described in **Section 5.0**	☐	☐	☐	☒	☒	☒
What are typical/average concentrations of pollutants in stormwater runoff?	Evaluate data already collected (ACWA 1997 and ACWA 2009) and augment with additional monitoring where data are lacking (specifically for mercury and toxics--including pesticides). Stormwater monitoring will be conducted as described in **Section 6.0**	☒	☒	☒	☐	☐	☒
What is the significance of illicit discharges in the permit area? Have illicit discharge elimination programs been successful in reducing problems?	The Gresham's historic approach included dry weather screening plus CCTVing of high priority pipes; neither approach revealed significant illicit connections; therefore, future resources will emphasize source control programs (e.g. EPSC and business inspections). Illicit discharge monitoring will occur as described in **Section 7.0** to meet state & federal requirements.	☒	☒	☒	☐	☒	☐
How effective are the various structural BMPs that are being implemented throughout the permit area at reducing pollutants?	Current national and regional literature related to BMP performance will be reviewed. Gresham will conduct structural BMP performance studies as described in **Section 8.0** and the collective effect of structural controls and selected nonstructural controls within the permit area will be modeled.	☐	☒	☐	☐	☒	☒
How effective are the nonstructural/source control BMPs at reducing pollutants?	The list of nonstructural/source controls currently employed will be reviewed and current and on-going research on the effectiveness of source control BMPs will be tracked. An attempt to characterize pollutants associated with the sediment and debris removed through source controls will be conducted as described in **Section 9.0**	☒	☒	☒	☐	☐	☒

Stormwater Management-related question	**Monitoring activities proposed to answer this question***	**Objectives addressed by monitoring activities****					
		1	2	3	4	5	6
Have all pollutants of potential concern been evaluated?	Conduct ongoing literature review of pollutants of concern and effectiveness of BMPs at their removal (described in **Section 9.0**) and conduct a pesticide assessment to determine if additional pollutants should be considered with Wet Weather Stormwater Monitoring (**Section 6.0**)	☒	☒	☐	☐	☐	☐
How are the answers to the above questions changing over time?	At the end of each year a simple, visual review of data collected in the past year will be conducted. At the end of year 4 for each permit, trends will be evaluated for instream quality, stormwater pollutants, and macroinvertebrates.	☐	☐	☐	☒	☐	☒

* Monitoring data is most useful when evaluated using statistical tools. The study design and anticipated statistical operation planned for use in evaluating the data are discussed in each of **Sections 3** through **8** of this plan, as well as in **Appendix A**.

** Numbers 1-6 correspond with the NPDES MS4 Permit monitoring objectives listed in **Section 1.3** above and Schedule B.1.a.(i-vi) in the 2010 NPDES MS4 permit:

This Monitoring Plan describes eleven different monitoring elements that Gresham and Fairview will utilize to meet these objectives. All eleven are described in **Appendix A-1**, and seven of them are detailed in individual sections of the Monitoring Plan:

- Section 3.0 Instream Monitoring,
- Section 4.0 Continuous Instream Flow and Temperature Monitoring,
- Section 5.0 Macroinvertebrate Monitoring,
- Section 6.0 Wet Weather Stormwater Monitoring,
- Section 7.0 Dry Weather Field Screening,
- Section 8.0 Structural Best Management Practices Monitoring, and
- Section 9.0 Source Control Assessment and Solids Tracking

Appendix A-2 is a summary of Gresham and Fairview environmental monitoring program which provides a concise overview of the location, frequency, type of sample, pollutants analyzed, and potential changes planned for these seven elements.

1.7 The Relationship between Environmental Monitoring and a Long-term Monitoring Program Strategy

The goals for the monitoring program are the objectives listed in the permit (Schedule B.1.a) and in **Section 1.3** above, which relate to the management questions shown in **Section 1.6: Table 1**. The permittees use national, state and local monitoring data and values from scientific studies obtained from literature reviews, together with models and regulatory approaches such as water quality standards, the 303(d) list, and TMDLs to determine which pollutants or channel forming factors are of concern at a given point in time, and how the effects of these things change over time, both in response to Co-permittee actions (e.g. BMPs and regulations), and to outside influences. Based on such findings, Co-permittees are able to adaptively manage best management practices to achieve performance and cost effectiveness to the maximum extent practicable, and regulate/encourage specific actions by the private sector.

Historical monitoring data, along with the data collected during the December 2010 NPDES MS4 permit cycle have answered some management questions—especially with respect to certain pollutants or BMPs, but environmental monitoring will be needed for the foreseeable future, both to allow for more findings of statistical significance, and to address new questions. For each element discussed below, additional detail is provided regarding the relationship between the current approach and long-term goals or strategies.

2.0 DATA GATHERING STRATEGIES

There are three primary strategies that the Co-Permittees will employ to obtain data and information to meet the six monitoring objectives listed in the NPDES MS4 permit:

1. Examine and evaluate historic water quality data and other information collected as part of previous monitoring efforts specifically for meeting monitoring objectives;
2. Collect new water quality data to complement the existing data and address specific objectives that have not been previously examined; and
3. Review data and technical information related to stormwater quality collected by others and track national trends in stormwater water quality assessment and best management practice (BMP) application and performance.

An important aspect of any research is the assurance that the samples collected represent the conditions desired to be tested and that the number of samples to be collected is sufficient to provide statistically relevant conclusions. An experimental design process can be used to estimate the number of samples needed based on the allowable error, the variance of the observations, and the degree of confidence and power needed for each constituent. The number of samples needed is therefore dependent on the objectives of the data (characterization, comparison, trends, etc.), the variation of the concentrations in the category being investigated (the ratio of the mean to the standard deviation or Coefficient of Variation (COV)), and the allowable errors (Burton and Pitt 2001). Due to the variability in stormwater data (COVs greater than 1), it can be difficult to identify trends in water quality, and large sample sizes are often needed to report statistically significant findings.

The Co-Permittees will continue to focus their water quality monitoring efforts related to instream samples on developing more robust information for existing monitoring sites. Trend analysis conducted for the 2010 renewal submittal and the 2014 Pollutant Load Reduction Evaluation identified some significant trends. Based on ~~nine~~fourteen years of data, positive trends reinforce our conclusion that the stormwater management program is yielding positive water quality effects and that the monitoring program is resulting in adequate data to help evaluate the program. New monitoring sites may be added in the future to help evaluate the effects of future development in the Springwater annexation area.

~~In July 2010, the City of Gresham contracted with a Kennedy/Jenks to determine the sample size needed to determine various percent differences (10, 20 and 50% difference between a given upstream vs. downstream location) at various confidence levels (80, 90 and 95%) based on the variability observed in data collected since 2002. The study showed that changes in some pollutants are already well characterized; the remaining pollutants will require far more samples than the Co-permittees can reasonably collect to overcome the effects of natural variability. Based upon this analysis, instream sampling frequencies were reduced from six samples per year to four samples per year, which is not expected to significantly alter the ability to determine long-term water quality trends.~~

~~A reduction in the instream monitoring frequency allows resources to be utilized for conducting instream biological monitoring once each year. Additional resources were also allocated for wet weather stormwater monitoring. A review of the Generalized Random Tessellation Stratified~~

~~(GRTS) survey design (probabilistic approach; Stevens and Olsen 2004) led the City to move from stormwater sampling at large catchments to sampling at spatially randomized, smaller drainage basins with a goal of reducing the effects of natural variability on the Co-permittees' ability to make statistically significant inferences.~~

Wet Weather Sampling has occurred at 180 UIC sites over the past 6 years. From these data some clear trends have been found. The most apparent trend is that roads with >1000 trips per day have higher levels of most measured pollutants than those with <1000 trips per day. Additionally, sites draining industrial land use had higher levels of total suspended solids and several metals than other land uses, and residential streets had higher levels for some pesticides than other street types.

We plan to prioritize reduction of pollutants from high-traffic streets by targeting these streets in retrofits. Further understanding of pollutant reduction strategies would greatly benefit from more information on the functioning of our BMPs. The City of Gresham has recently constructed several regional facilities with different designs, and several more are planned in the near future. Understanding the effectiveness of each of these facilities will help inform design and planning in the future to reduce pollutants from stormwater. We are currently sampling 2 storm events at 1 facility/year. By decreasing UIC Wet Weather Monitoring we will be able to increase our BMP Monitoring.

We currently collect water quality data during 5 storm events per year: 2 for BMPs and 3 for UIC Wet Weather. We propose to continue monitoring 5 storm events/year by moving effort from UICs to BMPs and collecting water quality data from: 4 events for BMPs and 1 event for UICs. We plan to decrease our UIC monitoring from 30 sites/year to 10 sites per year and to increase BMP sampling from 2 events/year at 1 facility to 4 "facility events"/year (e.g. 2 facilities may be sampled for each of 2 storms, or 4 facilities may be sampled during 1 storm each). The distribution of BMP storm monitoring may change from year to year as we address questions about certain facilities. If logistics allow, we may sample a given storm at two facilities to allow for direct comparisons.

Due to the difficulty in accurately predicting the size and duration of storms, we will collect a minimum of 3 grab samples/BMP location/storm instead of collecting 5 to 12-part composite samples/BMP location/storm. Although composite sampling has been shown to be an effective method for collecting representative water samples during the duration of a storm, in practice the samples are often not taken at the ideal points during the storm due to difficulty in prediction storm patterns. This can lead to mischaracterization of pollutant loads during storms. To account for this, we will be taking a minimum of 3 individual grab samples throughout each sampled storm and looking at the average and peak levels for each pollutant.

The City's dry weather screening monitoring currently occurs at 30 fixed outfalls annually. These outfalls were selected because they drain relatively large or industrial areas. We will continue to monitor 8 of these outfalls every year, while monitoring 22 new outfalls every year. This approach increases the probability of detecting illicitly connections and discovering illicit discharges in areas previously not frequently monitored. The 8 previously-sampled outfalls are prioritized by drainage from high-risk properties and data of past illicit discharges. The rotating 22 new outfalls will be selected using GIS risk attributes of drainage area size and land use. Our proposed approach is supported by a report by the Urban Water Resources Research Council as one of the best methods for addressing the bacteria TMDL in urban areas because it is an easy way to detect illicit connections between the stormwater and sanitary sewer systems (Urban Water Resources Research Council, 2014, Pathogens in Urban Stormwater Systems Technical Report, Eds: Clary, Pitt, Steets).

As required in Schedule B 2 e ii, these changes do not reduce the number of data points sampled by the Monitoring Program.

NPDES MS4 permitting and other programs with surface water monitoring components have helped to identify water quality problems associated with stormwater runoff. In response to these problems, the scientific community, public agencies, and private organizations interested in stormwater management continue to conduct research related to stormwater characterization and treatment. This research is costly and it is often beyond the means of any one permittee to conduct a significant study. Organizations such as the Oregon Association of Clean Water Agencies (ACWA), the Bay Area Stormwater Management Association (BASMA), the Center for Watershed Protection, and others assist public agencies with collaborative projects to examine complex issues that individual permittees could not likely accomplish on their own.

Historically, public departments of transportation (e.g., ODOT and Caltrans) have also performed large scale studies on stormwater pollution distribution, transport, and treatment. Additionally, vendors of proprietary stormwater treatment systems often participate in evaluation studies that follow strict protocols to have their devices approved by local agencies. By participating in these groups and following current research, the 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 will take advantage of information garnered by these groups to meet some of the more complex and costly objectives of the permit.

The Co-Permittees believe this Monitoring Plan represents the best possible allocation of limited resources, considering that water quality sampling requires significant staff time and funds, yet the activity itself does not result in direct water quality improvements. By continuing to collect data at existing instream sampling locations, and collaborating with other jurisdictions on larger studies and literature reviews, information will be gathered over time that will be useful to make informed adaptive management decisions.

The most resource-intensive element of water quality monitoring is sampling of storms. Because of the difficulty obtaining accurate weather forecasts of suitable storms that meet size and duration requirements, combined with the labor intensive efforts necessary to mobilize staff and equipment during a 24-hr timeframe, each storm may represent one or more failed attempts to sample. Therefore, to achieve the minimum storm sampling commitment represents a significant program administration costs. To this end, staff are assigned other responsibilities in addition to monitoring, such as erosion control inspections, water quality facility inspections, business inspections, spill response, citizen complaint response, and research and program evaluation.

- Thus, to ensure that monitoring does not consume inordinate resources at the expense of activities that prevent or reduce pollution, while still meeting NPDES MS4 and WPCF permit objectives, the following storm sampling limitations apply: In a given year, staff will endeavor to obtain samples from two to four storms at Gresham's structural BMPs, and from ~~3~~10 stormwater monitoring sites by tracking daily weather patterns. Staff will clear work and/or personal schedules up to fifteen times to allow for mobilization and mobilize up to eight times. Once this level of effort has been made, the Co-Permittees will consider the storm monitoring commitment for the year to have been met.
- Storms will not be sampled on federal holidays such as: Thanksgiving, Christmas, and New Year's Eve.
- The criteria for determining whether a storm is appropriate for sampling will be based on the climate of the Pacific Northwest and the specific weather patterns of a given year. For example, in a dry year, the size of an acceptable storm may be smaller than in a wet year. In a wet year the dry period preceding a storm may be shorter than average.
- The criteria for determining whether a storm is appropriate for sampling will also depend on the size of the drainage area for the stormwater being sampled, and the amount of base flow, if any, that normally exists within the catchment.
- The duration of time between samples taken as part of a composite sample, or as part of a time series will be varied as necessary to meet the goal of obtaining at least five samples per storm. Samples will not be taken more frequently than once each half hour, and a good-faith attempt will be made to characterize the duration of each storm.
- Stormwater sampling will target daylight hours to enhance the safety of sampling staff. A portion of the area to be sampled lies within an area of Gresham that has documented gang activity and experiences higher crime rates than other areas. If daylight hours prove too limiting to collect the required data, the monitoring locations may be adjusted away from some wet weather stormwater sampling sites selected through the GRTS protocol addressed in **Section 6.0** of this plan.

3.0 INSTREAM MONITORING

3.1 Project/Task Organization

As required by the NPDES MS4 permit, Schedule B, Table B-1 and 2. & 3, Instream monitoring refers to the monitoring of major streams and Fairview Lake within the permit area. Routine monitoring began at most in-stream sites in 2000; continued monitoring seeks to determine whether trends are showing improvements in water quality.

3.2 Monitoring Objectives

3.2.1 Monitoring Question and Background

Instream monitoring is intended to track the status and trends of water quality in water bodies receiving MS4 discharges to address the question "What is the impact that Gresham and Fairview's stormwater discharges are having on the exceedances of instream water quality standards?" It is assumed that by comparing water quality as each stream enters and exits the permit area, the effect on water quality of actions under the Co-permittees' jurisdiction may be discerned. It is further assumed that sampling during both wet and dry periods will allow the Co-permittees to distinguish between the effects of runoff, versus other effects, on streams.

As shown in **Appendix A-**, instream monitoring contributes to meeting NPDES MS4 monitoring objectives 1, 2, 3, 4, 5 and 6.

Objective 1. *Evaluate the source(s) of the 2004-06 303(d) listed pollutants applicable to the co-permittees' permit area*

Objective 2. *Evaluate the effectiveness of Best Management Practices (BMPs) to assist in identifying BMP priorities;*

Objective 3. *Characterize stormwater runoff discharges based on land use, seasonality, geography or other catchment characteristics;*

Objective 4. *Evaluate status and long-term trends in receiving waters associated with MS4 stormwater discharges;*

Objective 5. *Assess the chemical, biological and physical effects of MS4 stormwater discharges on receiving waters;*

Objective 6. *Assess progress towards meeting TMDL pollutant load reduction benchmarks.*

3.2.2 Data Analysis Methodology and Quality Criteria

Instream water quality data will be assessed using a trend analysis, conducted at least once for the ~~December 30, 2010~~ NPDES MS4 permit cycle. Since environmental data typically does not follow a normal distribution~~; therefore~~, a nonparametric equivalent to ordinary least squares regression will be used – the Seasonal Kendall, and the associated statistic, Kendall's tau. Because instream data has been and will be collected during the wet and dry season, trends will be assessed by those two periods. Data may also be evaluated by flow or rainfall data, since data collected in the wet season may not always be associated with higher flows or MS4 discharges. An assessment of trends based on potential for MS4 contribution might focus on instream monitoring events collected after 0.1" or more rain occurred within the preceding 24 hours. The significance of any trend would be evaluated against an alpha (α) value of at least 0.1, with a goal to demonstrate significance at α=0.05.

3.2.3 Assumptions and Rationale

The instream monitoring program described in this section was originally designed to determine whether water quality changes could be measured over time at sites selected to represent the upper and lower bounds of the permit area. Continued monitoring at the same locations will allow for assessing trends over time based on both wet and dry weather conditions. With more than 15~~0~~ years of monitoring data already collected at most instream monitoring sites, continued monitoring ~~for the December 30, 2010 NPDES MS4 permit cycle and into the future~~ will allow for assessment of long-term water quality trends.

3.2.4 Relationship to Long-term Monitoring Program Strategy

Instream monitoring provides a direct measure of the chemical, physical, and biological condition of waters of the state which receive MS4 stormwater discharges. The periodic water quality measurements described in this section are augmented by 1) correlating this data with continuous monitoring data described in **Section 4.0**, 2) collecting instream macroinvertebrate data as described in **Section 5.0** to assess biological condition, 3) comparing instream data to the Wet Weather Stormwater Monitoring data described in **Section 6.0,** to determine if changes in stormwater quality are related to changes in instream monitoring data, and 4) determining whether pollutant reduction estimates measured through the Structural BMP Monitoring described in **Section 8.0** are validated by trends detected instream. Continuing to conduct instream monitoring using an approach consistent with past instream monitoring efforts should enable the Co-Permittees to determine if short or long-term water quality trends are evident based on MS4 management decisions associated with implementation of their SWMPs.

3.3 Documentation and Record-keeping Procedures

Consistent with permit requirements specified in NPDES MS4 permit Schedule F, Section C.5., the Co-Permittees will retain records of all monitoring information, including: all calibration, major maintenance records, all original lab and field data (see **Appendix C** for example of field data sheet), copies of all reports required by the NPDES MS4 permit, and records of data used to complete the application for the NPDES MS4 permit for a period of at least 3 years from the date of the sample, measurement, report, or application.

Records will contain:

1. The date, exact place, time, and methods of sampling or measurements;
2. The individual(s) who performed the sampling or measurements;
3. The date(s) analyses were performed;
4. The individual(s) who performed the analyses;
5. The analytical techniques or methods used; and
6. The results of such analyses.

3.4 Monitoring Process/Study Design

3.4.1 Study Design

Instream Monitoring is conducted to help characterize or estimate the potential impacts of MS4 stormwater runoff on streams, as well as the potential benefits of the best management practices being applied by the Co-Permittees as described within their SWMPs. The study design is a paired test, where samples have historically been taken at even intervals throughout the year from where a stream enters and exits the permit boundary. Sites are always sampled in the same order at approximately the same time of day in order to facilitate long term trending of data collected at the same location over time. The timing interval between the paired upstream/downstream locations is always less than 2 hours, with the target being to collect samples on the same stream within an hour of each other.

The current study design has enabled the Co-permittees to conduct a Seasonal Kendall test and to check for trends over time. To date, stream quality has been well characterized, and some differences between upstream and downstream have been identified with statistical significance at the 95% confidence (α=0.05) level. When possible, a relationship will be made between BMP implementation and improving water quality trends, particularly for events collected during rain events or during the wet weather season. Continued monitoring will allow the Co-permittees to look for additional findings of significance.

~~For the December 30, 2010 NPDES MS4 permit cycle, the historical fixed sampling locations will continue to be monitored, but the frequency was changed from 6 times/year to 4 times/year to free up resources for adding macroinvertebrate monitoring and additional wet weather stormwater monitoring, including pesticides and mercury. The monitoring frequency of four (4) times/year meets the instream monitoring requirement in NPDES MS4 permit Table B-1.~~
We will continue to monitor the fixed instream sampling locations in the following ways: water quality 4 times/year, macroinvertebrates 1 time/year, and continuous summer temperatures.

3.4.2 Monitoring Locations

Instream monitoring stations are located in major creeks as close to the upstream and downstream intersections with Gresham and Fairview City boundaries as feasible. There are three major receiving waters for the Co-Permittees' surface water runoff. These include:

1. The Columbia Slough
2. Kelly/Burlingame/Beaver Creek system (Sandy River watershed)
3. Johnson Creek

Samples are also collected at sites in the following water bodies:

1. Fairview Creek (drains to Fairview Lake, and then to Columbia Slough)
2. Fairview Lake (drains to the Columbia Slough)
3. Kelley Creek (tributary to Johnson Creek)

Columbia Slough

The Columbia Slough flows east to west from the north end of the City of Gresham and Fairview toward Portland. The Slough proper begins at the outlet from Fairview Lake, so most of this narrow and shallow channel flows within the City of Portland. Instream Columbia Slough monitoring is being conducted through an inter-governmental agreement (IGA) with the City of Portland Bureau of Environmental Services (BES) **See Appendix F.** In 2010, Portland altered their historic fixed station monitoring and began ~~will begin doing~~ sampling using a probabilistic spatially-balanced and random approach (description of Oregon master sample in Larsen et al. 2008). Portland's monitoring ~~will~~ includes the segment of the Slough within Gresham, but the specific locations to be monitored on their ~~a~~ 4-year rotation ~~are not yet known,~~ and are ~~therefore~~

not reflected in **Table 2** or on **Figure 1**. The monitoring complies with the sampling requirements of the 1998 Columbia Slough TMDL. The Co-permittees will review the data Portland collects for the upper Slough in the context of the entire Slough, but the sites within Fairview Creek and Fairview Lake will be used to meet the required number of monitoring sites in the NPDES MS4 permit Table B-1.

Fairview Creek and Fairview Lake

The headwaters of Fairview Creek are within the City of Gresham's boundary. The creek flows through Gresham and Fairview and discharges to Fairview Lake. Fairview Lake discharges to the Columbia Slough. Gresham will conduct instream monitoring at two locations on Fairview Creek and one in Fairview Lake. Currently, the instream locations include one site just north of Stark Street, upstream of the Gresham-Fairview boundary and the other site is located within the City of Fairview just upstream of the discharge to Fairview Lake (see Stations 1, 2, and 3 on **Figure 1**). Monitoring activities at the two stream and one lake locations will be conducted by City of Gresham staff based on an inter-governmental agreement between Gresham and Fairview.

Kelly Creek

Kelly Creek enters and exits the City of Gresham on its eastern boundary. Two instream monitoring locations are located on this creek, one on the upstream section of the creek at the Gresham boundary and the other on the downstream section of the creek near Mount Hood Community College (MHCC) (see Stations 4 and 5 on **Figure 1**). Monitoring on Kelly Creek will be conducted by City of Gresham staff.

Johnson Creek

Johnson Creek flows from east to west across the southern part of the City of Gresham. Two instream monitoring locations are established on this creek, one on the upstream section of the creek near the City's eastern boundary, and a second on the downstream section near the City's boundary with Portland (see Stations 6, and 7, on **Figure 1**). Monitoring on Johnson Creek will be conducted by City of Gresham staff. Before the current permit expires in 2015, the City of Gresham will evaluate financial and staffing resources available to support the addition of one or two additional sampling locations in the Johnson Creek basin in order to characterize the Springwater annexation area prior to future development.

Kelley Creek

Kelley Creek flows from east to west across the southwestern part of Gresham, starting in the Kelley Creek Headwaters area and flowing through the Pleasant Valley area as shown on **Figure 1**. Two instream monitoring locations are established on this creek, one on the upstream section of the creek outside the Gresham's current boundary, and a second on the downstream section near the Gresham's boundary with Portland (see Stations 8 and 9 on **Figure 1**). Monitoring on Kelley Creek will be conducted by City of Gresham staff.

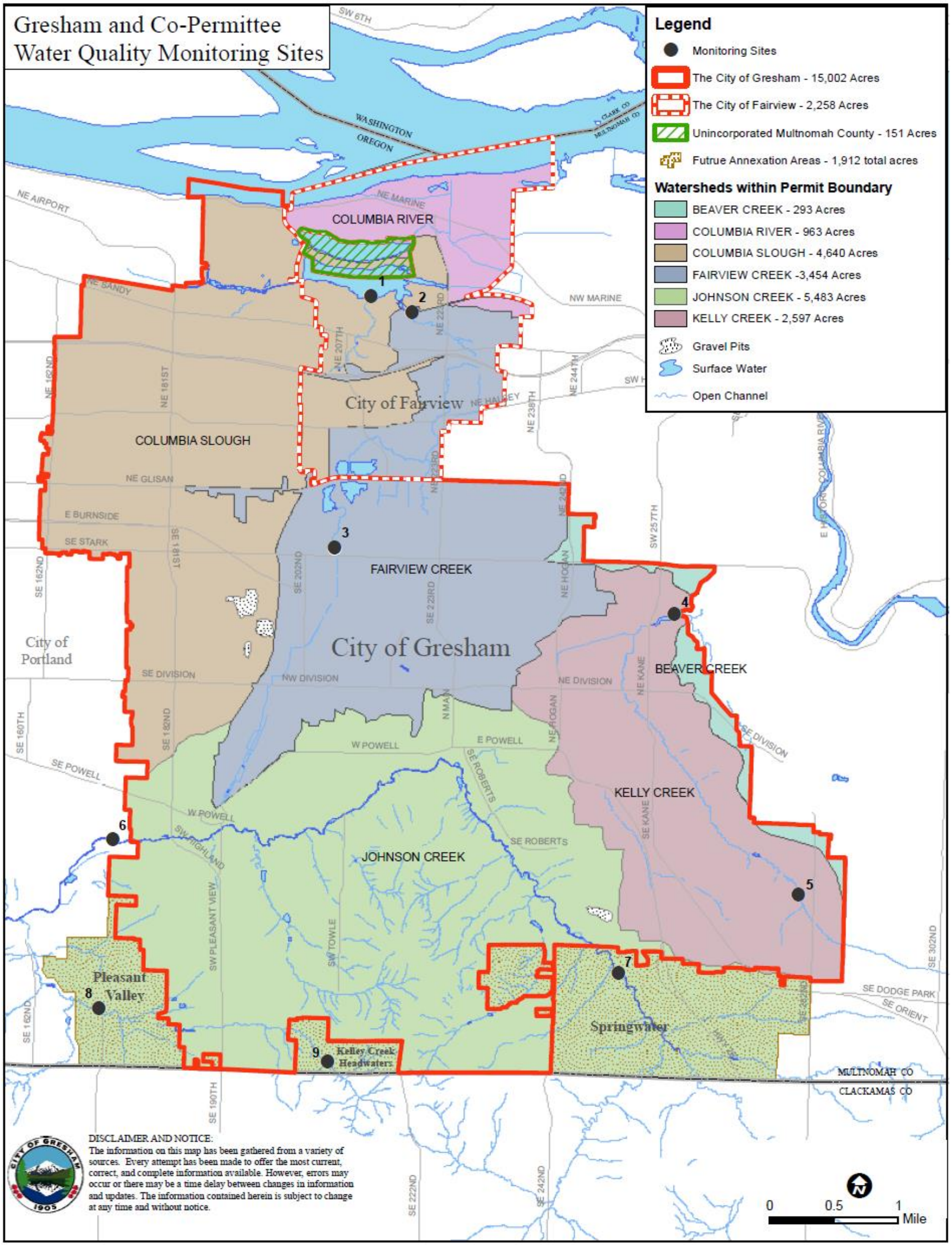
Table 2 summarizes the instream monitoring locations~~ for the December 30, 2010 NPDES MS4 permit cycle~~.

Table 2: Instream Monitoring Locations

Station Number*	Site Code	Stream	Location
Columbia Slough Basin			
1	FVL1	Fairview Lake	Lakeshore Park in City of Fairview
2	FCI0	Fairview Creek	Mobile estates upstream of Fairview Lake in City of Fairview
3	FCI1	Fairview Creek	Conifer Park (205th and Stark) in City of Gresham
Sandy River Basin			
4	KCI1	Kelly Creek	Downstream of Mount Hood Community College pond
5	KCI4	Kelly Creek	Upstream from Kelly Creek Detention Pond
Johnson Creek Subbasin			
6	JCI1	Johnson Creek	Near Jenne Rd Bridge
7	JCI2	Johnson Creek	Near Palmblad Bridge upstream of Gresham
8	KI1	Kelley Creek	Pleasant Valley Grange
9	KI2	Kelley Creek	Rodlun Rd near Alder Ridge

* Station numbers relate to Figure 1.

Figure 1. Instream Monitoring Locations



3.4.3 Sampling Event Criteria

The NPDES MS4 permit (Schedule B.3.a.) requires that a minimum of 50% of instream monitoring be conducted during the wet season (October 1 to April 1) and that each sample event be a minimum of 14 days apart. Reasonable attempts will be made to conduct sampling during storm events, since rainfall is related to stormwater runoff. A 2008 analysis of bi-monthly monitoring over an 8 year period (490 samples) indicated that 50% of monitoring events had measurable precipitation (0.01" min, 0.88" max) in the preceding 24 hours; 35% had 0.10" or more in the preceding 24 hours. This suggests that the current approach of sampling at a fixed date is an effective strategy for gathering wet weather data.

3.4.4 Frequency and Duration

Instream water quality samples will be collected during the dry season and wet season. At a minimum, grab samples will be collected four times per year at the instream sampling locations listed in **Table 2** ~~for the December 30, 2010 NPDES MS4 permit cycle~~.

3.4.5 Responsible Sampling Coordinator

This monitoring task is coordinated by the City of Gresham's Water Resources~~Watershed~~ Division on behalf of Gresham and Fairview, who target events, calibrate equipment, perform in-situ field measurements, collect samples for lab analysis, and coordinate delivery to the lab. Laboratory analysis for instream samples is conducted by Portland's Water Pollution Control Laboratory under an IGA with the City of Gresham for laboratory services, included as **Appendix F**.

3.5 Sample Collection and Handling

3.5.1 Sample Collection Method

The sample collection method varies by constituent. **Table 3** shows the collection method for each constituent, the instream monitoring locations, and periods when each constituent is monitored.

Table 3: Sample Collection Methods for Instream Monitoring

Constituents	Collection Method	Stations	Period
Field			
Temperature, DO, Conductivity, pH	In-situ	3-11	Quarterly
Turbidity	Grab	3-11	Quarterly
Conventional			
Biochemical Oxygen Demand (BOD_5), Total Suspended Solids, Hardness, *E. coli*	Grab	3-11	Quarterly
Chlorophyll-*a*	Grab	3-11	Summer*
Total Recoverable Metals			
Copper, Lead, Mercury**, Zinc	Grab	3-11	Quarterly
Dissolved Metals			
Copper, Lead, Zinc	Grab	3-11	Quarterly
Nutrients			

Nitrate + Nitrite Nitrogen, Total Kjeldahl Nitrogen (TKN)**, Ammonia Nitrogen, Total Phosphorus, Ortho-phosphorus	Grab	3-11	Quarterly
Legacy Pesticides			
DDT, Dieldrin	Grab	8, 9	Quarterly

* Chlorophyll-*a* is monitored May through October only.
** Mercury and TKN are not required in Table B-1 of the NPDES MS4 permit, so are subject to the Adaptive Management process described in **Section 1.4**.

3.5.2 Handling and Custody Procedures

Field measurements are collected by placing the multi-meter probe directly into the thalweg of the stream, and waiting for readings to stabilize. For grab samples, samples are collected directly into the appropriate containers directly from the thalweg, when possible. One bottle is field-filtered for ortho-phosphorus analysis. If needed, samples will be collected using a clean stainless steel bailer attached to an extension rod. The stainless steel bailer is cleaned prior to each site using laboratory-grade soap and distilled water or rinsed 3 times with the water to be sampled at each site prior to sampling.

Two-person clean sample collection techniques are followed to minimize the potential for contamination of samples: one person acts as "dirty hands" to move equipment, document field measurements, grab samples using the bailer and remove manhole lids; and one person acts as "clean hands" to fill sample bottles. The "clean hands" person wears powder-free nitrile gloves to avoid contamination of the sample and protect staff from possible health risks.

All samples collected for laboratory analysis are immediately placed into a cooler containing ice and transported to the lab immediately following sample collection. **Table 4** lists the volume of sample collected, the container used and maximum holding time. Once samples are delivered to Portland's Water Pollution Control Laboratory, they are responsible for following their own Quality Assurance Project Plan (QAPP) to ensure that samples are analyzed within the proper holding time (see **Appendix G**).

Table 4: Sample Containers and Holding Times for Instream Monitoring

Constituent	Minimum Sample Volume	Bottle Type	Holding Time
Conventional Constituents			
Biochemical Oxygen Demand (BOD_5)	250 mL	Plastic	24 hours
Total Suspended Solids	500 mL	Plastic	7 days
Hardness	250 mL	Plastic	6 months
E. coli	100 mL	Sterile Plastic	6 hours (max 24 hrs.)
Chlorophyll-*a*	1 liter	Amber Glass	3 weeks once filtered
Nutrients			
Nitrate Nitrogen	100 mL	Plastic	48 hours
Total Kjeldahl Nitrogen (TKN)	100 mL	Plastic	28 days

Ammonia Nitrogen	100 mL	Plastic	28 days
Total Phosphorus	100 mL	Plastic	28 days
Ortho-phosphorus	250 mL	Plastic	48 hours
Total Recoverable Metals			
Copper	400 mL	Plastic	6 months, once preserved
Lead			
Zinc			
Mercury			28 days
Dissolved Metals			
Copper	400 mL	Plastic	6 months, once preserved
Lead			
Zinc			
Legacy Pesticides			
DDT	1 liter	Amber Glass	28 days once extracted
Dieldrin			

After samples have been obtained and the collection procedures properly documented, a written record of the chain of custody for each sample requiring laboratory analysis is completed (see **Appendix C)**. Information included on the chain of custody includes:

- Name of the persons collecting the sample(s)
- Date and time of sample collection
- Location of sample collection
- Names and signatures of all persons handling the samples in the field and in the laboratory
- Laboratory analysis requested and control information (e.g., duplicate or spiked samples etc.) and any special instructions (e.g., time sensitive analyses).

To ensure that all necessary information is documented, a chain of custody form will accompany each sample or set of samples and a copy of the form is retained. Each person who takes custody will sign and date the appropriate portion of the chain of custody documentation.

3.6 Constituents and Methods

The analytical methods and method reporting limits (MRLs) for constituents monitored for instream sampling are listed in **Table 5**.

Although iron and manganese are included on the 2004/06 303(d) list for the Columbia Slough and Lower Willamette River, DEQ has stated that these concentrations are naturally elevated due to local geology. DEQ has also stated that a future Willamette River TMDL for iron and manganese is extremely unlikely given the data that the current listings are based upon. Therefore, iron and manganese have not been included in the list of constituents for analyses.

Only total recoverable mercury will be collected based on historic monitoring data for dissolved mercury being below the detection limit. Mercury sampling may be adaptively managed as allowed in the permit in the future to meet other regulatory program requirements.

Table 5: Constituents, Methods and MRLs for Instream Monitoring

Field Constituents	Analytical Method	MRL*	Units
Temperature	SM 2550 B	-5	Degrees C
DO	SM 4500-OG	0.1	mg/L
Conductivity	EPA 120.1	1.0	µs/cm
pH	EPA 150.1	3.0	S.U.
Turbidity	EPA 180.1	0.05	NTU
Conventional Constituents			
Biochemical Oxygen Demand (BOD_5)	SM 5210 B	2	mg/L
Total Suspended Solids	SM 2540 D	2	mg/L
Hardness	SM 2340 B	0.5	mg/L as $CaCO_3$
E. coli	COLILERT QT	10	MPN/100 mL
Chlorophyll-*a*	SM 10200 H	2.0	mg/M3
Nutrients			
Nitrate Nitrogen	EPA 300.0	1.10	mg/L
Total Kjeldahl Nitrogen	PAI-DK03[1]	0.20	mg/L
Ammonia Nitrogen	EPA 350.1	0.02	mg/L
Total Phosphorus	EPA 365.4	0.02	mg/L
Ortho-phosphorus	EPA 365.1	0.02	mg/L
Total Recoverable Metals			
Copper	EPA 200.8	0.2	µg/L
Lead	EPA 200.8	0.1	µg/L
Mercury	WPCLSOP M-10.02 [2]	0.002	µg/L
Zinc	EPA 200.8	0.5	µg/L
Dissolved Metals			
Copper	EPA 200.8	0.2	µg/L
Lead	EPA 200.8	0.1	µg/L
Zinc	EPA 200.8	0.5	µg/L
Legacy Pesticides			
DDT	EPA 8081 [3]	2.5	ng/L
Dieldrin	EPA 8081 [3]	2.5	ng/L

*Method Reporting Limit

[1] The PAI-DK03 method for TKN is a 40 CFR 136 method (flow injection gas method, see footnote 41, Table 1B, 40 CFR Part 136.3).

[2] The WPCLSOP M-10.02 method cited for total Hg is EPA 200.8 w/CEM digestion (footnote 4, Table 1B, 40 CFR Part 136.3)

[3] EPA SW846 Method 8081 is nearly identical to 40 CFR 136 approved method EPA 608 and is often used interchangeably with EPA Method 608 for analyzing organochlorine pesticides, including DDT, DDD, DDE and

Dieldrin. Based on a DEQ response dated 7/27/2011citing similarities between the methods, method 8081 meets the criteria of a modified version of 608 under the description outlined in 40 CFR Part 136.6 "Method Modifications and Analytical Requirements".

3.7 Quality Control Procedures

3.7.1 Quality Assurance

The data quality objectives for field measurements are listed in **Table 6**. Precision and accuracy are referenced from the DEQ Data Quality Matrix. Because field measurements for temperature, pH, DO and conductivity are made using a multi-meter probe, precision between replicates is usually not assessed since meter values are continuously assessed and not documented until they stabilize. Accuracy for field measurements is determined by measuring standards before and after each sampling event and assessing deviation from the standard in comparison to accuracy ranges in **Table 6**.

Table 6: Accuracy and Precision Targets for Instream Field Measurements

Parameter	Precision	Accuracy	Measurement Range
Temperature	± 1.0 ºC	± 0.5 ºC	-5 to 45 ºC
pH	± 0.3 SU	± 0.2 SU	0 to 14 SU
Dissolved Oxygen	± 0.3 mg/L	± 0.2 mg/L	1 to 50 mg/L
Conductivity	± 10% of Std. Value	± 7% of Std. Value	0 to 200 mS/cm
Turbidity	± 5% of Std. Value ± 1 NTU if NTU <20	± 5% of Std. Value	0 to 1000 NTU

Analytical methods for grab samples analyzed at Portland's Water Pollution Control Laboratory use an appropriate balance of quality assurance/quality control measures, including replicates, blanks, spiked samples and other measures approved under 40 CFR 136 to ensure that data meet quality objectives appropriate for compliance with state and federal regulatory requirements. A copy of the WPCL's QAPP is included in **Appendix G**.

Field duplicate samples will be collected at a minimum of 10% of the total number of monitoring locations (1 duplicate for every 10 sites). For in-stream sampling, one lab replicate will be collected from one of the 10 in-stream sampling sites on a random rotating basis. Any data or sample values outside of the expected range for the constituent being measured will be rechecked for validity with the laboratory or in the field by the field team as appropriate. Data that continue to be outside the expected values will be further evaluated to determine potential causes.

Duplicate measurements are not collected for field constituents (DO, pH, temperature, conductivity, turbidity). Instead, quality assurance for field constituents will be assessed by calibrating the equipment prior to mobilization on the day of the monitoring event and by measuring equipment with a known standard after each monitoring event to measure how accurately the equipment can still read the standard within the accuracy ranges specified in **Table 6**.

Field blanks will also be collected for 10% of sampling mobilization events. Equipment blanks will be generated annually by the WPCL to ensure that equipment and bottles provided by the lab are not producing false positive readings.

3.7.2 Representativeness

Instream samples are collected about 4 inches below the water surface from within the thalweg or near the center of the stream channel where the water is assumed to be well mixed and representative of the ambient conditions.

3.7.3 Comparability

The objective is to ensure that collected data are either directly comparable or comparable, with defined limitations, to literature data or other applicable criteria. Instream samples are collected and analyzed in the same manner as those collected for Wet Weather Stormwater Monitoring and Structural Best Management Practice Monitoring. Grab samples are analyzed at Portland's Water Pollution Control Laboratory to minimize variability and increase comparability of data collected on streams flowing through both jurisdictions.

3.7.4 Completeness

Completeness is a measure of the amount of valid data obtained from the analytical measurement system compared to the amount that was expected to be obtained. It is defined as the total number of samples taken for which valid analytical data are obtained divided by the total number of samples collected and multiplied by 100.

The goal for Instream Monitoring is to achieve a 100 percent complete data set for all analyses. It is anticipated that over the 5 year permit term, 20 samples will be collected from each monitoring location. It is understood that due to unforeseen circumstances, such as abnormal climatic conditions, unsafe or impractical sampling conditions, equipment vandalism or equipment failures that occur despite proper operation and maintenance, some results may be lost. Field and Laboratory staff will attempt to minimize data loss to the best of their ability by carefully following all protocols and procedures. If data sets are not 100 percent complete for this study, analyses will be evaluated on a case by case basis to determine whether additional samples are able~~need~~ to be collected considering available time, season, competing regulatory obligations, and cost.

3.7.5 Instrument Inspection and Maintenance

Field sampling equipment is inspected before and after each monitoring event. The multi-meter and turbidimeter will be cleaned and maintained according to the manufacturer's guidelines. Multi-meters will be professionally inspected, maintained and calibrated annually by Quality Control Services (2340 SE 11th Ave, Portland, OR. 503-236-2712).

Portland's Water Pollution Control Laboratory performs inspection and maintenance of laboratory instruments used for analysis of grab samples. A copy of the WPCL's QAPP is included in **Appendix G**.

3.7.6 Instrument Calibration

The multi-meter probe used to collect field measurements (temperature, pH, DO, and conductivity) will be calibrated prior to each event at mobilization. pH will be calibrated using a 3-point calibration (pH 4, 7 and 10 buffers). Conductivity will be calibrated using a standard within the range of expected measurement (typically 100 µS/cm). DO will be calibrated using percent saturation at the current barometric pressure. Meter calibration will be recorded in an electronic calibration log. Meters will be calibrated halfway through the monitoring event if the accuracy of the meter drifts during the monitoring event. After each sampling event the meter will be measured against known standards to check measurement accuracy.

The turbimeter will be calibrated annually. Prior to each sampling event, the meter will be measured against known secondary Gelex sample standards to ensure accuracy. Readings will be recorded in the electronic calibration log.

Portland's Water Pollution Control Laboratory performs calibration of laboratory instruments used for analysis of grab samples. A copy of the WPCL's QAPP is included in **Appendix G**.

3.8 Data Management, Review, Validation and Verification

3.8.1 Data Management

Results will be provided to Gresham by the laboratory in electronic format and shared with the City of Fairview. QA/QC files are included with the electronic reports and will be stored electronically on the City of Gresham's servers. A separate record will be generated for each sample date.

In addition, the key information such as station ID, sample date and time, name of sampler, name of constituent, all results, units, detection limits, EPA methods used, name of the laboratory, and any field notes will be entered into the database. Additional information, such as compositing of multiple samples, or the use of grab or automatic samples, will also be included.

All analytical results and applicable field measurements, including field data sheet information, will be stored in Gresham's Monitoring Program database. Lab data will be reviewed and entered as soon as practicable, with data entry, analysis, and summarization being shared with Fairview and summarized in the NPDES MS4 Annual Report. Additional analysis will be conducted for the permit renewal to assess instream trends. Periodic analysis of data may also occur to assess whether adaptive management of the Monitoring Plan or program is appropriate.

3.8.2 Data Review, Validation and Verification

The Monitoring Program Coordinator will check all field data sheets for completeness and accuracy at the end of each sampling event. Errors will be corrected prior to sample delivery and data entry. All data will be entered into Gresham's master NPDES MS4 data spreadsheet. The data will be reviewed and input by the sampling team leader. Ideally, the data should be reviewed for input accuracy, however, limited staff time does not typically allow for this step. A secondary check will be used to periodically validate data entry accuracy.

Once the data has been entered in the project database, the Monitoring Program Coordinator will print a paper copy of the data and proofread it against the original field data sheets. Statistical and graphical analysis may be used to reveal whether keystroke errors occurred during data entry. Potential errors in the database will be checked against field data sheets and lab reports. Once verified, errors in data entry will be corrected at that time. Outliers and inconsistencies will be flagged for further review, investigation, and if appropriate, discarded. Data quality problems will be discussed as they occur and in the final report to data users.

Reconciliation with data quality objectives as noted above will be performed as soon as possible after each sampling event. Calculations and determinations for precision, completeness, and accuracy will be made and corrective action implemented if needed. If data quality indicators do not meet the monitoring program's specifications, data may be discarded and re-sampling may occur. The cause of the failure will be evaluated. If the cause is found to be equipment failure, calibration and/or maintenance techniques will be reassessed and improved. If the problem is found to be sampling team error, field techniques will be assessed, revised, and retrained as needed.

4.0 CONTINUOUS INSTREAM FLOW AND TEMPERATURE MONITORING

4.1 Project/Task Organization

As required by the NPDES MS4 permit, Schedule B, Table B-1 and 2. & 3, continuous instream flow and temperature monitoring refers to the ongoing collection of data at short intervals (every 15, 30, or 60 minutes, depending on constituent) at fixed locations throughout key watersheds. There are three different sources of continuous data within the permit area:

1. The USGS operates and maintains gages on Johnson and Fairview Creeks that collect continuous flow data, based on a cost-sharing agreement with the City of Gresham (Johnson Creek gage also collects temperature and turbidity);
2. The City of Gresham deploys continuous temperature data loggers during summer months at the fixed Instream Monitoring locations listed in **Section 3.4.2**, **Table 2.**
3. The City of Portland operates Hydrolabs through Columbia Slough that collect continuous field constituents (temperature, pH, DO and conductivity). Because the City of Portland handles all monitoring and assessment of Columbia Slough through an IGA (see section 3.3.2 and Appendix F), the continuous monitoring for the Slough is not addressed in this Monitoring Plan.

The USGS currently operates stream discharge gages and has a joint funding agreement (see **Appendix E**) with Gresham to do so at two locations. Gresham also contributes to USGS monitoring efforts in the Johnson Creek watershed that cooperatively funds a gaging station at the mouth of Kelley Creek and ongoing USGS monitoring of groundwater in the watershed. **Section 4.4.2**, **Table 7** describes the USGS Gaging Stations.

During the review required for the 2006 Interim Evaluation Report, the City's consultant recommended that the Co-Permittees explore the potential for collecting continuous flow and temperature data at each of the instream monitoring locations. Summer temperature monitoring at each instream location has been conducted since summer 2008. Additional flow sites were considered, but it was determined that the calibration of models developed for the Stormwater Master Plans for each drainage basin has adequately characterized flows, and that additional continuous flow monitoring is not merited, especially given the Gresham's need to maximize the benefit of limited staff and financial resources.

Staff determined that new information on flow would be useful related to areas expected to annex and develop in the future. Gresham contracted with USGS to conduct a well study to determine current base flow conditions in the Pleasant Valley area, since it is expected to develop before the Springwater area. Gresham participates in the Johnson Creek Interjurisdictional Committee which cooperatively funds ongoing USGS monitoring of groundwater in the Johnson Creek watershed.

4.2.1 Monitoring Question and Background

Continuous Instream Flow and Temperature Monitoring is intended to track water quantity trends in two of the major water bodies within the permit area that receive MS4 discharges – Johnson and Fairview Creeks. Together with other data collected by the monitoring program, the use of flow and temperature models, and statistical analysis such as trending, this information should contribute toward an answer to the question: "To what degree and where are stormwater flows affecting water quality and/or aquatic life?" In addition to collecting rainfall data, continuous flow data helps the Co-permittees put the Instream Monitoring data described in **Section 3.0** into perspective and address the question "What is the impact that Gresham and Fairview's stormwater discharges are having on the exceedances of instream water quality standards?" As shown in **Appendix A**, continuous instream monitoring contributes to meeting NPDES MS4 monitoring objectives 1, 2, 3, 4, 5 and 6.

Objective 1. *Evaluate the source(s) of the 2004-06 303(d) listed pollutants applicable to the co-permittees' permit area*
Objective 2. *Evaluate the effectiveness of Best Management Practices (BMPs) to assist in identifying BMP priorities;*
Objective 3. *Characterize stormwater runoff discharges based on land use, seasonality, geography or other catchment characteristics;*
Objective 4. *Evaluate status and long-term trends in receiving waters associated with MS4 stormwater discharges;*
Objective 5. *Assess the chemical, biological and physical effects of MS4 stormwater discharges on receiving waters;*
Objective 6. *Assess progress towards meeting TMDL pollutant load reduction benchmarks.*

4.2.2 Data Analysis Methodology and Quality Criteria

Continuous instream flow and temperature data will be assessed graphically and through computation of summary statistics. The USGS graphs time plots of data they collect, as well as computing minimum, maximum and mean values. For flow and temperature, extreme values are the most critical for fish and aquatic life, so these extremes will be evaluated for ways the stormwater program can be adaptively managed to improve the chemical, physical and biological health of the MS4 receiving water.

4.2.3 Assumptions and Rationale

The Continuous Instream Flow and Temperature Monitoring performed by the USGS takes place at fixed locations. Continued monitoring at the same locations will allow for assessing long-term trends over time and provide a source of continuous information that can be used to put the Instream Monitoring described in **Section 3.0** into perspective. With 15~~0~~-25~~0~~ years of monitoring data already collected at the two continuous monitoring locations, continued monitoring over the ~~December 30, 2010~~ next NPDES MS4 permit cycle and into the future will allow for assessment of long-term status and trends.

4.2.4 Relationship to Long-term Monitoring Program Strategy

Continuous flow and temperature monitoring provides a direct measure of the chemical and physical condition of waters of the state which receive MS4 stormwater discharges. The continuous measurements described in this section are augmented by 1) correlating this data with periodic water quality monitoring data described in **Section 3.0**, 2) determining how flow and temperature affect the macroinvertebrate sampling described in **Section 5.0**, 3) comparing rainfall and instream flow data to the Wet Weather Stormwater Monitoring data described in **Section 6.0**, and 4) determining whether BMPs implemented and monitored (described in **Section 8.0**) result in improvements to instream flow or temperature measurements. Continuing to conduct continuous instream monitoring using an approach consistent with past monitoring efforts will assist the Co-Permittees in determining if flow or temperatures trends are evident based on MS4 management decisions associated with implementation of their SWMPs.

4.3 Documentation and Record-keeping Procedures

Consistent with permit requirements specified in Schedule F, Section C.5., the Co-Permittees will retain records of all monitoring information, including: all calibration, major maintenance records, all original data, copies of all reports required by the NPDES MS4 permit, and records of data used to complete the application for the NPDES MS4 permit for a period of at least 3 years from the date of the sample, measurement, report, or application. The USGS currently manages this data, and all data are available on-line through the Water Resources of Oregon, http://or.water.usgs.gov/

4.4 Sampling Process/Study Design

4.4.1 Study Design

Continuous flow and temperature monitoring conducted by the USGS was established to respond to the need for streamflow data related to the high-flow and low-flow hydrologic conditions. The sites were selected as part of a larger watershed study described in the "Hydrology of the Johnson Creek Basin" scientific investigation report (Lee and Snyder 2009). The City of Gresham began collecting continuous temperature data at fixed instream monitoring locations in an effort to better understand the diurnal fluctuations, determine the magnitude of summer maximums, and to develop a long-term baseline of temperature data that can be used to compare to shade targets established with the temperature TMDL.

4.4.2 Monitoring Locations

The City of Gresham deploys continuous temperature data loggers at the 8 fixed instream sampling locations listed in **Section 3.4.2 Table 2**. As stated in 4.3.1, continuous temperature monitoring may move to other locations if it is determined that annual measurement at the same fixed locations is too frequent for meeting the monitoring program objectives.

The USGS monitors continuous flow at the locations listed in **Table 7**. The first two locations listed are within the City of Gresham, while the third location on Kelley Creek is within Portland, but was added to assess flow from the Pleasant Valley Concept Plan area (See **Figures 1 and 2**), which will eventually be within the cities of Damascus, Gresham, and Portland.

Table 7: USGS Continuous Monitoring Locations*

#	Stream	Location (USGS Station ID)	Type	Constituents
1	Johnson Creek	Regner (USGS # 14211400)	Continuous	Flow Temperature Turbidity
2	Fairview Creek	Glisan (USGS #14211814)	Continuous	Flow
3	Kelley Creek	159^{th}, upstream from Johnson Creek Confluence (USGS #14211499)	Continuous	Flow Temperature Turbidity

*Continuation of these gages is contingent on ongoing support by USGS.

4.4.3 Sampling Event Criteria

Continuous sampling equipment is designed to be in place regardless of any specific flow or temperature extreme. Continuous temperature data loggers deployed by the City of Gresham during months where potential for temperatures to exceed water quality standards is high, generally June through September. USGS gaging stations operate year-round.

4.4.4 Frequency and Duration

Continuous temperature data loggers deployed by the City of Gresham are set to collect data at hourly intervals. Continuous temperature monitoring ~~was~~ has been conducted ~~in~~ each summer since 2008~~ and 2009~~. This activity will continue to occur annually at the instream monitoring locations in **Section 3.4.2 Table 2**, unless evaluation of data indicates that sampling an equal number of ~~sites determined probabilistically~~ other locations makes more sense. ~~A statewide network of probabilistically selected stream monitoring sites called the Oregon Master Sample is described in Larsen et al. (2008).~~

Continuous flow is measured by the USGS at either 15 or 30 minute intervals, depending upon the gage. The Johnson Creek gage at Regner has been in operation since February 1998. The Fairview Creek gage at Glisan has been in operation since May 1992. The Kelley Creek gage near the confluence with Johnson Creek has been in operation since March 2000.

4.4.5 Responsible Sampling Coordinator

Continuous temperature monitoring is coordinated by the City of Gresham's Water Resources~~Watershed~~ Division on behalf of Gresham and Fairview, who deploy and retrieve data loggers, then download the data.

The U.S. Geological Survey's Oregon Water Resource Center manages the collection of flow and temperature data at their gaging stations, including equipment calibration and maintenance.

4.5 Sample Collection and Handling

4.5.1 Sample Collection Method

Continuous measurements are made in-situ by securing the data collection devices into the stream channel. Measurements are collected at regular intervals ranging from 15-minutes to 1-hour, depending upon the station and constituent.

4.5.2 Handling and Custody Procedures

Because instream flow and temperature measurements are collected in-situ, sample handling is not involved in collection of these measurements.

4.6 Constituents and Methods

Streamflow: The USGS measures streamflow according to methods described in Rantz and others (1982).

Temperature: Continuous temperature data collected by the City of Gresham is obtained using temperature data loggers with a measurement range of –5º C to 35ºC. Methods for USGS measurement of temperature and turbidity are contained in the "National Field Manual for the Collection of Water-Quality Data" (USGS, variously dated).

4.7 Quality Control Procedures

4.7.1 Quality Assurance

The data quality objectives for continuous temperature data measured by the City of Gresham are determined by pre- and post-deployment accuracy checks and by assessing precision between the temperature from the data logger versus in-stream measurements made during Instream Monitoring. The data quality objectives are accuracy: ± 0.5 ºC, precision: ± 0.5 ºC.

The USGS manages all aspects of installation, maintenance, calibration, reporting and storage of data from their gaging stations. USGS data is flagged as provisional until it is reviewed and meets USGS data quality standards. Quality assurance procedures for USGS streamflow data is described in Rantz and others (1982).

4.7.2 Representativeness

All continuous instream monitoring locations are positioned to capture the most representative readings for ambient conditions at each site, considering flow, shading, depth, and other factors. Temperature data loggers are placed in areas where they will not be subject to direct solar radiation, while also targeting locations that will not be vandalized or dry during low summer flows.

4.7.3 Comparability

The USGS uses similar equipment at all of the gaging locations so that flow and temperature data can be compared between locations. The City of Gresham uses the same model of data loggers at all locations, and syncs the internal timing device so that data collected by each device is at the same time. This allows for temperature data to be compared between each of the in-stream sites monitored for temperature.

4.7.4 Completeness

The key period for continuous temperature data is the low flow summer months – primarily July, August and September. The goal for continuous instream temperature monitoring is to achieve a 100 percent complete data set for the summer months. Hourly measurements for a 3 month period ~~would~~ will result in approximately 2160 data points each summer. Due to unforeseen circumstances some results may be lost. Field and Laboratory staff will attempt to minimize data loss to the best of their ability by carefully following all protocols and procedures. If data sets are not 100 percent complete for this monitoring task, analyses will be evaluated on a case by case basis to determine whether the monitoring program needs to collect additional samples in the future in order to meet monitoring objectives in order to accommodate data loss.

For USGS gaging stations collecting data points every half hour (48 data points per day), an annual period would produce 17,520 data points. USGS stations collecting data points every 15 minutes would produce 35,040 data points annually. The USGS manages all aspects of installation, maintenance, calibration, reporting and storage of data from their gaging stations.

4.7.5 Instrument Inspection and Maintenance

The continuous temperature data loggers are cleaned and inspected annually before and after deployment. The USGS manages all aspects of installation, maintenance, calibration, reporting and storage of data from their gaging stations.

4.7.6 Instrument Calibration

The continuous temperature data loggers cannot be calibrated. Pre- and post-deployment accuracy checks and in-situ precision checks are used to determine whether data meet the quality objectives outlined in **Section 4.7.1**. Accuracy checks are performed using a water bath at both cold and room temperature conditions. All data loggers are deployed and submerged in the water bath; the readouts from each data logger is compared with the other loggers as well as to a NIST-traceable thermometer inserted into the water bath.

The USGS manages all aspects of installation, maintenance, calibration, reporting and storage of data from their gaging stations.

4.8 Data Management, Review, Validation and Verification

4.8.1 Data Management

The continuous temperature data collected by the City of Gresham will be stored in a spreadsheet file stored on the City's server. The USGS manages the flow and temperature data they collect, and all data are available on-line through the Water Resources of Oregon web site at: http://or.water.usgs.gov/

4.8.2 Data Review, Validation and Verification

The Monitoring Program Coordinator will use statistical and graphical analysis to reveal whether errors occurred during data download. Potential errors in the dataset will be checked against field duplicate measurements and date/time of deployment/retrieval. Once verified, errors in data entry will be corrected at that time. Outliers and inconsistencies will be flagged for further review, investigation, and if appropriate, discarded. Data quality problems will be discussed as they occur and in the final report to data users.

The USGS utilizes their own documented procedures for validating flow and temperature data that is considered provisional until it has been reviewed and verified. Quality assurance procedures for USGS streamflow data is described in Rantz and others (1982).

5.0 MACROINVERTEBRATE MONITORING

5.1 Project/Task Organization

As required by the NPDES MS4 permit, Schedule B, Table B-1 and 2. & 3, macroinvertebrate monitoring refers to the annual monitoring of benthic macroinvertebrates from the fixed sampling locations where instream monitoring occurs. Monitoring began at most in-stream sites in 2008; continued monitoring seeks to determine whether and to what degree the biological conditions of streams are changing related to habitat, hydrology, or water quality conditions. Macroinvertebrate monitoring may be timed to coincide with instream monitoring in order to collect biological information at the same time summer water quality data is collected.

5.2 Monitoring Objectives

5.2.1 Monitoring Question and Background

Macroinvertebrate monitoring is intended to track the status and trends of the biological community within water bodies receiving MS4 discharges to address the question "Is stormwater affecting the biological community of the receiving waters?" The Co-Permittees will monitor benthic macroinvertebrates at instream sampling sites in order to more adequately assess the long-term trends in objective 4, and the biological component of objective 5, in addition to helping meet objective 6. As shown in **Appendix A**, macroinvertebrate monitoring also helps address other goals as well.

Objective 4. *Evaluate status and long-term trends in receiving waters associated with MS4 stormwater discharges;*

Objective 5. *Assess the chemical, biological and physical effects of MS4 stormwater discharges on receiving waters; and,*

Objective 6. *Assess progress towards meeting TMDL pollutant load reduction benchmarks.*

5.2.2 Data Analysis Methodology and Quality Criteria

The tool(s) used to assess macroinvertebrate data is almost as important as the protocol used for collection and identification. Several tools are available for analyzing macroinvertebrate data, and the preferred choice changes as more knowledge is gained, so it is critical to keep both the data and the tool. Multi-metric indices, such as Oregon's Benthic Index of Biological Integrity (B-IBI), can be used to look at multiple measures of the biological community, including: Total Taxa, Mayfly Taxa, Stonefly Taxa, Caddisfly Taxa, Sensitive Taxa, Sediment Sensitive Taxa, Hilsenhof Biological Index (HBI), Percent Tolerant Taxa, Percent Sediment Tolerant Taxa, and Percent Dominance.

Macroinvertebrates will be identified to a taxonomic level that allows for calculation of an IBI. DEQ has been moving away from the use of the IBI as other tools have become available. Currently, the Predictive Assessment Tool for Oregon (PREDATOR) allows for comparison of the biological community observed in stream sites with the expected community that is present in best available condition reference sites within the same eco-region. DEQ's PREDATOR model can be used with macroinvertebrate data identified to the same taxonomic level required by the IBI, so ensuring that macroinvertebrate samples are identified to the same taxonomic level as DEQ (generally genus/species) is the primary criteria for selection of a taxonomist. To the degree practicable, an attempt will be made to use the same taxonomist over time to maximize consistency.

5.2.3 Assumptions and Rationale

Macroinvertebrates live in the streambed substrate and are therefore affected by short and long-term exposures to pollution. The biological community may be affected by a wide range of factors including temperature, sediment, in-stream and near-stream riparian habitat, hydro-modification, and water quality pollutants from land use in the contributing watershed area. It is assumed that long-term monitoring of macroinvertebrates will aid the Co-permittees in determining whether the physical, biological, and chemical condition of MS4 receiving water bodies is improving over time due to efforts to manage stormwater and improve habitat. Continued monitoring at the same locations will allow for assessing long-term trends over time.

5.2.4 Relationship to Long-term Monitoring Program Strategy

Macroinvertebrate monitoring provides a periodic measure of the biological condition of waters of the state which receive MS4 stormwater discharges. The annual biological monitoring described in this section augments other monitoring efforts by 1) comparing instream water quality trends described in **Section 3.0** with biological conditions, 2) evaluating how the biological community is affected by the flow and temperature data described in **Section 4.0**, and 3) determining if changes in stormwater data described in **Section 6.0** relate to changes in the instream macroinvertebrate community. Continuing macroinvertebrate monitoring using an approach consistent with instream water quality monitoring efforts should enable the Co-Permittees to determine if short or long-term water quality trends are evident based on MS4 management decisions associated with implementation of their SWMPs.

5.3 Documentation and Record-keeping Procedures

Consistent with permit requirements specified in Schedule F, Section C.5., the Co-Permittees will retain records of all monitoring information, including: all original data, copies of all reports required by the NPDES MS4 permit, and records of data used to complete the application for the NPDES MS4 permit for a period of at least 3 years from the date of the sample, measurement, report, or application.

Records will contain:

1. The date, exact place, time, and methods of sampling or measurements;
2. The individual(s) who performed the sampling or measurements;
3. The date(s) analyses were performed;
4. The individual(s) who performed the analyses;
5. The analytical techniques or methods used; and
6. The results of such analyses.

5.4 Sampling Process/Study Design

5.4.1 Study Design

Collecting benthic macroinvertebrate samples provides a direct measure of the biological health of the streams within the permit area. Macroinvertebrate sampling will be conducted as close to the Co-permittee’s instream fixed sampling locations as possible. Following DEQ’s biological monitoring procedure requires selection of riffles or the best available fast water habitat near the monitoring stations, focusing on an area upstream equal to 40 times the wetted stream width.

5.4.2 Monitoring Locations

Macroinvertebrates are currently monitored at the same fixed instream monitoring locations where instream water quality monitoring occurs. The instream macroinvertebrate sampling locations are listed in **Table 8**. Sampling locations may be moved to random sites selected probabilistically if data analysis reveals that annual monitoring of the same locations is not needed to show long-term changes in the biological community.

Table 8: Instream Macroinvertebrate Monitoring Locations

Station Number*	Site Code	Stream	Location
Columbia Slough Basin			
1**	FCI0	Fairview Creek	Mobile estates upstream of Fairview Lake in City of Fairview
2	FCI1	Fairview Creek	Conifer Park (205th and Stark) in City of Gresham
Sandy River Basin			
3	KCI1	Kelly Creek	Downstream Mount Hood Community College
4**	KCI4	Kelly Creek	Upstream from Kelly Creek Detention Pond
Johnson Creek Subbasin			
5	JCI1	Johnson Creek	Near Jenne Rd Bridge
6	JCI2	Johnson Creek	Near Palmblad Bridge upstream of Gresham
7**	KI1	Kelley Creek	Pleasant Valley Grange
8**	KI2	Kelley Creek	Rodlun Rd near Alder Ridge

* Station numbers refer to locations on **Figure 1** (see **Section 3.0**).

** These sampling locations will be monitored each year only if adequate summer flows, or presence of suitable fast water habitat, are present. Not sampling these sites will still meet the minimum requirements listed in Table B-1 of the NPDES MS4 permit (1 site in Columbia Slough basin, 1 site in the Sandy River basin, and 2 sites in the Johnson Creek subbasin).

5.4.3 Sampling Event Criteria

Macroinvertebrate data collection will occur once each year during summer low flows. This activity will most likely occur during July or August in conjunction with instream water quality monitoring.

5.4.4 Frequency and Duration

A single sample will be collected at each site annually. Sampling began in 2008, and is planned to continue~~ over the December 30, 2010 NPDES MS4 permit cycle~~, but changes in location or frequency may be proposed if data analysis reveals that annual monitoring of the same locations is not needed to show long-term changes in the biological community.

5.4.5 Responsible Sampling Coordinator

This monitoring task is coordinated by the City of Gresham's Water Resources~~Watershed~~ Division on behalf of Gresham and Fairview, who determine sample collection timing, gather needed equipment, collect samples for lab analysis, and coordinate delivery to the taxonomist.

5.5 Sample Collection and Handling

5.5.1 Sample Collection Methods

Macroinvertebrate samples will be collected according to DEQ's Field Methods for the Collection of Macroinvertebrates in Wadeable Streams (DEQ 2009). Samples will be collected from suitable fast moving water habitat (riffles, or runs/glides if no riffle is present) once per year during summer/low flow conditions. Eight separate one-foot square (1 ft^2) samples will be collected using a 500 µm kick net from riffle habitat over a reach length of 40 times the average wetted stream width.

5.5.2 Handling and Custody Procedures

The 8-part composite sample is collected following DEQ's 9-cell grid method, moving from downstream to upstream in the fast water habitat from bottom left to center then right for the first three samples, and then moving in the same sequence from left to right upstream until all 8-parts of the composite sample have been collected.

A two-person team is used, where one person holds the D-frame net securely against the bottom of the streambed substrate, while the second person dislodges insects by rubbing rocks and disturbing substrate using their hands, brush or garden tool. Each of the 8 separate 1 ft^2 samples is placed into a sieve bucket with a 500 µm grid. The entire 8-part composite is transferred to Nalgene jars prior to being preserved using 70-95% ethanol or isopropyl alcohol. A Rite-in-the-Rain label with sample information written in pencil will be added inside the sample jar and the alcohol is added to the sample before the jars are sealed. A second label will be added to the outside of the jar before being sent to a professional entomologist for identification.

The label contained in each sample contains the following information:

- Date of sample collection
- Location of sample collection
- Name of sample collectors
- Number of jars used for sample from each site (Jar # __ of __)

Samples held for more than a week prior to shipment to the taxonomist may have the alcohol replaced with fresh ethanol or isopropyl alcohol. This step is most important for samples containing large amounts of organic material. A list of sample details, including site code, stream name, site location, sample date, and number of jars, is provided to the taxonomist to aid in data reporting.

5.6 Constituents and Methods

Macroinvertebrate samples will be collected according to DEQ's Field Methods for the Collection of Macroinvertebrates in Wadeable Streams (DEQ 2009). In order to get samples identified to the taxonomic level required to conduct the data analyses listed in **Section 5.2.2**, specimens will be sent to a professional entomologist for identification.

5.7 Quality Control Procedures

5.7.1 Quality Assurance

A field duplicate will be collected at a minimum of 10% of the total number of monitoring locations (1 duplicate for every 10 sites). The identification results from the field duplicate data will be compared to the results for the site it was collected from to determine the precision of the taxonomists' identification. A lab duplicate is also performed for each sampling period. A lab duplicate differs from a field replicate in that the taxonomist takes a second random subsample from the composite sample for determining precision and representativeness of the subsampling procedure. The accuracy target for field duplicates is to have less than 10% variability between organisms identified and relative abundance of each taxa.

5.7.2 Representativeness

Macroinvertebrate samples are collected from 8 separate locations within riffles or the best available fast water habitat. Based on procedures published by EPA and DEQ, these habitat conditions are believed to be well mixed and provide the most diverse biological community for comparing sites within the same watershed or around the ecoregion or state.

5.7.3 Comparability

The objective is to ensure that collected data are either directly comparable, or comparable within defined limitations, to literature data or other applicable criteria. Macroinvertebrate samples are collected and identified using the same method used by DEQ and other jurisdictions, so data should be comparable among the instream locations monitored as part of this plan, as well as comparable with other macroinvertebrate data collected from sites around the state.

5.7.4 Completeness

The goal for macroinvertebrate monitoring is to achieve a 100 percent complete data set. It is anticipated that over the 5 year permit term, annual sampling at 8 sites will result in 40 data points being collected. Due to unforeseen circumstances some results may be lost. Field and Laboratory staff will attempt to minimize data loss to the best of their ability by carefully following all protocols and procedures. If data sets are not 100 percent complete for this study, analyses will be evaluated on a case by case basis to determine whether the project needs to collect additional samples.

5.7.5 Equipment Inspection and Maintenance

Prior to field data collection, all equipment is cleaned and visually inspected to ensure that the net and sieve bucket do not contain any openings that might allow organisms through during sample collection.

5.7.6 Equipment Calibration

No equipment involved in collection of macroinvertebrates requires calibration.

5.8 Data Management, Review, Validation and Verification

5.8.1 Data Management

All macroinvertebrate data will be stored in an annual summary spreadsheet stored on Gresham's server. Once data is received from the taxonomist, it will be reviewed and analyzed using an analysis tool (B-IBI, PREDATOR or other). Data analysis will occur as soon as practicable, with data summarization being shared with Fairview and summarized in the NPDES MS4 Annual Report. Additional analysis will be conducted for the permit renewal to assess instream trends. Periodic analysis of data may also occur to assess whether adaptive management of the Monitoring Plan or program is appropriate.

5.8.2 Data Review, Validation and Verification

Once the macroinvertebrate data from the taxonomist has been analyzed, the results will be compared to other sites and past data from the same site to check for consistency. Raw data from the field and lab duplicate measurements will be assessed against the quality assurance objectives listed in **Section 5.7.1** to determine if the collection and identification results meet the 10% target. Calculations and determinations for completeness and accuracy will be made and corrective action implemented if needed. If data quality indicators do not meet the monitoring program's specifications, data may be discarded and re-sampling may occur. The cause of the failure will be evaluated. If the cause is found to be collection method, techniques will be reassessed and staff will be retrained. If the problem is found to be identification, the taxonomist utilized by the Co-permittees will be assessed and a new taxonomist will be rehired as needed.

6.0 WET WEATHER STORMWATER MONITORING

6.1 Project/Task Organization

As required by the NPDES MS4 permit, Schedule B, Table B-1 and 2. & 3, Wet Weather Stormwater Monitoring refers to the monitoring of stormwater runoff from roads and other paved surfaces. While the majority of monitoring is conducted within the City of Gresham, the drainage characteristics (land uses and vehicle trips per day) are also representative of the City of Fairview. Land use based wet weather outfall monitoring has been conducted at four locations throughout the permit boundary, including an ACWA study conducted between 1990-1996 (ACWA 1997), and monitoring conducted by the Co-permittees between 1996-2011 as part of the monitoring requirements in the NPDES MS4 permit. This data, along with other regional jurisdictions' data, was compiled and analyzed through a study managed by the Oregon Association of Clean Water Agencies (ACWA 2009).— The 2009 ACWA data analysis provided statewide stormwater characterization and compared the influence of land use and vehicle trips on runoff quality.

The findings from the ACWA (2009) stormwater analysis indicated that stormwater data is highly variable and that vehicle trips per day may be more strongly correlated to differences in the data than land use. Some of the data included in the ACWA (2009) report was collected for compliance with a Water Pollution Control Facility (WPCF) permit for Underground Injection Control systems (UICs). Stormwater data related to UICs showed lower variability, which may be related to the smaller scale drainage basins, or the fact that sites were selected using a spatially balanced and random ("probabilistic") site selection protocol (see **Section 6.4.1**). In an effort to reduce bias in sample site selection, eliminate variability that may be related to large drainage areas and produce stormwater data with greater statistical power, the Co-permittees are changing their monitoring approach from looking at outfalls from large drainage areas to evaluating smaller drainages selected using the probabilistic monitoring design.

6.2 Monitoring Objectives

6.2.1 Monitoring Question and Background

Wet weather stormwater monitoring is intended to characterize the status and, if possible, determine trends in stormwater quality by focusing on the question "What are typical/average concentrations of pollutants in stormwater runoff?" Through evaluation of data that has already been collected (e.g. ACWA 1997 and ACWA 2009), and assessing monitoring approaches used for other stormwater monitoring programs (e.g. Portland's UIC monitoring program), the Co-permittees plan to continue characterizing stormwater and augment with additional monitoring where data are lacking (specifically for mercury and toxics, especially pesticides). To meet monitoring Objectives 1, 3, and 6 from the NPDES MS4 permit, the Co-Permittees will collect stormwater samples from representative locations.

Objective 1. *Evaluate the source(s) of the 2004-06 303(d) listed pollutants applicable to the co-permittees' permit area*

Objective 2. *Evaluate the effectiveness of Best Management Practices (BMPs) to assist in identifying BMP priorities;*

Objective 3. *Characterize stormwater runoff discharges based on land use, seasonality, geography or other catchment characteristics;*

Objective 6. Assess progress towards meeting TMDL pollutant load reduction benchmarks.

Appendix A has a more extensive overview of how storm event monitoring, mercury monitoring and pesticide monitoring address each of the six monitoring objectives.

6.2.2 Data Analysis Methodology and Quality Criteria

Wet weather stormwater monitoring data will be assessed by comparing sites selected using the probabilistic Generalized Random Tessellation Stratified (GRTS) survey design described in **Section 6.4.1**. After randomly selecting sites with small drainage areas, the characteristics of each drainage area will be assessed, and a nonparametric statistical measure of difference between groups (e.g. Mann-Whitney) will be used to determine if stormwater is significantly different between sites based on land use, traffic patterns, power pole density, or other drainage characteristics. The significance of any difference would be evaluated against an alpha (α) value of at least 0.1, with a goal to demonstrate significance at α=0.05.

6.2.3 Assumptions and Rationale

Because patterns of development and management of stormwater are the generally the same across the City, stormwater draining to UICs should not be different from that draining to the MS4. Both the UIC and MS4 areas are comprised of a mixture of residential, commercial, and industrial land uses, and a mixture of high volume and low volume traffic patterns and are therefore also representative of Fairview. The UIC monitoring approach used by Portland has demonstrated lower variability in stormwater data than the historic MS4 data that focused on outfalls from larger drainage areas.

It is assumed that by shifting stormwater monitoring to smaller UIC drainages that can be entirely characterized, versus the larger land use based outfall monitoring conducted in the past, the stormwater data will be less variable and more representative of specific land uses and factors that have the potential to affect stormwater quality. Using a probabilistic approach for selecting monitoring locations will remove any bias associated with site selection, and selecting a large enough number of sites allows for meaningful analysis of the stormwater data regardless of the strata (land use, vehicle trips, etc.) being assessed.

The ACWA evaluation of statewide stormwater data (ACWA 2009) indicated that vehicle trips per day more closely correlates with pollutant concentrations than does land use. It is assumed that the statewide data is relevant to Gresham, and the effect of vehicle trips per day will be a primary factor for further analysis.

6.2.4 Relationship to Long-term Monitoring Program Strategy

Wet Weather Stormwater Monitoring provides a direct measure of the water quality of stormwater within the permit area. Using a probabilistic monitoring design that allows assessment of stormwater within the permit area provides the Co-permittees with useful management information for both the MS4 and UIC system management. ~~The monitoring design proposed for the December 30, 2010 NPDES MS4 permit cycle will be adapted to also meet the goals and requirements of the 10-year WPCF UIC permit.~~ The long-term strategy for stormwater monitoring will likely involve keeping a long-term “fixed” panel of 5 sites monitored annually to allow for assessment of long-term trends, while also monitoring a rotating panel of ~~2~~5 random sites each year to allow for greater assessment of stormwater status within the permit area.

6.3 Documentation and Record-keeping Procedures

Consistent with permit requirements specified in NPDES MS4 permit Schedule F, Section C.5., the Co-Permittees will retain records of all monitoring information, including: all calibration, major maintenance records, all original lab and field data (see **Appendix C** for example of field data sheet), copies of all reports required by the NPDES MS4 permit, and records of data used to complete the application for the NPDES MS4 permit for a period of at least 3 years from the date of the sample, measurement, report, or application.

Records will contain:

1. The date, exact place, time, and methods of sampling or measurements;
2. The individual(s) who performed the sampling or measurements;
3. The date(s) analyses were performed;
4. The individual(s) who performed the analyses;
5. The analytical techniques or methods used; and
6. The results of such analyses.

6.4 Monitoring Process/Study Design

6.4.1 Study Design

Compared to the historic stormwater data collected at outfalls, the data collected during a one year (2009-2010) wet-weather study of 60 sites conducted by the City of Gresham, as well as the City of Portland’s UIC monitoring program data (2007 to present) shows much lower variability and greater consistency than stormwater data collected during the previous decade at outfalls. The wet weather stormwater monitoring approach and locations listed in this plan seeks to continue to build upon those efforts and combine stormwater monitoring requirements, to the extent practicable in order to meet the requirements of both the NPDES MS4 and WPCF permits in order to protect local water resources using the public’s rates in the most efficient and scientific manner possible given limited resources.

A major benefit to using a combined stormwater monitoring approach to address both the MS4 and WPCF permit requirements is that rather than using the three large MS4 drainage outfalls, stormwater monitoring would be conducted annually at a greater number of small UIC drainages (0.5 to 5 acres). Sites are selected using a spatially-balanced and random probabilistic approach, which is described below. The greatest benefit to using the Generalized Random Tessellation Stratified (GRTS) survey design (probabilistic approach; see Stevens and Olsen 2004) is that the small drainage areas will be composed of a single land use, versus the mixed use inherent in the past stormwater outfall monitoring approach that focused on drainage areas that were hundreds of acres in size. Based on findings from Portland and Gresham stormwater sampling summarized in ACWA (2009), stormwater data may be affected more by vehicle trips per day than land use. Therefore, monitoring locations will be stratified by vehicle trips (< and > 1000 trips per day), which will also allow data to be comparable to similar sampling locations in nearby Portland.

The GRTS survey design developed by Dr. Don L. Stevens Jr. (Department of Statistics, Oregon State University) and Dr. Anthony R. Olsen (EPA National Health and Environmental Effects Research Laboratory) is specifically designed to efficiently characterize a large system with many potential sampling locations, such as a stream network or stormwater system. It randomly selects sampling locations from a population of potential locations whose members (stormwater structures for potential sampling) are distributed over a large space in a manner that produces a spatially balanced sample. Since the Co-Permittees have a large number of major and minor outfalls draining areas that range from a few acres up to nearly 1000 acres, it is not technically practicable or financially feasible to routinely collect and analyze stormwater from each of these outfalls during every storm event. Due to the large drainage areas and therefore large number of potential confounding factors, the Co-Permittees will monitor smaller stormwater catchments (0.5 to 5 acres) associated with UICs that can be accurately characterized according to land use, vehicular trips, and other characteristics that may influence the water quality of the stormwater effluent. In order to identify small catchments consisting of 1 to 4 catch basins, statistical methods will be applied to select a subset of points for monitoring so that there will be a high degree of confidence that the subset chosen is appropriately representative of stormwater within the permit area.

Stratification

Of the roughly 1100 small City-owned and operated UIC catchments, approximately 60% are in residential areas, and have <1000 vehicle trips per day (TPD), while the other 40% have >1000 TPD and surrounding land use is primarily commercial and multi-family residential with some industrial. In order to ensure that data is collected from a greater number of high vehicle trip sites, a weighting factor will be applied during site selection so that a disproportionately high number of sites with greater than 1000 TPD will be monitored each year. The goal is to have a roughly equal number of sites within the two traffic strata by the end of the permit term. Since the majority of active UICs are in the <1000 TPD, the sample design is conservative in that it will be overly representative of sampling locations from streets with higher traffic counts (>1000 TPD).

6.4.2 Monitoring Locations

Selection of stratified, spatially-balanced and random sampling locations using the GRTS procedure was accomplished by:

- Determining the exact geographic locations (latitude-longitude) of all UICs within the permit boundary that are owned and operated by the City of Gresham;[1]
- Running the GRTS selection tool, which places nested random grids over the City's entire UIC system. Each grid is further divided into smaller nested grids until the smallest grid scales contain only a single UIC;
- In order to have a disproportionately greater number of >1000 TPD sites selected, a weighting factor was applied to the GRTS selection run. For the initial selection run, where a higher number of sites was selected than will be needed to account for sites that eliminated after field screening for determining whether the sampling location is feasible/suitable, 390 locations (188 <1000 TPD and 202 >1000 TPD) were selected using weighting factors of 6.78 for <1000 TPD and 10.25 for >1000 TPD;
- The program systematically selected a random and evenly spaced sample from the UIC locations within the nested grids. Output is a ranked list of locations;

[1] Sites selected from UIC Systemwide Assessment conducted October 2011.

- In order to end up with an equal number of sites in the two traffic strata each year (~~1~~5 sites in both the <1000 and >1000 TPD), the number of sites randomly selected within each traffic strata were evaluated. Since a fixed panel of 5 locations will be monitored each year (consisting of the top 3 ranked sites with <1000 TPD and the top 2 ranked sites with >1000 TPD), the rotating panel for each year was determined by selecting the next ~~1~~2 locations with <1000 TPD and ~~1~~3 locations from >1000 TPD. Having slightly more sites in the higher traffic strata of the rotating panel was made purposely so that a disproportionately large number of these sites would be sampled over the permit term~~ (4 more >1000 TPD sites over 5 years and 9 more over 10 years)~~.
- Before sampling the ~~2~~5 rotating sites selected for each year, field reconnaissance will be performed to determine if the randomly selected sites were unsuitable for sampling (~~e.g~~e.g., unsafe or inaccessible due to design). Replacement sites will be selected in ranked order from the list of oversample panel locations.

The proposed sampling locations for Wet Weather Stormwater Monitoring are listed in **Tables 9 and 10**. Since exact sampling locations to be monitored each year may vary based on changes to the stormwater system, **Table 9** lists the number of fixed and rotating sites that will be monitored in each year~~ of the December 30, 2010 NPDES MS4 permit cycle~~. Each year, monitoring will occur at one panel of 5 fixed locations (described in **Table 10**) and one panel of ~~2~~5 rotating locations that will be monitored once during the permit term (specific list of rotating panel locations detailed in the separate "Stormwater Monitoring Plan" created to meet the requirements of the WPCF permit). The goal of including fixed and rotating sample locations is to assess status and trends in stormwater – status being evaluated by covering a large random sample of the permit area, and trends being evaluated by long-term assessment of the same locations. In the long-term it may make sense to revisit the same rotating locations on a 5 or 10 year cycle; or it may prove scientifically advantageous to *not* re-visit the same locations and rely solely on the fixed panel to evaluate trends. A decision regarding such future monitoring will be based on regulatory requirements, questions raised or answered by the data collected, available resources, and other relevant criteria.

Table 9: Stormwater Sampling Locations to be Monitored During Permit Term

Permit Year	Fixed Locations*	Rotating Locations	Wet Season
1	5	~~2~~5	2016~~1~~-17~~2~~
2	5	~~2~~5	2017~~2~~-18~~3~~
3	5	~~2~~5	2018~~3~~-19~~4~~
4	5	~~2~~5	2019~~4~~-20~~15~~
5	5	~~2~~5	2020~~15~~-21~~16**~~

* One panel of five fixed sampling locations will be monitored each year.~~,~~ The ~~2~~5 rotating sampling locations monitored each year will consist of ~~1~~3 UICs on >1000 TPD and ~~1~~2 locations on <1000 TPD locations. Locations of the rotating panel locations are specified in the Stormwater Monitoring Plan.

~~** Note that this wet season extends beyond the term of the December 2010 NPDES MS4 permit. Data from this wet season will be included in the appropriate annual report, but will not be available in time for the permit renewal application.~~

Both the panel of 5 fixed monitoring locations and the rotating panel of ~~2~~5 sites consist of sites selected probabilistically using the GRTS survey design described previously. The rotating panel locations to be monitored each year are subject to change as a result of field reconnaissance or system changes, so the list of locations monitored will be reported to DEQ each year as part of the required annual report. The random panel of sites, which are specified in the Stormwater Monitoring Plan, will be representative of any UICs constructed or discovered during the permit term since it was selected from the 1100 active UICs owned and operated by the City of Gresham. The current probability of randomly selecting a single site from a population of 1100 UICs is 1 in 1100 or 0.091%. While new UICs may be constructed or discovered over the permit term, it is anticipated that only 5 new UICs would likely be added annually. Over a 5 year period, this would mean 25 potential new sampling locations could be added. The probability of selecting a single site after those 25 sites were added to the system would be 1 in 1125 or 0.088%. The probability that any of the 25 newly added sites would be selected would be 25 in 1125 or 2.2%. Based on a similar criteria used by Portland in their Sampling and Analysis Plan (Portland 2006), sampling locations will not be re-selected using GRTS unless the probability for selecting a newly constructed or discovered sampling site becomes greater than 5% (more than 55 UICs added over 5 year period). The inventory of UICs will be evaluated annually and a determination will be made prior to the beginning of each wet weather sampling season.

Table 10: Wet Weather Stormwater Monitoring Fixed Locations*

Basin**	System ID	Functional Class	Trips per Day	Land Use
Fairview	3151-F-064	Collector	>1000	MRES
Fairview	3251-F-013	Residential	<1000	SFR
Columbia Slough	3148-W-014	Community	>1000	SFR/COM
Fairview	3150-F-030	Residential	<1000	SFR
Fairview	3153-F-040	Residential	<1000	SFR

* Sites and frequency subject to change contingent upon pending WPCF permit. No decrease in effort or resource allocation will be made should changes be proposed.

**Nonstructural BMPs and requirements for new and redevelopment are consistent throughout the City. Land use and trips per day are considered a better indicator of pollutants than surface water drainage basin.

6.4.3 Sampling Event Criteria

Prior to initiating a sampling event, the storm will be predicted and evaluated against the criteria listed below to assess whether the predicted storm should be targeted as Wet Weather Stormwater Monitoring event. Storm event criteria are as follows:

- Predicted rainfall amount of ≥ 0.2 inches per storm [NPDES MS4 permit B(3)(b)(i.) requires sampling to occur during storms > 0.1"];
- Predicted rainfall duration ≥ 6 hours; and
- Antecedent dry period ≥ 6 hours (as defined by < 0.1 inches of precipitation over the previous 6 hours). When possible, samples will be collected after an antecedent dry period of 24 hours [NPDES MS4 permit B(3)(b)(ii.)].

Based on experience and review of historic weather data related to stormwater monitoring in this region, storms meeting these criteria are expected to provide the volume of runoff necessary to implement sampling. Smaller storms, or storms of shorter duration, are considered to have a low probability of producing sufficient runoff to warrant the extensive preparation and mobilization time required for Wet Weather Stormwater Monitoring. It is likely that a sampled storm may not meet the target criteria listed above when the sampling event is completed, or that unpredicted events will occur that do meet the criteria. Thus, the criteria will be used as general guidance to determine when forecasted storms should be targeted for sampling.

Hourly and daily rainfall records are maintained and available on the HYDRA Data Report System. This data is available on the web at:
http://or.water.usgs.gov/non-usgs/bes/raingage_info/clickmap.html.

6.4.4 Frequency and Duration

As listed in **Section 6.4.2**, **Table 9**, a single sample will be collected annually for each of the 1~~3~~0 sites per year. ~~A maximum of 10 sites will be sampled per storm event, so that sampling will be conducted during a minimum of 3 different storm events.~~ As described in Section 6.4.3, storms not likely to result in enough runoff for samples from 5 sites to be collected will not be targeted. This will likely result in average pollutant concentrations that are slightly higher than the true average, because pollutant loads correlate with rainfall intensity.

6.4.5 Responsible Sampling Coordinator

This monitoring task is coordinated by the City of Gresham's Water Resources~~Watershed~~ Division on behalf of Gresham and Fairview, who target events, calibrate equipment, perform in-situ field measurements, collect samples for lab analysis, and coordinate delivery to the lab. Laboratory analysis for instream samples is conducted by Portland's Water Pollution Control Laboratory under an IGA with the City of Gresham for laboratory services (see **Appendix F**).

6.5 Sample Collection and Handling

6.5.1 Sample Collection Method

As described in the NPDES MS4 permit Schedule B 3. b. iv. 1, Co-permittees have selected grab samples for Wet Weather Stormwater Monitoring. The samples will be collected at each of the ~~3~~10 locations to be sampled in a given year. Because of the spatial extent of this sampling effort (i.e., sites are distant from one another), composite sampling is infeasible. By focusing on a larger spatial area of the stormwater system sampled in a probabilistic manner over a period of hours, the large number of samples should reflect average conditions as well or better than collecting composite samples from fewer sites. Thus, the Co-permittees concluded that flow-weighted composites are scientifically unwarranted and are financially infeasible. To this end, the selection of smaller drainages for sampling allows for the evaluation of the influence of a variety of watershed characteristics, including, but not limited to land use, traffic patterns, and presence of utility poles which are known to leach pentachlorophenol.

6.5.2 Handling and Custody Procedures

For grab samples, samples are collected directly into the appropriate containers from the center of flow, when possible. If needed, samples will be collected using a clean stainless steel bailer attached to an extension rod. A separate laboratory-cleaned stainless steel bailer is used for each sampling location. Field measurements are made by collecting a representative sample using the stainless steel bailer and then pouring the sample into the measurement/storage cup of the multi-meter probe. One bottle is field-filtered for ortho-phosphorus analysis.

Two-person clean sample collection techniques are followed to minimize the potential for contamination of samples: one person acts as "dirty hands" to move equipment, document field measurements, grab samples using the bailer and remove manhole lids; and one person~~s~~ acts as "clean hands" to fill sample bottles. The "clean hands" person wears powder-free nitrile gloves to avoid contamination of the sample and protect staff from possible health risks.

All samples collected for laboratory analysis are immediately placed into a cooler containing ice and transported to the lab immediately following sample collection. **Table 11** lists the volume of sample collected, the container used and maximum holding time. Once samples are delivered to Portland's Water Pollution Control Laboratory, they have their own QAPP to ensure that samples are analyzed within the proper holding time and preservation methods are employed.

Table 11: Sample Containers and Holding Times for Wet Weather Stormwater Monitoring

Constituent	Minimum Sample Volume	Bottle Type	Holding Time
Conventional Constituents			
Biochemical Oxygen Demand (BOD_5)	250 mL	Plastic	24 hours
Total Suspended Solids	500 mL	Plastic	7 days
Hardness	250 mL	Plastic	6 months
E. coli	100 mL	Sterile Plastic	6 hours (max 24 hrs.)
Nutrients			
Nitrate Nitrogen	100 mL	Plastic	48 hours
Total Kjeldahl Nitrogen (TKN)	100 mL	Plastic	28 days
Ammonia Nitrogen	100 mL	Plastic	28 days
Total Phosphorus	100 mL	Plastic	28 days
Ortho-phosphorus	250 mL	Plastic	48 hours
Total Recoverable Metals			
Copper	400 mL	Plastic	6 months if preserved
Lead			
Zinc			
Mercury			
Dissolved Metals			
Copper	400 mL	Plastic	6 months if preserved
Lead			
Zinc			
Pesticides			
2,4-D	250 mL	Amber Glass	14 days
Pentachlorophenol			

After samples have been obtained and the collection procedures properly documented, a written record of the chain of custody for each sample requiring laboratory analysis is completed. Information included on the chain of custody includes:

- Name of the persons collecting the sample(s)
- Date and time of sample collection
- Location of sample collection
- Names and signatures of all persons handling the samples in the field and in the laboratory
- Laboratory analysis requested and control information (e.g., duplicate or spiked samples etc.) and any special instructions (e.g., time sensitive analyses).

To ensure that all necessary information is documented, a chain of custody form will accompany each sample or set of samples and a copy of the form is retained. Each person who takes custody will sign and date the appropriate portion of the chain of custody documentation.

6.6 Constituents and Methods

The analytical methods and method reporting limits (MRLs) for constituents monitored for wet weather stormwater monitoring are listed in **Table 12**.

Table 12: Wet Weather Stormwater Monitoring Constituents, Methods, and MRLs

Field Constituents	Analytical Method	MRL**	Units
Temperature	SM 2550 B	-5	Degrees C
DO	SM 4500-OG	0.1	mg/L
Conductivity	EPA 120.1	1.0	µs/cm
pH	EPA 150.1	3.0	S.U.
Turbidity	EPA 180.1	0.05	NTU
Conventional Constituents			
Biochemical Oxygen Demand (BOD_5)	SM 5210 B	2	mg/L
Total Suspended Solids	SM 2540 D	2	mg/L
Hardness	SM 2340 B	0.5	mg/L as $CaCO_3$
E. coli	COLILERT QT	10	MPN/100 mL
Total Organic Carbon (TOC)*	5310B	1	mg/L
Nutrients			
Nitrate Nitrogen	EPA 300.0	1.10	mg/L
Total Kjeldahl Nitrogen*	PAI-DK03 [1]	0.20	mg/L
Ammonia Nitrogen	EPA 350.1	0.02	mg/L
Total Phosphorus	EPA 365.4	0.02	mg/L
Ortho-phosphorus	EPA 365.1	0.02	mg/L
Total Recoverable Metals			
Copper	EPA 200.8	0.2	µg/L
Lead	EPA 200.8	0.1	µg/L
Zinc	EPA 200.8	0.5	µg/L

Mercury*	WPCLSOP M-10-02*[2]	0.002	µg/L
Dissolved Metals			
Copper	EPA 200.8	0.2	µg/L
Lead	EPA 200.8	0.1	µg/L
Zinc	EPA 200.8	0.5	µg/L
Pesticides			
2,4-D	EPA 515.3	0.2	µg/L
Pentachlorophenol	EPA 515.3	0.08	µg/L

* TOC, Mercury, and TKN are not required in Table B-1 of the NPDES MS4 permit, ~~(beyond the 2 sites twice per year in DEQ's Mercury memo),~~ so are subject to the Adaptive Management process described in **Section 1.4**.
** Method Reporting Limit
[1] The PAI-DK03 method for TKN is a 40 CFR 136 method (flow injection gas method, see footnote 41, Table 1B, 40 CFR Part 136.3).
[2] The WPCLSOP M-10.02 method cited for total Hg is EPA 200.8 w/CEM digestion (footnote 4, Table 1B, 40 CFR Part 136.3)~~- this is a method Portland's WPCL received ATP approval for about 5 years ago, but cite as WPCLSOP M-10.02~~.

Pesticides

Based on a preliminary assessment of current use pesticides used within the permit area, the Co-permittees will conduct sampling for the following:

- **2,4-D (Dichlorophenoxyacetic acid, dimethylamine salt):** The most widely available and used phenoxy herbicide; selected because of its widespread use, known toxicity to fish and aquatic invertebrates, potential for groundwater pollution (due to high mobility), and likelihood for transport in urban stormwater. In addition, the City has conducted residential outreach to discourage use of this and other lawn chemicals, and trends over time are of interest.
- **Pentachlorophenol:** A previously widely used, but now is a restricted-use fungicide that was identified through Portland's stormwater monitoring as a potential concern based on use as a utility pole wood preservative. Gresham also found pentachlorophenol during a special stormwater study conducted in wet season 2009-10. This chemical has the potential to be a surface and groundwater pollutant, is known to be toxic to aquatic organisms and humans and is a suspected carcinogen, mutagen and teratogen.

The two pesticides slated for monitoring are not the only pesticides of interest (see **Appendix K**). However, they are two of the more widely applied pesticides, which local laboratories are capable of analyzing at levels that are anticipated to be found in storm, surface, and ground water. Screening tests that quantify large numbers of pesticides are not currently available to detect pesticides at relevant concentrations.

In addition to these two pesticides, Gresham staff have prepared an assessment of the pesticides included in Schedule B of the NPDES MS4 permit; the pesticides used by the Co-permittees during operations and maintenance activities; the pesticides identified by DEQ or other regional research in local water bodies; and pesticides available to residents based on a shelf survey conducted by Metro. The "Pesticide Assessment for Stormwater Monitoring" (2011) is submitted in **Appendix K**.

6.7 Quality Control Procedures

6.7.1 Quality Assurance

The data quality objectives for field measurements are listed in **Table 13**. Precision and accuracy are referenced from the DEQ Data Quality Matrix. Because field measurements for temperature, pH, DO and conductivity are made using a multi-meter probe, precision between replicates is usually not assessed since meter values are continuously assessed and not documented until they stabilize. Accuracy for field measurements is determined by measuring standards before and after each sampling event and assessing deviation from the standard in comparison to accuracy ranges in **Table 13**.

Table 13: Accuracy and Precision Targets for Stormwater Field Measurements

Parameter	Precision	Accuracy	Measurement Range
Temperature	± 1.0 ºC	± 0.5 ºC	-5 to 45 ºC
pH	± 0.3 SU	± 0.2 SU	0 to 14 SU
Dissolved Oxygen	± 0.3 mg/L	± 0.2 mg/L	1 to 50 mg/L
Conductivity	± 10% of Std. Value	± 7% of Std. Value	0 to 200 mS/cm
Turbidity	± 5% of Std. Value ± 1 NTU if NTU <20	± 5% of Std. Value	0 to 1000 NTU

Analytical methods for grab samples analyzed at Portland's Water Pollution Control Laboratory use an appropriate balance of quality assurance/quality control measures, including replicates, blanks, spiked samples and other measures approved under 40 CFR 136 to ensure that data meet quality objectives appropriate for compliance with state and federal regulatory requirements. A copy of the WPCL's QAPP is included in **Appendix G**.

Field duplicate samples will be collected at a minimum of 10% of the total number of monitoring locations (1 duplicate for every 10 sites). For wet weather stormwater sampling, one lab replicate will be collected from one of the 10 stormwater sampling sites. ~~Since the goal is to monitor 10 stations each wet weather event, a field duplicate will typically be gathered during each event.~~ Any data or sample values outside of the expected range for the constituent being measured will be rechecked for validity with the laboratory or in the field by the field team as appropriate. Data that continue to be outside the expected values will be further investigate to determine the cause.

Duplicate measurements are not collected for field constituents (DO, pH, temperature, conductivity, turbidity). Instead, quality assurance for field constituents will be assessed by calibrating the equipment prior to mobilization on the day of the monitoring event and by measuring equipment with a known standard after each monitoring event to measure how accurately the equipment can still read the standard within the accuracy ranges specified in **Table 13**.

Field blanks will also be collected for 10% of sampling mobilization events. Equipment blanks will be generated annually by the City of Portland WPCL to ensure that equipment and bottles provided by the lab are not producing false positive readings.

6.7.2 Representativeness

Stormwater samples are collected from the center of the flow to obtain a well-mixed sample representative of the stormwater conditions. Sampling sites are selected using the GRTS study design, so data collected using this random and spatially balanced approach is assumed to be representative of conditions within the entire permit area.

6.7.3 Comparability

The objective is to ensure that collected data are either directly comparable, or comparable with defined limitations, to literature data or other applicable criteria. Wet Weather Stormwater samples are collected and analyzed in the same manner as those collected for Instream Monitoring and Structural Best Management Practice Monitoring. Grab samples are analyzed at Portland's Water Pollution Control Laboratory to minimize variability and increase comparability of data collected on streams flowing through both jurisdictions. Portland utilizes the GRTS approach in the selection of their stormwater sampling locations, so regional assessment of stormwater data will be possible based on using a similar study design.

6.7.4 Completeness

Completeness is a measure of the amount of valid data obtained from the analytical measurement system compared to the amount that was expected to be obtained. It is defined as the total number of samples taken for which valid analytical data are obtained divided by the total number of samples collected and multiplied by 100.

Based on QA/QC procedures outlined in this Stormwater Monitoring Plan, the Wet Weather Stormwater monitoring goal is to achieve a 100 percent complete data set for all analyses. It is anticipated that ~~3~~10 samples will be collected annually. Over the 5 year permit term, ~~1~~50 samples will be collected consisting of 5 monitoring locations being "fixed" sites monitored each year and ~~1~~25 spatially balanced and random sites selected probabilistically that are each monitored once. It is understood that due to unforeseen circumstances some results may be lost. Field and Laboratory staff will attempt to minimize data loss to the best of their ability by carefully following all protocols and procedures. If data sets are not 100 percent complete for this study, analyses will be evaluated on a case by case basis to determine whether the project needs to collect additional samples.

6.7.5 Instrument Inspection and Maintenance

Field sampling equipment is inspected before and after each monitoring event. The multi-meter and turbidimeter will be cleaned and maintained according to the manufacturer's guidelines. Multi-meters will be professionally inspected, maintained and calibrated annually by Quality Control Services (2340 SE 11th Ave, Portland, OR. 503-236-2712).

Portland's Water Pollution Control Laboratory performs inspection and maintenance of laboratory instruments used for analysis of grab samples. A copy of the WPCL's QAPP is included in **Appendix G**.

6.7.6 Instrument Calibration

The multi-meter probe used to collect field measurements (temperature, pH, DO, and conductivity) will be calibrated prior to each event at mobilization. pH will be calibrated using a 3-point calibration (pH 4, 7 and 10 buffers). Conductivity will be calibrated using a standard within the range of expected measurement (typically 100 μS/cm). DO will be calibrated using percent saturation at the current barometric pressure. Meter calibration will be recorded in an electronic calibration log. Meters will be calibrated halfway through the monitoring event if the accuracy of the meter drifts during the monitoring event. After each sampling event the meter will be measured against known standards to check measurement accuracy.

The turbidimeter will be calibrated annually. Prior to each sampling event, the meter will be measured against known secondary Gelex sample standards to ensure accuracy. Readings will be recorded in the electronic calibration log.

Portland's Water Pollution Control Laboratory performs calibration of laboratory instruments used for analysis of grab samples. A copy of the WPCL's QAPP is included in **Appendix G**.

6.8 Data Management, Review, Validation and Verification

6.8.1 Data Management

All analytical results and applicable field measurements including field data sheet information will be stored in Gresham's master Monitoring Program database. Lab data will be reviewed and entered as soon as practicable, with data entry and analysis always taking place annually for meeting NPDES MS4 annual reporting requirements. Final reporting will be performed in conjunction with the NDPES Annual Report and the permit renewal to assess stormwater status. Periodic analysis of data may also occur to assess whether adaptive management of the Monitoring Plan or program is appropriate as described in **Section 1.4**.

6.8.2 Data Review, Validation and Verification

Once the data has been entered in the monitoring program database, the Monitoring Program Coordinator will print a paper copy of the data and proofread it against the original field data sheets. Statistical and graphical analysis may be used to reveal whether keystroke errors occurred during data entry. Potential errors in the database will be checked against field data sheets and lab reports. Once verified, errors in data entry will be corrected at that time. Outliers and inconsistencies will be flagged for further review, investigation, and if appropriate, discarded. Data quality problems will be discussed as they occur and in the final report to data users.

Reconciliation with data quality objectives as noted above will be performed as soon as possible after each sampling event. Calculations and determinations for precision, completeness, and accuracy will be made and corrective action implemented if needed. If data quality indicators do not meet the monitoring program's specifications, data may be discarded and re-sampling may occur. The cause of the failure will be evaluated. If the cause is found to be equipment failure, calibration and/or maintenance techniques will be reassessed and improved. If the problem is found to be sampling team error, field techniques will be assessed, revised and retrained, as needed.

7.0 DRY WEATHER FIELD SCREENING

7.1 Project/Task Organization

As required by the NPDES MS4 permit Schedule A 4. a iii- vii and ix-xii, Dry Weather Field Screening is part of an overall Illicit Discharge Detection and Elimination (IDDE) program and refers to the annual inspection of priority outfalls during the dry season. The screening includes documentation of visual observations, uncharacteristic odors and certain field measurements (if sufficient flow is observed). Water quality samples will be collected for laboratory analyses when field screening test values exceed the Co-permittee's protocol. The Co-permittee's existing pollutant parameter action levels protocol will be refined by July 1, 2012 to ensure NPDES MS4 permit compliance.

7.2 Monitoring Objectives

7.2.1 Monitoring Question and Background

The goal for dry weather screening is to identify illicit discharges to the MS4 system. Dry Weather Field Screening seeks to answer the questions "What is the significance of illicit discharges in the permit area?" and "Have illicit discharge elimination programs been successful in reducing problems?" Illicit discharge sources may vary, but of primary interest are wastewater cross connections, floor drains or catch basins capturing wash water or fluids from industrial or commercial facilities, and spills and dumping. Flows from non-stormwater discharges such as landscape irrigation and car washing are addressed by the Co-permittee's education and outreach program and are not a priority for follow-up response given limited staff resources and the limited potential for harm. Note that annual assays are less likely to catch spills and dumping than illicit connections, since the former are typically intermittent.

During permit years 1-10, alternate screening protocols were employed including screening on different days of the week and times of day to see whether discharges due to spills and dumping were more likely to be caught in the evening or on weekends than during the workweek; however no temporal differences were observed. In 2003-2005, Gresham hired contractors to investigate the piped system in industrial and commercial areas using closed circuit television, with the goal of identifying all cross connections. No illicit cross connections were identified.

Dry weather screening will address the following four monitoring objectives from the permit, in addition to other dry weather field screening requirements that are listed in the permit under Schedule A(4)(a)(iv).

Objective 1. *Evaluate the source(s) of the 2004-06 303(d) listed pollutants applicable to the co-permittees' permit area*

Objective 2. *Evaluate the effectiveness of Best Management Practices (BMPs) to assist in identifying BMP priorities;*

Objective 3. *Characterize stormwater runoff discharges based on land use, seasonality, geography or other catchment characteristics;*

Objective 5. *Assess the chemical, biological and physical effects of MS4 stormwater discharges on receiving waters;*

7.2.2 Data Analysis Methodology and Quality Criteria

Dry Weather Field Screening data is continually evaluated to determine the range of values typically present in non-stormwater discharges found in the MS4 during the dry season. After 15 years of screening values, follow up laboratory testing, and tracing sources back to permitted, natural, ~~-~~or illicit sources, the outliers in the field screening data ~~can be~~ were used to establish the evaluate where Pollutant Parameter Action Levels described in **Section 7.5.3**~~ should be set~~. ~~The proposed values listed in **Table 15** will be refined, if necessary, by July 1, 2012 to ensure NPDES MS4 permit compliance.~~

7.2.3 Assumptions and Rationale

Dry Weather Field Screening is most likely to detect illicit connections to the storm system rather than identify pollutants related to spills or dumping. In the past, Gresham used closed circuit television (CCTV) equipment to inspect high priority commercial and industrial areas, including some major arterials and the downtown area for cross connections with the wastewater system. In additional to high priority outfall dry weather screening for Gresham and Fairview, currently, Gresham conducts periodic camera inspections of pipes, and video inspects all new piped systems that will become publically owned to the point of the private connection within its boundary and the City of Fairview conducts inspections within its boundary of additional outfalls annually. Conducting dry weather screening following a sufficient dry period will allow for the identification of any additional on-going discharges that result in discoloration, odor or changes over background in field screening tests.

7.2.4 Relationship to Long-term Monitoring Program Strategy

Dry Weather Field Screening provides an opportunity for monitoring staff to evaluate the Co-permittee's major pipesheds on an annual basis. This monitoring activity helps the Co-permittees identify potential sources of pollutants that exist within the storm system that could potentially be contributing to pollutant loads observed during Wet Weather Stormwater Monitoring (**Section 6.0**). Since the IDDE Program's inception in 1995, Gresham has identified very few illicit discharges, and as such prefers to limit the amount of staff time devoted to this activity in order to balance competing permit requirements and given the resource limitations with regard to staff and financial resources.

7.3 Documentation and Record-keeping Procedures

Consistent with permit requirements, the Co-Permittees will retain records of all monitoring information, including: all calibration, major maintenance records, all original data, copies of all reports required by the NPDES MS4 permit, and records of data used to complete the application for the NPDES MS4 permit for a period of at least 3 years from the date of the sample, measurement, report, or application.

7.4 Monitoring Process/Study Design

7.4.1 Study Design

The Co-permittees have identified all priority outfalls within the permit area based on more inclusive criteria than the original description in the code of federal regulations. The original program identified major outfalls as 36" or greater, but the Co-Permittees have also selected some outfalls that are smaller. The goal of dry weather screening is to determine whether any illicit discharges are present at the priority outfalls as illustrated in **Figure 2**. A combination of visual observations and field measurements is used to determine the source of any non-stormwater discharge present. The Co-permittees have a process for tracing sources and following up on any suspected illicit discharges identified through the screening process that is described in **Section 7.6.2.**

7.4.2 Monitoring Locations

The Co-Permittees will continue to perform dry-weather outfall monitoring at a revised list of priority outfalls originally identified in the Part II NPDES MS4 Application dated May 17, 1993. Revisions to the original outfall list account for upgrades to the MS4 system which have been made since 1993. The Co-permittee's proposed list of priority outfalls to be screened during this permit term is provided in Table 14. The priority locations are located at the outfall or at the most accessible downstream location from any potential source of suspected illegal or illicit activity that might occur within major pipesheds. Twenty-two sites/year will rotate. They will be selected using a randomized selection process to increase the likelihood of identifying illicit connections.

Eight fixed Dry Weather Screening Locations~~,~~ are listed in **Table 14** and in **Figure 2**. They were selected from the 30 priority outfalls previously monitored after data analysis. These outfalls were the most likely to have illicit discharges due to land use within the drainage area and findings from past years. These fixed sites are distributed between the Columbia Slough, Fairview Creek, and Johnson Creek watersheds. We will monitor 22 additional outfalls each year which will be selected based on ~~, will be evaluated to determine whether sites should be added or deleted from those currently screened each year. Factors which will be considered for additional dry weather screening sites include:~~ hydrological conditions, land use, size of drainage area, traffic density, age of structures or buildings in the area, history of the area, personnel safety, accessibility, historical complaints, and whether new development or redevelopment has occurred within the drainage area.

Table 14: ~~Priority Outfalls for~~ Fixed Illicit Discharge Monitoring/Dry Weather Screening Locations

Site ID	Location	Watershed	Channel Type	Land Use
~~P12A~~	~~South OF @ NE 19th & Hogan (BCO1)~~	~~Burlingame~~	~~OF~~	~~C/R~~
~~P12B~~	~~North OF @ NE 19th & Hogan~~	~~Burlingame~~	~~OF~~	~~C/R~~
~~P13~~	~~Open channel @ NE 19th & Hogan (BCO2)~~	~~Burlingame~~	~~Open~~	~~C/R~~
~~S11~~	~~MH @ NE 23rd, west of Kane~~	~~Burlingame~~	~~MH~~	~~R/C~~
~~S18~~	~~MH @ 300 SE Palmblad~~	~~Burlingame~~	~~MH~~	~~R/C~~
~~S20~~	~~OF west of SE Hacienda, just south of SE 23rd~~	~~Burlingame~~	~~OF~~	~~R~~
~~T18~~	~~OF @ Hwy 26 & Palmquist~~	~~Burlingame~~	~~OF~~	~~R/C~~
D2A	MH south of NE 181st Ave Bridge (CSO1) (Drains 181st St)	Columbia	MH	I/C
~~D2B~~	~~MH under NE 181st Ave Bridge (Drains US Bank pond)~~	~~Columbia~~	~~MH~~	~~I/C~~
F2	OF @ Sandy (open channel) north of Boeing (Stormdrain Cr)	Columbia	MH	I/C
G1	Boeing Outfall (east outfall entering CSWQF)	Columbia	OF	I/Ag
~~H3~~	~~OF @ Catellus (north of Columbia Slough)~~	~~Columbia~~	~~OF~~	~~C~~
~~I12B~~3250-F-004	Manhole at inlet to Fairview Creek facility~~MH @ 14th and Riverview~~	Fairview	MH	C/R
~~J10~~	~~MH @ SE Stark & SE 208th~~	~~Fairview~~	~~MH~~	~~R~~
~~L7~~	~~West OF @ Glisan~~	~~Fairview~~	~~OF~~	~~I~~

~~L7A~~	~~East OF @ Glisan (Clear Creek Business Park)~~	~~Fairview~~	~~OF~~	~~C~~
~~4155~~	~~Chinook Detention Pond~~	~~Fairview~~	~~OF~~	~~C/R~~
~~2043~~	~~23303 NE Sandy Blvd.~~	~~Fairview~~	~~OF~~	~~I~~
~~913~~	~~325 Bridge Street~~	~~Fairview~~	~~OF~~	~~R/C~~
~~4249~~	~~Multnomah Detention Pond~~	~~Fairview~~	~~OF~~	~~R~~
~~2112~~	~~223rd and Cedar Street~~	~~Fairview~~	~~OF~~	~~R~~
~~969~~	~~Bridge Street and Fairview Creek~~	~~Fairview~~	~~OF~~	~~R/C~~
~~1221~~	~~20609 NE Lakeside Drive~~	~~Fairview Lake~~	~~OF~~	~~R~~
~~1283~~	~~21929 NE Alton Street~~	~~Fairview Lk~~	~~OF~~	~~R~~
~~1685~~	~~Fairview Lake PS Detention Pond~~	~~Fairview Lk~~	~~OF~~	~~R~~
~~E18A~~N15B	NE Elliott & Powell, north bank of trib to Johnson~~MH under Highland Dr Bridge (Safeway Gas & New Condo)~~	Johnson	OF~~MH~~	R/C~~/I~~
~~F18~~	~~MH west of 190th on Powell Loop @ Club Paesano Entrance~~	~~Johnson~~	~~MH~~	~~R/C/I~~
~~G18A~~	~~MH @ Pleasant View south of Powell Loop~~	~~Johnson~~	~~MH~~	~~R/C~~
~~H18~~	~~MH @ 761 SW Mawrcrest~~	~~Johnson~~	~~MH~~	~~R/I~~
~~J17~~	~~OF @ Towle & Eastman~~	~~Johnson~~	~~OF~~	~~R~~
~~J18~~	~~MH south of SW 8th Dr, north side of creek (1590 SW 8th Dr)~~	~~Johnson~~	~~MH~~	~~R~~
J18A	OF @ Eastman/Towle~~(Chastain Creek)~~ on South side of Johnson Creek	Johnson	OF	R
~~L16B~~	~~MH south of Powell, west of Walters Rd (inside school fence)~~	~~Johnson~~	~~MH~~	~~R/C~~
M16	West OF in Main City Park (JCOS1)	Johnson	OF	C
N16	East OF in Main City Park (JCO3)	Johnson	OF	C/R
~~P15~~	~~1st MH north of NE Liberty and E Powell (209 NE Liberty)~~	~~Johnson~~	~~MH~~	~~C~~
~~R14~~	~~MH north of Division & east of Village Squire~~	~~Kelly~~	~~MH~~	~~R~~
~~R15~~	~~MH @ 2832 NE 7th (near Village Squire)~~	~~Kelly~~	~~MH~~	~~R/C~~
~~T14A~~	~~MH @ NE 2nd & Scott~~	~~Kelly~~	~~MH~~	~~R~~
~~K4/573~~	~~Park Cleone~~	~~Osburn~~	~~OF~~	~~R~~

Channel Types
OF = outfall
MH = manhole

Land Uses
R = residential
I = industrial
C = commercial

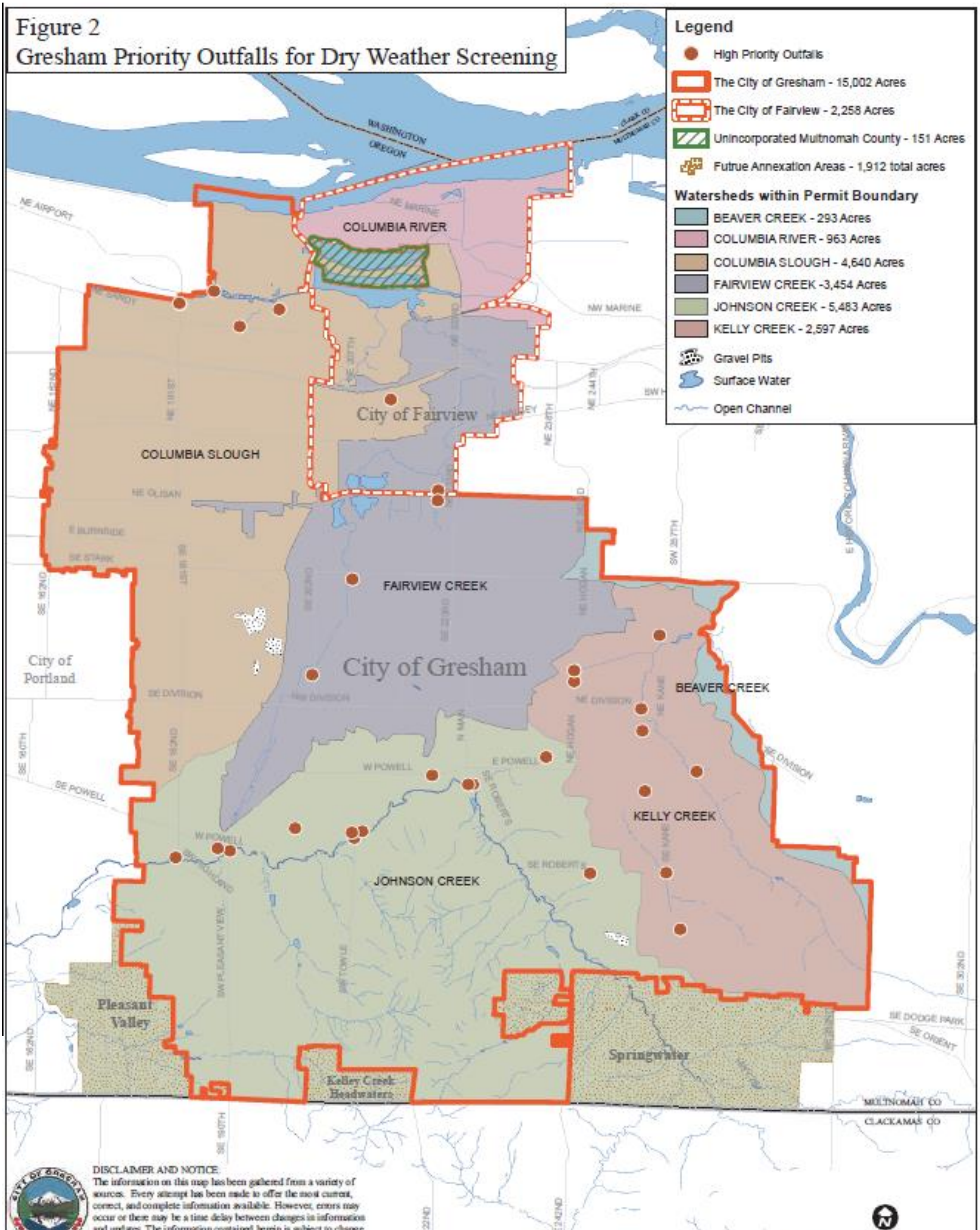
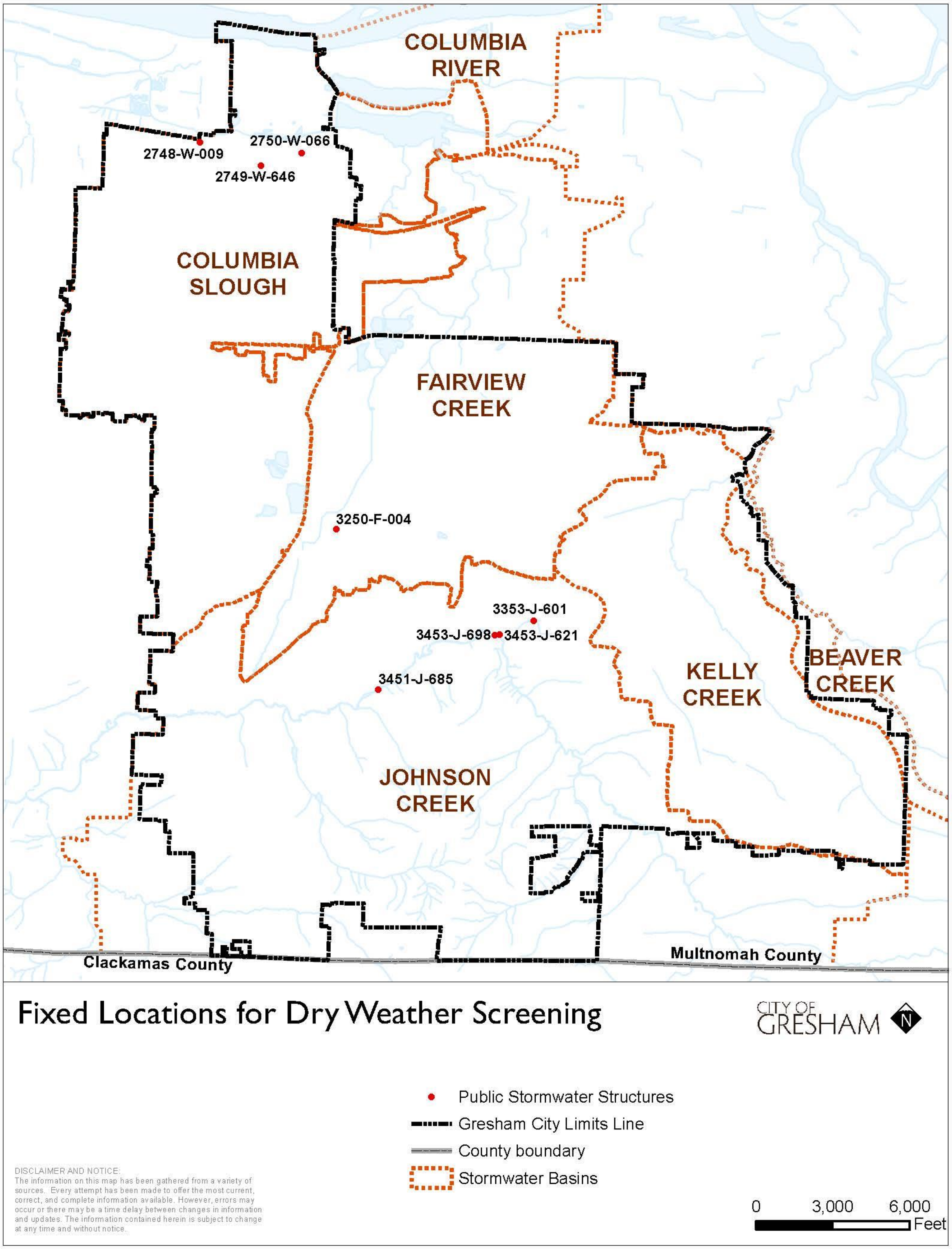


Figure 2
Gresham Priority Outfalls for Dry Weather Screening

Figure 2. Fixed Dry Weather Screening Locations



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7.4.3 Sampling Event Criteria

Dry weather screening will be conducted during the dry summer months, typically during July, August or September. As required by the permit, dry weather screening will be conducted following at least a 72-hour antecedent dry period.

7.4.4 Frequency and Duration

Dry weather field screening will be conducted one time annually at each of the locations listed in **Table 14**. ~~The high priority sites~~ Sampling frequency may be adaptively managed as additional outfalls are assessed.~~this activity is evaluated to meet the permit requirements by July 1, 2012 as required by the NPDES MS4 permit Schedule A4. a. iv.~~

7.4.5 Responsible Sampling Coordinator

This monitoring task is coordinated by the City of Gresham's Water Resources~~Watershed~~ Division on behalf of Gresham~~ and Fairview~~, who target proper dry weather conditions, calibrate equipment, perform field observations and screening, collect samples for lab analysis, and coordinate delivery to the lab. Laboratory analysis for any sample collected for laboratory analysis is conducted by Portland's Water Pollution Control Laboratory under an IGA with the City of Gresham for laboratory services (see **Appendix F**).

7.5 Dry Weather Screening Activities

7.5.1 General Observations

For each of the sites listed in **Section 7.4.2.**, **Table 14**, the following conditions are noted – odor, color, clarity, floatable, deposit/stains, vegetative condition (if applicable), structural condition, biological, and other observations that may indicate presence of non-stormwater or illicit discharges.

7.5.2 Field Screening

When flow is present, a sample will be collected and screened for illicit discharges using field measurements of temperature, pH, conductivity, turbidity, ammonia, and chlorine. If any of the observations or screening data indicate an illicit discharge may be present, the source is investigated within the drainage system. If a source cannot be identified or the pollutant parameter action level indicates there is a need for additional information, a sample may be collected and sent to the laboratory for analysis.

7.5.3 Pollutant Parameter Action Levels

As described in **Section 7.2.2**, field observations and screening values are compared against historic information for each monitoring location and the system. Screening values which indicate that an illicit discharge may be present will be investigated using the process described in **Section 7.6**. **Table 15** contains the pollutant parameter action levels and suspected sources the Co-permittees will investigate based on action levels.

The Co-permittees have evaluated ~~plan to evaluate the~~ field screening constituents listed in **Section 7.5.2**~~ during the coming year and will develop more refined pollutant parameter action levels by July 1, 2012~~ as required in Schedule A(4)(a)(iii). The values in Table 15 at based on evaluation of our Dry Weather Screening data and Herrera's 2013 Illicit Discharge Indicator Thresholds Memo which reviewed the literature as well as jurisdictional levels.

Table 15: Pollutant Parameter Action Levels

Parameter	Action level [1]~~[2]~~	Suspected Source and Action
Ammonia nitrogen	~~NH_3~~ > 0.5 mg/L	Presence of ammonia >0.5 mg/L likely indicates sewage, industrial waste or pets/wildlife. Action: conduct source identification investigation looking for upstream bacteria or waste source.
Total chlorine	> 0.5 mg/L [2]~~[3]~~	Presence of chlorine, absent other parameters that exceed action levels, likely indicates municipal treated water, a discharge of municipal water, residential car washing, or pool/hot tub water. If greater than action level, conduct source identification investigation looking for pool or nearby irrigation discharge to system.
Turbidity	> 15 NTU [3]~~[4]~~	Turbidity is a supplemental measurement that is not conclusive by itself, but may help identify problem outfalls that merit follow-up. Turbidity above the action level may indicate whether discharge consists of something other than tap water or groundwater. Action: conduct source identification investigation looking for upstream sediment source.
Conductivity	> 300 µS/cm [4]~~[5]~~	Conductivity is a supplemental measurement that is not conclusive by itself, but may help identify problem outfalls that merit follow-up. If turbidity is high, conductivity may indicate whether the turbidity is due to dissolved substances rather than fine particulates. Groundwater typically has higher conductivity than clean stormwater, so conductivity will rarely be indicative of pollution on its own. Action: conduct source identification investigation and, if needed, collect lab sample for appropriate pollutants based on suspected pollutants.

~~[2] Action levels may be adaptively managed if the City determines that implementation of these triggers fails to accurately identify potential illicit discharges during review for the IDDE submittal due on July 1, 2012.~~

~~[3] Value based on past 10 years of Gresham IDDE data and the fact that Maximum Residual Disinfection Level standards for total chlorine in drinking water is 4 mg/L, with the range found in treated Bull Run water ranging from non-detectable to 1.9 mg/L~~

~~[4] Value based on past 10 years of Gresham IDDE data, where 11% of samples have exceeded 15 NTU. This value was selected since EPA is discussing this as a construction site effluent limit. CWP and Pitt (2004) use >1000 NTU as assessment threshold for determining some industrial discharges.~~

~~[5] Value based on past 10 years of Gresham IDDE data, where 6% of samples exceeded 300 uS/cm. Many of these samples also had high ammonia levels associated with them. CWP and Pitt (2004) use >2000 uS/cm as assessment threshold for determining industrial discharges.~~

pH	Outside 6.5-8.5 [56]	pH is a supplemental measurement that is not conclusive by itself, but may help identify problem outfalls that merit follow-up. In combination with other screening levels, actions may include conduct source tracing and, if source not found, collect lab sample for pollutants suspected to cause or be associated with pH levels. Discharge sources that may cause high or low pH include among others: natural sources (bacteria, algae) and certain industrial discharges.
Temperature	> ambient air temperature[6]	Water warmer than ambient air temperature may indicate a human-caused heat source.
Flow	Water level above base flow level indicated by pipe staining	Conduct source identification investigation within upstream pipeshed, by lifting manhole lids and checking flow volume against pipe staining level.

7.5.4 Laboratory Analysis

Water quality samples will be collected for additional analysis when visual observations or field screening tests indicate a potential pollutant for which the source cannot be identified through source identification investigation (Section 7.6). Typically, this will be determined after source identification investigation has occurred, and no discharge source has been identified. However, there can be cases in which none of the field measurements exceed action levels, but sensory observation indicates the presence of pollutants. Additional analyses may consist of bacteria, metals, nutrients, phenols, hydrocarbons or other analyses deemed appropriate based on observations and field screening. Analyses are deemed appropriate if the pollutant relates to a suspected type of source or discharge; or known land uses or activities in the pipeshed. Once water quality results are received from the lab—which is typically several days to weeks after samples were taken, additional source identification investigation may occur.

7.6 Source Identification Investigation

7.6.1 Source Tracing

If any of the observations or field screening outlined in **Section 7.5** indicate an illicit discharge may be present, the source is investigated within the drainage system using GIS mapping to

[1] Action levels may be adaptively managed if the City determines that implementation of these triggers fails to accurately identify potential illicit discharges during review for the IDDE submittal due on July 1, 2012.
[2] Value based on past 10 years of Gresham IDDE data and the fact that Maximum Residual Disinfection Level standards for total chlorine in drinking water is 4 mg/L, with the range found in treated Bull Run water ranging from non-detectable to 1.9 mg/L
[3] Value based on past 10 years of Gresham IDDE data, where 11% of samples have exceeded 15 NTU. This value was selected since EPA is discussing this as a construction site effluent limit. CWP and Pitt (2004) use >1000 NTU as assessment threshold for determining some industrial discharges.
[4] Value based on past 10 years of Gresham IDDE data, where 6% of samples exceeded 300 uS/cm. Many of these samples also had high ammonia levels associated with them. CWP and Pitt (2004) use >2000 uS/cm as assessment threshold for determining industrial discharges. [56] Action level based on Oregon in-stream water quality standard for pH (6.5-8.5)
[6] Action level based on Herrera Illicit Discharge Indicator Thresholds Memo, 2013

illustrate the stormwater system and corresponding tax lots and follow the system upstream to investigate. Upstream points such as manholes and catch basins will be observed visually for connections to the system. Based upon experience, staff generally investigate a minimum of ¼ mile and up to ½ a mile from the screening location or until flow is no longer observed and/or no probable source can be identified for further investigation, which are described below in **Section 7.6.2**.

If general observations, field screening action levels, or source tracing indicate that the flow present is a non-stormwater discharges as described in the NPDES MS4 permit Schedule A 4. a. xii, an illicit discharge investigation (**Section 7.6.2**) will not be conducted. Some of the most commonly occurring non-stormwater discharges include: landscape irrigation, lawn watering, discharges from potable water sources, residential car washing, charity car washing, flows from diverted streams or wetlands, springs, infiltration or pumping of groundwater, foundation drains, and footing drains.

7.6.2 Illicit Discharge Investigation

When field screening indicates there may be an illicit discharge to the MS4, the upstream area will be inspected in an attempt to identify the pollutant(s) source. The level of effort staff spend investigating potential illicit discharges will be evaluated on a case-by-case basis, but will consider the following factors:

- Volume and extent of discharge (detectable at outfall to waters of state, or only in localized area within pipe system);
- Frequency and duration of discharge (isolated episode, intermittent, or ongoing);
- Suspected type of discharge (determined by screening criteria – color, smell, water quality measurements); and
- Risk and potential to impact surface water quality or harm human health or aquatic life.

Some discharges detected during dry weather screening may be deemed to be low risk to the MS4 based on the above listed criteria. If a source cannot be identified with a reasonable amount of effort, it may be determined that the risk from the discharge is low enough that the effort needed to identify the source is not cost–effective, and that other measures (e.g., inspections or outreach programs to educate and prevent against dumping and spills) are a better expenditure of program resources. Small or episodic contributions to the MS4 can be deemed *de minimus* after city staff have expended a reasonable amount of investigational effort with no positive results.

Sources that are deemed to pose a moderate or high level of risk to the MS4 or waters of the state due to either the quantity or type of pollutant will be investigated immediately and will receive a high level of effort. In addition to visual investigation of the upstream system, water flushing, dye testing, closed circuit television, or other such methods may be used to aid in source identification. Additionally, if any field screening action level indicates a need for additional information, a sample may be collected and sent to the laboratory for analysis.

If the suspected illicit discharge is deemed to be a threat to water quality and originates from private property, permission for inspection may be required from the property owner or tenant; if denied, an Administrative Inspection Warrant can be obtained within 3-5 days.

Once a source has been identified, an initial evaluation to eliminate the discharge will be completed within 5 working days. If the elimination of the illicit discharge will take more than 15 working days due to technical, logistical or other reasonable issues, an action plan to eliminate the discharge in an expeditious manner will be created. The action plan will be completed within 20 working days of determining the source of the illicit discharge and submitted to DEQ as required by the permit. City Code allows for the use of civil penalties and/or abatement for stormwater violations where a responsible party has been identified and provided with direction from the City with regard to gaining compliance, but has not complied within the specified timeframe.

To this end, the permit further requires that illicit discharges entering or exiting one Co-permittee's area into the other requires notification to the affected jurisdiction within one working day.

7.7 Data Management, Review, Validation and Verification

7.7.1 Data Management

All applicable field observations and measurements will be stored in Gresham's dry weather screening database. Field observations and screening data are typically entered directly into the database during dry weather field screening activities. When laboratory analysis is conducted, data will be reviewed and entered as soon as practicable so that follow up source identification investigation can take place.

Dry weather field screening data entry and analysis will occur annually and will be reported to DEQ with the NPDES MS4 Annual Report. Periodic analysis of data may also occur to assess whether adaptive management of the Monitoring Plan or program is appropriate.

7.7.2 Data Review, Validation and Verification

Once the data has been entered in the monitoring program database, the Monitoring Program Coordinator will review the data to determine if all values are within the expected range, and detect any outliers due to keystroke errors during data entry. If the error can be identified, errors in data entry will be corrected at that time. Outliers and inconsistencies will be flagged for further review, investigation, and if appropriate, discarded. Data quality problems will be discussed as they occur and in the final report to data users.

8.0 STRUCTURAL BEST MANAGEMENT PRACTICE MONITORING

8.1 Project/Task Organization

Structural Best Management Practice Monitoring refers to the effectiveness monitoring of structural ~~regional scale~~ BMPs recently constructed by the City of Gresham ~~during the last permit cycle~~. ~~Since 2006, two~~The city currently has four regional-scale facilities. ~~have been constructed, and s~~Since the City has proposed constructing other regional facilities as part of the Springwater and Pleasant Valley Plan Districts, which will be incorporated into the City in the future, assessing the effectiveness of regional facilities is important for the adaptive management of Gresham's stormwater program, as well as for refining the values used in TMDL pollutant reduction benchmarks.

The Fairview Creek Water Quality Facility provides stormwater treatment for a combined drainage area of approximately 959 acres of residential, commercial, and industrial development that previously discharged partially treated stormwater (e.g., catch basin filters and street sweeping) directly to Fairview Creek. The single large outfall, which is now the inlet to this BMP, was previously monitored as part of the land use based monitoring performed in permit years 1, 2 and 3 during the first 5-year permit cycle, and continued as a stormwater outfall monitoring site (mixed land use) in permit years 7, 8, 9, and 10.

The ~~recently constructed~~ Columbia Slough Water Quality Facility will provide stormwater treatment for a combined drainage area of approximately 709 acres of primarily commercial and industrial development that previously discharged partially treated stormwater (e.g., catch basin filters and street sweeping) directly to the Columbia Slough. There are 2 major outfalls that drain similar land uses that discharge to this facility. Since the facility contains multiple components, including sedimentation forebays, vegetated swales and holding cells for base and low flows, as well as wetland detention with emergent vegetation, and riparian forest for periodic inundation, monitoring of the facility would provide pollutant removal effectiveness for this specific large-scale facility.

The Kelly Creek detention pond is an in-line facility in Kelly Creek that drains into Beaver Creek. It was retrofitted in 2013-2014 to improve water quality in a stream that receives water from mostly residential use. The Brookside Regional Facility was constructed at the base of a new housing sub-development project in Pleasant Valley area. It contains a meandering swale within a detention pond that was designed to slow water and allow for longer contact time with plants and soil before entering Kelley Creek.

Each of these facilities has a unique design, and monitoring data on the effectiveness of stormwater treatment at the various facilities would greatly inform future design and management.

8.2 Monitoring Objectives

8.2.1 Monitoring Question and Background

Structural BMP effectiveness monitoring is intended to answer the question "How effective are the various structural BMPs that are being implemented throughout the permit area at reducing pollutants?" The City of Gresham plans to examine the performance of at least one of the structural

BMPs recently constructed to enhance water quality. As shown in **Appendix A**, Structural BMP monitoring contributes to meeting NPDES MS4 monitoring objectives 1, 2, 3, and 6.

Objective 1. *Evaluate the source(s) of the 2004-06 303(d) listed pollutants applicable to the co-permittees' permit area*
Objective 2. *Evaluate the effectiveness of Best Management Practices (BMPs) to assist in identifying BMP priorities;*
Objective 3. *Characterize stormwater runoff discharges based on land use, seasonality, geography or other catchment characteristics;*
Objective 6. *Assess progress towards meeting TMDL pollutant load reduction benchmarks.*

8.2.2 Data Analysis Methodology and Quality Criteria

Structural BMP Effectiveness Monitoring requires a paired sampling design, with the event mean concentrations being compared for influent and effluent. Because stormwater data typically doesn't follow a normal distribution, a nonparametric statistic, such as Mann-Whitney, will be used to compare the influent and effluent concentrations to determine if there is a significant change in stormwater quality. The current TMDL benchmark approach requires calculation of an effluent concentration for specific BMPs, so the effluent concentrations from various events will be evaluated for central tendency and variability. Based on findings from other BMP effectiveness studies, a reliable estimate of effluent water quality can be determined using 5-20 samples.

8.2.3 Assumptions and Rationale

Based on other BMP effectiveness studies (see International BMP Database), ~~it is assumed that~~ influent concentrations are more variable than effluent concentrations. Based on this assumption, enough data may be collected to accurately represent the mean effluent concentration after monitoring 2 events per year for 3-5 years (6-10 events total).

8.2.4 Relationship to Long-term Monitoring Program Strategy

The structural BMP Effectiveness Monitoring described in this section provides a direct measure of innovative regional CIP projects constructed to treat stormwater within the permit area. The two facilities described in this section are each composed of a different series of BMPs (FCWQF has sedimentation forebay → wet detention pond → constructed wetland; CSWQF has sedimentation manhole → sedimentation forebay → series of terraced wetland swales → wet detention pond) that will be evaluated to determine overall effectiveness of the different combination of these BMPs. Gresham has proposed constructing other regional facilities as part of the Springwater and Pleasant Valley Plan Districts, which will be incorporated into the City of Gresham in the future, so assessing the effectiveness of regional facilities is important for the adaptive management of Gresham's stormwater program; specifically, determining what components of a BMP "treatment train" will be incorporated into future regional facilities. Data collected for the two regional facilities described in this section will provide values to be used in future TMDL pollutant load reduction benchmark calculations.

8.3 Documentation and Record-keeping Procedures

Consistent with permit requirements specified in NPDES MS4 permit Schedule F, Section C.5., the Co-Permittees will retain records of all monitoring information, including: all calibration, major maintenance records, all original lab and field data (see **Appendix C** for example of field data sheet), copies of all reports required by the NPDES MS4 permit, and records of data used to complete the application for the NPDES MS4 permit for a period of at least 3 years from the date of the sample, measurement, report, or application.

Records will contain:

1. The date, exact place, time, and methods of sampling or measurements;
2. The individual(s) who performed the sampling or measurements;
3. The date(s) analyses were performed;
4. The individual(s) who performed the analyses;
5. The analytical techniques or methods used; and
6. The results of such analyses.

8.4 Monitoring Process/Study Design

8.4.1 Study Design

The study design for Structural BMP Effectiveness Monitoring is a paired study looking at influent and effluent concentrations. Because the facilities are designed to provide detention time, as well as water quality treatment, obtaining representative samples involves collecting several grab ~~composite~~ samples throughout the duration of the event as stormwater enters and leaves the facility. Flow and rainfall data are used to determine representativeness of the water quality data collected.

8.4.2 Monitoring Locations

Gresham has sampled at the inlet and outlet of the Fairview Creek Water Quality Facility (FCWQF) or the Columbia Slough Water Quality Facility (CSWQF) every year since spring 2006. Over the next permit cycle, the City of Gresham will continue to sample these ~~this~~ water quality facilitiesy to some extent ~~until the data shows a clear and consistent response from the FCWQF~~. Once staff determine that the FCWQF and CSWQF ~~has~~ have been sufficiently characterized to meet the objectives in **8.2**, monitoring efforts may~~will~~ switch to sampling other structural BMPs~~the inlets and outlets of the Columbia Slough Water Quality Facility~~. Proposed sampling locations for ~~both~~ the four regional facilities are listed in **Table 16**. ~~The inlets to both facilities (FWQF-1, CSWQF-1 and CSWQF-2) will be used as the monitoring locations for the wet weather stormwater mercury monitoring requirement outlined in DEQ's December 23, 2010 memo titled, "Mercury Monitoring Requirements for Willamette Basin Permittees."~~ The Kelly Creek Detention Pond (KCDP) and the Brookside Regional Water Quality Facility (BRWQF) each have one inlet and one outlet location.

Table 16: Structural Best Management Practices Sampling Locations

Station Number	Site Code	Location	Sample Frequency	Duration
12	FWQF-1	Inlet of FCWQF	1-2 Events/Year	0~~1~~-5~~2~~ years
13	FWQF-2	Outlet of FCWQF	1-2 Events/Year	0~~1~~-5~~2~~ years
17	CSWQF-1~~*~~	Inlet #1 of CSWQF	1-2 Events/Year	1-5~~3~~ years
18	CSWQF-2~~*~~	Inlet #2 of CSWQF	1-2 Events/Year	1-5~~3~~ years
19	CSWQF-3~~*~~	Outlet of CSWQF	1-2 Events/Year	1-5~~3~~ years
20	KCDP-1	Inlet of KCDP	1-2 Events/Year	1-5 years

21	KCDP-2	Outlet of KCDP	1-2 Events/Year	1-5 years
22	BRWQF-1	Inlet of BRWQF	1-2 Events/Year	1-5 years
23	BRWQF-2	Outlet of BRWQF	1-2 Events/Year	1-5 years

~~* In addition to the constituents listed in **Section 8.6**, the co-permittees will collect samples for low level total and dissolved mercury and total and dissolved methyl mercury at the inlet locations. In addition to the 2 sites required by DEQ's mercury monitoring memo under the Gresham/Fairview permit, a sample will also be collected at one additional site on behalf of Multnomah County to meet the monitoring requirements outlined in their NPDES MS4 permit. See also **Appendix J**.~~

8.4.3 Sampling Event Criteria

Prior to initiating a sampling event, the storm will be predicted and evaluated against the criteria listed below to assess whether the predicted storm should be targeted as a potential sampling event. Storm event criteria are as follows:

- Predicted rainfall amount of ≥ 0.5 inches per storm;
- Predicted rainfall duration ≥ 6 hours; and
- Antecedent dry period ≥ 24 hours (target is <0.1 inches of precipitation).

Since the goal for Structural BMP Effectiveness Monitoring is to determine how effective regional facilities are at pollutant removal, longer antecedent dry periods may be required to ensure that stormwater from previous wet weather events is no longer being detained in the facility. Discrete precipitation events with greater than 24 hours meeting the antecedent dry period condition listed above preceding and following the wet weather event will be targeted when feasible, as described in section 2.0.

~~In order to comply with the DEQ mercury monitoring memo (**Appendix H**), the first suitable wet weather expected to meet the storm event criteria will be targeted during the late summer/early fall storm season. Due to the unpredictable nature of late summer/early fall storm events, sampling may occur during a storm predicted to meet some, but not all, of the storm event criteria (e.g. volume predicted to be 0.1" or greater, but duration not expected to be 6 hours).~~

Hourly and daily rainfall records are maintained and available on the HYDRA Data Report System. This data is available on the web at:
http://or.water.usgs.gov/non-usgs/bes/raingage_info/clickmap.html.

8.4.4 Frequency and Duration

A total of four "facility events" will be sampled per year; for example, two facilities may be sampled for each of two storms, or four facilities may be sampled during one storm each. ~~Two events will be sampled annually from one of the two regional facilities listed under 8.3.1. It is anticipated that one regional facility will be monitored during each year of the 5 year permit term, but t~~The decision of which BMPs to monitor will depend on the results of the sampling, the status of the facilities~~y~~, and the related management objectives. ~~To meet the intent of DEQ's December 23, 2010 "Mercury Monitoring Requirements for Willamette Basin Permittees" memo (See **Appendix H**), total and dissolved mercury and total and dissolved methyl mercury will be monitored twice annually at the two regional facilities (3 sites total – 2 on behalf of the Co-Permittees and an additional site monitored on behalf of Multnomah County) listed in **Table 16**. See also **Appendix J**. DEQ's Mercury memo requires at least 2 years worth of sampling; if two~~

~~consecutive years of monitoring fail to yield environmentally relevant results, the Co-permittees will request to eliminate the monitoring from the wet weather stormwater monitoring.~~

8.4.5 Responsible Sampling Coordinator

This monitoring task is coordinated by the City of Gresham's Water Resources~~Watershed~~ Division on behalf of Gresham, Fairview~~, and with respect to mercury monitoring only – Multnomah County. See **Appendix J**.~~ Gresham will target events, calibrate equipment, perform in-situ field measurements, collect samples for lab analysis, and coordinate delivery to the lab. Laboratory analysis for instream samples is conducted by Portland's Water Pollution Control Laboratory under an IGA with the City of Gresham for laboratory services (see **Appendix F**).

8.5 Collection Method and Handling

8.5.1 Sample Collection Method

~~Both~~The four regional facilities described above have continuous flow monitoring equipment installed at the inlets and outlets. Data from past events will be used to determine when to take representative grab samples. ~~The CSWQF was designed to allow for installation of automated samplers, so flow-weighted samples will be collected for appropriate constituents when monitoring of that facility begins. Time-paced composite sampling has proven to provide consistent and reliable data at the FCWQF, so it will continue to be employed according to the number of samples and timing in **Table 16**.~~

Table 17: Sample Collection Method and Timing for Structural BMP Monitoring

Constituents	Number of Samples*	Collection Method	Timing
Field			
Temperature, Conductivity, pH, Turbidity	≥3 ~~10~~	Grab/in situ	Periodic
Conventional			
E. coli	1-3	Grab	Rising Limb, Middle**, Falling Limb
Biochemical Oxygen Demand (BOD_5), Total Suspended Solids, Hardness, Particle Size Distribution	≥3~~1 (5-20 aliquots)~~	Grab~~Composite~~	Rising Limb, Middle, Falling Limb~~All~~
Total Recoverable Metals			
Copper, Lead, Mercury, Zinc	≥3~~1 (5-20 aliquots)~~	Grab~~Composite~~	Rising Limb, Middle, Falling Limb~~All~~
Dissolved Metals			
Copper, Lead, Zinc	≥3~~1 (5-20 aliquots)~~	Grab~~Composite~~	Rising Limb, Middle, Falling Limb~~All~~
Mercury			
Total ~~and dissolved~~ mercury	1	Grab	1/3
~~Total and dissolved methyl mercury~~	~~1~~	~~Grab~~	~~1/3~~

Nutrients			
Nitrate + Nitrite Nitrogen, Total Kjeldahl Nitrogen, Ammonia Nitrogen, Total Phosphorus, Ortho-phosphorus	≥3~~1 (5-20 aliquots)~~	Grab~~Composite~~	Rising Limb, Middle, Falling Limb~~All~~

~~* The number of aliquots listed reflects time-paced composite sampling performed at FCWQF. Sampling at the CSWQF will likely be conducted using flow-weighted automated sampling, and an appropriate number of aliquots will be determined once monitoring of that facility begins.~~

** When the decision is made to collect only a single bacteria sample, the sample is typically collected 1/3 of the way through sample collection. Based on sampling history, the rising limb of an event hydrograph is usually well represented by a sample collected 1/3 of the way into an event, and a falling limb sample collected approximately 2/3 of the way through an event.

8.5.2 Handling and Custody Procedures

For grab samples, samples are collected directly into the appropriate containers directly from the center of flow, when possible. If needed, samples will be collected using a clean stainless steel bailer attached to an extension rod. The stainless steel bailer is cleaned prior to each site using laboratory-grade soap and distilled water. Field measurements are made by collecting a representative sample using the stainless steel bailer and then pouring the sample into the measurement/storage cup of the multi-meter probe.

Two-person clean sample collection techniques are followed to minimize the potential for contamination of samples: one "dirty hands" to move equipment, document field measurements, grab samples using the bailer and remove manhole lids; and one "clean hands" to fill sample bottles. The "clean hands" member wears powder-free nitrile gloves to avoid contamination of the sample and protect the sampler from possible health risks.

~~When collecting low-level mercury samples, staff will follow "clean hands" and "dirty hands" collection techniques as per EPA Method 1669: "Sampling Ambient Water for Trace Metals at EPA Water Quality Criteria Levels." Amber borosilicate glass bottles with fluoropolymer or fluoropolymer-lined caps will be utilized for mercury samples. Additionally, staff will wear Tyvek coveralls and shoulder-length PVC powder free gloves to minimize risk of contaminating samples. Mercury samples will be collected by submerging the sampling bottles in the stormwater source so that no additional apparati are required for collection; therefore eliminating the need for field equipment blanks.~~

All samples collected for laboratory analysis are immediately placed into a cooler containing ice and transported to the lab immediately following sample collection. **Table 17** lists the volume of sample collected, the container used and maximum holding time. Once samples are delivered to Portland's Water Pollution Control Laboratory, they have their own QAPP to ensure that samples are analyzed within the proper holding time and preservation methods are employed.

~~Low-level mercury and methyl mercury samples will be couriered overnight to a certified lab for filtration, preservation and analysis. Portland's WPCL has a contract with Test America to perform the mercury and methyl mercury analyses at the quantitation limits specified in DEQ's Mercury Monitoring Memo. Test America will provide sampling equipment, containers, and reagent water to be used to field blanks that meet the criteria detailed in EPA Method 1669. As the laboratory performing the mercury and methyl mercury analyses, Test America will be~~

~~responsible for generating an acceptable equipment blank that meets the requirements outlined in EPA 1669. Test America prepares bottle kits and tests every bottle kit lot to confirm that methyl mercury is <0.05 ng/L.~~

Table 18: Sample Containers and Holding Times for Structural BMP Monitoring

Constituent	Minimum Sample Volume	Bottle Type	Holding Time
Conventional Constituents			
Biochemical Oxygen Demand (BOD_5)	250 mL	Plastic	24 hours
Total Suspended Solids	500 mL	Plastic	7 days
Hardness	250 mL	Plastic	6 months
E. coli	100 mL	Sterile Plastic	6 hours (max 24 hrs)
Particle Size Distribution	1 liter	Plastic	28 days
Nutrients			
Nitrate Nitrogen	100 mL	Plastic	48 hours
Total Kjeldahl Nitrogen	100 mL	Plastic	28 days
Ammonia Nitrogen	100 mL	Plastic	28 days
Total Phosphorus	100 mL	Plastic	28 days
Ortho-phosphorus	250 mL	Plastic	48 hours
Total Recoverable Metals			
Copper			
Lead	400 mL	Plastic	6 months if
Zinc	~~1 liter~~	~~Glass~~	~~P~~preserved
Mercury			~~48 hours~~
~~Methyl Mercury*~~			~~6 mo if preserv~~
Dissolved Metals			
Copper			
Lead	400 mL	Plastic	6 months if
Zinc			Preserved
~~Mercury*~~	~~1 liter~~	~~Glass~~	~~48 hours~~
~~Methyl Mercury*~~			~~6 mo if preserv~~

~~*Mercury and Methyl Mercury will be sampled for two samples during a late summer/early fall and winter event. After two years, the City may submit a request for elimination of the mercury monitoring requirements to DEQ for approval.~~

After samples have been obtained and the collection procedures properly documented, a written record of the chain of custody for each sample requiring laboratory analysis is completed (see **Appendix C**). Information included on the chain of custody includes:

- Name of the persons collecting the sample(s)
- Date and time of sample collection
- Location of sample collection
- Names and signatures of all persons handling the samples in the field and in the laboratory

- Laboratory analysis requested and control information (e.g., duplicate or spiked samples etc.) and any special instructions (e.g., time sensitive analyses).

To ensure that all necessary information is documented a chain of custody form will accompany each sample or set of samples and a copy of the form is retained. Each person who takes custody will sign and date the appropriate portion of the chain of custody documentation.

8.6 Constituents and Methods

The analytical methods and method reporting limits (MRLs) for constituents monitored for structural BMP monitoring are listed in **Table 18**.

Table 19: Structural BMP Monitoring Constituents, Methods, and MRLs

Field Constituents	**Analytical Method**	**MRL**	**Units**
Temperature	SM 2550 B	-5	Degrees C
DO	SM 4500-OG	0.1	mg/L
Conductivity	EPA 120.1	1.0	µs/cm
pH	EPA 150.1	3.0	S.U.
Turbidity	EPA 180.1	0.05	NTU
Biochemical Oxygen Demand (BOD_5)	SM 5210 B	2	mg/L
Total Suspended Solids	SM 2540 D	2	mg/L
Hardness	SM 2340 B	0.5	mg/L as $CaCO_3$
E. coli	COLILERT QT	10	MPN/100 mL
Particle Size Distribution	OPTICAL	1000	# Part/100 mL
Nutrients			
Nitrate Nitrogen	EPA 300.0	1.10	mg/L
Total Kjeldahl Nitrogen	PAI-DK03 [1]	0.20	mg/L
Ammonia Nitrogen	EPA 350.1	0.02	mg/L
Total Phosphorus	EPA 365.4	0.02	mg/L
Ortho-phosphorus	EPA 365.1	0.02	mg/L
Total Recoverable Metals			
Copper	EPA 200.8	0.2	µg/L
Lead	EPA 200.8	0.1	µg/L
Zinc	EPA 200.8	0.5	µg/L
Mercury	WPCLSOP M-10.02 *[2] ~~EPA 1631E~~	0.002 ~~0.5~~	µg/L ~~ng/L~~
~~Methyl Mercury *~~	~~EPA 1630~~	~~0.05~~	~~ng/L~~
Dissolved Metals			
Copper	EPA 200.8	0.2	µg/L
Lead	EPA 200.8	0.1	µg/L

Zinc	EPA 200.8	0.5	µg/L
~~Mercury~~ *	~~EPA 1631E~~	~~0.5~~	~~ng/L~~
~~Methyl Mercury~~ *	~~EPA 1630~~	~~0.05~~	~~ng/L~~

* Mercury and TKN are not required in Table B-1 of the NPDES MS4 permit (beyond the 2 sites twice per year in DEQ's Mercury memo), so are subject to the Adaptive Management process described in **Section 1.4**.

[1] The PAI-DK03 method for TKN is a 40 CFR 136 method (flow injection gas method, see footnote 41, Table 1B, 40 CFR Part 136.3).

[2] The WPCLSOP M-10.02 method cited for total Hg is EPA 200.8 w/CEM digestion (footnote 4, Table 1B, 40 CFR Part 136.3)~~– this is a method Portland's WPCL received ATP approval for about 5 years ago, but cite as WPCLSOP M-10.02~~.

~~**Low Level Mercury**~~

~~To meet the intent of DEQ's December 23, 2010 "Mercury Monitoring Requirements for Willamette Basin Permittees" memo (see **Appendix H**), total and dissolved mercury and total and dissolved methyl mercury will be monitored at the inlet sampling locations listed in **Section 8.4.2**. The memo requires at least 2 years worth of sampling; if two consecutive years of monitoring fail to yield environmentally relevant results, the Co-permittees will request to eliminate the monitoring from the wet weather stormwater monitoring.~~

8.7 Quality Assurance

8.7.1 Quality Control Objectives

The data quality objectives for accuracy and precision for field and lab analysis of Structural BMP monitoring are the same as those listed under Wet Weather Stormwater Monitoring. Because Structural BMP monitoring often occurs at the same time as other instream or wet weather stormwater monitoring, and because greater than 10% duplicates are typically collected, duplicates are not typically collected for this monitoring activity, but instead included as part of Wet Weather Stormwater Monitoring. Field duplicates will be collected for a minimum of 10% of the combined BMP and wet weather sampling events. Field blanks will also be collected for 10% of sampling mobilization events. Equipment blanks will be generated annually by the WPCL to ensure that equipment and bottles provided by the lab are not producing false positive readings.

8.7.2 Representativeness

Stormwater samples are collected from the center of the flow to obtain a well-mixed sample representative of the stormwater conditions. Composite sampling is used for most constituents to ensure that samples collected are representative of conditions that likely occur throughout the entire event.

8.7.3 Comparability

The objective is to ensure that collected data are either directly comparable, or comparable within defined limitations, to literature data or other applicable criteria. Structural Best Management Practice Monitoring samples are collected and analyzed in the same manner as those collected for Instream Monitoring and Wet Weather Stormwater. Samples are analyzed at Portland's Water Pollution Control Laboratory to minimize variability and increase comparability of data collected by both jurisdictions.

8.7.4 Completeness

The Structural BMP monitoring goal is to achieve a 100 percent complete data set for all analyses. It is anticipated that 2 events will be collected annually, so over the 5 year permit term, 10 samples will be collected. It is understood that due to unforeseen circumstances some results may be lost. Field and Laboratory staff will attempt to minimize data loss to the best of their ability by carefully following all protocols and procedures. If data sets are not 100 percent complete for this study, analyses will be evaluated on a case by case basis to determine whether the project needs to collect additional samples.

8.7.5 Instrument Inspection and Maintenance

Field sampling equipment is inspected before and after each monitoring event. The multi-meter and turbidimeter will be cleaned and maintained according to the manufacturer's guidelines. Multi-meters will be professionally inspected, maintained and calibrated annually by Quality Control Services (2340 SE 11th Ave, Portland, OR. 503-236-2712).

Portland's Water Pollution Control Laboratory performs inspection and maintenance of laboratory instruments used for analysis of grab samples. A copy of the WPCL's QAPP is included in **Appendix G**.

8.7.6 Instrument Calibration

The multi-meter probe used to collect field measurements (temperature, pH, DO, and conductivity) will be calibrated prior to each event at mobilization. pH will be calibrated using a 3-point calibration (pH 4, 7 and 10 buffers). Conductivity will be calibrated using a standard within the range of expected measurement (typically 100 µS/cm). DO will be calibrated using percent saturation at the current barometric pressure. Meter calibration will be recorded in an electronic calibration log. Meters will be calibrated halfway through the monitoring event if the accuracy of the meter drifts during the monitoring event. After each sampling event the meter will be measured against known standards to check measurement accuracy.

The turbimeter will be calibrated annually. Prior to each sampling event, the meter will be measured against known secondary Gelex sample standards to ensure accuracy. Readings will be recorded in the electronic calibration log.

Portland's Water Pollution Control Laboratory performs calibration of laboratory instruments used for analysis of grab samples. A copy of the WPCL's QAPP is included in **Appendix G**.

8.8 Data Management, Review, Validation and Verification

All analytical results and applicable field measurements including field data sheet information will be stored in Gresham's master NPDES MS4 data spreadsheet. Lab data will be reviewed and entered as soon as practicable, with data entry and analysis always taking place annually for meeting NPDES MS4 annual reporting requirements. Final reporting will be performed in conjunction with the NDPES Annual Report and the permit renewal to assess instream trends. Periodic analysis of data may also occur to assess whether adaptive management of the Monitoring Plan or program is appropriate.

8.8.1 Data Management

All analytical results and applicable field measurements including field data sheet information will be stored in Gresham’s Stormwater Database. Lab data will be reviewed and entered as soon as practicable, with data entry and analysis taking place prior to calculating benchmarks due with the permit renewal submittal. Periodic analysis of data may also occur to assess whether adaptive management of the Monitoring Plan or program is appropriate.

8.8.2 Data Review, Validation and Verification

Once the data has been entered in the project database, the Monitoring Program Coordinator will print a paper copy of the data and proofread it against the original field data sheets. Statistical and graphical analysis may be used to reveal whether keystroke errors occurred during data entry. Potential errors in the database will be checked against field data sheets and lab reports. Once verified, errors in data entry will be corrected at that time. Outliers and inconsistencies will be flagged for further review, investigation, and if appropriate, discarded. Data quality problems will be discussed as they occur and in the final report to data users.

Reconciliation with data quality objectives as noted above will be performed as soon as possible after each sampling event. Calculations and determinations for precision, completeness, and accuracy will be made and corrective action implemented if needed. If data quality indicators do not meet the project’s specifications, data may be discarded and re-sampling may occur. The cause of the failure will be evaluated. If the cause is found to be equipment failure, calibration and/or maintenance techniques will be reassessed and improved. If the problem is found to be sampling team error, field techniques will be assessed and revised as needed.

9.0 SOURCE CONTROL ASSESSMENT AND SOLIDS TRACKING

Each Co-Permittee's source control best management practices are described in their respective Stormwater Management Plans, which include the type of activity, frequency of implementation, and measurable goals. Gross solids are collected during various operations & maintenance activities as described in the SWMP and will be reported in the annual NPDES report to DEQ.

Gresham developed a debris characterization study to attempt to identify specific contaminants that may be related to gross solids and debris (see **Appendix I**). Data has been collected and will be assessed to determine whether additional chemical analyses would provide more detailed characterization of contaminants associated with solids being removed by source controls.

Objective 2. *Evaluate the effectiveness of Best Management Practices (BMPs) in order to help determine BMP implementation priorities;*
Objective 6. *Assess progress towards meeting TMDL pollutant load reduction benchmarks.*

9.1 Literature Tracking

Stormwater management is a continually evolving field, covering many disciplines. There is extensive existing and new literature on treatment system performance monitoring conducted by researchers, public entities, and private companies to meet both regulatory and non-regulatory needs. Some of these studies provide estimates of effectiveness of treatment controls. An important part of the Co-Permittees' strategy for collecting information to aid their stormwater management efforts is to track current and developing literature on relevant topics. In particular, literature related to the performance and cost effectiveness of both treatment and source control best management practices will be followed.

The Co-Permittees are currently involved with AWCA, which provides an open forum for stormwater management discussions. Additionally, managers and staff attend local conferences, coordinate with other agencies, and track stormwater management related literature. These activities aid in addressing:

Objective 1. *Evaluate the source(s) of the 2004-06 303(d) listed pollutants applicable to the co-permittees' permit area*
Objective 2. *Evaluate the effectiveness of Best Management Practices (BMPs) in order to help determine BMP implementation priorities;*

The Co-Permittees will track and review the literature in order to keep current with innovations and technological advances that may be utilized to enhance treatment and source controls. Typically, the Co-permittee will review research to determine whether the findings merit changes to their respective SWMPs that will be submitted for DEQ's consideration during the permit renewal submittal. Changes that can be made with adaptive management may occur annually, but the Co-permittees may not always have the resources to do ongoing annual analysis. Examples of resources that provide data relevant to performance monitoring and evaluation for potential tracking are given below. The Co-Permittees also contributed to development of a BMP effectiveness database that ACWA commissioned. The database is available from ACWA in electronic format.

9.2 Literature Search Resources

Technical literature and research that is available for review includes but is not limited to the following sources:

- ASCE and USEPA. 2004. International Stormwater Best Management Practices (BMP) Database. [Online] http://www.bmpdatabase.org.
- WERF and NCHRP Stormwater Research Efforts. Both organizations are active in preparing research documents on stormwater runoff and best management practices performance.
- Federal Highway Administration (FHWA). 2000. Stormwater Best Management Practices in an Ultra-Urban Setting: Selection and Monitoring. Prepared by Tetra-Tech, Inc. and Hagler Bailly Services, Inc. FHWA-EP-00-002, Washington, DC.
- Green, D., Grizzard, T., Randall, C. 1994. "Monitoring of Wetlands, Wet ponds, and Grassed Swales." Proc Eng Found Conf Stormwater NPDES Related Monitoring Needs, pp. 487-513.
- Heyvaert, A.C., Reuter, J.E. and E.W. Strecker. 2003. Selected Results from Monitoring Relevant to the Design and Performance of Stormwater BMPs in the Tahoe Basin, Draft Report Prepared for California Tahoe Conservancy, South Lake Tahoe, California.
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Appendix A

Monitoring Program Objectives Matrix

Environmental Monitoring Elements

Additional SWMP BMP Monitoring

	Basic Instream Monitoring	Enhanced Instream Monitoring	Stormwater Monitoring	Hydraulic Monitoring	Structural BMP Monitoring	Dry Season Field Screening
	Dry and Wet Season Monitoring	**Macroinvertebrate Monitoring**		**Flow / Rainfall**		
Locations(s)	fixed sites; citywide 9 locations	fixed sites; citywide 8 locations	5 fixed sites and 5 citywide probabilistic sites	Flow: fixed USGS gages; Rainfall: fixed HYDRA rainfall gages	in/out for 2-4 facility/year	8 major fixed outfalls and 22 rotating citywide outfalls
Frequency	3/year during wet season (Oct. 1 - Apr. 30); 1/year during dry season (max 4/year)	1/year during dry season in connection with basic instream data collection	during storm events: 1/year	Flow: continuous every 15-minute; Rainfall: continuous every 1-hour	during storm events: 2-4/year	during dry season: 1/year
Sampling Type	Grab	Composite kick	Grab	Continuous	3 grabs/site	Grab (as needed)
Monitoring Categories	Field (pH, temperature, conductivity, DO, turbidity); Conventional (BOD, TSS, hardness, *E. coli*); Nutrients (nitrate, ammonia, total phosphorus, ortho-phosphorus); Metals (copper, lead, mercury*, zinc); Seasonal (chlorophyll-a; dry season only)	Macroinvertebrates	Field (pH, temperature, conductivity, DO, turbidity); Conventional (BOD, TSS, hardness, *E. coli*); Nutrients (nitrate, ammonia, total phosphorus, ortho-phosphorus); Metals (copper, lead, mercury*, zinc); current use pesticides (2,4-D, pentachlorophenol)	Water Quantity (Flow - in-stream; Rainfall - storm event)	Water Quantity; Water Quality: Field (pH, temperature, conductivity, DO, turbidity); Conventional (BOD, TSS, hardness, *E. coli*); Nutrients (nitrate, ammonia, total phosphorus, ortho-phosphorus); Metals (copper, lead, mercury*, zinc)	Field screening; follow-up analyses depending on result of field screening
Off-Ramps / Possible Changes	any analyte that is ND > 90% of the samples will be eliminated from routine sampling	Decrease frequency if no change is observed after 3 annual events	Changes in number of locations and frequency based on collected data; any analyte that is ND > 90% of the samples will be eliminated from routing sampling	USGS proposed changes to flow gages	Will choose which BMPs are evaluated based on consistency of results and BMP strucutre through time	May decide to alternate field screening locations if continued investigation of major outfalls yields no illicit discharges and another suitable sampling locations can be identified.

* Dissolved and total phase metals monitored for all but mercury (total phase only)

	Environmental Monitoring Elements					Additional SWMP BMP Monitoring	Modeling Element	Literature Review and Data Evaluation Element	
Monitoring Objective	**Basic Instream Monitoring**	**Enhanced Instream Monitoring**	**Stormwater Monitoring**	**Hydraulic Monitoring**	**Structural BMP Monitoring**	**Dry Season Field Screening**	**Pollutant Load Modeling**	**Literature Review**	**Data Evaluation**
	Dry and Wet Season Monitoring	**Macroinvertebrate Monitoring**		**Flow / Rainfall**					
1. Evaluate the source(s) of the 2004/2006 303(d) listed pollutants applicable to the co-permittees permit area	Includes many TMDL and a few 303(d) listed pollutants (some are monitored using surrogates, such as TSS). Many 303(d) listed pollutants are listed for media other than surface water	Macroinvertebrate sampling will provide information to support the identification of pollutant sources.	Stormwater monitoring will provide information to evaluate what influences stormwater quality; limited data exists for current use pesticides in stormwater. Characterizing presence in stormwater will help determine	N/A	Influent and effluent samples may be analyzed for applicable TMDL and 303(d) parameters	Dry weather field screening will be used to determine potential sources of pollutants, which may include 303(d) and TMDL pollutants	Comparison of modeled pollutant load by land use may assist in evaluating sources of pollutants	Conduct literature reviews as needed, and attend local ACWA stormwater committee meetings and conferences to gather and exchange information	Dry weather field screening will be evaluated to determine potential sources of pollutants
2. Evaluate the effectiveness of Best Management Practices (BMPs) to assist in identifying BMP priorities	Can be used to evaluate to overall effectiveness of BMPs in combination with basic stormwater monitoring	Assessment of overall improvements made using multiple BMPs	Stormwater monitoring will provide information to support the evaluation of the overall effectiveness of BMPs to reduce pollutants in the monitored catchment	Measurement of discharge from BMP provides information on effectiveness	BMP effectiveness monitoring data will be used to evaluate effectiveness of similar BMPs	Assess the overall effectiveness of the IDDE program BMP	Conduct pollutant load modeling at the end of the permit term to estimate the overall pollutant load reduction achieved through the implementation of BMPs.	Track and review literature related to the performance and cost effectiveness of BMPs (e.g. International Stormwater BMP database)	Report on literature review findings and pollutant load modeling results at the end of the permit term or as appropriate in annual compliance report.
3. Characterize stormwater runoff discharges based on land use type, seasonality or geography	Provides information to support the evaluation and comparison of in-stream concentrations during dry and wet weather. This information will support the characterization of stormwater discharges.	Indirectly provides information to support the long-term water quality and in-stream habitat conditions, some of which are affected by stormwater runoff	Probabilistic stormwater monitoring design allows for stormwater characterization that can be assessed by land use, vehicle trips, or other watershed criteria	Seasonal and geographic variations of rainfall and instream flow may assist in evaluating MS4 discharges	Influent to BMPs being monitored are long-term stormwater monitoring locations	Screening may identify legal and illicit non-stormwater discharges	Pollutant loads can be modeled by land use type or other catchment characteristics	Compare local data to International Stormwater BMP Database to evaluate differences, pollutants monitored, etc.	Submit data with annual compliance report, conduct data evaluation (update land use based concentrations) at the end of year 4 for submittal with pollutant load reduction benchmarks
4. Evaluate status and long-term trends in receiving waters associated with MS4 stormwater discharges	In-stream monitoring during wet season will allow for assessing trends in pollutants likely associated with MS4 stormwater discharges	Macroinvertebrate sampling will provide information to support the evaluation of trends in receiving waters and allows for trending as an independent measure	Stormwater monitoring will assist in the interpretation of in-stream trend analyses.	Instream flow can be used to evaluate long-term changes in MS4 discharge volume	Determine whether BMP effectiveness data is verified by in-stream trends	N/A	N/A	Review data collected by DEQ and USGS and published in peer-reviewed articles and compare to and enhance data collected by permittee.	Submit data with annual compliance report, conduct data evaluation at the end of year 4 for submittal with pollutant load reduction benchmarks
5. Assess the chemical, biological, and physical effects of MS4 stormwater runoff on receiving waters	In-stream water quality monitoring will provide information to assess the chemical effects of stormwater runoff on receiving waters.	Macroinvertebrate monitoring will provide information to assess the biological effects of stormwater runoff on receiving waters.	Stormwater monitoring will assist in the interpretation of in-stream water quality concerns and will be used to evaluate potential impacts of stormwater on receiving water	Rainfall/flow monitoring will provide information to assess the physical effects of stormwater runoff	Understanding of BMP effectiveness may assist in assessment of stormwater affects on receiving water	N/A - unless legal non-stormwater discharges are involved	Modeled loads can assist in evaluating MS4 runoff effects on receiving waters	Review studies conducted by other jurisdictions to learn about methods used and conclusions drawn	Submit data with annual compliance report, conduct data evaluation at the end of year 4 for submittal with pollutant load reduction benchmarks
6. Assess progress towards meeting TMDL pollutant load reduction benchmarks	In-stream monitoring will provide information regarding progress towards meeting pollutant load reduction benchmarks and TMDL waste load allocations.	Macroinvertebrates are senstiive to some TMDL pollutants. Macro data will provide information regarding progress towards meeting pollutant load reduction benchmarks and TMDL waste load allocations.	Stormwater monitoring will provide information (improved land use concentrations; answer to specific quesitons) for use in the pollutant loads model to assess progress towards meeting pollutant load reduction benchmarks.	Rainfall/flow monitoring is necessary to calculate pollutant loads	Evaluate pollutant load reductions related to specific BMPs for use in pollutant load reduction benchmark calculations	N/A	Conduct pollutant load modeling at the end of the permit term to estimate progress towards achieving pollutant load reduction benchmarks.	N/A	See benchmark reporting requirements under the permit renewal application requirements.

Appendix B

Standard Operating Procedures

SOP A-1 Weather Tracking and Monitoring Preparation

The Storm Event Coordinator will review the daily forecasts and track all potential rainfall events.

If an event being tracked has a 75% or greater probability of generating 0.5" of rainfall within a 24 hour period, the Storm Event Coordinator will inform the Monitoring Team 48 to 72 hours before its predicted arrival and a the Team will be placed in a "Prepare/Stand-by Mode".

<u>Monitoring Team "Prepare/Stand-by Mode"</u>

- Alert lab of possible monitoring activities
- Check field boxes for supplies (see checklists; SOP A-6, A-7 and A-8)
- Test, maintain, and clean, if necessary, all field equipment
- Identify, confirm and arrange team members schedule for field activities
- Arrange vehicle for monitoring activities
- Installed charged battery in flow meter

At 24 hours before the event is predicted to arrive if there is still a 75% probability that the storm will generate 0.5" of rainfall within 24 hours the Storm Event Coordinator will continue to consult with the Weather Consultant and a monitoring "Alert" will be issued.

<u>Monitoring Team "Alert Mode"</u>

- Prep and label bottles
- Assemble field equipment and paperwork
- Load vehicle with monitoring equipment
- Update lab on monitoring activities
- At 4-8 hours before a target event is scheduled to arrive, a Go/No-Go decision on monitoring will be made by the Storm Event Coordinator based on final reports from and discussions with the Weather Consultant.

SOP A-2 Clean Sampling Techniques

Sample collection personnel should adhere to the following rules while collecting stormwater samples to reduce potential contamination.

- No Smoking
- Do not sample near a running vehicle.
- Always wear clean powder-free nitrile gloves when handling bottles, lids, and sample collection equipment.
- Never touch the inside surface of a sample bottle, lid, or sampling tube (even with gloved hands) to be contacted by any material other than the sample water.
- Never allow any object or material to fall into or contact the collected sample water.
- Avoid allowing rainwater to drip from rain gear or other surfaces into sample bottles.
- Do not eat or drink during sample collection.
- Do not breathe, sneeze, or cough in the direction of an open sample bottle.

SOP A-3 Equipment Decontamination Procedures

Non-dedicated sampling equipment will be properly cleaned before sample collection. Non-dedicated equipment may include:

- Teflon or fluoropolymer sampling equipment is preferred. Typically, stainless steel should not be used in the collection of trace metals, however because the sample will collected by stainless steel bailer and transferred immediately into appropriate bottles for each of the specific parameters, it will be acceptable. An equipment rinseate will be collected for stainless steel bailer. Metals will be analyzed to ensure quality control.
- Water quality probe for field parameter measurements

Scoops and buckets used to transfer samples into the sample bottles required for will be cleaned as follows:

- Clean with tap water and phosphate-free laboratory detergent, such as Liquinox®
- Rinse thoroughly with tap water
- Rinse thoroughly with analyte-free water
- Air dry
- Rinse with analyte-free water prior to grab sample collection
- Rinse three times with sample water prior to grab sample collection

Before the water quality probe is used at each site, the probe will be double-rinsed with analyte-free water.

SOP A-4 Grab Sampling

Grab samples will be taken for lab-analyzed constituents, which may include:

- Bacteria
- Ammonia
- Nitrate
- Biochemical Oxygen Demand (BOD)
- Ortho-phosphorus
- Total Phosphorus
- TSS
- Hardness
- Total and Dissolved Metals: Cu, Pb, Zn, Hg
- Particle Size Distribution (BMP and Outfall monitoring only)
- Pesticides (e.g. DDT, Dieldrin, 2,4-D), dependent upon location and time

Labels should be filled out prior to sample collection with point code, date, and time.

Grab sample technique is described as follows:

- Put on sterile nitrile gloves
- Adhere to clean sampling techniques in SOP A-2
- Collect well-mixed, representative sample from mid-depth in thalweg of stream. Do not collect samples from pooled areas.

- Depending upon stream size and bank shape, sample may be collected using stainless steel bailer or directly into sample bottles.
- For samples collected using the stainless steel bailer, the sample collection point should be a mid-depth of the flow stream with the bailer facing upstream.
- Remove lid of sample bottle
- Do not touch or allow inside of lid to contact any objects. Hold lid in hand with lid top down so that the inside isn't exposed to dust or rain while sample bottle is filled.
- Fill the sample bottle to the shoulder of the bottle.
- Replace lid on sample bottle
- Ensure the sample has been labeled and place in cooler

SOP A-5 Chain of Custody Records

A chain of custody (COC) record is a legal document designed to track samples and persons who are responsible for them during preparation of the sample container, sample collection, sample delivery, and sample analysis. These forms are supplied by the analytical laboratory performing the sample analysis. The procedures for filling out these forms are as follows:

<u>Prior to sampling</u>
After bottles are labeled placed in coolers, fill out general information on COC form including:

- Company information and Client Code
- Project Name
- Sample Site ID
- Matrix (stormwater)
- Date
- Type of sample

<u>After sampling is complete</u>
After sampling has been completed, fill out remainder of the COC including:

- Time sampling was initiated
- Number of containers
- Comments or special instructions
- Disposal requirements

<u>Sample transfer</u>
Whenever custody of the samples is relinquished:

- Sign and date
- Have receiving custodian sign and date
- Unique sample code or number assigned to each bottle set
- Relay any special instructions
- Take one copy of COC for your records

SOP A-6 Personal Protective Equipment Checklist

The following items are required for most field sampling to protect field staff conducting sampling:

- Health and Safety Plan
- Safety vest
- Raingear
- Nitrile (or powder-free latex) gloves
- First Aid kit
- Traffic safety cones
- Traffic control signs

SOP A-7 Portable Field Equipment Checklist

The following equipment

- YSI 556 MSP Meter (calibrated)
- Hach 2100P Turbidimeter (calibrated)
- Camera
- Cellular Phone

Lab Sample Receiving:	503-823-5696
Weekdays :	503-823-5631
Weekends:	503-823-5677

- Fueled vehicle

The following items are recommended, depending upon the type of sampling taking place:

- Headlight/flashlight (for storm sampling early morning or late night)
- Manhole hook

SOP A-8 Sampling Equipment Checklist

The following items are required each sampling trip:

- Field data sheet on right in the rain paper
- Chain of custody form
- Cooler(s) with bottles

  For Ambient Monitoring:
  - 2 – plastic quarts (1 L),
  - 2 – 500 mL pre-cleaned plastic "metals" bottles,
  - 1 – plastic pint (500 mL),
  - 2 – plastic 1/2-pints (250 mL),
  - 1 – sterile/autoclaved bacteria bottle (250 mL)
  - 1 – amber glass (1 L) for chlorophyll-*a* (May through October only)

  For BMP and Outfall Monitoring:

  Same list as above, except
  - No Chl-a
  - Add 1 additional 1L plastic bottle for particle size distribution
- Blue ice
- Sharpie or writing utensil
- Extension pole
- Bailer (stored in Ziploc bag)

- Duct tape
- Analyte-free water
- Paper towels

The following items are optional, but recommended, each sampling trip:

- Labeling tape
- One gallon plastic bags

Appendix C

Field Data Sheets and Chain of Custody Forms

CITY OF GRESHAM
Department of Environmental Services
Field Data Sheet

Project Name: ____________ **Date:** ______
Field Crew: ____________ **Weather:** ______
____________ **Event Precip:** ______
Antecedent Precip: ______

GRAB SAMPLES

Site Number	FCI0	FCI1	JCI1	JCI2	KCI1	KCI3	KCI4	KI1	KI2	BCI1	BCI2	FVL1
Time												
DO												
pH												
Temp												
Cond												
Turb												
Color												

Field Replicate Station #: ______ **Time:** ______ **No Field Replicate:** ______

CITY OF GRESHAM
Department of Environmental Services
Field Data Sheet

Project Name:		**Date:**	
Field Crew:		**Weather:**	
		Event Precip:	
		Antecedent Precip:	

GRAB SAMPLES

Site Number	3151-F-064	3251-F-013	3148-W-014	3150-F-030	3153-F-040	3349-W-034	3254-F-072	3047-W-047	3150-W-038	3048-W-077		
Time												24-Hour
DO												mg/L
pH												S.U.
Temp												Celsius
Cond												mS/cm
NH4												mg/L
Turb												NTU
Color												Visual

Field Replicate Station #: ____________ **Time:** ____________ **No Field Replicate:** ____________

Comments: ____________

CITY OF GRESHAM
Department of Environmental Services
Field Data Sheet

Project Name: BMP Effectiveness Monitoring
Field Crew: ______________________

____

Date: __________
Weather: __________
Event Precip: __________
Antecedent Precip: __________

Site	Date	Time	DO	pH	Temp	Cond	Turb	Color	Comments
CSWQF-3 (out)									
CSWQF-3 (out)									
CSWQF-3 (out)									
CSWQF-3 (out)									
CSWQF-3 (out)									

Water Pollution Control Laboratory
6543 N. Burlington Ave.
Portland, Oregon 97203-4552
Sample Custodian: (503) 823-5696
General Lab: (503) 823-5681

City of Portland Chain-of-Custody

Bureau of Environmental Services

Work Order #: ________________

Collected By: ________________

Client Name: City of Gresham   Matrix: Surfacewater

Project Name: City of Gresham Streams

Requested Analyses

Special Instructions:

[1] Field Filtered

[2] Chlorophyll a - May through October Only

Lab Number	Location ID	Sample Date	Sample Time	Sample Type	BOD	TSS	E. coli	Ammonia-Nitrogen	Nitrate-Nitrogen[1]	Total Phosphorus	O-Phosphate Phosphorus[1]	TKN	Chlorophyll a[2]	Hardness	Total Metals (Cu, Pb, Zn) + Hg	Dissolved Metals (Cu, Pb, Zn)	Pesticides (low-level - CAS)	# of Containers	Remarks
01	FCI0			G	●	●	●	●	●	●	●	●	●	●	●	●			West of Blue Lake Rd in Trailer Court
02	FCI1			G	●	●	●	●	●	●	●	●	●	●	●	●			North of Stark St
03	JCI1			G	●	●	●	●	●	●	●	●	●	●	●	●	●		174th Ave
04	JCI2			G	●	●	●	●	●	●	●	●	●	●	●	●	●		Palmblad Rd & 252nd Ave
05	KCI1			G	●	●	●	●	●	●	●	●	●	●	●	●			Outflow from MHCC Pond
06	KCI3			G	●	●	●	●	●	●	●	●	●	●	●	●			Kelly Ck below Kelley Creek Pond
07	KCI4			G	●	●	●	●	●	●	●	●	●	●	●	●			Inflow to Kelley Creek Pond
08	KI1			G	●	●	●	●	●	●	●	●	●	●	●	●			17115 SE Foster Rd
09	KI2			G	●	●	●	●	●	●	●	●	●	●	●	●			8605 SE Rodlun Rd
10	BCI1			G	●	●	●	●	●	●	●	●	●	●	●	●			Glen Otto Park
11	BCI2			G	●	●	●	●	●	●	●	●	●	●	●	●			Division St at Troutdale Rd
12	FD			G	●	●	●	●	●	●	●	●	●	●	●	●			Field Duplicate

Relinquished By:	Received By:	Relinquished By:	Received By:
Signature: Date:	Signature: Date:	Signature: Date:	Signature: Date:
Printed Name: Time:	Printed Name: Time:	Printed Name: Time:	Printed Name: Time:

Water Pollution Control Laboratory
6543 N. Burlington Ave.
Portland, Oregon 97203-4552
Sample Custodian: (503) 823-5696
General Lab: (503) 823-5681

City of Portland Chain-of-Custody

Bureau of Environmental Services

Work Order #: ________________

Collected By: ________________

Client Name: City of Gresham

Project Name: City of Gresham UIC

Matrix: Stormwater

Requested Analyses

Special Instructions:

Lab Number	Location ID	Sample Date	Sample Time	Sample Type	BOD	TSS	E. coli	Ammonia-Nitrogen	Nitrate-Nitrogen	Total Phosphorus	Orth-Phosphate Phosphorus	TKN	PAHs + phthalates	Hardness	Total Metals (Sb, As, Cd, Cu, Pb, Zn) + Hg	Dissolved Metals (Cu, Pb, Zn)	Herbicides (EPA 8321) PAL								# of Containers	Remarks
				G	●	●	●	●	●	●	●	●	●	●	●	●	●									
				G	●	●	●	●	●	●	●	●	●	●	●	●	●									
				G	●	●	●	●	●	●	●	●	●	●	●	●	●									
				G	●	●	●	●	●	●	●	●	●	●	●	●	●									
				G	●	●	●	●	●	●	●	●	●	●	●	●	●									
				G	●	●	●	●	●	●	●	●	●	●	●	●	●									
				G	●	●	●	●	●	●	●	●	●	●	●	●	●									
				G	●	●	●	●	●	●	●	●	●	●	●	●	●									
				G	●	●	●	●	●	●	●	●	●	●	●	●	●									
				G	●	●	●	●	●	●	●	●	●	●	●	●	●									
	Field Duplicate			G	●	●	●	●	●	●	●	●	●	●	●	●	●									Field Duplicate

Relinquished By:	Received By:	Relinquished By:	Received By:
Signature: Date:	Signature: Date:	Signature: Date:	Signature: Date:
Printed Name: Time:	Printed Name: Time:	Printed Name: Time:	Printed Name: Time:

Water Pollution Control Laboratory
6543 N. Burlington Ave.
Portland, Oregon 97203-4552
Sample Custodian: (503) 823-5696
General Lab: (503) 823-5681

City of Portland Chain-of-Custody

Bureau of Environmental Services

Work Order #: ____________

Collected By: ____________

Client Name:	City of Gresham	Matrix:	Stormwater
Project Name:	City of Gresham BMP Stormwater		

Requested Analyses

Special Instructions:
[1]Field Filtered

					Composite														Grab								
Lab Number	Location ID	Sample Date	Sample Time	Sample Type	BOD	TSS	Ammonia-Nitrogen	Nitrate-Nitrogen[1]	Total Phosphorus	O-Phosphate Phosphorus[1]	TKN	Particle Size (CML)	Hardness	Total Metals (Cu, Pb, Zn)	Dissolved Metals (Cu, Pb, Zn)	Total Mercury - EPA 200.8			E. coli							# of Containers	Remarks

Relinquished By:		Received By:		Relinquished By:		Received By:	
Signature:	Date:	Signature:	Date:	Signature:	Date:	Signature:	Date:
Printed Name:	Time:	Printed Name:	Time:	Printed Name:	Time:	Printed Name:	Time:

Appendix D

IGA between the City of Gresham and City of Fairview

Gresham IGA# 5100

10/11/2059

INTERGOVERNMENTAL AGREEMENT BETWEEN THE CITY OF FAIRVIEW AND THE CITY OF GRESHAM FOR JOINT SERVICES UNDER A MUNICIPAL NPDES SEPARATE STORM SEWER PERMIT

This Agreement is entered into between the City of Gresham, Oregon (Gresham) and the City of Fairview, Oregon (Fairview).

RECITALS

WHEREAS, the goal of this intergovernmental agreement is to continue to comply with existing federal and state National Pollutant Discharge Elimination System (NPDES) municipal separate storm sewer system (MS4) permit requirements ("MS4 Permit"); and

WHEREAS, the Fairview City Council and the Gresham City Council both recognize the need to identify and control pollutants entering the MS4 through the application of best management practices established and implemented through the jurisdiction of local government via each municipality's Stormwater Management Plan (SWMP); and

WHEREAS, it has been determined that urban stormwater runoff is a carrier of pollutants into our rivers and streams; and

WHEREAS, the MS4 Permit issued by the Oregon Department of Environmental Quality (DEQ) requires that each co-permittee is individually responsible for the operation of a municipal separate storm sewer system within their respective permit boundary; and

WHEREAS, the cities of Gresham and Fairview are authorized to implement a stormwater management program which is detailed in their respective SWMPs to reduce the contribution of pollutants in stormwater to the maximum extent practicable, to address applicable TMDL wasteload allocations, and to discharge stormwater to waters of the State in conformance with the requirements and conditions set forth in the MS4 Permit conditions issued by Oregon DEQ as permit #101315.

WHEREAS, the MS4 Permit requires that co-permittees "Control through interagency agreements among the co-permittees the contribution of pollutants from one portion of the municipal system to another portion of the municipal system"; and

WHEREAS, compliance with the MS4 Permit and implementation of the SWMP are deemed to be compliance with the requirement to reduce the discharge of pollutants from the MS4 to the maximum extent practicable; and

WHEREAS, water quality needs and development of a consistent and comprehensive SWMP that satisfies the MS4 Permit requirements can best be realized by co-compliance between Gresham and Fairview; and

WHEREAS, it is necessary to provide a basis for defining the co-permittees' primary intentions and relationships, responsibilities and obligations under the MS4 Permit; and

WHEREAS, the purpose of this Agreement is to detail the responsibilities, compensation and services to be provided by each co-permittee in meeting the requirements of the MS4 Permit.

NOW THEREFORE, the parties agree to the following:

1. GENERAL PROVISIONS

A) Gresham and Fairview are co-permittees to an MS4 Permit as provided in 40 CFR Section 122.26; and permitted by Oregon DEQ Municipal NPDES Permit #101315.

B) Each co-permittee is responsible for complying with MS4 Permit conditions relating to stormwater discharges from those parts of the MS4 they continue to operate or own. Neither co-permittee is responsible for the other co-permittee's permit compliance efforts or infractions thereof.

C) Each co-permittee implements their own SWMP in order to control to the maximum extent practicable the contribution of pollutants from one portion of the municipal system to another portion of the municipal system to comply with the MS4 Permit.

2. SCOPE OF FAIRVIEW SERVICES

A) Fairview shall work cooperatively with Gresham and its representatives in developing procedures to ensure effective coordination.

B) Based on mutual agreement, Fairview may undertake tasks to assist with co-permittee compliance activities.

C) Fairview shall be responsible for implementing its SWMP as described in the NPDES permit co-application submitted to Oregon DEQ, or its successive updates.

D) Fairview shall be responsible for writing its portion of the annual report to Oregon DEQ that is based upon its SWMP, and shall provide the report to Gresham at least one week prior to the required report submittal date as defined in the MS4 Permit.

3. SCOPE OF GRESHAM SERVICES

A) Gresham shall provide, or shall contract to provide, or shall lead a joint effort to contract for the following services to Fairview with regard to the MS4 Permit:

1) Gresham shall perform monitoring required by the MS4 Permit, including reporting of the monitoring data and other associated information required by the monitoring component of the MS4 Permit. Gresham shall also provide the monitoring data directly to Fairview at Fairview's request.

2) Gresham shall compile and summarize water quality data required for the MS4 Permit including but not limited to Monitoring and Reporting Requirements as described in Schedule B of the MS4 Permit, or any subsequent modifications to the MS4 Permit.

3) Based on mutual agreement, Gresham may undertake tasks to assist with additional co-permittee compliance activities.

B) Gresham shall assume the lead role with regard to the MS4 Permit and implementation of the Stormwater Management Program in the following manner:

1) Gresham will initiate programmatic discussions with the Oregon DEQ as needed to facilitate implementation of the MS4 Permit requirements that apply to the entire MS4 Permit boundary.

2) Gresham will coordinate and manage the co-permittee process as necessary to ensure a timely and responsive submittal of the annual report as required by the permit.

3) Gresham will prepare and submit the annual report for the MS4 Permit requirements so as to include the Fairview operated municipal separate storm sewer system within the permit boundary.

4. COMPENSATION

Fairview shall pay Gresham for work performed under this Agreement after the effective date as set out below. Likewise, Gresham shall pay Fairview for activities that Fairview conducts on Gresham's behalf, by mutual consent. The payment shall be full compensation for the reasonable cost of work performed, for services rendered, and for all labor, materials, supplies, equipment, and incidentals necessary to perform the work and services. Work will include costs incurred related to management and coordination of the co-permittee process between Gresham and Fairview.

Annual payment to either party shall not exceed $15,000, except by mutual agreement.

5. EFFECTIVE AND TERMINATION DATES

This Agreement shall be effective on the date at which all parties sign the agreement and shall terminate upon expiration of the MS4 Permit. If the MS4 Permit is extended or renewed, the term of this Agreement shall extend automatically to conform to the extended term of the MS4 Permit.

6. BILLING AND PAYMENT PROCEDURE

Billing and payment procedures shall be as set out below.

In July, the Cities shall submit invoices for work performed during the previous fiscal year. Each invoice shall include the amount due and shall include sufficient information to enable the parties to identify the service or product being invoiced as needed to satisfy fiscal requirements.

Invoiced payments are due within 60 days of the invoice date. Payments to Gresham shall be made payable to the City of Gresham, and mailed to City of Gresham, Financial Services Division, 1333 NW Eastman Parkway, Gresham, Oregon, 97030. Payments to Fairview shall be made payable to City of Fairview, and mailed to City of Fairview, 1300 NE Village Street, Fairview, Oregon, 97024.

If a payment is not received within sixty (60) days of the invoice date, interest of 1.5% per month (18% per annum) may be assessed against the entire delinquent balance. The past-due invoice may be subject to either city's collection policy and may be submitted to a collection agency for further action.

7. EARLY TERMINATION OF AGREEMENT

A) Gresham and Fairview, by mutual written agreement, may terminate this Agreement at any time.

B) Either party may terminate this agreement by giving 90 day written notice to the other party.

C) Either Gresham or Fairview may terminate this Agreement in the event of a breach of the Agreement by the other. Prior to such termination, however the party seeking the termination shall give to the other party written notice of the breach and of the party's intent to terminate. If the party has not cured the breach within thirty (30) days of the notice, then the party giving the notice may terminate the Agreement at any time thereafter by giving a written notice of termination.

8. INDEMNIFICATION

Subject to the limitations of the Oregon Constitution and statutes, Gresham and Fairview each shall be solely responsible for any loss or injury caused to third parties arising from Gresham's or Fairview's own acts or omissions under this Agreement and Gresham and Fairview shall defend, hold harmless and indemnify the other party to this agreement with respect to any claims, litigation or liability arising from Gresham's or Fairview's own acts or omissions under this Agreement.

9. <u>FUNDS</u>

Both Fairview and Gresham certify that sufficient funds are available and authorized for expenditure to finance the cost of the Agreement.

10. <u>NON-APPROPRIATION CLAUSE</u>

This agreement is subject to future appropriations by any future Gresham or Fairview City Council.

THE CITY OF GRESHAM

By: ________________________
Erik Kvarsten, City Manager

Date: 1/3/11

THE CITY OF FAIRVIEW

By: ________________________
Mike Weatherby, Mayor for City of Fairview

Date: 1/22/11

APPROVED AS TO FORM

By: ________________________
DAVID RIS, City Attorney for City of Gresham, Oregon

Reviewed:

By: ________________________
NANCY WERNER, City Attorney for City of Fairview, Oregon

RESOLUTION
(29-2010)

A RESOLUTION OF THE CITY COUNCIL FOR THE CITY OF FAIRVIEW APPROVING THE INTERGOVERNMENTAL AGREEMENT WITH THE CITY OF GRESHAM TO COORDINATE COMPLIANCE WITH NPDES MS4 STORMWATER PERMIT.

WHEREAS, The City of Fairview and the City of Gresham are co-permittees on a National Pollutant Discharge Elimination System Municipal Separate Storm Sewer System Permit, #101315 (MS4 Permit) issued by the Oregon Department of Environmental Quality; and

WHEREAS, the MS4 Permit requires that co-permittees "[c]ontrol through interagency agreements among the co-permittees the contribution of pollutants from one portion of the municipal system to another portion of the municipal system"; and

WHEREAS, compliance with the MS4 Permit and implementation of the Stormwater Management Plan (SWMP) is deemed to be compliance with the requirement of the MS4 Permit to reduce the discharge of pollutants from the Municipal Separate Storm System to the maximum extent practicable; and

WHEREAS, the City of Fairview did develop the SWMP consistent with the MS4 Permit requirements; and

WHEREAS, the City of Fairview finds it necessary to define each jurisdictions intentions and relationships, responsibilities and obligations under the MS4 Permit;

NOW, THEREFORE, BE IT RESOLVED BY THE CITY COUNCIL OF THE CITY OF FAIRVIEW AS FOLLOWS:

1. The City approves the Intergovernmental Agreement with the City of Gresham to Coordinate Compliance with NPDES MS4 Stormwater Permit substantially in the form attached hereto as Exhibit A.

2. This Resolution is and shall be effective from and after its passage by the City Council.

Resolution adopted by the City Council of the City of Fairview, this 1st day of September, 2010.

Mayor, City of Fairview
Mike Weatherby

Date of Signing
ATTEST:

Recorder, City of Fairview
Joseph Gall

{00110277; 1 }

COPY

Appendix E

Joint Funding Agreement between the USGS and City of Gresham for Oregon Water Science Center

Form 9-1366
(Oct. 2005)

U.S. DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

JOINT FUNDING AGREEMENT

Customer #:	6000000230
Agreement #:	
Project #:	
TIN #:	93-6002176
Fixed Cost Agreement	YES

FOR

OREGON WATER SCIENCE CENTER

THIS AGREEMENT is entered into as of the, 1st day of October, 2014 by the U.S. GEOLOGICAL SURVEY, UNITED STATES DEPARTMENT OF THE INTERIOR, party of the first part, and the THE CITY OF GRESHAM, party of the second part.

1. The parties hereto agree that subject to availability of appropriations and in accordance with their respective authorities there shall be maintained in cooperation a hydrologic monitoring program in the Johnson Creek basin and Fairview Creek herein called the program. The USGS legal authority is 43 USC 36C; 43 USC 50; and 43 USC 50b

2. The following amounts shall be contributed to cover all of the cost of the necessary field and analytical work directly related to this program. 2(b) includes In-Kind Services in the amount of $0.00 .

(a) by the party of the first part during the period

Amount	Date	to	Date
$119,110.00	October 1, 2014		September 30, 2019

(b) by the party of the second part during the period

Amount	Date	to	Date
$174,100.00	October 1, 2014		September 30, 2019

(c) Additional or reduced amounts by each party during the above period or succeeding periods as may be determined by mutual agreement and set forth in an exchange of letters between the parties.

(d) The performance period may be changed by mutual agreement and set forth in an exchange of letters between the parties.

3. The costs of this program may be paid by either party in conformity with the laws and regulations respectively governing each party.

4. The field and analytical work pertaining to this program shall be under the direction of or subject to periodic revie by an authorized representative of the party of the first part.

5. The areas to be included in the program shall be determined by mutual agreement between the parties hereto or their authorized representatives. The methods employed in the field and office shall be those adopted by the part of the first part to insure the required standards of accuracy subject to modification by mutual agreement.

6. During the course of this program, all field and analytical work of either party pertaining to this program shall be open to the inspection of the other party, and if the work is not being carried on in a mutually satisfactory manner either party may terminate this agreement upon 60 days written notice to the other party.

7. The original records resulting from this program will be deposited in the office of origin of those records. Upon request, copies of the original records will be provided to the office of the other party.

8. The maps, records, or reports resulting from this program shall be made available to the public as promptly as possible. The maps, records, or reports normally will be published by the party of the first part. However, the party of the second part reserves the right to publish the results of this program and, if already published by the party of the first part shall, upon request, be furnished by the party of the first part, at costs, impressions suitable for purposes of reproduction similar to tha for which the original copy was prepared. The maps, records, or reports published by either party shall contain a statement the cooperative relations between the parties.

9. USGS will issue billings utilizing Department of the Interior Bill for Collection (form DI-1040). Billing documents are to be rendered quarterly. Payments of bills are due within 60 days after the billing date. If not paid by the due date, interest will be charged at the current Treasury rate for each 30 day period, or portion thereof, that the payment is delayed beyond the due date. (31 USC 3717; Comptroller General File B-212222, August 23, 1983).

U.S. Geological Survey United States Department of the Interior		The City of Gresham	
USGS Point of Contact		**Customer Point of Contact**	
Name:	Adam Stonewall, USGS ORWSC	Name:	Lynne Kennedy, City of Gresham
Address:	2130 SW 5th Avenue Portland, Oregon 97201	Address:	1333 NW Eastman Parkway Gresham, Oregon 97030
Telephone:	503-251-3276	Telephone:	503-988-3663
Email:	stonewal@usgs.gov	Email:	

Signatures and Date

Signature:	Date: 7/3/14	Signature:	Date:
Name:	James D. Crammond	Name:	Erik Kvarsten
Title:	Center Director	Title:	City Manager

Approved as to Form

City Attorney's Office

Appendix F

City of Gresham and Portland IGAs

JUL 3 0 2007 52898

CITY OF GRESHAM 2601
AGREEMENT

INTERGOVERNMENTAL AGREEMENT BETWEEN THE CITY OF PORTLAND AND THE CITY OF GRESHAM REGARDING LABORATORY ANALYTICAL SERVICES

This agreement is entered into on July 1, 2007 by and between the City of Gresham, Oregon (Gresham) and the City of Portland, Oregon (Portland).

RECITALS

WHEREAS, the goal of this intergovernmental agreement is to provide laboratory analytical services for the City of Gresham by the City of Portland and;

WHEREAS, the City of Gresham was issued a National Pollutant Discharge Elimination System (NPDES) discharge permit. The NPDES permit requires the implementation of a stormwater management plan, monitoring requirements, and submittal of an annual report;

WHEREAS, the City of Gresham has been identified by Oregon Department of Environmental Quality (DEQ) as a designated management agency (DMA) and is required to comply with the Total Maximum Daily Load (TMDL) requirements for discharges to the Columbia Slough and Johnson Creek.

WHEREAS, the Columbia Slough, Fairview Creek, and Johnson Creek have been placed on the DEQ 1994/1996 and 1996/1998 303(d) list of water quality limited, impaired waterbody list for multiple parameters; and

WHEREAS, the City of Gresham is implementing a storm and surface water monitoring program to assess: instream baseline conditions, identification of pollutants and their sources, illicit connections and illegal dumping, long-term trends, and pollutant reduction effectiveness.

WHEREAS, the City of Gresham has submitted a request for both rule authorization and a Water Pollution Control Facility (WPCF) permit to comply with Underground Injection Control (UIC) rules. The UIC rules require implementation of a stormwater management plan and monitoring requirements.

WHEREAS, this intergovernmental agreement (IGA) is in conformance with the Columbia Slough monitoring IGA.

WHEREAS, this IGA is in conformance with a Memorandum of Agreement (MOA), which outlines an agreement with jurisdictions throughout the Johnson Creek watershed for cooperation, coordination, and support.

WHEREAS, the purpose of this Agreement is to detail the responsibilities, compensation and services to be provided by each party.

NOW THEREFORE, the parties agree to the following:

1. SCOPE OF PORTLAND'S SERVICES

A. Portland shall be responsible for providing laboratory analytical services (including methods and rates) to Gresham as shown in the attached fee schedule (Exhibit A).

B. Portland shall provide Gresham with all necessary sample bottles, ice-chests, and chain-of-custody documents.

C. Portland shall provide a 14-day turn-a-round time on all sample analyses results, except in the event of delay caused by conditions beyond Portland's reasonable control. In the event of delay, Portland shall promptly notify Gresham of the delay and provide an estimated time for turn-a-round of the delayed sample analyses.

D. Portland shall provide data reports listing the analyses results, detection limits, methods used and routine quality assurance/quality control documentation as requested.

E. Portland shall notify Gresham of changes in the attached fee schedule (Exhibit A) in writing no less than two months before implementation.

F. Portland shall annually provide Gresham with the lab analytical cost sheet for the upcoming fiscal year.

2. SCOPE OF GRESHAM'S SERVICES

A. Gresham shall be responsible for review and acceptance of all products prepared by Portland.

B. Gresham shall annually review the lab analytical cost sheet for the upcoming fiscal year supplied by Portland.

3. COMPENSATION

Gresham shall reimburse Portland promptly for costs incurred in accordance with Section 4 INVOICE AND PAYMENT PROCEDURE. Gresham shall pay Portland within 30 days of being invoiced. Gresham shall pay Portland for laboratory services incurred as shown in the attached schedule of rates (Exhibit A) which may be amended by Portland pursuant to section 1.E above.

4. INVOICE AND PAYMENT PROCEDURE

Portland's invoice and Gresham's payment procedures shall be as set out below.

Quarterly, Portland's project manager, shall submit to Gresham's project manager, a detailed statement describing analyses performed for approval. The invoice shall include all approved analytical costs related to this IGA. Portland will furnish Gresham such statements of expenditures as may be needed to satisfy fiscal requirements.

Payment of the amounts set out in paragraph 3 above shall be made to City of Portland, no later than 30 days of being invoiced, and shall be sent to:

City of Portland
Accounting Division, Office of Finance and Administration
Accounts Receivable
1120 SW Fifth Avenue, Room 1250
Portland, OR 97204

5. <u>EFFECTIVE DATE</u>

This agreement shall be effective as of July 1, 2007.

6. <u>AMENDMENT OR TERMINATION OF AGREEMENT</u>

A. Portland and Gresham, by mutual written agreement, may modify, amend, or terminate this Agreement at any time.

B. Either Portland or Gresham may terminate this Agreement in the event of a breach of the Agreement by the other. Prior to such termination, however, the party seeking the termination shall give to the other party written notice of the breach and of the party's intent to terminate. If the party has not cured the breach within thirty (30) days of the notice, then the party giving the notice may terminate the Agreement at any time thereafter by giving a written notice of termination.

C. Either Portland or Gresham may terminate this Agreement in the event of Portland's Water Pollution Control Laboratory is rendered inoperable by an Act of God.

D. Either Portland or Gresham may terminate this Agreement for convenience on 60 days prior written notice of intent to terminate

7. <u>INDEMNIFICATION</u>

To the extent permitted by the Oregon Tort Claims Act, Portland agrees to indemnify, defend, and hold harmless Gresham from any and all claims, demands, suits, and actions (including attorney fees and costs) resulting from or arising out of the acts of Portland and its officers, employees, and agents in performance of this intergovernmental agreement. To the extent permitted by the Oregon Tort Claims Act, Gresham agrees to indemnify, defend, and hold harmless Portland from any claims, demands, suits, and actions (including attorney fees and costs) resulting from or arising out of the acts of Gresham and its officers, employees, and agents in performance of this intergovernmental agreement.

8. <u>FUNDS</u>

Portland and Gresham certify that sufficient funds have been requested for the 2007-2008 fiscal year and when approved both Portland and Gresham are authorized to spend funds to cover the costs associated with this agreement for that fiscal year. Both Portland and

Gresham will use their best efforts to urge appropriation of funds to cover the costs of this agreement in the ensuing fiscal years.

9. NON-APPROPRIATION CLAUSE

This Agreement is subject to future appropriations by the Portland or Gresham City Councils.

Executed in five (5) copies by the duly authorized representatives of the parties.

CITY OF PORTLAND

By:__________
Sam Adams, Commissioner of Public Affairs

Date: 7/24/07

By:__________
Dean Marriott, Bureau Director

Date: 7/13/07

By:__________
Gary Blackmer, Auditor

Date: 7/26/07

CITY OF GRESHAM

By:__________
Mayor Shane Bemis

Date: 5/2/07

By:__________
Erik Kvarsten, City Manager

Date:__________

APPROVED as to form:

Portland City Attorney,
for City of Portland, Oregon

By:__________

Gresham City Attorney
for City of Gresham, Oregon

By:__________

Water Pollution Control Laboratory

FY 2007-08 Analysis Price List

City of Gresham Monitoring

Department	Analysis[2]	Method	Price[1] FY 2006-07	FY 2007-08	Project
Metals	Total Metals (Cu, Pb, Ni, Zn)	EPA 200.8	$101	$101	Instream, Fairview Lake, Outfall
	Dissolved Metals (Cu, Pb, Ni, Zn)	EPA 200.8	$107	$107	Instream, Fairview Lake, Outfall
	Mercury	EPA 200.8	$29	$29	Instream, Fairview Lake, Outfall
Microbiology	E. coli	EPA 9223 B	$36	$39	Instream, Fairview Lake, Outfall
Nutrients	Chloride	EPA 300	$23	$25	Instream, Fairview Lake
	Ammonia-Nitrogen	EPA 350.1	$28	$31	Instream, Fairview Lake, Outfall
	Nitrate-Nitrogen	EPA 300	$23	$25	Instream, Fairview Lake, Outfall
	o-Phosphate-Phosphorus, Dissolved	EPA 365.1	$30	$31	Instream, Fairview Lake, Outfall
	Total Kjeldahl Nitrogen (TKN)	EPA 351.2	$47	$49	Instream, Fairview Lake, Outfall
	Total Phosphorus	EPA 365.4	$41	$49	Instream, Fairview Lake, Outfall
Organics	Pesticides	EPA 8081	$101	$101	Instream
	Polychlorinated Biphenyls (PCBs)	EPA 8082	$101	$108	Instream
	Polynuclear Aromatic Hydrocarbons (PAHs)	EPA 8270-SIM	$153	$155	Instream
General Chemistry	BOD5	SM 5210B	$55	$59	Instream, Fairview Lake, Outfall
	Total Suspended Solids	SM 2540D	$24	$25	Instream, Fairview Lake, Outfall
	Particle Size	Optical	$153	$158	Instream
	Hardness, Total	SM2340 B	$23	$27	Instream, Fairview Lake, Outfall

[1] The prices listed here are pulled from the City of Portland 06-07 and 07-08 Laboratory analytical price lists.

[2] This list does not limit the City of Gresham to only these constituents but was generated based on the City of Gresham's current monitoring activities.

ORDINANCE No. 181035

Authorize an Intergovernmental Agreement with the City of Gresham to provide Laboratory Analytical Services (Ordinance)

Section 1. The Council finds:

1. The City of Gresham was issued a National Pollutant Discharge Elimination System (NPDES) wastewater discharge permit. The NPDES permit requires implementation of a stormwater-monitoring program. The City of Gresham uses the services of contract laboratories as needed to comply with requirements of the stormwater monitoring program;

2. The goal of this intergovernmental agreement is to provide laboratory analytical services for the City of Gresham by the City of Portland, and;

3. The purpose of this agreement is to detail the responsibilities, compensation, and services to be provided by each party.

NOW, THEREFORE, the Council directs:

a. The Director of the Bureau of Environmental Services is authorized to execute an intergovernmental agreement with the City of Gresham for the purpose described in Section 1.

b. The Mayor and Auditor are hereby authorized to accept approximately $60,000 per year for revenues in the Bureau of Environmental Services Sewer Operating Fund, centercode 14713030, from the City of Gresham for the City of Portland providing laboratory analytical services.

Passed by the Council, JUN 13 2007
Sam Adams
Commissioner of Public Utilities

[Duane Linnertz]
[5-23-07]

Gary Blackmer
Auditor of the City of Portland
By Susan Parsons
Deputy

JUL 3 0 2007 52899 CITY OF GRESHAM AGREEMENT 2602

INTERGOVERNMENTAL AGREEMENT
BETWEEN THE CITY OF PORTLAND AND THE CITY O F GRESHAM
REGARDING INSTREAM MONITORING AND COORDINATION FOR THE
COLUMBIA SLOUGH

RECEIVED
AUG 10 2007
DES

This agreement is entered into on April 2, 2007, by and between the City of Gresham, Oregon (Oregon) and the City of Portland, Oregon (Portland).

RECITALS

WHEREAS, the goal of this intergovernmental agreement is to assess the water quality and pollutant loading of the Columbia Slough, continue to comply with existing federal Total Maximum Daily Load (TMDL) rules and regulations, coordinate TMDL Implementation activities, and comply with the Municipal Separate Storm Sewer System (MS4) National Pollutant Discharge Elimination System (NPDES) Permit requirements.

WHEREAS, the Columbia Slough is a 19-mile long complex of narrow and shallow channels located on the southern floodplain of the Columbia River between Fairview Lake and the Willamette River.

WHEREAS, the water quality in the Columbia Slough is affected in a complex manner by sources such as, groundwater, landfill leachate, airport deicing fluids, stormwater runoff, industrial stormwater runoff, past practices, and point sources of pollution.

WHEREAS, the Columbia Slough from the mouth (Willamette River) to Fairview Lake, was placed on the Oregon Department of Environmental Quality's (DEQ's) 1994/1996 and 1996/1998 303(d) list of water quality limited, impaired waterbodies for multiple parameters.

WHEREAS, DEQ adopted and Environmental Protection Agency (EPA) approved a TMDL for multiple pollutants in 1998, and added temperature in 2006 as part of the TMDL for the Lower Willamette.

WHEREAS, the TMDL waste load allocations will be implemented via NPDES MS4 permits and industrial stormwater permits.

WHEREAS, both Portland and Gresham have been identified by DEQ as designated management agencies (DMA), responsible for compliance with TMDL regulations and implementation of water quality management plans.

WHEREAS, Portland and Gresham desire to work together to conduct in-stream monitoring in the upper Columbia Slough pursuant to the requirements of the Columbia Slough TMDL and each city's NPDES MS4 permits.

Lab Quality Assurance Plan (QAP), Environmental Investigations Division Field Operations Standard Operating Procedures (SOP) and the EPA-approved Columbia Slough Revitalization QA/QC Plan within 30 days of modification.

C. In case of unforeseen circumstances beyond the control of Portland, which prevent Portland from conducting sampling activities in accordance with the Columbia Slough TMDL, Portland shall notify Gresham as soon as practicable but not later than one week after the occurrence. In such a circumstance, Gresham shall determine whether to notify DEQ on its own behalf or to make alternative arrangements for sampling. Examples of unforeseen circumstances include but are not limited to: widespread and long-lasting flood events, equipment failures causing loss of data, or human error causing loss of data or irretrievable sample data.

D. Portland shall provide Gresham with electronic lab analytical data results including QA/QC as soon as practicable but no later than 60 days after each sampling event.

E. The Portland Water Pollution Control Lab shall bill Gresham annually, by May 31for sampling costs incurred during the fiscal year.

F. Portland shall annually provide Gresham with the lab analytical cost sheet for the upcoming fiscal year.

G. Portland shall meet with Gresham annually to discuss monitoring changes.

2. SCOPE OF GRESHAM'S SERVICES

A. Gresham shall be responsible for review and acceptance of all products prepared by Portland.

B. Gresham shall meet with Portland annually to discuss monitoring changes.

3. COMPENSATION

For fiscal year 2006/2007, Gresham shall reimburse Portland 10% of the total monitoring costs for the current in-stream monitoring activities as outlined in Gresham IGA #731. Gresham shall pay Portland $11,872 for FY2006/2007, based on the 5% annual increase referenced in IGA #731 Exhibit B.

For fiscal year 2007/2008, Gresham shall reimburse Portland 10% of the costs for in-stream monitoring at three (3) sites and 100% of the costs for one (1) additional in-stream monitoring site in the Upper Slough. The reimbursement is based on the sampling regime outlined in Section 1A above, Attachment A, and the reimbursement determination outlined in Attachment B. The estimated cost to Gresham for FY2007/2008 is $11,624.

6. AMENDMENT OR TERMINATION OF AGREEMENT

A. Either party may amend, by mutual written agreement, this IGA effective not less than 30 days from delivery of written notice.

B. Either party may terminate this IGA effective not less than 30 days from written notice or at such other date as may be established by both parties under any of the following conditions:

1. If funding is not obtained and continued at levels sufficient to allow for specified services. When possible, and when agreed upon, the IGA may be modified to accommodate a reduction in funds.
2. If federal or state regulations or guidelines are modified, changed or interpreted in such a way that the services are no longer allowable or appropriate under this IGA, or are no longer eligible for the funding proposed for payments authorized by this IGA.
3. In the event of a breach of the Agreement by the other. However, prior to such termination, the party seeking the termination shall give to the other party written notice of the breach and of the party's intent to terminate. If the party has not cured the breach within 30 days of the notice, then the party giving the notice may terminate the Agreement at any time thereafter by giving a written notice of termination.

C. Either party may terminate this IGA at will, effective not less than one (1) year from written notice or at such other date as may be established and agreed upon by both parties.

7. INDEMNIFICATION

Subject to the limitations of the Oregon Constitution and statutes, Portland and Gresham each shall be solely responsible for any loss or injury caused to third parties arising from Portland's or Gresham's own acts or omissions under this Agreement and Portland and Gresham shall defend, hold harmless and indemnify the other party to this agreement with respect to any claims, litigations, or liability arising from Portland's or Gresham's own acts or omissions under this Agreement.

8. FUNDS

Portland and Gresham certify that sufficient funds are available during the 2006/2007 fiscal year and are authorized for expenditure for costs of the Agreement incurred during 2006/2007.

ATTACHMENT A
COLUMBIA SLOUGH MONITORING IGA BETWEEEN THE CITIES OF PORTLAND AND GRESHAM
Sampling Commitments for July 1, 2007

The 2006/2007 monitoring commitments are outlined in Gresham IGA #731 Exhibit A, Section A.

The monitoring plan for fiscal year 2007/2008 includes sampling at a minimum of four (4) sites throughout the waterway. At least two (2) monitoring sites will be in the Upper Columbia Slough. Of the four (4) monitoring sites, three (3) will be monitored to comply with the Columbia Slough TMDL and Portland's NPDES permit. The fourth site will be monitored to comply with Gresham's NPDES permit. During fiscal year 2007/2008, hydrolabs will continue to be employed at three (3) sites. To comply with regulatory requirements, additional E. coli samples will be collected twice per year: during wet season (January) and during dry season (August) four (4) additional times at each location within 30 days of bi-monthly samples.
Constituents that will be monitored either by grab sample or hydrolab include:

Biological Oxygen Demand
Total Suspended Solids
Hardness
Temperature
Dissolved Oxygen
Conductivity
pH
Chlorophyll a
Total Cu, Pb, Hg, Ni, Zn
Dissolved Cu, Pb, Ni, Zn
Ammonia nitrogen
Nitrate nitrogen
Total Kjeldhal Nitrogen
Total phosphorus
Ortho-phosphorus
E. coli

ATTACHMENT B
COLUMBIA SLOUGH MONITORING IGA BETWEEEN THE CITIES OF PORTLAND AND GRESHAM
Reimbursement Determination

As part of the 1999 Intergovernmental Agreement between City of Gresham (Agreement No. 731) and City of Portland (Ordinance No. 173697) the reimbursement calculation was determined. Exhibit B of that Intergovernmental Agreement (IGA) established that the proposed Gresham share be based on the area located within the Columbia Slough watershed based on the NPDES MS4 permits:

Columbia Slough Watershed within:	**Acres**	**Percent of Total**
City of Portland	16,972	90.4
City of Gresham	1,800	9.6
Total	18,772	

Gresham's share is therefore 10% of the total monitoring costs. Gresham's share for 06/07 is $11,872. The following fiscal years will be based on the annual in-stream sampling, hydrolabs, and lab analytical costs for the year that monitoring is performed and shall not exceed more than a 5% increase annually unless the frequency of events or number of constituents changes in accordance with Section 1.A.i.

The monitoring plan for fiscal year 2007/2008 includes sampling at a minimum of four (4) sites throughout the waterway. At least two (2) monitoring sites will be in the Upper Columbia Slough. Of the four (4) monitoring sites, three (3) will be monitored to comply with the Columbia Slough TMDL and an additional site will be monitored to comply with Gresham's NPDES MS4 permit. Therefore, Gresham will reimburse Portland 10% of the total cost for monitoring the three (3) sites and the full cost of monitoring the additional site. The following is a breakdown of approximate costs for fiscal year 2007/2008 based on constituents outlined in Attachment A and current laboratory prices.

	Total Lab Monitoring Costs	**Cost Per Site***	**Gresham Share 10% of 3 sites****	**Gresham Share 100% of 1 site**	**Total Gresham Costs**
Lab Costs	$24,264.00	$4,044.00	$2,022.00	$4,044.00	$6,066.00
Field Ops Costs	$7,560.00	$1,260.00	$630.00	$1,260.00	$1,890.00
Hydrolabs	$36,684.00		$3,668.40		$3,668.40
					$11,624.40

*Includes the field duplicate and rinsate. Cost per site equals the total lab costs divided by six (four sites plus the duplicate and rinsate.)
**Includes three sites plus the field duplicate and rinsate.

Page 2 contains the Exhibit B from the previous IGA, which established the monitoring costs for fiscal year 1999/2000 through 2003/2004.

ORDINANCE No. 181034

Authorize an Intergovernmental Agreement with the City of Gresham to coordinate water quality monitoring of the Columbia Slough (Ordinance)

The City of Portland ordains:

Section 1. The Council finds:

1. The Columbia Slough from the mouth (Willamette River) to Fairview Lake, was placed on the Oregon Department of Environmental Quality's (DEQ) 1994/1996 and 1996/1998 303(d) list of water quality limited, impaired waterbodies.

2. DEQ adopted and the Environmental Protection Agency (EPA) approved a TMDL for multiple pollutants in 1998, and added temperature in 2006 as part of the TMDL for the Lower Willamette.

3. The TMDL waste load allocations are implemented via the National Pollution Discharge Elimination System (NPDES) MS4 permits and industrial stormwater permits. Both Portland and Gresham have been identified by DEQ as designated management agencies (DMA), responsible for compliance with TMDL regulations and implementation of water quality management plans

4. Portland and Gresham's NPDES MS4 permits require water quality monitoring of the Columbia Slough. The Portland MS4 permit requires water quality monitoring in each the upper, middle and lower reach of the Slough. The Gresham MS4 permit requires water quality monitoring at two locations in the upper reach of the Columbia Slough.

5. The Portland Watershed Management Plan (PWMP) was adopted by City Council on March 8, 2006. The purpose of the PWMP is to improve watershed health in all the watersheds of the City, such as the Columbia Slough Watershed. Water quality monitoring and coordination with other jurisdictions is part of the implement of the PWMP.

6. Portland is prepared to conduct water quality monitoring pursuant to the Columbia Slough TMDL and each city's MS4 NPDES permits and Gresham is prepared to reimburse Portland for Gresham's share of monitoring and analytical costs.

7. For fiscal year 2006/2007 Gresham will reimburse Portland for 10% of the total monitoring costs. In fiscal year 2007/2008 Gresham will reimburse Portland 10% of the monitoring costs for three (3) sites and 100% of the monitoring costs for one (1) site located in the upper reach of the Slough.

8. The total cost for fiscal year 2006/2007 is $118,720 of which Gresham's share is $11,872.

NOW, THEREFORE, the council directs:

181034

a. The Director of the Bureau of Environmental Services and Auditor are authorized to execute an intergovernmental agreement with the City of Gresham for the purpose of water quality monitoring and laboratory services.

Passed by the Council, JUN 13 2007
Sam Adams
Commissioner of Public Utilities

[Nancy Hendrickson]
[May 23, 2007]
[145-32-041] - ord

Gary Blackmer

Auditor of the City of Portland
By Susan Parsons
Deputy

Appendix G

City of Portland Water Pollution Control Lab Water Quality Manual

QUALITY MANUAL

for

City of Portland, Oregon
Bureau of Environmental Services

Water Pollution Control Laboratory

6543 N. Burlington Avenue
Portland, Oregon 97203

Name	Function (Unit)	Signature	Date	Contact Information
Charles R. Lytle	Laboratory Director			Ph. 503-823-5568 Charles.Lytle@portlandoregon.gov
Jennifer Shackelford	Quality Manager			Ph. 503-823-5614 Jennifer.Shackelford@portlandoregon.gov
Charles R. Lytle	Technical Manager			Ph. 503-823-5568 Charles.Lytle@portlandoregon.gov

Revision Number:	**7.0**	**Effective Date:**	**June 1, 2013**
Document Number:			

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Section 3

INTRODUCTION AND SCOPE
(TNI V1:M2 – Sections 1,2,3)

The purpose of this *Quality Manual* is to outline the management system for the Water Pollution Control Laboratory (WPCL), a work section within the municipal government of the City of Portland, Oregon (City). The *Quality Manual* defines the policies, procedures, and documentation that assure analytical services continually meet a defined standard of quality that is designed to provide clients with data of known and documented quality and, where applicable, demonstrate regulatory compliance.

The *Quality Manual* sets the standard under which all laboratory operations are performed, including the laboratory's organization, objectives, and operating philosophy. The *Quality Manual* has been prepared to assure compliance with the 2009 TNI Environmental Laboratory Sector Standard – Volume 1 **–** Management and Technical Requirements for Laboratories Performing Environmental Analysis (EL-V1-M1 through M7-ISO-2009). This Standard is consistent with ISO/IEC 17025:2005 requirements that are relevant to the scope of environmental testing services and thus, the laboratory operates a quality system in conformance with ISO/IEC 17025:2005(E). In addition, the policies and procedures outlined are compliant with the general specifications of NPDES and EPA SW-846 analytical requirements.

3.1 Scope of Testing

The laboratory's scope of accredited analytical testing services includes analyses listed in Appendix F.

A full list of analyses performed at WPCL is found in Appendix K. Analyte lists for multi-analyte tests (mainly organics) are available in the LIMS and may be printed upon request.

3.2 Table of Contents, References and Appendices

The Table of Contents is in Section 2 and Appendices follow Section 28.

This *Quality Manual* uses the following referenced documents:

References included in Modules 1, 2, 4, and 5 in the 2009 TNI Environmental Laboratory Sector Standard – Volume 1 – Management and Technical Requirements for Laboratories Performing Environmental Analysis.

Standard Methods for the Examination of Water and Wastewater (Online Edition). APHA, AWWA, WEF

40 CFR Pt. 136 (2012)

Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (SW-846 3rd Edition). U.S. EPA, Office of Solid Waste.

3.3 Glossary and Acronyms Used

3.3.1 Glossary

This laboratory adopts the definitions found in the *Terms and Definitions* sections of Modules 1-7 in the 2009 TNI Environmental Laboratory Sector Standard – Volume 1 – Management and Technical Requirements for Laboratories Performing Environmental Analysis. Additional and alternative terms (e.g., LOD / MDL) are also used in this document and in WPCL SOPs, as listed in Appendix E, *Glossary/Definitions*.

3.3.2 Acronyms

Acronyms used in this document and in WPCL SOPs are listed and defined in Appendix D.

3.4 Management of the *Quality Manual*

The Quality Manager is responsible for maintaining the currency of the *Quality Manual*.

The *Quality Manual* is reviewed annually by the Quality Manager and laboratory personnel to ensure it still reflects current practices and meets the requirements of any applicable regulations or client specifications. It may be reviewed and modified more frequently if procedural changes warrant it. Sections of the manual are updated by making a change to the Section and then increasing the revision number by one. The cover sheet of the *Quality Manual* (Section 1) must be re-signed and the Table of Contents (Section 2) is updated whenever a Section is updated. The QA Coordinator prepares a written summary report of changes. This report is forwarded to the Laboratory Manager and reviewed with all staff. A copy is archived in the common S-drive.

The *Quality Manual* may not be altered in any way except by approval of the Laboratory Director and Quality Manager. If it is distributed to external users, it is for the purpose of reviewing WPCL's management system and may not be used for any other purpose without written permission.

Section 4

ORGANIZATION
(TNI V1:M2 – Section 4.1)

The Water Pollution Control Laboratory (WPCL) is a legally identifiable organization operating within the city of Portland, Oregon. The laboratory is responsible for carrying out testing activities that meet the requirements of the TNI Standard, the ISO/IEC 17025 Standard, and that meet the needs of the client. Through application of the policies and procedures outlined in this Section and throughout the *Quality Manual*:

- The laboratory assures that it is impartial and that personnel are free from undue commercial, financial, or other undue pressures that might influence their technical judgment.

- Management and technical personnel have the authority and resources to carry out their duties and have procedures to identify and correct departures from the laboratory's management system.

- Personnel understand the relevance and importance of their duties as related to the maintenance of the laboratory's management system.

- Ethics and data integrity procedures (see Appendix A, Section 5*, Management,* and Section 19, *Data Integrity Investigations*) ensure personnel do not engage in activities that diminish confidence in the laboratory's capabilities.

- Though WPCL data is generally considered public record, data generated for other municipalities is considered confidential and must be accessed through those municipalities.

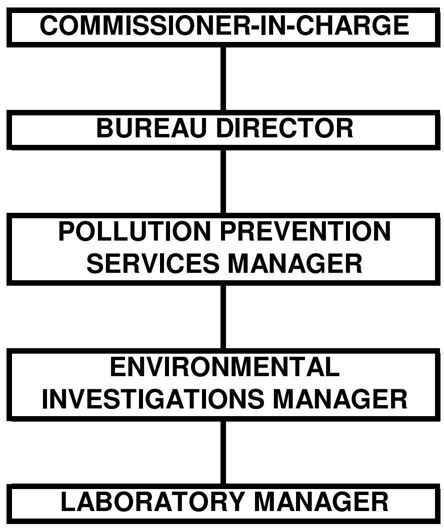
4.1 Organization

The WPCL operates as part of the City of Portland, Bureau of Environmental Services and functions as an "in-house" lab for the Bureau. It also accepts samples on a commercial basis from other Oregon municipalities under Inter-government Agreements (IGAs). The WPCL analyzes water, wastewater, and solids for the various missions of the Bureau and outside clients. The lab analyzes samples for compliance with the Clean Water Act, the Resource Conservation and Recovery Act, and any other applicable EPA or Oregon rules for which the lab has capacity. The Laboratory is responsible for carrying out its environmental testing activities in accordance with the Quality Manual and established Quality Systems so as to meet the requirements of current TNI Standards and of 40 CFR 136 and to satisfy the needs of its clients and appropriate regulatory authorities. The WPCL is not part of a larger organization that may have conflicting interests such as production, commercial marketing or financing. The laboratory is free from influence that may adversely affect the lab's ability to produce data of the highest integrity.

The laboratory functions as a Section of the Environmental Investigations Division of the Pollution Prevention Services Group within the City's Bureau of Environmental

Services. The laboratory work group is responsible for generating, validating, and approving data from the analysis of water, wastewater, and solids. The overall organizational chart is provided in Figure 4-1. The laboratory organizational chart is provided in Appendix B.

Figure 4-1: City of Portland Organizational Hierarchy



Additional information regarding responsibilities, authorities, and interrelationship of personnel who manage, perform or verify testing is included in Section 5*, Management* and Section 20*, Personnel.* These Sections also include information on supervision, training, technical management, job descriptions, quality personnel, and appointment of deputies for key managerial personnel.

The WPCL staff includes: a manager, a production coordinator, a QA coordinator, a technical coordinator, analytical specialists, and analysts. The WPCL operates 7/365. Weekdays, the laboratory operates a single, staggered shift, with staff on site from 6:30 AM until 6:45 PM. There is a two-person shift Saturdays and Sundays. There is extensive cross training within the Metals, Organics, Nutrients, and Process Control Sections. In addition, all Analysts are cross-trained for the basic operations of the Microbiology Section.

The laboratory has the resources and authority to operate a management system that is capable of identifying departures from that system and from procedures during testing, and initiates actions to minimize or prevent departures.

4.2 Conflict of Interest and Undue Pressure

The organizational structure indicated above minimizes the potential for conflicting or undue interests that might influence the technical judgment of analytical personnel. In addition, procedures are in place to prevent outside pressures or involvement in activities that may affect competence, impartiality, judgment, operational integrity, or the quality of the work performed at the laboratory.

Arrangements, such as policies and procedures to prevent commercial, financial or other influences that may negatively affect the quality of the work or negatively reflect on the competence, impartiality, judgment or operational integrity are described in the Ethics and Data Integrity Policy in Appendix A.

Section 5

MANAGEMENT
(TNI V1:M2 – Section 4.2)

The laboratory maintains a management system that is appropriate to the scope of its activities.

5.1 Management Requirements

The City of Portland Water Pollution Control Laboratory (WPCL) is in the Environmental Investigations Division of the Pollution Prevention Services Group of the Bureau of Environmental Services. The Division and Group managers support the Laboratory Manager but are not directly involved in compliance with ORELAP or TNI standards. Top management of the WPCL includes the Laboratory and Investigation & Monitoring Systems Managers and the Laboratory Production, Technical, and QA Coordinators. Because all lab staff under the Manager are represented and work under a collective bargaining agreement (CBA), the Laboratory Coordinators technically cannot be called managers or supervisors. However, their work includes the administration of work processes and quality assurance/quality control throughout laboratory operations. Also, designated Technical Directors except the Laboratory Manager cannot be called directors per se and are referred to in this Quality Manual as Technical Leads, which at least has a precedence in the CBA as "Lead Workers." For the sake of brevity only, managers and coordinators will be referred to in this section as managers or collectively as management.

Management's commitment to good professional practice and to the quality of its products is defined in Section 5.3*, Quality Policy Statement*.

Management has overall responsibility for the technical operations and the authority needed to generate the required quality of laboratory operations. Management ensures communication within the organization to maintain an effective management system and to communicate the importance of meeting customer, statutory, and regulatory requirements. Management assures that the system documentation is known and available so that appropriate personnel can implement their part. When changes to the management system occur or are planned, managers ensure that the integrity of the system is maintained.

Management is responsible for carrying out testing activities that meet the requirements of the TNI Standard, the ISO/IEC 17025 Standard, and that meet the needs of the client.

Managers implement, maintain, and improve the management system, and identify noncompliance with the management system of procedures. Managers initiate actions to prevent or minimize noncompliance.

Management ensures technical competence of personnel operating equipment, performing tests, evaluating results, or signing reports, and limits authority to perform laboratory functions to those appropriately trained and/or supervised. The

City of Portland WPCL seeks to hire persons who are well trained and qualified for their positions and responsibilities. All personnel requirements as per current TNI Standards, NELAC (National Environmental Laboratory Accreditation Conference) standards, and ORELAP (Oregon Environmental Laboratory Accreditation Program) standards are met or exceeded. All employees receive extensive on-the-job training in the specific methods used by the laboratory, and in the specific requirements of the Quality Manual. Personnel are not compensated to pass Quality Control tests or to test more samples than is normally expected in a given period of time. Laboratory personnel are impartial and are free from any undue commercial, financial and other pressures that may influence technical judgment.

Education and expected knowledge, skills, and abilities for each of the five laboratory staff classifications are detailed on the City's Bureau of Human Resources website under "Classification Specifications."

Training requirements are detailed in *Section 20, Personnel* of this QA Manual.

All WPCL laboratory staff meet or exceed the personnel requirements of Section 5.2.1 of the TNI 2009 Standard. Adequate supervision is provided to staff by persons familiar with the methods, procedures, and the purpose of each analytical test. See Section 20, *Personnel*. The Laboratory Manager acts as the Technical Director with overall responsibility for the technical operation and the provision of resources needed to ensure the required quality of laboratory operations. The Laboratory Manager certifies that personnel with the appropriate educational and technical background are hired and are allowed to perform the tests for which the laboratory has ORELAP accreditation. The certification for each analyst is documented in the Initial Demonstration of Competency forms in individual personnel files.

The Laboratory Production Coordinator acts as the Quality Assurance (QA) Coordinator during the absence of the QA Coordinator, and vice versa. Any of the three Lab Coordinators may act as the Laboratory Manager during the absence of the Laboratory Manager for more than five days. If any two positions are absent at the same time, the remaining two cover for the absences. If any three positions are absent at one time, the remaining position covers all duties. This is unlikely to occur for more than one or two days. See *Section 4, Organization* for an organizational chart.

Training is kept up to date as described in Section 20, *Personnel* by periodic review of training records and through employee performance review.

Management has specific responsibility for maintenance of the management system. This includes defining roles and responsibilities to personnel, approving documents, providing required training, providing a procedure for confidential reporting of data integrity issues, and periodically reviewing data, procedures, and documentation. The assignment of responsibilities, authorities, and interrelationships of the personnel who manage, perform, or verify work affecting the quality of environmental tests is documented in Section 20, *Personnel*. Management ensures that audit findings and corrective actions are completed within required time frames.

5.2 Management Roles and Responsibilities

5.2.1 <u>Laboratory Manager, Laboratory Director, Technical Director</u>

The Laboratory Manager serves as both the Laboratory Director and Technical Director. This position will be referred to as the Laboratory Manager and will include the position of Laboratory Director and Technical Director. If the Laboratory Manager is absent for five (5) or more work days, a deputy (see Table 5-1 below) with appropriate qualifications will perform the Technical Manager's duties. Beyond a thirty-five (35) calendar day absence, management will notify the primary accreditation body in writing of the absence of the Technical Director and the appointment of the deputy. The Laboratory Manager does not serve as the Technical Director of any other accredited environmental laboratory.

The Laboratory Director/Laboratory Manager/Technical Director is qualified as the Laboratory Director under current TNI standards and ORELAP and is responsible for the following activities:

5.2.1.1 Responsibilities

a. the operation and management oversight of the laboratory
b. technical supervision of the laboratory
c. monitoring performance data and the validity of laboratory analyses
d. responsible for contacting Regulatory Compliance or the State for departure issues
e. ensuring the laboratory has the resources and personnel necessary to carry out the duties required so as to meet the goals of the Quality Assurance Plan
f. ensuring that people with the required skills are hired, and that all lab staff have demonstrated capability in the activities for which they are responsible
g. supervising all personnel employed within the laboratory work group.
h. leading the efforts of the laboratory work group in providing support services as needed to other Bureau work groups and outside agencies
i. investigating complaints from internal and external customers that are related to water quality data and lab operations. Complaints are handled on a case-by-case basis, and stakeholder identification and formal problem-solving procedures are used where appropriate.
j. technical supervision of the Chemistry, Organic, and Microbiology work areas
k. annual Management Audit
l. management of laboratory records
m. ensuring that personnel are free from any commercial, financial and other undue pressures that might adversely affect the quality of their work.
n. reviews and approves all SOPs and policies prior to their implementation and ensures all approved SOPs and policies are provided to laboratory personnel and are adhered to.

The Laboratory Manager provides the resources necessary to implement and maintain an effective quality and data integrity program.

5.2.2 <u>Laboratory Quality Assurance Coordinator, Laboratory Quality Assurance Officer</u>

The Laboratory Quality Assurance (QA) Coordinator is the Laboratory Quality Assurance Officer and is responsible for the oversight and review of quality control data, but is independent from laboratory operations. See Section 4, *Organization* and the laboratory organizational chart in Appendix B. The QA Coordinator's training and proof of experience in QA/QC procedures, knowledge of analytical methods, and the laboratory's management system are available in the Lab Manager's Office in the personnel files and in the training records. The QA Coordinator is responsible for ensuring that the quality system requirements are implemented and followed at all times. The QA Coordinator has general knowledge of the analytical test methods for which data review is performed. See Section 20, *Personnel*.

5.2.2.1 Responsibilities

a. serves as a focal point for QA/QC and is responsible for the oversight and/or review of quality control data
b. arranges and conducts annual internal audits, reviews data objectively, and performs assessments without outside (e.g., managerial) influence
c. notifies management of deficiencies, and monitors corrective actions;
d. oversight and review of quality control data
e. final approval of all samples analyzed by laboratory staff, as tracked electronically in the LIMS and/or in logbooks and as indicated by the Coordinator's signature on official copies of raw data to be archived
f. facilitates the maintenance of raw data archives
g. approves the results of PT samples and submitting the results to the PT provider and to ORELAP
h. reviews all new laboratory work and ensures that the work is not undertaken unless the appropriate facilities and resources are available
i. arranges for and conducts internal audits annually and as needed
j. monitors corrective actions, audits and reviews
k. ensures that management system components related to quality are implemented and followed at all times
l. monitors and maintains laboratory certifications
m. maintains training records for DOC
n. reviews and approves all SOPs and policies prior to their implementation and ensures all approved SOPs and policies are provided to laboratory personnel and are adhered to
o. documents training and /or experience in QA/QC procedures and is knowledgeable in the quality system as defined under current TNI standards
p. has general knowledge of the analytical/microbiological test methods for which data review is performed
q. ensures compliance with current TNI standards, 40 CFR 136, and Standard Methods
r. keeps the *Quality Manual* current.

The Laboratory Quality Assurance Coordinator has the responsibility for ensuring that the quality system requirements are implemented and followed at all times and has direct access to the highest level of management at all times.

5.2.3 Laboratory Key Personnel Deputies

Table 5-1 defines WPCL titles, staff, and deputies for all TNI management positions.

TABLE 5-1 WPCL KEY PERSONNEL AND DEPUTIES			
TNI TITLE	WPCL TITLE	WPCL STAFF	WPCL DEPUTY
Laboratory Director	Laboratory Manager	Laboratory Manager	Production or QA Coordinator
Laboratory Manager	Laboratory Manager	Laboratory Manager	Production or QA Coordinator
Technical Director	Lab Manager/Tech. Coord.	Lab Manager/Tech. Coord.	QA or Production Coordinator
---	Production Coordinator	Production Coordinator	QA Coordinator
Quality Manager	QA Coordinator	QA Coordinator	Production Coordinator

5.3 Quality Policy

Management's commitment to quality and to the management system is stated in the Quality Policy below, which is upheld through the application of related policies and procedures described in the laboratory's *Quality Manual*, SOPs, and policies.

The objective of the management system and the commitment of management is to consistently provide our customers with data of known and documented quality that meets their requirements. Our policy is to use good professional practices, to maintain quality, to uphold the highest quality of service, and to comply with the TNI Standard. The laboratory ensures that personnel are free from any commercial, financial, and other undue pressures, which might adversely affect the quality of work. This policy is implemented and enforced through the unequivocal commitment of management, at all levels, to the Quality Assurance (QA) principles and practices outlined in this manual. However, the primary responsibility for quality rests with each individual within the laboratory organization. Every laboratory employee must ensure that the generation and reporting of quality analytical data is a fundamental priority. Every laboratory employee is required to familiarize themselves with the quality documentation and to implement the policies and procedures in their work. All employees are trained annually on ethical principles and procedures surrounding the data that is generated. The laboratory maintains a strict policy of client confidentiality.

5.4 Ethics and Data Integrity System

The WPCL has an ethics and data integrity policy that is provided in Appendix A. The laboratory's ethics and data integrity program, training, and investigation procedures are discussed in Section 19, *Data Integrity Investigations*.

5.5 Documentation of Management/Quality System

The management system is defined through the policies and procedures provided in this *Quality Manual* and written laboratory Standard Operating Procedures (SOPs) and policies.

5.5.1 <u>Standard Operating Procedures (SOPs)</u>

Standard operating procedures (SOPs) represent all phases of current laboratory operations (they include an effective date, revision number, and signature of the approving authorities as detailed in the WPCL SOP QAQC-03.03, Preparation, Implementation, and Control of Standard Operating Procedures) and are available to all personnel. They contain sufficient detail such that someone with similar qualifications could perform the procedures. There are two types of SOPs used in the laboratory: (1) test method SOPs, which have specific requirements as outlined below; and (2) general use SOPs which document general procedures.

Each accredited analyte or method has an SOP. Sometimes an SOP is a copy of a method, and any additions are clearly described. The laboratory's test method SOPs include the following topics, where applicable:

i. identification of the method;
ii. applicable matrix or matrices;
iii. limits of detection and quantitation;
iv. scope and application, including parameters to be analyzed;
v. summary of the method;
vi. definitions;
vii. interferences;
viii. safety;
ix. equipment and supplies;
x. reagents and standards;
xi. sample collection, preservation, shipment and storage;
xii. quality control;
xiii. calibration and standardization;
xiv. procedure;
xv. data analysis and calculations;
xvi. method performance;
xvii. pollution prevention;
xviii. data assessment and acceptance criteria for quality control measures;
xix. corrective actions for out-of-control data;
xx. contingencies for handling out-of-control or unacceptable data;
xxi. waste management;
xxii. references; and
xxiii. any tables, diagrams, flowcharts and validation data.

5.5.2 Order of Precedence

In the event of a conflict or discrepancy between policies, the order of precedence is as follows unless otherwise noted:

1) Quality Manual
2) SOPs and Policy Statements
3) Other (Work Instructions, memos, flow charts, etc.).
4) Reference standards

Section 6

DOCUMENT CONTROL
(TNI V1:M2 – Section 4.3)

This Section describes how the laboratory establishes and maintains a process for document management. Procedures for document management include controlling, distributing, reviewing, and accepting modifications. The purpose of document management is to preclude the use of invalid and/or obsolete documents.

Documents can be SOPs, policy statements, specifications, calibration tables, charts, textbooks, posters, notices, memoranda, software, drawings, plans, etc. These may be on various media, whether hard copy or electronic, and they may be digital, analog, photographic, or written. Note that documents are most often statements, requirements, or explanations. Records are most often logs or tables of data or observations, such as refrigerator temperature tables and control charts.

The laboratory manages three types of documents: 1) controlled, 2) approved, and 3) obsolete.

A controlled document is one that is uniquely identified, issued, tracked, and kept current as part of the management system. Controlled documents may be internal documents or external documents.

An approved document means it has been reviewed, and either signed and dated, or acknowledged in writing or by secure electronic means by the issuing authority(ies).

Obsolete documents are documents that have been superseded by more recent versions or are no longer needed.

6.1 Controlled Documents – Standard Operating Procedures

The Water Pollution Control Laboratory procedures for control standard operating procedures (SOPs) are detailed in WPCL SOP QAQC-03. This SOP details WPCL procedures for all four requirements of Section 4.3 of V1:M2 of the 2009 TNI Standard.

6.2 Approved Documents – Policy Statements

Current WPCL policies can be found at GROUP 100 (\\OBERON) S:\LAB\Policy Statements.

6.3 Obsolete Documents

All invalid or obsolete documents are removed from general distribution, or otherwise prevented from unintended use.

Obsolete documents are identified as being obsolete by management. All copies of the obsolete document are collected from employees and clearly marked "Obsolete" (or otherwise out of use) on the first page or destroyed. At least one copy of any retained obsolete document is kept in Room 129 on the main floor of the office portion of the WPCL. This room has restricted access, and only the Laboratory Manager, QA Coordinator, and Production Coordinator have keys. Retention is as required by regulations or clients.

Section 7

REVIEW OF REQUESTS, TENDERS AND CONTRACTS
(TNI V1:M2 – Section 4.4)

The review of all new work assures that oversight is provided so that requirements are clearly defined, the laboratory has adequate resources and capability, and the test method is applicable to the customer's needs. This process assures that all work will be given adequate attention without shortcuts that may compromise data quality.

Contracts for new work may be formal bids, signed documents, verbal, or electronic. The client's requirements, including the methods to be used, must be clearly defined, documented and understood. Requirements might include target analyte lists, project specific reporting limits (if any), project specific quality control requirements (if any), turnaround time, and requirements for data deliverables. The review must also cover any work that will be subcontracted by the laboratory.

7.1 Procedure for the Review of Work Requests

7.1.1 Investigations & Monitoring Services (IMS) Section

All new work coming to the WPCL is managed by the IMS Section. Work may come from three sources: internal to the Bureau of Environmental Services (BES), other bureaus within the city, or other municipalities. Work for other municipalities is done under formal Intergovernmental Agreements (IGAs). See Section 7.1.5, below. All aspects of setting up, reviewing, and administering new work are delineated in formal documents written as part of the responsibility matrix prepared as part of the implementation of the Laboratory Information Management System (LIMS).

7.1.2 LIMS Responsibility Matrix

The LIMS Responsibility Matrix documents are available on the BES network at

\\oberon\LIMS_Element\Responsibility_Matrix.

The S-drive is labeled on the MS Windows My Computer screen as

Grp100 on 'Oberon' (S:).

The Responsibility_Matrix folder contains flow charts, a table of responsibilities for key staff, a table of definitions, a spread sheet of all business practices organized to follow work flow throughout the enterprise, and finally a set of detailed procedures for each practice.

7.1.3 Responsibility Matrix Documentation

Individual documents relevant to this section include:

- Clients

- Project[s] and Samples
- Work Requests
- Analyses and Analytes
- Sample Log-in and Work Orders.

Documents cover the following topics:

- Lab capability to do the work
- Liaison with the WPCL contract laboratory
- Point of contact for client communication
- Detection limit issues (see also 7.1.4, below)
- Method appropriateness (see also 7.1.4, below)
- Review of project specifics with client.

Each document contains an introduction, a table of tasks and responsibilities (including a backup person for each task), an attestation that named staff must follow the business practice, and detailed step-by-step procedures. Also included are relevant computer screen shots and examples of all forms, with detailed instructions on how data are entered into the LIMS and how forms are to be filled out. Where appropriate, tables detail: work element type; who generates the document; who reviews the document; who distributes the document; distribution list; who is responsible for document format.

7.1.4 Method Selection and Non-Routine Analyses

The WPCL QA Coordinator is the technical resource for these two issues and is also the contact person for issues involving detection limits. QA Coordinator involvement occurs at the earliest stages of the work request process and can involve both the IMS project manager and the client. The work flow details are in WPCL Policy Statement #12 – Method Appropriateness.

WPCL policy statements are available on the BES network at

S:\LAB\Policy Statements.

The S-drive is labeled on the MS Windows My Computer screen as

Grp100 on 'Oberon' (S:).

7.1.5 Intergovernmental Agreements (IGAs)

All IGAs are written and administered by the manager of the IMS section in consultation with and under the review of the BES Contract Development and Review Administrator, who retains the original, signed document. The various steps in developing an IGA, including forms, dollar thresholds, and required concurrences, are detailed in city codes and guidance documents available on the city Procurement Services website. After all documents are signed, a copy is kept by the IMS manager, and the work set-up process is begun.

7.2 Documentation of Review

Records are maintained for every contract or work request, when appropriate. This includes pertinent discussions with a client relating to the client's requirements or the results of the work during the period of execution of the contract. All records are maintained and filed by the IMS Section, including records of all project-related communication with the client.

Section 8

SUBCONTRACTING OF ENVIRONMENTAL TESTS
(TNI V1:M2 – Section 4.5)

A contract or subcontract laboratory is defined as a laboratory that is external to and performs analyses for the City of Portland Water Pollution Control Laboratory (WPCL). Note that all work sent outside by the WPCL is brokered to or through a single primary laboratory. This primary laboratory may further subcontract specialty analyses, either because the primary laboratory does not have the capability or because WPCL clients require a laboratory other than the primary lab. For the purposes of clarity in this QA Manual, the primary laboratory will be called the **contract lab**, and any other laboratory will be called a **subcontract lab**.

At the WPCL, ongoing contracted and subcontracted work is managed by the Investigations & Monitoring Section (IMS) of the Bureau of Environmental Services in consultation with the Laboratory Manager and QA Coordinator. Responsibilities include: primary contact with the subcontract laboratory project manager for WPCL; communications regarding turnaround times, report production, difficult matrices, and any other issues impacting work flow or data quality; billing, including late charges or fast turnaround surcharges; issues involving subcontracting by the primary contract laboratory for specialty analyses, such as dioxins/furans and PCB congeners.

When contracting analytical services, the IMS Manager and the WPCL Laboratory Manager work together to assure that work requiring accreditation is placed with an appropriately accredited laboratory or one that meets applicable statutory and regulatory requirements for performing the tests.

8.1 Procedure

The IMS Manager maintains a list of contractors subcontractors and copies of the current certificates and analyte lists as evidence of compliance. Certificate and analyte lists are reviewed by the IMS Manager and the WPCL QA Coordinator to ensure the contracting and subcontracting laboratories have the appropriate accreditation to do the work.

The Laboratory Manager, in consultation with the IMS Manager, has the responsibility and authority to review subcontracting requests according to City of Portland purchasing requirements. When awarding contracts for environmental testing, the Laboratory Manager, in consultation with the QA Coordinator and IMS Manager, determines that the requirements, including the methods used, are adequately defined, documented and understood. The Laboratory Manager, in consultation with the QA Coordinator and IMS Manager, determines if the contract laboratory has the resources and capability to meet the defined requirements and is ORELAP accredited, where required. The purpose of this review is to determine if the laboratory possesses the necessary physical, personnel and information resources to perform the environmental tests and/or calibrations requested. The review includes results of earlier participation of interlaboratory comparisons and proficiency testing results as well as the current accreditation status of the laboratory.

When the WPCL contracts for new, project-specific laboratory work, it is with the request and agreement of the Project Manager for the particular sampling project. The laboratory performing the contracted work is indicated in all applicable sample results reports, and any non-ORELAP accredited work is clearly identified. E-mail records documenting the contracted work are stored in the IMS Manager's files by project and are retained indefinitely.

The IMS Manager maintains a register of all subcontractors it uses for environmental testing and calibration with a record of evidence of ORELAP compliance. The laboratory performing the contracted work is identified in all applicable sample results reports. The contracted laboratory assumes responsibility to the WPCL for their work, except in the case where a Project Manager has specified a particular subcontractor for specialty work.

8.2 Approval of Contract and Subcontract Laboratories

The contract with the primary commercial laboratory is established using the requirements as put forth by the City of Portland's Bureau of Purchasing. An extensive Request for Proposal document is written by the Laboratory Manager that describes the nature of the contracted work, including expected volume of work, any required methods and quality assurance requirements, and any requirements for accreditation to perform the work. The request for proposal (RFP) requires proposing labs have available, if required, copies of their quality manual, standard operating procedures, any proficiency testing results, accreditations, a statement of lab and staff qualifications, and a list the methods used for all work performed.

The City of Portland's Bureau of Purchasing officially makes the RFP available to commercial laboratories. Interested commercial laboratories must provide a written proposal by the specified date. All proposals that are not received by the specified date and time are rejected and the laboratory is notified. All proposals that don't meet the stated requirements of the RFP are also rejected.

The proposals are received by the City of Portland Bureau of Purchasing and distributed to a panel to be reviewed and evaluated. The panel includes the Laboratory and IMS Managers, the QA and Production Coordinators, and by City purchasing requirements, a qualified person who is not employed by the City. Panel members review, evaluate, and score the proposals independently, and the results are compiled. A short list is created of the most qualified labs, and each lab on the short list is visited by the panel. The contract is awarded based on the panel's results and on evaluation criteria that were included in the original RFP. Cost of performing the work is an element of the review, but is not the only determining factor in awarding the contract. The contract is awarded to the commercial laboratory that best meets the requirements of the Request for Proposal, and meets all of the quality assurance and accreditation requirements. The final contract with the commercial laboratory is negotiated and established by the bureau's purchasing personnel and the Laboratory Manager.

The contract with the primary commercial laboratory is typically established for a period of three years with two additional option years. The City of Portland requires that contracts do not exceed five years in duration.

During the duration of the contract, the Laboratory Manager, in consultation with the QA Coordinator and IMS Manager, continues to ensure that the contracted lab consistently meets the required quality assurance and accreditation requirements. Contracts may be terminated at the discretion of the WPCL as per the terms of the contract and City of Portland Purchasing rules.

Section 9

PURCHASING SERVICES AND SUPPLIES
(TNI V1:M2 – Section 4.6)

The laboratory ensures that purchased supplies and services that affect the quality of environmental tests are of the required or specified quality, by using approved suppliers and products.

The laboratory has procedures for purchasing, receiving, and storage of supplies that affect the quality of environmental tests.

9.1 Procedure

9.1.1 Non-Capital (<$5,000) Equipment and Supplies

All purchase requests are done in writing on the Bureau Request For Materials or Service form. All requests are reviewed for technical and business appropriateness and then approved by the Laboratory Manager or the Acting Laboratory Manager. Signed request forms are turned in to the Stores Acquisition Specialist assigned to the WPCL facility.

Evaluation of suppliers and supplies occurs by laboratory staff before making the request using the requirements of particular SOPs or the agency methods themselves (EPA, SM, etc.). Note that for many procedures, WPCL staff have conducted in-house studies to determine best materials and/or suppliers.

Evaluation of suppliers is accomplished by ensuring the supplier ships the product or material ordered and that the material is of the appropriate quality by signing packing slips or other supply receipt documents. The purchasing documents contain the data that adequately describes the services and supplies ordered. The description may include type, class, grade, identification, specifications or other technical information.

WPCL Policy Statements 021*, Non-Capital Purchasing*, and 022*, Documentation of Reagents, Standards, and Minor Equipment,* cover all aspects of ordering and receiving of all supplies (chemicals, labware, small equipment) under $5,000.00. Included are individual policies for: fitness for purpose; approved vendors; approvals and reviews; ordering; order tracking; receipt at WPCL; inspection of all goods; distribution of goods ordered and appropriate paperwork; filing of documentation. Included are special requirements such as immediate refrigeration, hazardous materials, and other issues such as short expiration dates of some standards.

Purchased supplies and reagents that affect the quality of the tests are not used until they are inspected or otherwise verified as complying with requirements defined in the test method.

9.1.2 Capital Equipment (>$5,000)

The purchase of capital equipment follows strict city of Portland purchasing procedures as detailed in Procurement Services Bureau documents and procedural guidelines, which may be accessed on the city's website for the Office of Management and Finance under "Procurement Services."

All capital purchases are under the direction of the Laboratory Manager, who is the lead for all of the many steps involved. Appropriate lab staff participate in vendor presentations and follow-up Q&A sessions and are consulted for technical specifications and requirements. They also may be involved in the writing of technical statements of work that are incorporated into formal solicitation documents.

9.1.3 Services

The WPCL currently has annual maintenance agreements (contracts) for many instruments and pieces of equipment, the house water purification system, and the laboratory information management system (LIMS). These contracts are off-the-shelf packages provided by the manufacturers and are administered by the Laboratory Manager following city Procurement Services documents and procedural guidelines. The packages include guaranteed call-back and on-site response times, detailed provisions of services and materials covered, and warrantees of equipment return to fitness-of-purpose.

The annual calibration of balances, weights, and thermometers is covered on a purchase order basis with a local metrology company. Specifications for this work are covered in Sections 23 and 24 of the QA Manual.

9.2 Approval of Suppliers

The Stores Acquisition Specialist maintains a list of approved suppliers.

Evaluation and selection of suppliers and vendors is performed, in part, on the basis of the quality of their products (as assessed against method- or WPCL-specific requirements), their ability to meet the demand for their products, the overall quality of their services, their past history, and competitive pricing. This is achieved through evaluation of objective evidence of quality furnished by the supplier, which can include certificates of analysis, recommendations, or proof of historical compliance with similar programs for other municipal labs. To ensure that quality, critical consumables and equipment conform to specified requirements, all purchases from specific vendors are approved by the Laboratory Manager or Acting Laboratory Manager.

Section 10

SERVICE TO THE CLIENT
(TNI V1:M2 – Section 4.7)

The Water Pollution Control Laboratory (WPCL) collaborates with customers in clarifying their requests and in monitoring laboratory performance related to their work. Each request is reviewed to determine the nature of the request and the laboratory's ability to comply with the request within the confines of prevailing statutes and/or regulations without risk to the confidentiality of other clients.

The WPCL has three types of clients: internal to the Bureau of Environmental Services, within the city of Portland but outside the Bureau, and other municipalities. The majority of the work is within the Bureau.

10.1 Client Confidentiality

The laboratory confidentiality policy is to not divulge or release any information to a third party without proper authorization.

All electronic data (storage or transmissions) are kept confidential, based on technology and laboratory limitations, as required by client or regulation.

The WPCL is part of the Bureau of Environmental Services of the city of Portland, a public agency. The city is thus required by law to comply with applicable public records laws and administrative rules and must provide data and records pertaining to work done for the city of Portland via official public record requests in accordance with those laws and rules. All laboratory data and reports for other municipalities are the property of those municipalities, and requests for such data and reports are referred to the municipalities.

10.2 Client Support

Communication with the client, or their representative, is maintained to provide proper instruction and modification for testing. Technical staff is available to discuss any technical questions or concerns the client may have.

The client, or their representative, may be provided reasonable access to laboratory areas for witnessing testing.

Delays or major deviations to the testing are communicated to the client immediately by either the QA or Production Coordinators (wastewater treatment plants, biosolids program, industrial pretreatment) or by Investigation & Monitoring Services (IMS) staff (other Bureau and city workgroups and other municipalities).

The laboratory provides clients with all requested information pertaining to the analysis of their samples.

10.3 Client Feedback

The laboratory seeks both negative and positive feedback following the completion of projects and periodically for ongoing projects. Feedback provides acknowledgement, corrective actions where necessary, and opportunities for continuous improvement.

Negative customer feedback is documented as a customer complaint (see Section 11 – "Complaints").

The WPCL has historically not formally queried clients for feedback but has relied on close and frequent communication either directly by the QA and Production Coordinators (treatment plants, industrial pretreatment program, biosolids program) or by project managers in the IMS Section. Problems and their resolutions are accomplished by either telephone or emails.

Section 11

COMPLAINTS
(TNI V1:M2 – Section 4.8)

The purpose of this Section is to assure that customer complaints are addressed and corrected. This includes requests to verify results or analytical data. Complaints provide the laboratory an opportunity to improve laboratory operation and client satisfaction.

Complaints may be received from clients within the Bureau of Environmental Services, from other bureaus within the city, or from outside municipalities, as described in *Section 10, Service to Clients.* Complaints by customers or other parties are reviewed by either the QA or Production Coordinators (wastewater treatment plants, biosolids program, industrial pretreatment) or by Investigation & Monitoring Services (IMS) staff (other Bureau and city workgroups and other municipalities) and an appropriate action is determined. All customer complaints are documented by the person receiving the complaint and are resolved in consultation with the responsible manager.

If it is determined that the complaint has merit, the procedures outlined in *Section 14, Corrective Actions* are utilized. If it is determined that a complaint is without merit, it is documented, and the client is contacted by either one of the laboratory Coordinators or the appropriate IMS staff member.

A complaint such as a concern that data are repeatedly late is reviewed for preventive action to minimize a future occurrence. (See Section 15*, Preventive Action*.)

Section 12

CONTROL OF NON-CONFORMING ENVIRONMENTAL TESTING WORK
(TNI V1:M2 – Section 4.9)

Non-conforming work is work that does not meet acceptance criteria or requirements. Nonconformances can include departures from standard operating procedures or test methods or unacceptable quality control results. (See Section 27, *Quality Assurance for Environmental Testing*.) Identification of non-conforming work can come through customer complaints, quality control, instrument calibration, evaluating consumable materials, staff observation, final report review, management reviews, and internal and external audits.

12.1 Exceptionally Permitting Departures from Documented Policies and Procedures

Requests for departures from laboratory procedures are approved by the QA Coordinator and documented. They are documented by hand-written comments and/or notations in the LIMS. The QA Coordinator initials these comments and may add other explanatory notes which are kept with the data. The client is notified in a case narrative or by using a date qualifier on the laboratory report. Planned departures from procedures or policies do not require audits or investigations.

Examples of permitted departures from policy or methodology include:

Using a non-validated method for estimated results if requested by the client. There must be a reasonable expectation that the customer understands the potential effect on data quality and data usability.

Using a smaller sample volume when method-specified sample volume is not available.

Analysis after holding time is limited to situations where the results are unlikely to be affected, or when the client has already indicated that such analysis should proceed.

12.2 Non-Conforming Work

The lab policy for control of non-conforming work is to identify the non-conformance, determine if it will be permitted, and take appropriate action. All employees have the authority to stop work on samples when any aspect of the process does not conform to laboratory requirements.

The responsibilities and authorities for the management of non-conforming work rest with the QA Coordinator. Corrective action for routine, non-recurring exceedances can be documented on raw data worksheets, logbooks, data print-outs and/or as comments in the LIMS. More serious cases of non-conforming work require a more formal corrective action process that usually includes the use of a corrective action report. The procedure for investigating and taking appropriate corrective actions of non-conforming work are described in Section 14, *Corrective Actions.* Section 14.3 describes procedures for Technical Corrective Actions. Formal corrective action procedures must be followed for non-conforming work that could reoccur (beyond expected random QC failures) or where there is doubt about the laboratory's compliance to its own policies and procedures.

The investigation and associated corrective actions of non-conforming work involving alleged violations of the laboratory's Ethics and Data Integrity policies must follow the procedures outlined in Section 19, *Data Integrity Investigations.*

The laboratory evaluates the significance of the non-conforming work, and takes corrective action immediately. The laboratory allows the release of non-conforming data only with approval by the QA Coordinator on a case-by-case basis. Non-conforming data is clearly identified in the final report. (See Section 28, *Reporting the Results*.) Non-conformances that are resolved internally and prior to reporting, through re-analysis or other evaluation, are not reported to the customer.

The discovery of a nonconformance for results that have already been reported to the customer are immediately evaluated for significance of the nonconformance, its acceptability to the customer, and determination of the appropriate corrective action. (See Section 14, *Corrective Action*.) If it is determined that results are affected, the customer is notified and a revised reported is issued.

12.3 Stop Work Procedures

Personnel notify the QA Coordinator or Production Coordinator of any significant nonconformance that may require stopping work. In general, the Production Coordinator oversees resolution of nonconformances for wet chemistry methods; the QA Coordinator works with analysts in the metals and organics sections.

The Coordinator reviews the significance of the nonconformance and works with the analyst to develop a course of action. When an investigation indicates that the cause of the nonconformance requires that a method be restricted or not used until modifications are implemented, the Coordinator will immediately notify all affected personnel of the suspension/restriction. The lab will hold all relevant reports to clients pending review. The QA Coordinator must verify that the issue is resolved and authorize resumption of work. Personnel are notified by the QA or Production Coordinator when resumption of work is authorized. The analyst and relevant Coordinator will document the issue, root cause and resolution using the corrective action procedures described in Section 14, *Corrective Action.*

Section 13

IMPROVEMENT
(TNI V1:M2 – Section 4.10)

13.1 Laboratory Processes

Improvement in the overall effectiveness of the laboratory management system is a result of the implementation of the various aspects of the laboratory's management system: quality policy and objectives (*Section 5, Management*); internal auditing practices (Section 17*, Internal Audits*); the review and analysis of data (Section 27*, Quality Assurance for Environmental Testing*); the corrective action (Section 14*, Corrective Action*) and preventive action (Section 15*, Preventive Action*) process; and the annual management review of the quality management system (Section 18*, Management Reviews)* where the various aspects of the management/quality system are summarized, and evaluated and plans for improvement are developed.

13.2 Management System Performance Metrics

The Laboratory Manager monitors a number of performance metrics for the laboratory as a whole and for the various sections within the laboratory. Note that many of these metrics are possible because the Bureau operates the laboratory under a charge back system for city clients. These same prices are charged to outside municipalities. These metrics include:

- Gross revenue – monthly and total-to-date generated by the lab and sent out to contract laboratories
- Direct expenses (fully burdened salaries and supplies) – monthly and total-to-date for the lab as a whole and for each section of the lab
- Pro forma projections to the end of the fiscal year for total lab gross revenue and direct expenses (monthly from the end of the first quarter to the eleventh month of the fiscal year)
- Contracted work as percent of gross revenue (monthly and total-to-date)
- Supplies costs per full-time equivalent (FTE) for each section of the lab (monthly and total-to-date)
- Supplies costs per lab section broken out by category – repairs & maintenance, miscellaneous (shipping, licenses, fees, etc.), office supplies, chemicals, gases, QA/QC and commercial standards, labware & bottles, instrument supplies, safety, maintenance supplies, minor equipment (monthly and total-to-date)
- Gross revenue per FTE (monthly and total-to-date)

- Percent analyses reported within lab turnaround time of two weeks (monthly). Note that this statistic is blended with that for the outside contract laboratories and includes extended turnaround times for analyses such as bioassays, dioxins/furans, PCB congeners, etc.

- Overtime hours spent on overhead (holiday and weekend vacation coverage) and actual production (monthly and total-to-date).

All metrics are compared to agreed-upon targets and reported monthly to upper management in a performance/financial executive summary. Results are used to assess and improve business practices throughout the laboratory.

Section 14

CORRECTIVE ACTION
(TNI V1:M2 – Section 4.11)

Corrective action is the action taken to eliminate the causes of an existing non-conformity, defect, or other undesirable situation in order to prevent recurrence.

Deficiencies cited in external assessments, internal quality audits, data reviews, customer feedback/complaints, control of nonconforming work or managerial reviews are documented and require corrective action. Corrective actions taken are appropriate for the magnitude of the problem and the degree of risk.

14.1 General Procedure

For most situations the laboratory uses a Corrective Action Report (CAR) form to document and track event-specific corrective actions. An example of this form is shown in Figure 14-1. The form is also available in a format designed for electronic entry. All deficiencies are investigated and a corrective action plan is developed and implemented if determined necessary. The implementation is monitored for effectiveness.

For analytical nonconformances, the analyst is responsible for initiating corrective action where a nonconformance is found that could reoccur (beyond expected random QC failures) or where there is doubt about the compliance of the laboratory to its own policies and procedures. Personnel notify the QA Coordinator or Production Coordinator of a nonconformance that may require corrective action. The Production Coordinator may oversee resolution of nonconformances for wet chemistry methods; the QA Coordinator generally works with analysts in the metals and organics sections.

For other types of significant nonconformances such as external assessments and customer complaints, the QA Coordinator initiates corrective action and may assign other personnel to participate in the resolution of non-conformance. For resolution of a customer complaint, a routine CAR may be used. For response to a laboratory assessment, a corrective action plan is developed, implemented, and documented. This is a more extensive document that lists findings, planned corrective actions, and verification of implementation. The completed corrective action plan may incorporate individual CARs used for investigating specific findings.

14.1.1 Cause Analysis

When failures due to systematic errors have been identified, the first step of the corrective action process starts with the initial investigation and determination of root cause(s) of the problem. Records are maintained of corrective actions to show that the root cause(s) was investigated, and includes the results of the investigation. The records are in the form of CAR hardcopies and electronic copies on the S:Lab network drive, which are numbered and maintained by the QA Coordinator.

Where there may be non-systematic errors and as such the initial cause is readily identifiable or expected random failures (e.g. failed quality control), a formal root cause analysis is not performed and the process begins with selection and implementation of corrective action. (See also Section 14.3, *Technical Corrective Actions*.)

14.1.2 Selection and Implementation of Corrective Actions

Where uncertainty arises regarding the best approach for analysis of the cause of exceedances that require corrective action, appropriate personnel will recommend corrective actions that are appropriate to the magnitude and risk of the problem and that will most likely eliminate the problem and prevent recurrence

The QA or Production Coordinator authorizes appropriate corrective action and ensures that a corrective action is discharged within the agreed upon time frame.

14.1.3 Monitoring of Corrective Action

The QA Coordinator monitors implementation and documentation of the corrective action to assure that the corrective actions were effective. This is done through follow-up discussions with the personnel involved in the corrective action, and is documented through notes on the CAR.

14.2 Additional Audits

Where the identification of nonconformances or departures from normal lab procedures cast doubt on the laboratory's compliance with its own policies and procedures, or on its compliance with the TNI Standard, the laboratory ensures that the appropriate areas of activity are audited as soon as possible in accordance with Section 17, *Internal Audits*.

In many cases, the additional audits are follow-ups after the corrective action has been implemented to ensure it is effective. These are done when a serious issue or risk to the laboratory has been identified.

14.3 Technical Corrective Action

Sample data associated with a failed quality control are evaluated for the need to be reanalyzed or qualified. Unacceptable quality control results are documented, and if the evaluation requires cause analysis, the cause and solution are recorded. (See also Section 12, *Control of Nonconforming Environmental Testing Work*.)
Analysts routinely implement corrective actions for data with unacceptable QC measures. First level correction may include re-analysis without further assessment. If the test method SOP addresses the specific actions to take, they are followed. Otherwise, corrective actions start with assessment of the cause of the problem.

Corrective action for non-systematic errors or expected random failures are documented on raw data worksheets, logbooks, data print-outs and/or as comments in the LIMS. Corrective actions for nonconformances that may reoccur (beyond expected random QC failures) or where there is concern that the laboratory is not in compliance with its own policies and procedures require that a Corrective Action Report be completed. (See Section 14.1.)

If the data reported are affected adversely by the nonconformance, the affected results are clearly identified in the report for the customer. (See Section 28, *Reporting the Results*.) If affected results were previously reported to the customer, a revised reported is issued with revisions clearly indicated.

CAR # ____________
(assigned by QA Coordinator)

City of Portland
Water Pollution Control Laboratory

Corrective Action Report

This CAR form is to be utilized as documentation of a QA/QC non-conformance and subsequent corrective action. The CAR is initiated by the analyst and routed to the QA Coordinator. The CAR form should be submitted for QA approval before sample results are reported.

CAR initiated by: ___________ Date: ______________ Lab area / analysis: ______________________

Non-conformance:

Samples affected:

Corrective action:

Conclusion / Comments:

Comment required on sample report(s)? Yes / No   Further action required? Yes / No

Corrective action executed by: ____________________ Completion date: _________________

Other approval: ____ Date: ____________________

QA Coordinator Section   Verification: _________ Date: _____________

Comment required on sample report(s)? Yes / No   Further action required? Yes / No

QA Coordinator comments:

rjc 12/13/12   Qadocs\CARform.doc

Figure 14-1. Corrective Action Report

Section 15

PREVENTIVE ACTION
(TNI V1:M2 – Section 4.12)

Preventive action is a pro-active process to identify opportunities for improvement rather than a reaction to the identification of problems or complaints.

Preventive action includes, but is not limited to:

- -routine instrument maintenance, both internal and vendor-provided
- -evaluation of QC data and PT results for developing bias (trending)
- -review of QA/QC issues at staff meetings, to ensure lab-wide understanding
- -full consideration of client feedback to look for improvement opportunities
- -maintaining awareness of new technology and methods for improved data

When improvement opportunities are identified or if preventive action is required, action plans are implemented and monitored to reduce the likelihood of the occurrence of nonconformities.

Procedures for preventive actions include the initiation of such actions and subsequent monitoring to ensure that they are effective.

All personnel have the authority to offer suggestions for improvements and to recommend preventive actions. Laboratory Coordinators are generally responsible for directing the implementation of preventive actions.

As a preventive action, a new technology or analytical method may be recommended by analytical staff as a means of improving data and/or reducing cost. The Laboratory Manager approves time and expenses for developing new methods and the QA Coordinator approves implementation based on completion of appropriate method validation procedures.

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Section 16

CONTROL OF RECORDS
(TNI V1:M2 – Section 4.13)

Records are a subset of documents, usually data recordings that include annotations, such as daily refrigerator temperatures posted to a laboratory form, lists, spreadsheets, or analyst notes on a chromatogram. Records may be on any form of media, including electronic and hard copy. Records allow for the historical reconstruction of laboratory activities related to sample-handling and analysis.

The laboratory maintains a records system appropriate to its needs, records all laboratory activities, and complies with applicable standards or regulations as required. Records of original observations and derived data are retained to establish an audit trail. Records help establish factors affecting the uncertainty of the test and enable test repeatability under conditions as close as possible to the original.

16.1 Records Maintained

Records of all procedures to which a sample is subjected while in the possession of the laboratory are kept. The laboratory retains all original observations, calculations and derived data (with sufficient information to produce an audit trail), calibration records, personnel records and a copy of the test report for a minimum of five years from generation of the last entry in the records. At a minimum, the following records are maintained by the laboratory to provide the information needed for historical reconstruction:

16.1.1 Analytical Data

Analytical data includes all raw data, whether hard copy or electronic, for calibrations, samples and quality control measures, including analysts' worksheets and data output records (chromatograms, quantitation reports, data summary sheets, and other instrument printouts). This includes documentation of sample preparation and cleanup protocols.

Specific information recorded for each analytical batch includes:

-laboratory sample ID numbers
-volumes and weights of samples and reagents
-reagent identifications (LIMS number)
-date of analysis
-time of analysis (may be a single time designation for a batch)
-analyst's initials/signature or electronic identification
-incubation periods
-all data used in calculations (including manual integrations)
-final calculated results for samples and QC
-data review and validation verification

For instrumental analysis, records include instrument identification. Print-outs of instrument operating conditions/parameters are maintained, with start and end dates indicated. Calibration results are maintained along with analytical data.

Depending on the analysis, raw data is maintained in laboratory notebooks, the LIMS, and/or instrument files and hardcopies of those files. Notebooks are initialed and dated when data is generated or reviewed. Packets of printed instrumental data are initialed and dated by the analyst and reviewer. For analyses that load raw data directly into the LIMS (e.g., balance readings for solids analysis), the benchsheets with the raw data and calculated results are printed and maintained. Copies of those benchsheets are also stored electronically as back-up. The LIMS has a status progression system that documents the process of sample login, batching, analysis, peer review and QA review, with the date/time and initials electronically recorded.

16.1.2 Sample Chain-of-Custody Records

All samples are documented on a chain-of-custody form. The form is electronically scanned so a copy is available in the LIMS. The original form is maintained with a copy of the final customer report. (See Section 16.1.3.)

Sample transfers are documented on a separate chain-of-custody form. A copy of that form is maintained with the final customer report, usually incorporated into the data report from the subcontract laboratory.

16.1.3 Laboratory Reports to Customers

Laboratory reports are generated and stored electronically as .pdf files. Each final report is also printed and stored, with the original chain-of-custody form attached to the front. The exception is routine daily analysis for CBWTP and TCWTP. These reports are generated and stored as .pdf files, but are not printed. Reports are filed by client and project.

Correspondence relating to laboratory projects is handled by the IMS section. Records of e-mail, telephone, and hardcopy correspondences are managed by IMS.

16.1.4 QA Records

QA documents are maintained in hardcopy and/or electronic form. For example, standard and reagent preparation are only required to be documented in the LIMS, and printed summaries are then available as needed. QA records include the following:

-copies of all current and historical laboratory SOPs and *Quality Manual*s
-written policies and guidance documents
-alternative test procedure and other method modification approvals
-standard and reagent origin, receipt, certificates of analysis, and preparation
-temperature records for sample storage refrigerators, ovens, and incubators
-equipment calibration records (e.g., balances, weights, pipettors)
-testing records for new supplies and equipment
-personnel qualification, experience and training records
-records of demonstration of capability for each analyst

-a list of names, initials, and signatures for laboratory staff
-proficiency testing results
-interlaboratory comparison study results
-copies of internal and external audits including audit responses
-corrective action reports
-management reviews
-data archive records

16.2 Records Management and Storage

The laboratory maintains a record management system for control of all forms of laboratory data, sampling records, reports and QC records.

Where both electronic and hardcopy records are maintained, the hardcopy is considered the primary medium for long-term storage.

Analytical data is recorded immediately and legibly in permanent ink, or recorded electronically. Major instrument systems have computerized data collection. Corrections to manually entered data or printed hardcopies are initialed and dated with the reason noted for corrections other than transcription errors. A single line strikeout is used to make corrections so that the original record is not obliterated. The original record is not obliterated. Changes to data in the LIMS are documented through an electronic audit trail. Comments may be added in the audit trail spreadsheet. Manually integrated chromatographic peaks are automatically flagged by the instrument data system.

Records, including electronic records, are easy to retrieve, legible, and protected from deterioration or damage; and are available to accrediting bodies for a minimum of five years or as required by regulation or contract. Records that are stored only on electronic media are supported by the hardware and software necessary for their retrieval. Access to protected records is limited. Printed records are stored within the laboratory or in a locked file room to prevent unauthorized access or amendment.

Electronic records are stored on computer hard drives and servers. The server share is commonly known as the S-drive. Portable media are not used for data or records storage. Three types of electronic records are maintained:

Instrumental raw and calculated results are maintained at the instrument for a period of time. In some cases the hard drives can store at least five years of data. Where that is not possible, the data are stored on a remote City network server computer called BESFILE1, which is managed by City IT professionals. This server is backed up every weekday, Monday to Friday, at 6 PM.

The LIMS database is on a remote server computer called the SQL server, which is managed by City IT professionals. The server is backed up six nights a week, Sunday to Friday. Each backup file is saved for 5 days before being automatically deleted. Additionally, a transaction log backup is run every two hours on Monday to Friday between 6 AM and 6 PM. This allows recovery from a major outage with a loss of no more than two hours worth of work.

The LIMS active database storage capacity depends upon the number of records. Thus it is impossible to predict capacity in terms of years of data. The LIMS documentation library contains a policy and procedure for truncating the active database and transferring it to an archive. Data are stored in a read-only mode, and access to the archived (truncated) database is under the control of the Laboratory LIMS Administrator. The policy and procedure are in the document "Element Database Truncation" on the S-Drive at:

\\oberon\LIMS_ELEMENT\Installation_and_Updates\Element.Database.Truncation.doc

Laboratory documents and reports derived from the LIMS reside on a remote City network server computer called Oberon, which is managed by City IT professionals. This server is backed up every weekday, Monday to Friday, at 6 PM. The laboratory files stored on this server include:

- -controlled documents (QM and SOPs)
- -policy statements
- -notebook forms
- -audit responses and CARs
- -PT results
- -benchsheets
- -reports to clients (in .pdf format)
- -data transfer files
- -scanned chain-of-custody forms

Additional information regarding control of data is included in Section 22.5, *Control of Data*.

After five years or more, physical records are transferred to the City of Portland archive center. The City defines laboratory records as permanent records. The City archive program has specific protocols for identifying and indexing all boxes of records to ensure that records can be readily retrieved. Laboratory records are divided into five categories: raw data records, outside lab reports, sampling records and reports, electronic data (media), and QA records. Each archive shipment is logged on specific forms provided by the archive center. Boxed records are transferred to the archive center by City personnel from Printing and Distribution Services. Copies of the logs are maintained at the laboratory and are available from the archive center. Archived information and access logs are protected against fire, theft, loss, environmental deterioration, vermin, and in the case of electronic records, electronic or magnetic sources. Archived records have limited access and are checked out through an access log.

Appropriate regulatory and state legal requirements concerning laboratory records shall be followed.

16.3 Legal Chain of Custody Records

Not applicable.

Section 17

AUDITS
(TNI V1:M2 – Section 4.14)

Audits measure laboratory performance and verify compliance with accreditation and project requirements. Audits specifically provide management with an on-going assessment of the management system. They are also instrumental in identifying areas where improvement in the management/quality system will increase the reliability of data. Audits are of four main types: internal, external, performance, and system. Section 17.5 discusses the handling of audit findings.

17.1 Internal Audits

Annually, the laboratory prepares a schedule of internal audits to be performed during the year. These audits verify compliance with the requirements of the management/quality system, including analytical methods, SOPs, the *Quality Manual*, the ethics and data integrity policy, other laboratory policies, and the TNI Standard. Internal audits are scheduled throughout the year for different laboratory sections. The QA Coordinator plans and organizes audits as required by the schedule and requested by management. The TNI checklist, or a modified version, is used for management system audits. Prepared checklists are used for analysis audits. These audits are carried out by trained and qualified personnel who are, wherever resources permit, independent of the activity to be audited. In most cases, the QA Coordinator performs the internal audits.

To begin an analysis audit, the auditor requests data and supporting documentation for specific samples from the analytical staff. The auditor reviews the information to verify traceability of results and conformance with SOPs and reference methods. The auditor also goes into the work area to verify that QA protocols are consistently applied (i.e, refrigerator temperatures are monitored, equipment calibration checks are documented, etc.).

In addition to the scheduled internal audits, it may sometimes be necessary to conduct special audits as a follow-up to corrective actions, PT results, complaints, regulatory audits or alleged data integrity issues. These audits address specific issues.

The area audited, the audit findings, and corrective actions are recorded. Audits are reviewed after completion to assure that corrective actions were implemented and effective. This review generally occurs within one month after corrective actions are in effect. For non-analytical corrective actions that do not directly impact data validity, the review may occur during the next scheduled audit.

17.2 External Audits

It is the laboratory's policy to cooperate and assist with all external audits, whether performed by clients or an accrediting body. Management ensures that all areas of the laboratory are accessible to auditors as applicable and that appropriate personnel are available to assist in conducting the audit.

17.3 Performance Audits

The main performance audits at WPCL are Proficiency Test Samples (PTs). PTs are discussed in Section 27, *Quality Assurance for Environmental Testing.* The laboratory analyzes two sets of PTs per year for accredited analytes. Additional PTs are analyzed as part of the corrective action when a routine PT result is unacceptable.

Internal single-blind samples are occasionally used as part of method start-up procedures, for training, or to help resolve an analytical problem. To assure accuracy, these samples are purchased from an accredited PT provider whenever possible.

Currently, WPCL participates in an annual round-robin study for low-level mercury analysis, and may participate in other studies when invited.

17.4 System Audits

The Laboratory's management system is audited though annual management reviews. Refer to Section 18, *Management Reviews* for further discussion of management reviews.

17.5 Handling Audit Findings

Internal or external audit findings are responded to within the time frame agreed to at the time of the audit. The response may include action plans that could not be completed within the response time frame. A completion date is established by management for each action item and included in the response.

The responsibility for developing and implementing corrective actions to findings is the responsibility of QA Coordinator. Corrective actions are documented through the corrective action process described in Section 14, *Corrective Actions*.

Audit findings that cast doubt on the effectiveness of the laboratory operation to produce data of known and documented quality or that question the correctness or validity of sample results must be investigated. Corrective action procedures described in Section 14, *Corrective Action* must be followed. Clients must be notified in writing if the investigation shows the laboratory results have been negatively affected and the clients requirements have not been met. The client must be notified within five working days after the laboratory determines that results have been affected. Laboratory management will ensure that this notification is carried out within the specified time frame.

All investigations that result in findings of inappropriate activity are documented and include any disciplinary actions involved, corrective actions taken, and all appropriate notifications of clients. See Section 19, *Data Integrity Investigations* for additional procedures for handling inappropriate activity.

Section 18

MANAGEMENT REVIEWS
(TNI V1:M2 – Section 4.15)

Top management reviews the management system on an annual basis and maintains records of review findings and actions.

18.1 Management Review Topics

The following are reviewed to ensure their suitability and effectiveness:

- the suitability of policies and procedures;
- reports from managerial and supervisory personnel;
- the outcome of recent internal audits;
- corrective and preventive actions;
- assessments by external bodies;
- the results of interlaboratory comparisons or proficiency tests;
- changes in the volume and type of the work;
- customer feedback;
- complaints;
- recommendations for improvement;
- other relevant factors, such as quality control activities, resources, and staff training;
- performance measures, such as $/FTE, supplies as % revenue, overtime, % analyses on-time, etc.

18.2 Procedure

18.2.1 Policy

Annual management reviews follow the elements in Section 18.1, above, as delineated in *WPCL Policy Statement 017, Management Reviews*.

18.2.2 Procedure

Reviews are held on a work section basis with appropriate staff in attendance:

- organics
- metals
- nutrients
- process control/general chemistry
- microbiology
- sample receiving.

Reviews are also held with the laboratory production and QA Coordinators.

18.2.3 Reports

Findings and follow-up actions from management reviews are recorded and summarized in a report to the Division Manager. An electronic copy is kept on the WPCL Group 100 S-Drive. A hard copy is kept in a binder in the office of the Laboratory Manager. Management will determine appropriate completion dates for action items and ensure they are completed within the agreed upon time frame.

Section 19

DATA INTEGRITY INVESTIGATIONS
(TNI V1:M2 – Section 4.16)

In addition to covering data integrity investigations, this Section covers all topics related to ethics and data integrity policies, procedures and training.

The City of Portland Water Pollution Control Laboratory (WPCL) is committed to ensuring the integrity of its data and providing valid data of known and documented quality to its clients. Elements in the WPCL Ethics and Data Integrity program include:

- Documented ethics & data integrity procedures signed and dated by top management.
- A written Mission Statement.
- An Ethics and Data Integrity Policy signed by all management and staff at the annual data integrity training. (See Appendix A.) This policy and the annual signature page are signed and dated by all laboratory personnel. The original signature pages are stored in a 3-ring binder, which is kept in the office of the Laboratory Manager.
- Annual data integrity training.
- Procedures for confidential reporting of alleged data integrity issues.
- An audit program that monitors data integrity and procedures for handling data integrity investigations and client notifications. (See Section 17, *Audits*.)

19.1 Ethics and Data Integrity Procedures

The Ethics and Data Integrity Policy provides an over view of the program. Written procedures that are considered part of the Ethics and Data Integrity program include:

- An ethics and data integrity policy (see Appendix A)
- A written manual integration standard operating procedure (WPCL SOP QAQC-10.01, Manual Integration)
- Written procedures for corrective actions (see Section 14)
- A written policy on corrective action reports
- Written procedures for data integrity investigations (see Section 19.4, below)
- Training for laboratory ethics and data integrity (see Section 19.2, below)

Management reviews data integrity procedures yearly and updates these procedures as needed.

19.2 Training

19.2.1 Overview

Data integrity training is provided as a formal part of new employee orientation and a refresher is given annually for all employees. Employees are required to understand that any infractions of the laboratory data integrity procedures shall result in a detailed investigation that could lead to very serious consequences up to and including termination for cause and/or civil or criminal prosecution. This is discussed in the WPCL Code Of Ethics that every employee is required to read and sign annually as part of the WPCL Laboratory Ethics And Data Integrity training. Attendance at this training is attested by a signature attendance sheet.

19.2.2 Training Agenda

At the beginning of the training session, the WPCL Code of Ethics and Mission Statement are reviewed. Attendees are required to sign a concurrence page attesting that they have read and understand the WPCL Code of Ethics. An agenda and list of topics to be covered are provided to each trainee prior to the training class. Data integrity training emphasizes the importance of proper written narration on the part of the analyst with respect to those cases where analytical data may be useful, but are in one sense or another partially deficient. The following topics and activities are covered:

- organizational mission and its relationship to the critical need for honesty and full disclosure in all analytical reporting;
- how and when to report data integrity issues;
- record keeping;
- training, including discussion regarding all data integrity procedures;
- data integrity training documentation;
- in-depth data monitoring and data integrity procedure documentation; and
- specific examples of breaches of ethical behavior such as improper data manipulations, adjustments of instrument time clocks, and inappropriate changes in concentrations of standards.

The current training PowerPoint is in the public domain and was developed by Mr. Dennis Wells and Dr. Charles Lytle, both members of the Oregon Environmental Accreditation Program (ORELAP) Technical Advisory Committee (OTAC), and is used for “train the trainer” sessions at the annual Pacific NW Clean Water Association Short School.

19.2.3 Records

All attendees are required to sign an attendance sheet, which is kept in the WPCL Ethics Training Log binder in the Laboratory Manager’s office. The concurrence page for the Code of Ethics is kept in the same binder. An electronic copy of the training

PowerPoint presentation along with several others from various public organizations are kept on the WPCL Group 100 S-Drive.

19.2.4 Absent Staff

Staff not present at the formal, group training must schedule an appointment with the Laboratory Manager to review the WPCL Mission Statement and Code of Ethics and to sign the Code of Ethics concurrence page. They will then view the ethics training PowerPoint at a convenient computer and return to the Manager's office and sign the training log.

19.3 Confidential Reporting of Ethics and Data Integrity Issues

Confidential reporting of data integrity issues is assured through the "Duty To Report" section of the WPCL Code of Ethics. Both confidentiality and a receptive environment are assured so that employees can discuss ethical issues in private. Management is immediately informed so that further action, if necessary, can be taken.

19.4 Investigations

All investigations resulting from data integrity issues are conducted confidentially. They are documented and notifications are made to clients who received any negatively affected data that did not meet the client's data quality requirements. Because of the potential of disciplinary action, all investigations involving the potential of ethics violations are conducted under the rules and direct oversight of the City of Portland Bureau of Human Resources in consultation with the City Attorney's Office.

Section 20

PERSONNEL
(TNI V1:M2 – Section 5.2)

The Water Pollution Control Laboratory (WPCL) employs competent personnel based on education, training, experience, and demonstrated skills. The laboratory's organization chart is provided in Appendix B.

20.1 Overview

All personnel are responsible for complying with all quality and data integrity policies and procedures that are relevant to their area of responsibility.

All personnel who are involved in activities related to sample analysis, evaluation of results or who sign test reports, must demonstrate competence in their area of responsibility. Appropriate supervision is given to any personnel in training and the trainer is accountable for the quality of the trainees work. Personnel are qualified to perform the tasks they are responsible for based on education, training, experience and demonstrated skills as required for their area of responsibility.

The QA Coordinator ensures the competence of all lab personnel who operate specific equipment, perform environmental tests, evaluate results, and sign test reports. When staff are undergoing training, appropriate supervision is provided by the QA Coordinator and experienced lab analyst or specialist. Personnel who are performing specific tasks are qualified on the basis of appropriate education, training, experience, and demonstration of capability. The laboratory currently has sufficient personnel with the necessary education, training, technical knowledge, and experience for their assigned functions. All staff are responsible for complying with specified quality assurance/quality control requirements that are related to their technical function. Each member of the analytical staff has a combination of experience and education to adequately demonstrate a specific knowledge of their particular function and a general knowledge of laboratory operations, test methods, quality assurance/quality control procedures and records management. Laboratory Analysts have cross training in the Process Control, General Chemistry, and Nutrients Sections.

In consultation with the drinking water lab and the WPCL, the city has detailed job classification descriptions that include specific requirements for each classification rank (Analyst I and II, Analytical Specialist, Laboratory Coordinator, and Laboratory Manager) with respect to education, training, skills, and abilities. (See Section 20.2, below).

Training needs are identified and addressed by the Laboratory Manager and QA Coordinator. Regular training meetings are scheduled whenever policies or procedures have changed. Training needs are identified at the time of employment and when personnel are moved to a new position or new responsibilities are added to their job responsibilities. Ongoing training, as needed, is also provided to personnel in their current jobs. The effectiveness of the training must be evaluated before the training is considered complete.

The WPCL only uses personnel who are employed by the City of Portland. Contracted personnel, when used, must meet the same competency standards and follow the same policies and procedures that laboratory employees must meet.

The laboratory maintains current job descriptions for all personnel who manage, perform or verify work affecting the quality of environmental tests. The Laboratory Manager authorizes specific personnel to perform particular types of sampling, environmental tests, to issue test reports, to give opinions and interpretations, and to operate particular types of equipment. The laboratory maintains records of the relevant authorizations, competence, educational and professional qualifications, training, skills and experience of all currently employed technical personnel. These records are maintained in personnel training files, which also include records of demonstrated proficiency for each laboratory test method.

20.2 Job Descriptions

Job descriptions are available for all positions that manage, perform, or verify work affecting data quality, and are located on the city of Portland website, portlandoregon.gov, on the Human Resources page under "Classification Specifications."

These classification specifications include detailed requirements for education, experience, knowledge base, and responsibilities for each position. An overview of top management's responsibilities are included in Section 5*, Management*.

20.3 Training

All personnel are appropriately trained and competent in their assigned tasks before they contribute to functions that can affect data quality. It is management's responsibility to assure personnel are trained. Training records are used to document management's approval of personnel competency. The date on which authorization and/or competence is confirmed is included.

20.3.1 Overview

The goals of training at WPCL are to: (1) provide information and practice to the trainee under supervision of a skilled trainer; and (2) verify and document the analyst's skill in the procedure through analysis of known samples and a demonstration of capability (DOC).

20.3.2 Trainer Qualifications

The trainer must be a person qualified to do the analysis and should have at least three months experience performing the procedure. Because method details change over time, the trainer should be currently active in performing the analysis. Whenever possible, the laboratory employee most experienced with the procedure will train the new analyst.

20.3.3 Training Opportunities and Trainee Qualifications

Training opportunities are based on the principle of progressive advancement. An analyst must be successful at simpler tasks before training on complex methods. Being successful means consistently performing an analysis with good results.

An analyst must demonstrate a thorough understanding of assigned bench methods before progressing to instrumentation, and must master the simpler instruments before advancing to complex instrument systems. Evaluation of progressive advancement includes verified experience at another laboratory. Other factors that affect cross-training assignments include the analyst's interest in learning the method, proven aptitude for the type of task, ability to meet the time requirements of the task, and the cross-training needs of the laboratory. The Laboratory Production and QA/QC Coordinators are responsible for training assignments.

Note that the idea of progressive advancement does not require that every analyst take the same route of analytical experience. Quality of work is the most important factor in evaluating analytical success. Reliability and thoroughness indicate an ability to move on to other tasks. Solving analytical problems is an indication of understanding and mastery of an analysis. Taking the initiative to fix a problem, improve a procedure, or work on a new method demonstrates independent motivation to do higher level work.

20.3.4 General Training Protocol

Training for a specific analysis or laboratory protocol is the same for a new employee or an established analyst learning a new method (cross-training). However, for new analysts with little or no experience, Section 20.3.6 below provides an outline of basic training topics that must be covered before focusing on a particular analysis. During cross-training, it is important not to make assumptions about the trainee's abilities. While the trainee may be an experienced co-worker, she/he does not know the specific requirements of the new analysis. All the training steps should be followed for cross-training, including discussion of the specific safety precautions.

The following steps for training serve as a guideline. They are generally applicable for bench methods and for initial training phases of instrumental analyses. Emphasis is on hands-on experience for the trainee, but it is also important that the chemical basis of the analysis and the reason for each step in the procedure is explained. Depending on the method, more or less time may be spent on certain steps, extra practice may be required, or the training steps may be ordered differently.

- The trainee observes the trainer perform the procedure. The trainer should explain each step as it is done. Point out any special techniques that produce the best results, discuss the QC requirements for the method, and point out safety concerns throughout the procedure. The trainee should take written notes.

- The trainee reads the reference method, the laboratory SOP, and the MSDS sheets for the reagents. The trainee should also have access to equipment/instrument manuals and other resources that explain the theory and applications of the method.

- Depending on the complexity of the analysis, the trainee may need to observe the procedure again, with further discussion of theory and equipment.

- The trainee performs the procedure on a known sample while the trainer observes. It is important that the trainer watch every detail of this first attempt, correct any errors or technique deficiencies, and answer questions as they come up.

- When the trainee feels comfortable with the method, he/she performs the procedure on one or more additional batches of practice samples, including method blanks and other standard QC samples. The trainer compares these practice results to the expected values. The cause of any poor results must be determined and corrected.

- When the trainee has independently performed the analysis on practice and QC samples with correct results, the formal demonstration of capability (DOC) can be done. The DOC requires analysis of 4 replicates of a known sample. The DOC sample is usually a laboratory control sample (blank spike) prepared by the trainer, with the true concentration unknown to the trainee. If a blank spike or other reference material is not available, a real sample that was previously analyzed by a qualified analyst may be used. The Production Coordinator and/or QA/QC Coordinator should be consulted in deciding when the trainee is ready to try the 4-replicate DOC.

- If the DOC results meet the method acceptance criteria for accuracy (%R) and precision (RPD), the training data and checklist are submitted to the QA/QC Coordinator. When the trainer, trainee, Production Coordinator, and QA/QC Coordinator are all confident that the trainee understands the analysis and can produce valid results, the trainee will be considered qualified to analyze real samples.

- If the DOC results do not meet the acceptance criteria, more practice samples must be analyzed, with the trainer closely evaluating the trainee's analytical technique. The trainee may not analyze and report results for real samples until proficiency has been demonstrated through a successful 4-replicate DOC.

- Even after the trainee is considered proficient in the procedure, the trainer or another qualified analyst should still be available to answer questions. Any difficult or unusual samples should be discussed with another qualified analyst or the

Production Coordinator, until the trainee's experience is adequate to allow independent resolution of analytical problems.

- At some time during the training process, key method-related procedures must be explained and demonstrated. These include preparation and storage of reagents and standards, method-specific glassware cleaning procedures, instrument maintenance, etc., as applicable. The trainer should closely supervise the trainee during the initial performance of these procedures.

20.3.5 Training Considerations for Instrumental Methods

The general training steps used for bench methods -- observation, reading, practice, discussion, and a DOC -- are also applicable for instrumental analysis. Training for a complex instrumental analysis is usually a multi-phase process, partitioned into phases including sample preparation, routine calibration and analysis, data interpretation, reporting, maintenance, troubleshooting, and handling non-routine samples and data. An analyst may become certified in sample preparation only. An analyst may be considered qualified to analyze routine samples if proficient in sample preparation, calibration and analysis, routine data interpretation, and reporting. For specialist-level certification, it is necessary to demonstrate skills in troubleshooting, instrument maintenance, non-routine analysis, and advanced data interpretation.

It may take several months before an analyst can independently generate results on a complex instrument system. A common approach to training for a complex analysis is for the trainee to first learn sample preparation. Then the trainer and trainee can work together on the instrument until the trainee understands all aspects of the analysis. The trainee should refer to the instrument manual, reference method, SOP, and other resources throughout the training process. It is important that the trainee fully understand the instrument and the data system, as well as the chemical/physical principles of both sample preparation and analysis. Close supervision during the training process is essential for the trainee to learn how to successfully analyze real samples. The trainer can use his/her judgment to determine when the trainee is ready to do certain steps such as instrument set-up, entering the sample queue, preparing standards, etc. The trainee may not process samples independently until proficiency has been demonstrated in sample preparation, calibration and analysis, and data interpretation.

20.3.6 Training for New Staff (Entry-Level Analysts)

A trainer must be aware of the educational background and experience of the trainee. A person with no lab experience will be lacking in some knowledge and technique skills that are fundamental to good analysis. These skills should be taught to the trainee, independent of a particular analytical method. That is, teach the trainee how to use laboratory equipment before teaching the analysis that requires the equipment. The trainer should ask a trainee, "Have you used this equipment before?" If no, then training and practice are necessary. If the answer is yes, the trainee should demonstrate correct usage to the trainer. The following types of laboratory equipment require specific training and time to develop skill in their use.

- Graduated glassware -- discuss the meniscus, how to estimate the final digit, TD vs. TC glassware

- Transfer techniques -- use of pipette bulbs, automatic pipettors, how to avoid contaminating reagents, quantitative transfer of samples

- Volumetric flasks -- how to fill to the meniscus, not to heat in oven or on hotplate, liquid should be at room temperature for final measurement

- Volumetric pipettes -- touching the tip to inside surface of container, reading the meniscus, care not to break tip, volumetrics are TD (do not blow out)

- Burettes -- removing air bubbles, managing the last drip on tip, the "quick-flip" to release minimal volume at endpoint, removing the stopcock to clean, pre-rinsing with titrant

- Filtering -- pre-wet filter paper in funnel, use of appropriate type of filter paper, how the vacuum works and how to release it

- Glassware -- fitting ground-glass joints, cleaning, never heat or scratch volumetrics

- Probes -- rinsing, appropriate storage conditions

- Top-loading balances -- how to use, taring to zero, cleanup, limits of sensitivity

- Analytical balance -- calibration checks, frequent zeroing, doors closed for weighing, the effects of fingerprints, absorbed moisture and drafts, sensitivity. Anyone using an analytical balance should have full knowledge of its functions and the care required to maintain its precision.

In addition to laboratory skills, a new technician must learn a number of concepts that are essential to the production of good laboratory data. Knowledge of the following procedures is required.

- Solutions -- normality vs. molarity, standardization, handling exothermic reactions

- Titrations -- use of indicators, determining the endpoint, $N_1V_1 = N_2V_2$

- Instrumentation -- all instrumental conditions must be maintained throughout an analytical batch, instrument warm-up/stabilization period, calibration checks

- Analytical documentation -- recording all data in permanent laboratory notebooks or appropriate log sheets, making written comments about unusual sample matrix or analytical response, filing of instrument and computer print-outs as permanent records, use of specific units for final reporting, documenting preparation of reagents and standards

- Use of standard methodology -- SOPs based on published analytical methods must be used whenever possible, methods must be referenced with the data

● Chain-of-custody -- understanding of the sample chain-of-custody procedures and the purpose of limited access to the laboratory / sample handling area

● Units -- metric units, conversions, equivalencies (μg/mL = mg/L, mg/Kg = ppm, etc.), fundamental relationships for water (1L = 1Kg, 1g = 1mL)

● Calculations -- use of calculation formulas, canceling out units to final reporting units, dilution factors, QC calculations (%R, RPD, etc.)

● Significant figures -- standard rules for determining significant figures and rounding-off, number of significant figures to report for specific analyses

● Standard curves and linearity -- standard curve coefficients of linearity, expected linear ranges for specific analyses, determining required dilutions

● Consistency -- the importance of a consistent analytical procedure and technique to ensure valid and reproducible results

● QA/QC measures -- system calibration, analysis of calibration checks, control samples, blanks, duplicates, and spikes to support the validity of sample results

● Sample preservation -- use of the proper sample bottle with correct preservation for a specific analysis, performing analysis within method-prescribed holding time

● Aliquots -- must attain a representative sample, shake liquids before each aliquot is taken, mix solids well

● Reagents and standards -- the importance of fresh reagents and standards, documentation of reagents and standards preparation, use of proper bottles and storage, periodic re-standardization of acids and bases, use of second-source QC checks to verify working standards

The following safety topics must be reviewed:

● Habitual use of routine safety equipment such as safety glasses, gloves, and fume hoods; understanding conditions which require additional protection such as goggles, rubber apron, etc.

● Knowledge of the locations of emergency equipment, including eyewash station, fire blanket, emergency showers, spill kits

● Knowledge of all lab safety rules

● Knowledge of emergency escape routes and thorough familiarity with the building Fire and Life Safety Plan

● Thorough familiarity with the Chemical Hygiene Plan, MSDS sheets, spill response for lab chemicals, waste disposal

Section 21

ACCOMMODATIONS AND ENVIRONMENTAL CONDITIONS
(TNI V1:M2 – Section 5.3)

21.1 Environmental

The Water Pollution Control Laboratory (WPCL) was commissioned in 1997 and was designed specifically for the testing of environmental samples. The entire building is known as the Water Pollution Control Laboratory even though the laboratory itself comprises about half the total square footage. The laboratory is serviced by a dedicated heating/ventilating/air conditioning (HVAC) system working in consort with a centralized exhaust unit such that conditioned air is supplied to the laboratory at a slightly greater rate than that removed by the exhaust unit. The triple-filtered supply air is nominally set at 68 °F with a stability target of $\pm$ 2 °F across the lab. The laboratory itself is kept at negative pressure in relation to the rest of the facility, with a ΔP target of -0.05 inches of water. Large-face thermometers are placed throughout the lab. The differential pressure between the laboratory and the rest of the building is continuously monitored via a magnahelic gauge on the south wall of Process Control Room 135. Any problems with lab temperature or HVAC are reported to the Lab Manager and subsequently to Bureau of General Services personnel.

Back up power is provided by a diesel powered generator with an amperage capacity to run the entire facility. Full current is available within two seconds of power loss to the building. Emergency and safety lighting, the facility security system, the exhaust system, and most instruments are on the emergency power tie-in. Because the instrument computers will shut down within this short time period, most major instruments (ICP, ICP/MS, GC, GC/MS, etc.) have uninterruptable power supplies (UPS) capable of running both the instruments and any ancillary equipment (turbo vacuum pumps, chillers, etc.) for a long enough time period to complete a controlled shut down of the instrument system. All UPS are also equipped with power conditioning transformers.

The HVAC and hood systems are monitored during the annual sash hood survey per the Fume Hood Monitoring SOP.

The laboratory has a named Chemical Hygiene Officer and operates under a Chemical Hygiene Plan (CHP) written following the model plan published by the American Chemical Society. A copy of the CHP is kept on the Group 100 common drive at

GROUP 100 (\\OBERON) S:/LAB/CHP DOCUMENTS/CHP.

21.2 Work Areas

Work areas may include access and entryways to the laboratory, sample receipt area, sample storage area, sample process area, instrumental analysis area, chemical and waste storage area and data handling and storage area.

Access to, and use of, areas affecting the quality of the environmental tests is controlled by restriction of areas to authorized personnel only. See Section 21.4, below.

The laboratory work spaces are adequate for their use, and appropriately clean to support environmental testing and ensure an unencumbered work area. A summary of the work parameters for the laboratory are provided in Table 21-1.

Table 21-1. Laboratory Workspace & Physical Plant

ROOM	FUNCTION	BENCH SPACE (LINEAR FEET)	HOODS SASH	HOODS CANOPY	SINKS	REFRIGERATORS
134	Nutrients	85	2	1	3	4
135	Process I	85	2	2	4	4
136	Organics I	107	2	0	3	3
138	Metals	79	3	0	2	1
139	Metals/Organics①	0	0	0	0	0
140	Organics II	69	2	2	2	4
141	Microbiology②	68	0	2	3	1
142	Gen Chem I③	77	0	2	3	1
143	Gen Chem II	100	3	0	3	3
153	Utililty	0	0	0	0	2
155	Sample Receiving	55	2	2	1	1
156	Utililty	48	0	0	2	0
---	Lab Corridor	30	0	0	0	0
	TOTALS	803	16	11	26	24

① this area also has an 8-ft, all plastic, laminar flow sash hood & a mobile ductless fume hood
② this area also has a 6-ft laminar flow sash hood
③ this area also has a dual snorkel vent system

The laboratory is an open module design in which each type of analysis (organics, metals, nutrients, etc.) is done in its own room. The rooms are open to a common hallway down the center of the lab. Laboratory space is arranged to minimize cross-contamination between incompatible areas of the laboratory. For example, the volatiles GC/MS is situated in the NW corner of Room 139, well away from the two rooms (136 & 140) in which organics extractions may occur. The laboratory is included in the duties of the contracted building janitorial services. These duties are limited to daily floor sweeping, emptying the regular trash and recycling containers, and removing any large cardboard flats.

21.3 Floor Plan

A floor plan of the laboratory is provided in Appendix C.

21.4 Building Security

The building and the laboratory section are locked 24/7, and access is via a card lock system. The laboratory portion of the building is separately card locked, and only laboratory staff and personnel whose duties require entering the laboratory have access cards. The door card lock system is tied into a general alarm package that includes fire and intrusions alarms throughout the facility. All alarms are local (sight and sound) and by automatic telephony to a local security company that dispatches either a private security patrol (door or intrusion alert) or first responders (fire or medical). Laboratory security is summarized in Policy Statement #20 – Lab Access. Security system problems are brought to the attention of the WPCL designated Facility Manager.

A visitor’s log is maintained on the counter of the main reception area for every visitor to sign in and out. Persons requesting lab access MUST identify themselves and MUST be okayed for admittance and then escorted into the lab by someone pre-authorized for lab entry. Examples include instrument repair engineers, supply vendors, and vendors on site in conjunction with Bureau of General Services building projects (electricians, HVAC engineers, etc.). If access is granted by a non-lab person, a member of the lab staff MUST be notified upon entry. The lab staff person will then serve as escort within the laboratory proper.

Signs are used to designate secure areas.

Section 22

ENVIRONMENTAL METHODS AND METHOD VALIDATION
(TNI V1:M2 – Section 5.4 and Sections 1.4, 1.5 and 1.6 of Technical Modules TNI V1:M 3-7)

Methods and/or procedures are available for all activities associated with sample analysis including preparation and testing. For purposes of this Section, "method" refers to both the sample preparation and determinative methods. Analytical methods performed at WPCL are listed in Appendix K.

Before being put into use, a test method is confirmed by a demonstration of capability or method validation process.

All methods are published or documented. Deviations from the methods are allowed only if the deviation is documented, technically justified, authorized by management and accepted by the customer.

22.1 Method Selection

A reference method is a method issued by an organization generally recognized as competent to do so. When the laboratory is required to analyze a parameter by a specified method due to a regulatory requirement, the parameter/method combination is recognized as a reference method. At WPCL, the source of most reference methods is either the U.S. EPA or *Standard Methods for the Examination of Water and Wastewater*.

The laboratory uses methods that meet the needs of the customer. Such methods are based on the latest revision of the method, within 1 year of approval, unless it does not meet the needs of the customer. For example, a client's NPDES permit may specify an older method version.

The laboratory selects methods that are appropriate to the customer needs. When the regulatory authority mandates or promulgates methods for a specific purpose, only those methods will be used.

If a method proposed by a customer is considered to be inappropriate or out-of-date, the customer is informed and the issue is resolved before proceeding with analysis of any samples. (See Section 7, *Review of Requests, Tenders and Contracts*.) The IMS project manager has direct contact with the customer to explain method requirements and resolve discrepancies and concerns.

If a method is not specified by the customer, an appropriate method will be selected based on regulatory requirement. For NPDES permit work, the method will be selected from those specified in 40 CFR Part 136. When methods are specified in a Sampling and Analysis Plan (SAP) and/or Quality Assurance Project Plan (QAPP) approved by Oregon DEQ and/or U.S. EPA prior, the project-specified methods are used. For environmental clean-up projects, methods from EPA SW 846, or listed in 40 CFR Part 136, and/or state-approved hydrocarbon methods are used.

If the end use of the data is not regulatory and the customer does not specify a method, the laboratory will determine the customer needs in terms of reporting level, requirements for precision and specificity (screening vs. quantitative), and laboratory capabilities. The laboratory will use a standard method which has been validated for use at WPCL, if one is available. If a non-standard screening procedure is used, it will be clearly stated in a case narrative included on the analysis report.

22.2 Laboratory-Developed Methods

WPCL does not create new methods but may modify standard chemistry methods for improved performance. If the method will be used to analyze samples under regulatory requirements and the standard method is significantly modified, the laboratory applies to U.S. EPA for Alternative Test Procedure (ATP) approval. At this time, WPCL has two formal ATP approvals. One is microwave digestion of water samples for subsequent ICP-MS analysis for mercury. The other is microwave digestion of water samples for subsequent ICP analysis for molybdenum and silver.

If the laboratory significantly modifies a method, the process is planned and documented. All personnel involved in the process are in communication during all stages of development. The U.S. EPA ATP protocols for method validation are followed. The laboratory Technical Manager is responsible for internal approval and the ATP application.

22.3 Method Validation

Validation is the confirmation, by examination and objective evidence, that the particular requirements for a specific intended use are fulfilled.

At a minimum, reference methods are validated by performing an initial demonstration of capability. This may be sufficient for simple methods or where the analyst has performed the analysis previously using the same or similar reference method. When an unfamiliar method is to be implemented, additional validation procedures are employed. Likewise, when a standard method is modified within the scope of acceptable modifications (ATP not required), validation procedures are used to ensure that sample results will be at least as accurate and precise as those produced by the pre-modified method.

Method validation is designed so that the laboratory can demonstrate that the method is appropriate for its intended use. All records (e.g., planning, method procedure, raw data and data analysis) shall be retained while the method is in use. To document completion of acceptable method validation procedures for a new method, the QA Coordinator prepares a memorandum to state the intended use of the method and assert that validation requirements have been met.

22.4 Estimation of Analytical Uncertainty

Analytical Uncertainty: A subset of Measurement Uncertainty that includes all laboratory activities performed as part of the analysis.

For each test measurement, uncertainly is characterized by the bias and precision targets as stated in the method and as determined by the analysis of appropriate QC check samples.

22.5 Control of Data

To ensure that data are protected from inadvertent changes or unintentional destruction, the laboratory uses procedures to check calculations and data transfers (both manual and automated).

22.5.1 Computer and Electronic Data Requirements

The laboratory assures that computers, user-developed computer software, automated equipment, or microprocessors used for the acquisition, processing, recording, reporting, storage, or retrieval of environmental test data are:

- documented in sufficient detail and validated as being adequate for use;
- protected for integrity of data entry or collection, data storage, data transmission and data processing;
- maintained to ensure proper functioning and are provided with the environmental and operating conditions necessary to maintain the integrity of environmental test data; and
- held secure including the prevention of unauthorized access to, and the unauthorized amendment of, computer records. Data archive security is addressed in Section 16, *Control of Records*, and building security is addressed in Section 21, *Accommodations and Environmental Conditions*.

The LIMS (Element DataSystem®) is a purchased program from a reputable vendor (Promium, LLC). The LIMS system includes a data transfer tool (DataTool) to transfer data from laboratory instruments into the LIMS. These programs were pre-validated by the vendor. When a LIMS software revision is to be implemented, basic funtions are checked by assigned IT and laboratory staff prior to laboratory-wide use of the new software version.

The laboratory controls access to the LIMS and all programs that are used to acquire, process, record or report data. An employee is granted access depending on assigned responsibilities and job description.

Instrumental data can be accessed at the instrument or instrument user’s business network desktop computer, which requires unique password-protected log-in for qualified analysts.

Each staff member has a unique identification and password for the LIMS. In the LIMS, analytical staff may modify data and change analysis status only for methods for which they are certified as analysts. The QA and Production Coordinators have privileges for final QA review for all methods. This includes the ability to modify results and analysis information, and add qualifiers. Programmers are IT professionals and have full access to the LIMS.

Changes to entries in the LIMS are allowed only for technically valid reasons. The LIMS audit trail function tracks changes that are made after the analyst has finalized and locked the data, i.e., changes made by a reviewer or by the analyst after initially locking the data. An internal comment (Q flag) may be added to explain changed data, or a comment may be added to the automatic audit trail entry. A data reviewer should change results only with approval of the analyst or another reviewer. If an obvious correction is needed, or if the analyst is not available, a change may be made without approval.

The LIMS has a system for tracking analysis status, which allows users to know whether results are in process or final. The general status progression is "Received", "Batched", "Analyzed", "Peer Reviewed", "QA Reviewed". Results that are not yet locked by the analyst and updated to "Analyzed" status are not considered reportable even as preliminary data. After set at "Analyzed," the data undergoes peer review by another analyst or a laboratory coordinator. This is a full review of the data, as described in Section 27.4, *Data Review*. If an analyst has performed the peer review, the laboratory coordinator need only perform the final QA review.

All analytical results in the LIMS are eventually updated to status "QA Reviewed" by a laboratory coordinator, indicating that the results are final. This status designation electronically locks the data, minimizing the chance of inadvertent changes to the data. If corrections are needed, a coordinator may make the corrections or may change the status back to "Analyzed," allowing an analyst to make corrections. After the corrections are reviewed, the status is re-set to "QA Reviewed" by a laboratory coordinator. The LIMS audit trail function tracks data changes and status changes.

In cases in which the laboratory uses spreadsheets external to the LIMS to calculate final results from the raw data, results are manually entered into the LIMS. Before reporting any results derived from these programs, the laboratory validates the underlying calculations by comparing results of the spreadsheet with manually calculated results. Because all analytical results are reviewed for accuracy, the spreadsheet calculations are routinely verified in the data review process. (See Section 27.4, *Data Review*.) If changes are made to a spreadsheet program, the changes are validated immediately by comparison with manual calculations.

Electronic data back-up is discussed in Section 16, *Control of Records*.

22.5.2 Data Reduction

The laboratory has manual integration procedures that must be followed when integrating chromatographic peaks during data reduction. Refer to SOP QA/QC-10.01 Manual Integration Guideline.

The analyst calculates final results from raw data, or appropriate computer programs provide the results in a reportable format. In most cases the LIMS calculates final results from data that are imported or manually entered into the system. The test methods provide required concentration units, calculation formulas and any other information required to obtain final analytical results, and these factors are programmed into the LIMS.

Analytical results are rounded to a specified number of significant figures for reporting. The number of significant figures reported depends on the analysis and on the precision of measurements that contribute to the final value. Laboratory policies for rounding and reporting significant figures are described in Appendix J.

All raw data is retained in printed hardcopies of instrument output, printed LIMS bench sheets, and/or laboratory notebooks. Instrument raw data is also retained electronically where applicable. Data records are maintained as described in Section 16, *Control of Records*.

22.5.3 Data Review Procedures

All analytical results are subject to multi-level data review procedures. Data review procedures are described in Section 27.4, *Data Review*.

Section 23

CALIBRATION REQUIREMENTS
(TNI V1:M2 – Sect 5.5 and Section 1.7 of Technical Modules TNI V1:M 3-7)

23.1 General Equipment Requirements

The laboratory provides all the necessary equipment required for the correct performance of the scope of environmental testing performed by the laboratory.

All equipment and software used for testing and sampling are capable of achieving the accuracy required for complying with the specifications of the environmental test methods as specified in the laboratory SOPs.

Equipment is operated only by authorized and trained personnel. (See Section 20, *Personnel*.)

The laboratory has procedures for the use, maintenance, handling and storage of equipment and they are readily available to laboratory personnel. Manuals provided by the manufacturer of the equipment provide information on use, maintenance, handling, and storage of the equipment.

The laboratory maintains an equipment list that include information on equipment location. (See Appendix H, Tables H-1 and H-2). Planned maintenance and calibration procedures for support equipment ensure proper functioning of the equipment and prevent contamination or deterioration. SOPs on the use of support equipment include maintenance and calibration procedures. Analytical instruments are maintained according to manufacturer and vendor recommendations. Routine maintenance activities for instruments are listed in Tables H-3a through H-3f of Appendix H. The method SOPs contain specific requirements and protocols for calibration of analytical instruments.

All equipment is calibrated or verified before being placed in use to ensure that it meets laboratory specifications and relevant standard specifications. New equipment is installed according to manufacturer instructions. Complex analytical instrumentation is installed by the vendor.

Support equipment such as refrigerators, ovens, incubators and balances are monitored each day of use. Daily readings for monitored parameters are documented on worksheet forms, which are retained as laboratory records.

All equipment, including hardware and software, are safeguarded from adjustments that would invalidate the test result measurements by limiting access to the equipment and using password protection where possible. (See Section 22.5, *Control of Data*.) In general, laboratory equipment is protected from inappropriate handling by limiting access to the locked laboratory and through training protocols that include demonstration and discussion of correct equipment usage.

Equipment that has been subject to overloading, mishandling, given suspect results, or shown to be defective or outside specifications is taken out of service. The equipment is isolated to prevent its use or clearly labeled as being out of service until it has been shown to function properly. If it is shown that previous tests are affected, then procedures for nonconforming work are followed and results are documented. (See Section 12, *Control of Nonconforming Environmental Testing Work* and Section 14, *Corrective Action*.)

The laboratory does not use equipment that is not in the permanent control of the laboratory.

Each item of equipment and software used for testing and significant to the results is uniquely identified. Records of equipment and software are maintained. This information includes the following:

a) identity of the equipment and its software;
b) manufacturer's name, type identification, serial number or other unique identifier;
c) checks that equipment complies with specifications of applicable tests;
d) current location;
e) manufacturer's instructions, if available, or a reference to their location;
f) dates, results and copies of reports and certificates of all calibrations, adjustments, and acceptance criteria;
g) maintenance plan where appropriate, and maintenance carried out to date; documentation on all routine and non-routine maintenance activities and reference material verifications;
h) any damage, malfunction, modification or repair to the equipment;
i) date received, if available.

23.2 Support Equipment

Support equipment includes, but is not limited to: fume hoods, balances, ovens, refrigerators, freezers, incubators, water baths, autoclaves, temperature measuring devices, volumetric dispensing devices, centrifuges, blenders, shakers, rotary extractors, ultrasonic disruptors, hot block digesters, and microwave digesters.

All support equipment is maintained in proper working order. Records are kept for all repair and maintenance activities, including service calls.

Records are retained to document equipment performance. These records include maintenance logbooks, calibration logbooks, and/or copies of vendor service records. In some cases, dated stickers are applied to the equipment to verify annual or other periodic maintenance.

23.2.1 Support Equipment Maintenance

Regular maintenance/calibration of calibrated support equipment, such as balances and fume hoods, is conducted at least annually. The HEPA fume hood filters are replaced as needed, based on flow. Rotary extractors, shakers, and centrifuges are cleaned and oiled as needed. Maintenance for temperature-monitored equipment, such as ovens and refrigerators, is conducted if daily checks indicate a problem.

A building mechanic is responsible for maintaining and servicing instrument power backup batteries and laboratory refrigerators, and may repair or oversee repair of other mechanical functions such as the fume hoods. The uninterruptable power supply (UPS) batteries are replaced every four years, based on the manufacturer's estimated five-year lifetime. Refrigerator coils are vacuumed annually.

Records of maintenance to support equipment are documented in maintenance logs, or copies of vendor maintenance records are kept in binders. Each piece of support equipment does not necessarily have its own logbook but must be documented. Maintenance logbooks may be shared with equipment that is housed in the same laboratory area. For some basic maintenance, a dated sticker is applied to the equipment to verify annual or other periodic maintenance.

For all microbiology equipment, detailed procedures for maintenance, calibration and documentation are found in the SOP called QA/QC for Microbiology.

23.2.2 Support Equipment Calibration

Support equipment calibration, verification, and acceptance criteria are described in SOPs for each type of equipment.

Balances, weights, and reference thermometers are calibrated annually by an A2LA-accredited calibration service provider. The equipment is calibrated over the entire range of use using NIST traceable references. Microwave digesters are serviced and calibrated annually by the vendor. Fume hoods are checked annually for flow. Rotary extractors that require method-specified rotation frequency are checked annually.

If the results of the calibration of support equipment are not within specifications, the equipment is removed from service until repaired, or a correction factor is applied. If correction factors are used this information is clearly marked on or near the equipment. Calibration procedures and results are documented on vendor calibration reports and/or in laboratory maintenance logbooks. The vendor also affixes a sticker to the equipment indicating the calibration date.

Balances, ovens, refrigerators, freezers, incubators, and water baths are verified with a NIST traceable reference each day prior to use, to ensure operation is within the expected range for the application for which the equipment is to be used. The daily readings are written on log sheets that are posted on or near the equipment.

Volumetric dispensing devices (except Class A glassware and glass microliter syringes) are checked for accuracy on a quarterly basis or if measurement accuracy is in question. These checks are documented in a logbook. Automatic pipets are sent to the vendor for repair and calibration as needed.

For all microbiology equipment, detailed procedures for calibration and maintenance are found in the SOP named QA/QC for Microbiology.

23.3 Analytical Equipment

23.3.1 Maintenance for Analytical Equipment

All analytical equipment is properly maintained, inspected, and cleaned. All vendor supplied and in-house (routine) maintenance is detailed in the tables in Appendix H.

Maintenance of analytical instruments and other equipment may include regularly scheduled preventive maintenance or maintenance on an as-needed basis. Records of maintenance to analytical instruments are documented in instrument maintenance logs, or copies of vendor maintenance records are kept in binders. Instrument malfunction is documented and becomes part of the laboratory's permanent records. A description of what was done to repair the malfunction and proof of return to control are also documented in the log.

23.3.2 Instrument Calibration

Information on instrument calibration can be found in method SOPs. Initial instrument calibration and continuing instrument calibration verification are an important part of ensuring data of known and documented quality. Generally, procedures and criteria regarding instrument calibrations are specified in the reference methods or associated guidelines (e.g., EPA SW846 chapters and general methods). Specific concentrations may be modified but the calibration procedures used are at least as stringent and specific as those listed in reference methods. Prior to use, new analytical equipment is calibrated during method validation procedures, and ongoing calibration is verified according to method SOPs. Analytical calibration documentation is filed with other analytical data.

Section 24

MEASUREMENT TRACEABILITY
(TNI V1:M2 – Section 5.6)

Measurement quality assurance comes in part from traceability of standards, reference materials and reagents to certified materials.

Note: The term "reference standard" refers to a physical entity used as a measurement reference, such as a reference weight or thermometer. The term "reference material" refers to a chemical reference solution (analytical standard) or microbiological culture.

The laboratory has procedures for purchase, receipt and storage of standards, reference materials and reagents. Purchase procedures are described in Section 9, *Purchasing Services and Supplies*.

All equipment used affecting the quality of test results are calibrated using reference standards or materials prior to being put into service and on a continuing basis. (See Section 23, *Calibration Requirements* and method SOPs.) These calibrations are traceable to national standards of measurement where available.

If traceability of measurements to SI units is not possible or not relevant, evidence for correlation of results through interlaboratory comparisons, proficiency testing, or independent analysis is provided.

24.1 Reference Standards

Reference standards are standards of the highest quality available at a given location, from which measurements are derived.

Reference Standards, such as ASTM Class 1 weights, are used for calibration only and for no other purpose.

Reference standards, such as ASTM Class 1 weights, are calibrated by an entity that can provide traceability to national or international standards. The following reference standards are sent out to be calibrated to a national standard as indicated in Section 23, *Calibration Requirements*:

- Class 1 and Class S weights
- NIST traceable reference thermometers

Additional working standards such as internal thermometers are checked using the protocol and frequency listed in the relevant SOP (e.g., Thermometer Calibration).

24.2 Reference Materials

Reference materials are substances that have concentrations that are sufficiently well established, both qualitatively and quantitatively, to use for calibration or as a frame of reference.

Reference materials, where commercially available, are traceable to national standards of measurement, or to Certified Reference Materials, usually by a Certificate of Analysis.

Purchased reference materials require a Certificate of Analysis where available. If a reference material cannot be purchased with a Certificate of Analysis, it is verified by analysis and comparison to a certified reference material and/or demonstration of capability for characterization.

Internally prepared reference materials, such as working analytical standards or intermediate stock solutions, are checked as far as is technically and economically practical. Working analytical standards are checked against a second source at first time of use. When a second source is not available, a vendor-certified different lot is accepted as a second source. In general, the analysis of an Initial Calibration Verification (ICV) standard is used as a second source confirmation for reference materials.

Working standards and intermediate stock solutions are given expiration dates when they are prepared based on method or regulatory requirements. These standards are generally either used up or disposed of by the expiration date. Expiration dates can be extended if the reference standard or material's integrity is verified. The extended date may not be beyond the expiration date of the reference standards used to re-verify. If the standard meets CCV recovery criteria and the ICV (second source) recovery is also acceptable, the standard is considered re-verified.

Preparation, storage and expiration of intermediate and working solutions are discussed in the method SOPs.

24.3 Reagents

In methods where the purity of reagents is not specified, analytical reagent grade is used. If the purity is specified, that is the minimum acceptable grade. Purity is verified and documented according to Section 9, *Purchasing Services and Supplies*. Purchased reagents are inspected upon receipt to verify acceptable quality. The label and packing list are checked to insure the correct product/grade was received, and the container is checked for damage.

Reagents are verified to meet the requirements of the test method at the time of initial use. If the analytical standards respond typically and the method blank and LCS results are acceptable, then the new reagent is assumed acceptable.

24.4 Transport and Storage of Reference Standards and Materials

The laboratory handles, stores and transports reference standards, reference materials and reagents in a manner that protects their integrity. Their integrity is protected by separation from incompatible materials and/or minimizing exposure to degrading environments or materials.

Reference standards are stored in appropriate containers and according to manufacturer's recommendations. Reference standards are handled with care when in use, to avoid physical jarring, scratching or other potential damage. If the integrity of a reference standard is potentially impaired, it is tested to determine whether reliability and accuracy have been affected.

Reference materials and reagents are stored according to manufacturer's recommendations and method SOP requirements. Reference materials and prepared dilutions used in trace analytical methods are stored separately from samples. This includes metals, organics, and nutrients standards.

24.5 Labeling of Reference Materials and Reagents

24.5.1 <u>Purchased Reference Materials, Reagents and Media</u>

Records for all reference materials, reagents and media include:

- the manufacturer/vendor name (or traceability to purchased stocks or neat compounds)
- the manufacturer's Certificate of Analysis or purity (if supplied)
- the date of receipt
- recommended storage conditions

Purchased reference materials, reagents and media are logged into the LIMS. The LIMS assigns and stores a unique identification number and labels are printed for each container. The labels contain the unique ID number, product name, expiration date, and preparer's name (vendor name, for purchased stock). A hardcopy record can be printed from the LIMS for each standard, reagent, or media logged in.

If the original container does not have an expiration date provided by the manufacturer or vendor it is not required to be labeled with an expiration date. If an expiration date is provided, it must be labeled with the expiration date, and the expiration date is entered in the LIMS.

Due to LIMS limitations, an expiration date must be entered for every standard, reagent, or media logged into the system. If no expiration date is available, choose the date farthest into the future that the system will allow. Also, the LIMS considers a material expired at time 00:00 on the expiration date given. However, it is allowable to use the material on the expiration date, though the LIMS may indicate that the material is expired.

24.5.2 <u>Prepared Analytical Standards, Reagents and Media</u>

Records for analytical standards, reagents and media preparation include:

- traceability to purchased stock or neat compounds
- preparation weights/volumes or reference to the method of preparation
- date of preparation
- an expiration date after which the material shall not be used (unless its reliability is verified by the laboratory)
- preparer's name or initials (if prepared)

Prepared analytical standards, reagents and media are logged into the LIMS. The information listed above is entered into the LIMS, including the ID number of the stock standard (reference material). The LIMS assigns a unique identification number and labels are printed for each container. The labels contain the unique ID number, product name, expiration date, and preparer's name. A hardcopy record can be printed from the LIMS for each prepared standard, reagent, or media.

Section 25

COLLECTION OF SAMPLES
(TNI V1:M2 – Section 5.7)

WPCL provides limited sampling services for one customer, discussed below. Otherwise, the laboratory's responsibility in the sample collection process lies in supplying samplers with the necessary coolers, reagent water, sample containers, preservatives, sample labels, custody seals, chain of custody (COC) forms, ice, and packing materials required to properly preserve, pack, and ship samples to the laboratory. The Field Operations (FO) section organizes sampling supplies for their sampling events. IMS prepares project COC forms and provides customers with necessary sample containers, coolers, and other supplies.

WPCL collects samples from the Columbia Boulevard Wastewater Treatment Plant (CBWTP) using procedures detailed in WPCL SOP QAQC-02.

25.1 Sampling Containers

The laboratory offers clean sampling containers for use by clients. For trace-level water sample and soils, appropriately certified clean containers are purchased for one-time use.

25.1.1 Preparing Container Orders

Containers (containing any required preservatives) are provided to the client upon request. See WPCL SOP QAQC-01.

25.1.2 Sampling Containers, Preservation Requirements, Holding Times

Sampling container, preservation and holding time requirements are provided in Appendix L.

If preservation or holding time requirements are not met, the procedures in Section 12, *Control of Nonconforming Environmental Testing Work* are followed.

25.2 Sampling Plan

The laboratory personnel are not responsible for collecting samples or providing sampling plans except as noted for CBWTP. Sampling plans are the responsibility of work groups outside the laboratory's purview.

25.3 Sampling Records

The following relevant sampling data are recorded on the COC: the date and time of sampling, the identification of the sampler, the sampling location, analyses requested, and any special considerations regarding the analyses.

Section 26

HANDLING SAMPLES AND TEST ITEMS
(TNI V1:M2 – Section 5.8 and Section 1.7 of Technical Modules TNI V1:M 3-7)

26.1 Sample Receipt

When samples are received at the laboratory, chain-of-custody is reviewed, condition is documented, and the samples are given unique identifiers, logged into the laboratory information management system (LIMS), and processed as required for the analyses requested.

26.1.1 Chain of Custody

The chain of custody (COC) from the field are reviewed. This documentation is completed in the field and provides a written record of the handling of the samples from the time of collection until they are received at the laboratory. Section 25, *Collection of Samples* and SOP QAQC-01 outline what information is needed on this record. The COC also provides information on what type of testing is being requested and can act as an order for laboratory services in the absence of a formal contract. An example COC is provided in Figure 26-1. Chain of custody and any additional records received at the time of sample submission are retained by the laboratory as hard copies filed with final data reports or in COC files maintained in a secure storage area. All COCs are scanned and entered into the LIMS.

26.1.1.1 Legal Chain of Custody

The WPCL does not accept samples identified for legal/evidentiary purposes.

26.2 Sample Acceptance

Procedures for opening shipping containers and examining samples are provided in SOP QAQC-01. Procedures for sample receiving during off hours or when the Sample Custodian is absent are provided in Policy Statements #10, *Late Arriving Samples*, #13, *Indirectly Relinquished Samples*, and #34, *Emergency Sample Receiving Instructions*. A responsibility flow-down list is provided in Policy Statement #11, *Sample Receiving*.

The laboratory sample acceptance policy is detailed in Section 8.1 of SOP QAQC-01. A checklist is used to check samples for the conditions detailed in the SOP and is provided in Figure 26-2. In addition the laboratory has nonconformance/corrective action procedures to handle samples that don’t meet the requirements or show signs of damage, contamination, or inadequate preservation. Guidelines are provided in Policy Statement #4, *Compromised Samples*. Data are appropriately qualified when samples are reported that do not meet sample acceptance requirements.

If these requirements are not met, the client is contacted prior to any further processing, then 1) the sample is rejected as agreed with the client, 2) the decision to proceed is documented and agreed upon with the client, 3) the condition is noted on the Chain of Custody form and/or lab receipt documents, and 4) the data are qualified in the report.

26.2.1 Preservation Checks

The following preservation checks are performed and documented upon receipt:

26.2.1.1 *Thermal preservation:*

a) For temperature preservation, the acceptable range is from just above freezing to 6 °C.

b) Samples that are delivered to the lab the same day as they are collected are likely not to have reached a fully chilled temperature. This is acceptable if the samples were received on ice and the chilling process has begun.

c) Record on the receipt form if ice is present and the temperature.

d) The pH of samples requiring acid/base preservation is checked upon sample receipt or upon initiation of analysis.

26.3 Sample Identification

Samples, including subsamples, extracts and digestates, are uniquely identified by the LIMS in a permanent chronological order to prevent mix-up and to document receipt of all sample containers.

Samples are assigned sequential numbers that reference more detailed information kept in the LIMS.

The following information is included in the LIMS:

- Client and project name
- Date and time of receipt at lab
- Unique laboratory identification number
- Signature or initials of person making the entries

In addition, the following information is maintained and linked to the log-in record:

- Date and time of sampling linked to the date and time of laboratory receipt.
- Unique field identification number linked to the laboratory sample ID
- Analyses requested (including applicable approved method numbers) linked to the laboratory sample ID.
- Comments regarding rejection (if any).

All documentation received regarding the sample, such as memos or chain of custody, are retained in project folders and electronically in the LIMS.

26.4 Sample Aliquots / Subsampling

In order for analysis results to be representative of the sample collected in the field, the laboratory has subsampling procedures. Procedures are detailed in Section 8.5, *Sample Compositing and Subsampling*, in SOP QAQC-01.

26.5 Sample Storage

Samples that require thermal preservation are stored under refrigeration. For samples with a specified storage temperature of 4 °C, storage at a temperature just above freezing to 6 °C is acceptable. Refer to SOPs QAQC-08 and QAQC-09.

Samples are held secure, as required. Samples are accessible only to laboratory personnel.

Samples are stored apart from standards, reagents, food or potentially contaminating sources, and such that cross-contamination is minimized. All portions of samples, including extracts, digestates, leachates, or any product of the sample is maintained according to the required conditions.

26.6 Sample Disposal

Samples are retained for various times depending upon the matrix and analysis. For example, all soil samples and water samples analyzed only for metals are stored for three months after the report is sent out, unless other arrangements have been made with the client.

Samples are disposed of according to Federal, State and local regulations. Procedures for the disposal of samples, digestates, leachates, and extracts are described in SOP QAQC-14, *Waste and Sample Disposal*.

26.7 Sample Transport

Samples that are transported under the responsibility of the laboratory, where necessary, are done so safely and according to storage conditions. This includes moving bottles within the laboratory. Specific safety operations are addressed outside of this document.

The WPCL does not ship samples. Samples for outside analyses are picked up daily or on an as-needed basis by the contract laboratory, whose personnel pack the samples and transport them back to their premises.

Rarely, lab personnel may need to transport samples to a contract lab. If so, the samples are packed in coolers with cooling material (freezer packs or ice) for transport.

Figure 26-1

Example Chain-of-Custody

Water Pollution Control Laboratory
6543 N. Burlington Ave.
Portland, Oregon 97203-4552
Sample Custodian: (503) 823-5696
General Lab: (503) 823-5681

City of Portland
Chain-of-Custody
Bureau of Environmental Services

Date: __________

Work Order #: __________

Collected By: __________

Client Name:	Project Number (if applicable):
Project Name:	Project Contact:

Requested Analyses

Special Instructions:

Turn-Around-Time Request:

- ☐ Standard (10 business days)
- ☐ Rush (5 business days)
- ☐ Other: __________

Lab Number	Location ID	Sample Date	Sample Time	Grab or Comp	Sample Matrix	Requested Analyses	# of Containers	Remarks
01								
02								
03								
04								
05								
06								
07								
08								
09								
10								

Relinquished By:	Received By:	Relinquished By:	Received By:
Signature: Date:	Signature: Date:	Signature: Date:	Signature: Date:
Printed Name: Time:	Printed Name: Time:	Printed Name: Time:	Printed Name: Time:

Blank Element COC.xls

Page ______ of ______

Figure 26-2

Sample Cooler Acceptance Checklist

Work Order Number:__________________

Client name and Project: ____

Received By (date/time): ____

Sample transport: Samples received on ice____
Directly from field_________
Temp. Blank present, temperature recorded___________

Is the COC present and signed? Yes No

Are sample bottles intact? Yes No
If not, please explain:____
____

Do the COC and sample labels match? Yes No
If not, please explain:____
____

Are the appropriate containers used? Yes No
If not, please explain:____
____

Are samples appropriately preserved? Yes No NA
If not, please explain:____
____

Do VOA vials have Headspace? Yes No NA
If yes, indicate which samples:____
____

Are samples received within holding times? Yes No NA

Comments:____
____
____
____
____
____

Section 27

QUALITY ASSURANCE FOR ENVIRONMENTAL TESTING *(TNI V1:M1, V1:M2 – Section 5.9 and Section 1.7 of Technical Modules TNI V1:M 3-7)*

The City of Portland Water Pollution Control Laboratory (WPCL) has procedures for monitoring the validity of the testing it performs. Quality control (QC) metrics (e.g., targets for percent recovery of independent standards and relative percent difference of duplicates) are entered into the Laboratory Information Management System (LIMS), and the LIMS software compares these targets to analytical results. Data are used to identify metric excursions and, where applicable, to identify trends via control charting. To evaluate the quality of test results, the laboratory utilizes:

- Certified reference materials and internal quality control using secondary reference standards
- Participation in interlaboratory comparison testing programs
- Tests to define the variability and/or repeatability of laboratory tests, such as the analysis of replicates
- Retesting of retained samples
- Correlation of results for different characteristics of a sample (for example total phosphate should be greater than or equal to orthophosphate.)
- Positive and negative controls such as blanks, spikes, etc.
- Measures to evaluate the accuracy of the test method, including calibration, continuing calibrations, use of certified reference materials, proficiency test samples
- Measures to evaluate test method capability such as LOD and LOQ determinations, linear ranges, spectral interference studies
- Selection of appropriate formulae to reduce raw data to final results, such as regression and other statistical analyses
- Measures to ensure constant and consistent test conditions, both instrumental and environmental

In addition to procedures for calibration, the laboratory monitors quality control measurements such as blanks, laboratory control samples (LCS), duplicates, matrix spikes (MS), matrix spike duplicates (MSD), surrogates, and internal standards to assess precision and accuracy. Proficiency testing samples are also analyzed to assess laboratory performance.

Quality control data are analyzed and, when found to be outside pre-defined criteria, action is taken to correct the problem and to prevent incorrect results from being reported. Results associated with quality control data outside of criteria but still deemed reportable are qualified so the end user may make a determination of data usability. (See Section 28 – "Reporting of Results.")

Quality control procedures as specified in the QA Manual and in analytical standard operating procedures (SOP) are followed by all laboratory personnel. These QC procedures are as detailed in the following:

- The NELAC Institute (TNI) 2009 Standard
- 40 *CFR* 136.7
- *Standard Methods for the Examination of Water and Wastewater*
- Individual protocols published by regulatory agencies, such as the EPA, or by recognized authorities, such as ASTM.

27.1 Essential Quality Control Procedures

The quality control procedures specified in test methods are followed by laboratory personnel. The most stringent of control procedures is used in cases where multiple controls are offered. If it is not clear which is the most stringent, that mandated by test method or regulation is followed.

For test methods that do not provide acceptance criteria for an essential quality control element or where no regulatory criteria exist, acceptance criteria are developed in-house and are included in the relevant SOPs.

Written procedures to monitor routine quality controls, including acceptance criteria, are located in the test method SOPs, except where noted, and include such procedures as:

- use of laboratory control samples and blanks to serve as positive and negative controls for chemistry methods
- use of laboratory control samples to monitor test variability of laboratory results
- use of calibrations, continuing calibrations, certified reference materials and/or PT samples to monitor accuracy of the test method
- measures to monitor test method capability, such as limit of detection, limit of quantitation, and/or range of test applicability, such as linearity
- use of regression analysis, internal/external standards, or statistical analysis to reduce raw data to final results
- use of reagents and standards of appropriate quality and use of second source materials as appropriate
- procedures to ensure the selectivity of the test method for its intended use
- measures to assure constant and consistent test conditions, such as temperature, humidity, rotation speed, etc., when required by test method;

- use of sterility checks for equipment, media and dilution water for microbiology
- use of positive and negative culture controls for microbiology.

27.2 Internal Quality Control Practices

Analytical data generated with QC samples that fall within all prescribed acceptance limits indicate the test method is deemed to be in control.

QC samples that fall outside QC limits indicate the test method are deemed to be out of control (nonconforming) and that corrective action is required and/or that the data are qualified. (See Section 12, *Control of Nonconforming Environmental Testing Work* and Section 14, *Corrective Actions*.)

Detailed QC procedures and QC limits are included in test method standard operating procedures (SOPs), or where unspecified in the SOPs, are detailed in the QA Manual.

All QC measures are assessed and evaluated on an on-going basis, so that trends are detected.

27.2.1 General Controls

The following general controls are used:

27.2.1.1 Positive and Negative Controls such as:

a) Blanks (negative)
b) Laboratory control sample (positive)
c) Sterility checks and control cultures (positive and negative).

27.2.1.2 Selectivity is assured through:

a) absolute and relative retention times in chromatographic analyses;
b) two-column confirmation when using non-specific detectors;
c) use of acceptance criteria for mass-spectral tuning (found in test method SOPs);
d) use of the correct method according to its scope assessed during method validation; and
e) use of reference cultures (positive and negative) from a recognized manufacturer (where applicable).

27.2.1.3 Consistency, Variability, Repeatability, and Accuracy are assured through:

a) proper installation and operation of instruments according to manufacturer's recommendations or according to the processes used during method validation;

b) monitoring and controlling environmental conditions (temperature, access, proximity to potential contaminants);

c) selection and use of reagents and standards of appropriate quality; and

d) cleaning glassware appropriate to the level required by the analysis as demonstrated with method blanks (Glassware cleaning protocols are detailed in individual SOPs. If there is no SOP guidance, glassware is cleaned with lab detergent and hot tap water and rinsed with cold tap water, with a final DI rinse if necessary).

e) For microbiology, glassware care includes use of borosilicate glassware, use of detergents designed for laboratory use, testing each day for alkaline or acid residue with bromothymol blue, and conduct of the Inhibitory Residue test when the detergent is changed or annually, whichever is more frequent.

f) following SOPs and documenting any deviation, assessing for impact, and treating data appropriately;

g) testing to define the variability and/or repeatability of the laboratory results, such as replicates;

h) use of measures to assure the accuracy of the test method, including calibration and/or continuing calibrations, use of certified reference materials, proficiency test samples, or other measures; and

i) use of duplicate plate counts on positive samples (microbiology only).

27.2.1.4 Test Method Capability (see also Section 22, *Environmental Methods and Method Validation*) is assured through:

a) establishment of the limit of detection where appropriate;

b) establishment of the limit of quantitation or reporting level; and/or

c) establishment of the range of applicability such as linearity.

27.2.1.5 Data reduction is assured to be accurate by:

a) selection of appropriate formulae to reduce raw data to final results such as regression;

b) following specific procedures for data reduction such as manual integration procedures;

c) periodic review of data reduction processes to assure applicability;and

d) microbiological calculations, data reduction, and statistical interpretations specified by each test method;

27.2.1.6 Sample specific controls are used to evaluate the effect of sample matrix on the performance of the selected analytical method (not a measure of laboratory performance). Examples include:

- Matrix Spike and Matrix Spike Duplicate (MS/MSD)
- Surrogate Spikes
- Sample Duplicates

27.2.1.7 The following tables summarize the key elements of a quality control system for a laboratory performing chemistry and microbiology testing.

Table 27-1 Essential Quality Control Elements for Chemistry

Item	Frequency	Acceptance Criteria	Corrective action
Negative Control (Method Blank)	1/batch	Method specific or reporting limit	Qualify data and take corrective action
Positive Control (Laboratory Control Sample)	1/batch	Method specific or determined by laboratory	Reprocess, reanalyze, or qualify data.
Matrix Spike; Matrix Spike Duplicates *Note : Samples are designed as data quality indicators for a specific sample using the designated method. These controls alone are not used to judge a laboratory's performance.*	Per method requirement	Method specific or determined by laboratory	Corrective action and qualify data.
Surrogate spikes *See note above.*	Per method requirement	Method specific or determined by laboratory	Corrective action and qualify data
Matrix Duplicates *See note above.*	Per method requirement	Method specific or determined by laboratory	Corrective action and qualify data
Continuing Calibration Verification	Per method requirement	Method specific or determined by the laboratory	Reanalyze standard immediately; Corrective action
Initial calibration Verification	Start of each analytical run, after calibration	Method specific or determined by laboratory	Reanalyze standard immediately; Corrective action

Table 27-2 Essential Quality Control Requirements for Microbiology – All Methods

Item	Frequency	Acceptance Criteria	Corrective Action[2]
Sterility check	Each lot of media prior to first use	No growth	Investigate cause
Sterility check containers	One container (bottle) for each lot or batch sterilized (NSGM)[3]	No growth	Investigate cause
Sterility check dilution water	One per batch of dilution water (NSGM)[3]	No growth	Investigate cause
Sterility check filters	One filter for each new lot of membrane filters (NSGM)[3]	No growth	Investigate cause
Positive control[1]	pure culture of target organisms/ each lot or batch of medium (prior to first use of medium)	Positive reaction	Investigate cause If necessary reject the medium
Negative control[1]	Pure culture of non-target organisms/each lot or batch of medium (prior to first use of medium)	Negative reaction	Investigate cause If necessary reject the medium
Duplicate colony counts (For numeric results only)	Monthly on one positive sample for each month performed.	Same analyst <5% difference between counts[4] Two analysts <10% difference between counts[4]	Investigate cause Qualify data

1) Microorganisms may be single use preparations or cultures maintained by documented procedures that demonstrate the continued purity and viability of the organism.
2) Corrective Action may include the need to retrain.
3) NSGM = non-selective growth media
4) Calculated by the QA Coordinator

Table 27-3 Essential Quality Control Requirements for Microbiology – Pour Plate Methods Only

Item	Frequency	Acceptance Criteria	Corrective action
Method Blank	Minimum of one plate per batch Done as part of test, use method media	Internally defined Suggest 1 cfu/plate	Investigate cause, qualify/ reject data

Table 27-4 Stock Cultures		
Item	**Frequency**	**Handling**
Reference cultures	Single use	Preserved and handled per mfg. specifications
Reference culture Reference stock	Culture stocks to make working stocks	Preserved and not refrozen Handling per mfg specs
Working stocks	Not transferred more than five times. Not sub-cultured to replace reference stocks	

27.2.2 Specific Controls

See Appendix E for definitions. The ICV is a second source standard to indicate if the procedure is in control. The continuing instrument calibration verification (CCV) is used to confirm the continued validity of the initial calibration. The CCV can be either the calibration standard or, a second source standard. Specific details for instrument calibration, continuing calibration verification and Laboratory Check Standards are listed in the Standard Operating Procedure for each analytical test. Generally, the following items are the essential elements:

27.2.2.1 Method Blanks

A method blank must be analyzed at a minimum of one per batch. The matrix of the method blank must be similar to the associated samples and be free from any analytes of interest. Method blanks are not required for some analyses such as pH, conductivity, flashpoint, alkalinity, and some solids.

Contaminated blanks are identified according to the acceptance limits in the test method SOPs or laboratory documentation.

When a blank is determined to be contaminated, the cause must be investigated and measures taken to minimize or eliminate the problem.

Data that are unaffected by the blank contamination (non-detects or other analytes) are reported unqualified.

Sample data that are suspect due to the presence of a contaminated blank are re-analyzed or qualified.

27.2.2.2 Initial Instrument Calibration:

The details of the initial instrument calibration procedures, including calculations, integrations, acceptance criteria and associated statistics are included and referenced in the SOP for each analytical method. Where initial instrument calibration procedures are referenced, the referenced material is retained and readily available to analysts.

Sufficient raw data records are retained to permit reconstruction of initial instrument calibration. The raw data records include:

> Calibration date
> Test method
> Instrument
> Analysis date
> Each analyte name
> Analyst's initials or signature
> Calibration concentration and response
> Calibration curve or response factor

Sample results are quantitated from the initial calibration and are not quantitated from any continuing instrument calibration verification unless otherwise required by regulation, method or program.

All initial instrument calibrations are verified with a standard (ICV), obtained from a second manufacturer or lot if the lot can be demonstrated from the manufacturer as prepared independently from other lots. Traceability is to a national standard where available. Certificates of Analysis are required where available and are maintained as part of the QA records.

Criteria for the acceptance of initial instrument calibration (such as correlation coefficient or RPD) are established for each analytical test method. The criteria used are appropriate to the calibration technique used in the method.

The lowest calibration standard is the lowest concentration for which quantitative data are reported. Any data reported below the lower limit of quantitation are considered to have an increased quantitative uncertainty and are not reported or are reported using a qualifier. The low calibration standard is usually at least 3-5 times the Method Detection Limit (MDL).

The highest calibration standard is the highest concentration for which quantitative data are reported. Any data reported above the highest standard are considered to have an increased quantitative uncertainty and are not reported or are reported using a qualifier with a narrative explanation.

> Results for samples above the concentration range established by the initial calibration are diluted and run again so as to achieve results within the calibration range.

If the initial instrument calibration results do not meet established acceptance criteria, corrective actions are initiated before any samples are analyzed.

Calibration standards include concentrations at or below the regulatory limit where applicable.

The SOP for each analytical test method details the number of calibration points necessary for establishing the initial instrument calibration. The minimum number of calibration standards is two where mandated methods do not specify the number of calibration standards, where one standard is at the lowest quantitation limit.

27.2.2.3 Continuing Calibration Control Samples

Intermediate checks are used to maintain confidence in the calibration status of an instrument using a continuing instrument calibration verification standard (CCV) and, where applicable, a low-level CCV (LLCCV) for each analytical run. The essential elements of the CCV and LLCCV are detailed below:

The details of the CCV and LLCCV procedures, calculations, and associated statistics are included in the SOPs for each analytical test method.

A CCV and LLCCV are repeated at the beginning and end of each analytical batch. The concentration of the CCV is generally set at the midpoint of the calibration range, and the LLCCV concentration is set at the lowest calibration standard.

Raw data records are retained to allow reconstruction of the CCV and LLCCV, for example: test method, instrument, analysis date, analyte name, concentration and response, calibration curve, CCV and LLCCV records explicitly connect the CCV and LLCCV data to in initial instrument calibration.

Criteria for the acceptance of the CCV and LLCCV are established in each SOP for analytical test methods.

If CCV or LLCCV results are outside established acceptance criteria, corrective actions are performed specific to the test method as specified in the SOPs. If routine corrective actions fail to produce a second consecutive (immediate) CCV or LLCCV within acceptance criteria, the Laboratory demonstrates performance after corrective action with two consecutive successful calibration verifications or a new initial calibration is performed. If acceptable performance can not be demonstrated, sample analysis does not occur until a new calibration curve is established and verified. Samples associated with unacceptable CCV/LLCCV are re-analyzed with acceptable CCV/LLCCV, not reported, or may be reported as qualified data under the following special conditions:

When the high limit of acceptance criteria for the CCV or LLCCV is exceeded (high bias), and there are associated samples that are non-detects, then the non-detects may be reported. Otherwise, the samples affected by the unacceptable CCV or LLCCV are reanalyzed after a new calibration curve has been established, evaluated and accepted.

When the low limit of acceptance criteria for the CCV or LLCCV is exceeded (low bias), those sample results may be reported if they exceed a maximum regulatory limit/decision level. Otherwise, the samples affected by the unacceptable CCV or LLCCV are reanalyzed after a new calibration curve has been established, evaluated and accepted.

If reanalyzing the samples is not possible, data associated with an unacceptable initial instrument calibration are not reported, or are reported with appropriate data qualifiers.

Where calibrations include a correction factor, the SOPs for each analytical method include procedures for updating analytical and reporting software. Each item of equipment, both hardware and software includes safeguards to prevent adjustments that would invalidate the test and/or calibration results.

27.2.2.4 Laboratory Control Samples

Laboratory control samples are analyzed at a frequency mandated by method, regulation, or client request, whichever is more stringent. The standard frequency of LCS preparation and analysis is one per analytical batch or as otherwise stated in a laboratory SOP. Exceptions would be for those analytes where spiking is impossible (pH) or no spiking solution is available (e.g., TSS, TDS, Volatile Solids, Total Solids, chlorophyll, flashpoint, etc.)

The analytes to be spiked in the LCS are specified in the test method SOP. In some cases a client may specify a list of analytes for spiking and the request is handled using the laboratory's nonconformance procedures. The LCS may also be used as the ICV, when it is from a source separate from that used for calibration.

The results of laboratory control samples (LCS) are calculated in percent recovery or other appropriate statistical technique that allows comparison to established acceptance criteria. The laboratory documents the calculation in the test method SOPs, LIMS and below.

$$\%R = \frac{AV}{TV} \times 100$$

Where:
AV = Analyzed Value
TV = True Value

The individual LCS is compared to the acceptance criteria as published in the mandated test method, or where there are no established criteria, the laboratory either uses the mean plus or minus three standard deviations as the control limits or as otherwise stated in the method SOPs.

27.2.2.5 Matrix Spikes and Matrix Spike Duplicates

The laboratory procedure for MS/MSD includes spiking appropriate analytes at appropriate concentrations, calculating percent recoveries and relative percent difference (RPD), and evaluating and reporting the results. The procedure can be found in the method SOP, LIMS and the formulas below:

$$\%R = \frac{AV}{TV} \times 100$$

Where:
AV = Analyzed Value – Sample Result
TV = True Value

$$RPD = \frac{|S - D|}{\frac{(S + D)}{2}} \times 100$$

Where:
S = Sample Concentration
D = Duplicate Concentration

Where there are no established criteria, the laboratory uses the mean plus or minus three standard deviations as the control limits for MS/MSD.

For MS/MSD results outside established criteria corrective action is documented or the data are reported with appropriate data qualifying codes. Only the data from the spiked sample is qualified, unless evaluation of other samples in the batch indicate the need for qualifiers.

27.2.2.6 Surrogate Spikes

Surrogate recovery results are compared to the acceptance criteria as published in the mandated test method. Where there are no established criteria, the laboratory uses the mean plus or minus three standard deviations as surrogate control limits.

For surrogate results outside established criteria, data are evaluated to determine the impact. Corrective actions could include trouble shooting instrument for non compliance, remaking of standards, and rerunning of samples. Refer to test method SOPs for appropriate actions.

27.3 Proficiency Test Samples or Interlaboratory Comparisons

27.3.1 Compliance to Accreditation Requirements

The City of Portland Water Pollution Control Laboratory (WPCL) is currently seeking accreditation by the Oregon Environmental Laboratory Accreditation Program (ORELAP). The WPCL has already analyzed two TNI-compliant proficiency testing (PT) sample sets in calendar year 2012 for each field of proficiency testing (FoPT) for which it will be seeking accreditation and has analyzed the first sample set for calendar year 2013.

The successive PTs are analyzed at least five months apart and no more than 7 months apart unless the PT is being used for corrective action to maintain or reinstate accreditation, in which case the dates of successive PT samples for the same accreditation FoPT is at least fifteen days apart.

This section of the QAM will be amended when the WPCL is accredited.

27.3.2 PT Sample Handling, Analysis and Reporting

The laboratory does not share PT samples with other laboratories, does not communicate with other laboratories regarding current PT sample results, and does not attempt to obtain the assigned value of any PT sample from the PT provider.

Proficiency Testing (PT) samples are treated as typical samples in the normal production process where possible, including the same analysts, methods, preparation, calibration, quality control and acceptance criteria, sequence of analytical steps, number of replicates, and sample log-in. PT samples are not analyzed multiple times unless routine environmental samples are analyzed multiple times. Where PT samples present special problems in the analysis process, they will be treated as laboratory samples where clients have special requests.

The type, composition, concentration and frequency of quality control samples analyzed with the PT samples are the same as with typical samples.

The laboratory uses only PT providers that have been approved by ORELAP.

PT studies consist of analyzing unknown samples for all accredited analytes using each analytical method for which the laboratory is seeking accreditation.

Samples are analyzed and the results reported to the PT provider before the closing date of the PT study.

For each program, method and analyte, ongoing accreditation is contingent upon passing two out of the last three PT studies. Failure to meet the semi-annual schedule is also regarded as a failed PT study. Repeat PT studies are conducted for any failed analytes, but are not scheduled sooner than 30 calendar days from the last analysis.

Official copies of PT study results may be provided by the WPCL. However, the current WPCL PT provider transmits all reports directly to the ORELAP Administrator.

Continued accreditation is dependent on the accurate analysis of PT samples and other criteria as specified by ORELAP. Interim accreditation for a given analyte is assigned by ORELAP when the reported PT results for any analyte are outside established limits.

A laboratory may withdraw from a PT study for an analyte(s) or for the entire study if the laboratory notifies both the PT provider and the ORELAP Administrator before the closing date of the PT study.

The laboratory institutes corrective action procedures for failed PT samples following the guidelines in Section 14 – "Corrective Action."

- Whenever a PT study is failed for an analyte(s), the QA Coordinator investigates, determines the cause for failure, and takes necessary corrective action. Corrective action is documented in the laboratory's internal records in the form of a written corrective action report. The corrective action report is also provided to the ORELAP administrator.

- If a second PT study is failed out of the most recent three, then ORELAP takes action within 60 calendar days to determine the accreditation status of all methods for the unacceptable analyte(s) for that program and matrix.

The laboratory maintains copies of all written, printed, and electronic records from PT studies for a minimum of five years. This includes, but is not limited to LIMS records, bench sheets, instrument strip charts or printouts, data calculations, and data reports. These records are made available to ORELAP assessors during on-site assessments.

Prior to the closing date of a study, laboratory personnel do not:

- Subcontract analysis of a PT sample to another laboratory being run for accreditation purposes.

- Knowingly receive and analyze a PT for another laboratory being run for accreditation purposes.

- Communicate with an individual from another laboratory concerning the analysis of the PT sample.

- Attempt to find out the assigned value of a PT from the PT Provider.

PT samples usually must be diluted prior to analysis to fall within our curves. Refer to test method SOPs for proper PT handling.

27.4 Data Review and Validation

The laboratory reviews all data generated in the laboratory for compliance with method, laboratory and, where appropriate, client requirements.

Initially, the analyst reviews data for acceptability of quality control measures and accuracy of the final result(s). The analyst assembles a data packet including all data necessary to generate a final result. The final result is then hand-entered into the LIMS, or transferred to the LIMS from an instrument or spreadsheet.

- All calibration data, quality control data and sample data are recorded in electronic instrument files, or in the appropriate Laboratory Analysis notebooks. The LIMS has been configured so as to minimize manual data entry to reduce the possibility of data entry errors.
- The analyst performing the analysis checks that all quality control criteria have been achieved according to the data acceptance criteria for each analytical test and produces the sample results.
- Analysts are responsible for performing and recording the results of quality control tests and laboratory control check samples, and reporting problems to the Production or QA Coordinator.
- Analysts enter manually or electronically download the data into LIMS for subsequent validation of each analytical batch.

A second reviewer (another analyst or Lab Coordinator) reviews any hand calculations, manual data entry, and checks the data packet for completeness and acceptability of QC measures. The reviewer also spot-checks electronic transfers of data. Only the Production Coordinator or QA Coordinator may designate data as "QA Reviewed", which is the final LIMS status before reporting. Other reviewing analysts designate data as "Peer Reviewed". Before moving data to "QA Reviewed", the data is considered in more detail by the second reviewer or QA Coordinator. Process Control and Microbiology data are usually moved to "QA Reviewed" by the Production Coordinator. Data from Nutrients, Organics, and Metals is usually "QA Reviewed" by the QA Coordinator. The QA Coordinator also occasionally compares raw data to data entry as part of auditing.

- The second reviewer performs the second level of data validation by checking to see that all data entered in LIMS are free from transcription and calculation errors.
- The QA Coordinator reviews sample login before samples are reported to confirm collection date, receipt, analysis times, analyses requested, etc.
- The second reviewer is responsible for checking all analytical data for transcription or reporting errors, for insuring that all internal quality control checks were performed by the analyst as required, and for verifying the accuracy and completeness of all data awaiting final approval. This reviewer signs the data as reviewed.
- The QA or Production Coordinator validates each analytical batch in LIMS, as"QA Reviewed".

Final reports are compared to raw data through the above reviewed steps. Final reports are reviewed by the QA Coordinator for completeness. The QA Coordinator generates final reports, unless absent, and then the Production Coordinator may fill in. The reports are electronically signed by the generator.

- The QA Coordinator performs the third level of data validation by checking the sample reports for completeness.
- Only the Production Coordinator or QA Coordinator may designate data as "QA Reviewed".
- When the completed samples are approved, reports are generated and distributed to clients as requested, and the results are stored in the database.

Section 28

REPORTING THE RESULTS
(TNI V1:M2 – Section 5.10)

The result of each analysis performed is reported accurately, clearly, unambiguously, and objectively and complies with all specific instructions contained in the test method.

Laboratory results are reported in a report that includes all the information requested by the customer and necessary for the interpretation of the analytical results and all information required by the method used. The WPCL is an in-house laboratory. All information associated with an analytical result and laboratory sample are readily available in LIMS.

Data are reported without qualification if they are greater than the lowest calibration standard, lower than the highest calibration standard, and without compromised sample or method integrity.

28.1 Reports

The report format has been designed to accommodate each analysis performed and to minimize the potential for misunderstanding or misuse. The report format presentation may vary according to client needs.

Each analytical report generated contains the following information:

a) cover page (for external clients or upon request) that contains the work order number, project name, and name and phone number of a contact person.

b) a title

c) the name and address of the laboratory and name of a contact person;

d) unique identification of the report, such as a work order number, on each page and a pagination system that ensures that each page is recognized as part of the report and a clear identification of the end of the report, such as 3 of 10;

e) the client and project name;

f) the identification of the method used;

g) a description of, and unambiguous identification of the sample(s) analyzed, including the client identification code;

h) the date of sample receipt, date and time of sample collection, dates the analyses were performed,

i) the analysis results, units of measurement, an indication of when results are reported on any basis other than as received (e.g. dry weight), failures identified (See Appendix G for a list of laboratory qualifiers);

j) the name, function, and signature or an equivalent electronic identification of the person authorizing the report, and the date of issue;

k) where relevant, a statement to the effect that the results relate only to the samples;

l) any non-accredited tests or parameters shall be clearly identified as such to the client when claims of accreditation to this Standard are made in the analytical report or in the supporting electronic or hardcopy deliverables

28.2 Supplemental Report Information

When necessary for interpretation of the results or when requested by the client, test reports include the following additional information:

a) deviations from, additions to, or exclusions from the test method, information on specific test conditions, such as environmental conditions, and any non-standard conditions that may have affected the quality of the results, and any information on the use and definitions of data qualifiers;

b) a statement of compliance/non-compliance when requirements of the management system are not met, including identification of test results that did not meet the laboratory and regulatory sample acceptance requirements, such as holding time, preservation, etc.;

c) where appropriate and needed, opinions and interpretations. When opinions and interpretations are included, the basis upon which the opinions and interpretations are documented. Opinions and interpretations are clearly marked as such in the test report.

d) additional information which may be required by specific methods or client;

e) qualification of results with values outside the calibration range as appropriate.

f) identifying statement that the report is a draft, partial, or amended or changed in some way, as necessary

28.3 Environmental Testing Obtained from Subcontractors

Test results obtained from tests performed by subcontractors are clearly identified on the test report by subcontractor name and/or accreditation number.

The subcontractors report their results in writing or electronically. A copy of the subcontractors report is attached to the WPCL report.

Data from any subcontractors are electronically downloaded into the LIMS system repository tables, but not into the LIMS database. The data in the repository is exported to another City database. See the WPCL Element Responsibility Matrix documents entitled Lab Reports and Outside Labs for information regarding the data export process.

The QA Coordinator is responsible for reviewing subcontract reports and notifying the subcontract lab of any errors or concerns regarding the data reports. Subcontractor data is identified in LIMS by different test codes and a status of Subcontracted within the work order.

28.4 Electronic Transmission of Results

All test results transmitted by telephone, fax, telex, e-mail, or other electronic means comply with the requirements of the TNI Standard and associated procedures to protect the confidentiality and proprietary rights of the client (see Section 22- "Environmental Methods and Method Validation").

28.5 Amendments to Reports

Material amendments to a test report after it has been issued are made only in the form of another document or data transfer. All supplemental reports meet all the requirements for the initial report and the requirements of this *Quality Manual*.

Amended analytical reports include a statement to assure they can be differentiated from other analytical reports.

28.6 Exceptions

When opinions and interpretations are included, the laboratory documents the basis upon which the opinions and interpretations have been made. Opinions and interpretations are clearly marked as such in a test report.

Appendix A

A.1 City Of Portland Code Of Ethics

All employees of the City of Portland are subject to the City Code of Ethics at Section 1.03 of the City Code. The City Code of Ethics addresses trust, objectivity, accountability, and leadership and applies to all City officials including elected officials, employees, appointees to boards and commissions, and citizen volunteers authorized to act on behalf of the City. Sections 2.2 and 2.3 of this document list requirements of the City Code of Ethics most relevant to laboratory employees. WPCL employees must follow all the items in the City Code of Ethics.

The City Code of Ethics made be found at

http://www.portlandonline.com/auditor/index.cfm?c=51735&a=279370.

A.2 Laboratory Ethics And Data Integrity

A.2.1 Introduction

The production of analytical data requires more detailed and focused ethics guidelines in addition to the broad, over-arching items found in the City Code of Ethics. By signing the concurrence page of the WPCL Ethics and Data Integrity Policy, laboratory employees agree to follow all of the ethical guidelines and prohibitions enumerated in this policy. Noncompliance with this policy is considered to be contrary to personnel regulations. Any laboratory employee who does not comply with this policy may be subject to the City's disciplinary process, up to and including termination. This policy does not apply to unintentional human errors that may occur from time to time. The laboratory's Ethics and Data Integrity program, training and investigations are discussed in Section 19, Data Integrity Investigations.

A.2.2 General Ethics

All WPCL employees are charged with meeting the City's and Laboratory's standard of ethical conduct in the performance of their duties and are further charged to report data, test results, and conclusions that are accurate to the best of their knowledge and that are obtained using sound laboratory practices. All WPCL employees are expected to follow established written protocols as detailed in the laboratory standard operating procedures and quality manual. Adherence to the WPCL ethics requirements is fundamental to maintaining data integrity.

A.2.3 Duty To Report

All WPCL employees must immediately report any accidental or intentional reporting of inauthentic data. Such reporting may be done to a Laboratory Coordinator, the Laboratory Manager, or Division Manager. If any WPCL employee is asked by another to engage in an activity that compromises data integrity, that employee has the duty and the right to refuse any such request and to immediately appeal the request to a Laboratory Coordinator, the Laboratory Manager, or Division Manager.

A.2.4 Management Coercion/Retaliation Prohibited

The Laboratory Manager or laboratory employee with oversight responsibility may not instruct, direct, or request any other laboratory employee to perform a practice that would violate the City or WPCL standards of ethical conduct. In addition, they may not discourage, intimidate, or inhibit a laboratory employee who refuses to follow an order to engage in unethical conduct and may not retaliate against the employee.

A.2.5 Specific Unethical Laboratory Practices

The following behaviors are prohibited and are considered improper and unethical, and, in certain instances, illegal. These activities are in opposition to concepts of data integrity.

- Falsification of data by reporting results other than those obtained by analysis.
- Falsification of data by reporting results for a sample that was not analyzed (dry labbing).
- Falsification of quality control results.
- Intentional contamination of samples bottles or omission of preservative.
- Intentional improper manipulation of a sample during sample handling procedures.
- Intentional improper manipulation of a sample or QC sample during analysis.
- Improper manipulation of data to produce a more desirable result.
- Re-analysis solely for the purpose of producing a more desirable result.
- Intentional deviation from established protocols or regulatory requirements.
- Non-reporting of an error or deviation from protocol that affects the analysis result.
- Failure to manually adjust computer-generated results that are in error.
- Any action intended to misrepresent, distort, or conceal analysis results.
- Reporting of dates and times of analyses different from the actual dates and times at which the analyses were performed.
- Intentional reporting of another’s work as one’s own or vice versa.

- Attesting to the review of analysis results (via initialing and dating) without actually performing the appropriate data checking protocols.

- Intentional improper treatment of PT samples or failure to observe the requirements for PT sample handling, analysis, and reporting, as listed in the promulgated TNI standard.

A.2.6 Acceptable Data Manipulation

Manual manipulation of computer-generated results may be necessary to correct errors in automated data processing. In some instances, re-analysis may be justified and preferable to reporting original data. The ethical limitation is that data manipulation and/or re-analysis are applied for purposes of determining a correct analytical result, not a more desirable result. Following are examples of acceptable post-analytical procedures.

- For chromatography methods, manual peak integration is sometimes necessary due to matrix interference or another condition that causes the computer to improperly integrate a peak. Refer to the WPCL SOP on Manual Integration.

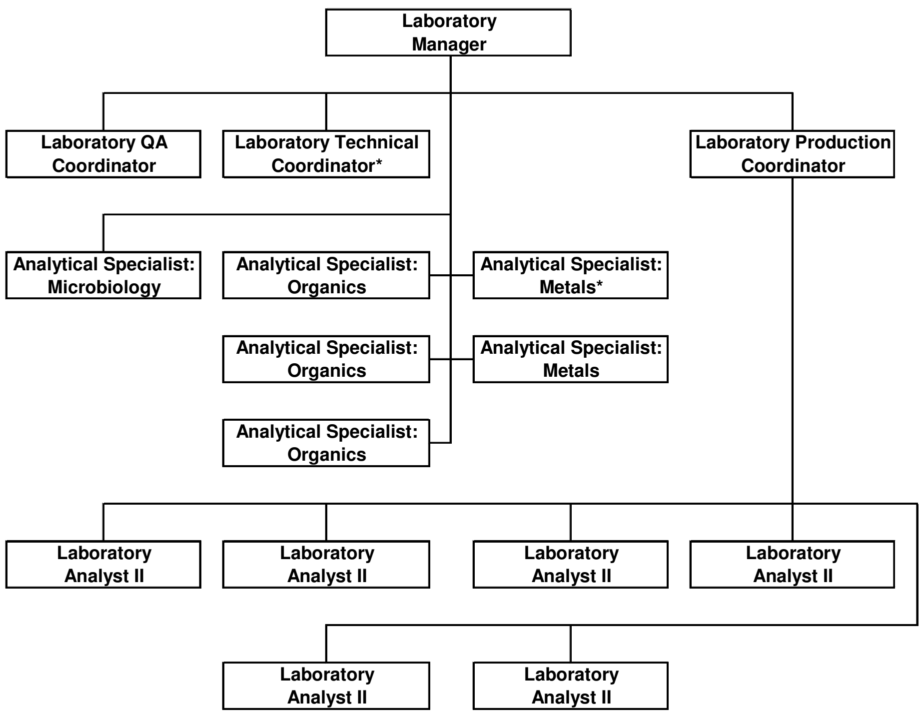
- In some instances, analytical parameters may be changed to alleviate interference. All calibration and QC criteria must be met using the secondary parameters, and the reason for using alternative parameters must be documented. Example: In ICPMS analysis, a secondary mass may be used to quantify an element if a recognized interference affects the primary mass.

- Re-analysis may be performed to verify a result if the result is unusual. If the re-analysis result is similar to the original (>20 RPD), report the original. If the results are significantly different, the cause must be investigated. Document all steps in resolving the discrepancy. It is not acceptable to simply choose one result as being “better” than the other.

- For regulated industry wastewater samples, re-analysis is performed to verify a permit limit exceedance. If the re-analysis result does not support the exceedance, investigate and document the cause of the discrepancy.

Appendix B

Figure B-1. Laboratory Organizational Chart



* POSITIONS FILLED BY SAME PERSON.

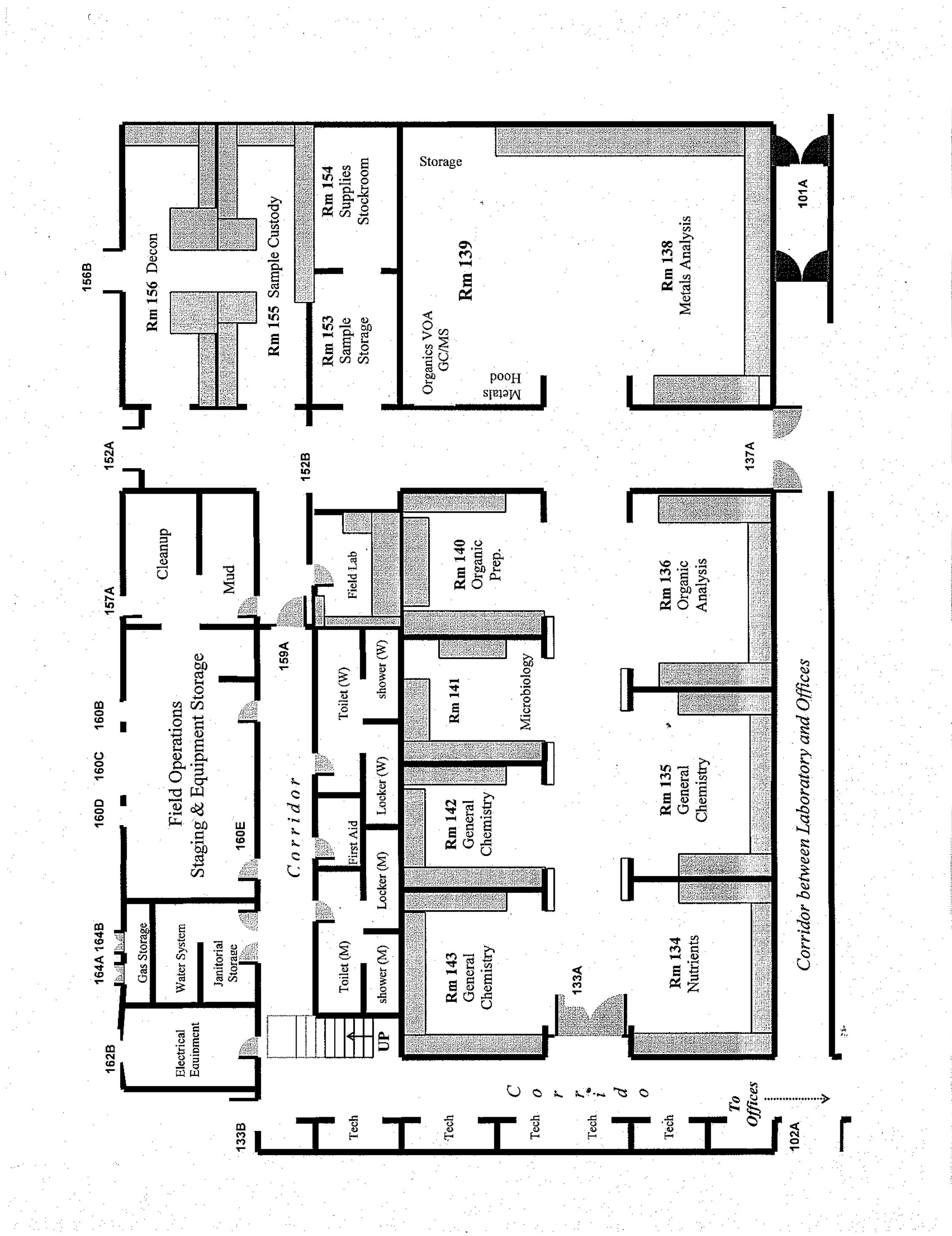
Appendix C

Laboratory Floor Plan

The Laboratory occupies approximately 12,000 square feet in the City of Portland WPCL building at 6543 North Burlington Avenue, Portland, Oregon. The building, built in 1996, is a steel and masonry structure of approximately 39,000 square feet that houses the Laboratory and a two-story office area. The Laboratory is equipped with a computer-controlled HVAC system for temperature, humidity, and ventilation control. Numerous built-in safety features include fume hoods, safety showers, and eye washes.

The laboratory design is open modular, with each area being dedicated to a particular type of analysis: metals, semi-volatile organics, volatile organics, microbiology, nutrients, general chemistry, process control, and sample receiving. The modules are open to a common corridor, which improves ventilation control and facilitates communication and sharing of resources. The floor plan is shown below.

Figure C-1. Laboratory Floor Plan



Appendix D

Acronyms and Abbreviations

This list includes acronyms and abbreviations used in this document and in SOPs.

AB	-	accrediting body
ANSI	-	American National Standards Institute
ASQC	-	American Society for Quality Control
ASTM	-	American Society for Testing and Materials
ATP	-	alternative test procedure
BOD	-	biochemical oxygen demand
BS	-	blank spike
°C	-	degrees Celsius
CAS	-	Chemical Abstract Service
CBWTP	-	Columbia Boulevard Wastewater Treatment Plant
CCB	-	continuing calibration blank
CCV	-	continuing calibration verification
CFR	-	*Code of Federal Regulations*
CHP	-	chemical hygiene plan
CoC	-	chain of custody
COD	-	chemical oxygen demand
DI	-	deionized (water)
DCM	-	dichloromethane
DO	-	dissolved oxygen
DOC	-	demonstration of capability
ECD	-	electron capture detector
EICP	-	extracted ion current profile
EPA	-	Environmental Protection Agency
°F	-	degrees Fahrenheit
FoPT	-	field of proficiency testing
GC	-	gas chromatography
GC/MS	-	gas chromatography/mass spectrometry
IC	-	ion chromatography
ICP-AES	-	inductively coupled plasma-atomic emission spectrometry
ICP-MS	-	inductively coupled plasma-mass spectrometry
ICV	-	initial calibration verification
IS	-	internal standard
ISO/IEC	-	International Organization for Standardization/International - Electrochemical Commission
LCS	-	laboratory control sample
LFB	-	laboratory fortified blank
LIMS	-	laboratory information management system
LLCCV	-	low-level continuing calibration verification
LLICV	-	low-level initial calibration verification
LOD	-	limit of detection
LOQ	-	limit of quantitation
MB	-	method blank
MDL	-	method detection limit
mg/Kg	-	milligrams per kilogram
mg/L	-	milligrams per liter

MRL	-	method reporting limit
MS	-	matrix spike
MS	-	mass spectrometer
MSD	-	matrix spike duplicate
MSD	-	mass selective detector
NELAC	-	National Environmental Laboratory Accreditation Conference
NELAP	-	National Environmental Laboratory Accreditation Program
ng/Kg	-	nanograms per kilogram
ng/L	-	nanograms per liter
NIST	-	National Institute of Standards and Technology
NPDES	-	National Pollutant Discharge Elimination System
ORELAP	-	Oregon Environmental Laboratory Accreditation Program
PB	-	preparation blank
PT	-	proficiency testing
PTP	-	proficiency testing provider
PTPA	-	proficiency testing provider accreditor
QA	-	quality assurance
QC	-	quality control
QM	-	*Quality Manual*
RL	-	reporting limit
RO	-	reverse osmosis (water)
RPD	-	relative percent difference
RSD	-	relative standard deviation
RT	-	retention time
SM	-	*Standard Methods for the Examination of Water and Wastewater*
SOP	-	standard operating procedure
SPLP	-	Synthetic Precipitation Leaching Procedure
SRM	-	standard reference material
TCLP	-	Toxicity Characteristic Leaching Procedure
TCWTP	-	Tryon Creek Wastewater Treatment Plant
TIC [1]	-	total ion chromatogram
TIC [2]	-	tentatively identified compound
TKN	-	total Kjeldahl nitrogen
TNI	-	The NELAC Institute
TOC	-	total organic carbon
ug/Kg	-	micrograms per kilogram
ug/L	-	micrograms per liter
UV	-	ultraviolet
VOA	-	volatile organics analysis
VOC	-	volatile organic compound
WPCL	-	Water Pollution Control Laboratory (of the City of Portland, Oregon)

Appendix E

Glossary / Definitions

The following definitions are applicable to the terms used in the WPCL Quality Manual and Laboratory SOPs.

Acceptance Limits: The minimum and/or maximum values for a QC result that meet established requirements for precision, accuracy, or other QC parameter. Also called Control Limits.

Accreditation: The process by which an agency or organization evaluates and recognizes a laboratory as meeting certain predetermined qualifications or standards, thereby accrediting the laboratory.

Accuracy: The degree of agreement between a measured value and the true or expected value. Accuracy of an analysis is generally determined from spiked (fortified) samples and is expressed in terms of percent recovery (%R).

Analyst: An individual who performs analytical methods and related protocols and who is responsible for applying the associated quality control requirements for the methods and protocols. If capitalized, the term refers to a member of the Laboratory staff who holds the specific rank of Analyst.

Analytical System: The sum of the components required to effect sample analysis, including preparative steps. The analytical system includes instrumentation, equipment, glassware, reagents, standards, sample containers, and the analyst.

Analytical Uncertainty: A subset of Measurement Uncertainty that includes all laboratory activities performed as part of the analysis.

Assessment: The evaluation process used to measure or establish the performance, effectiveness, and conformance of an organization and/or its systems to defined criteria (to the standards and requirements of laboratory accreditation).

Audit: A systematic and independent examination of facilities, equipment, personnel, training, procedures, record-keeping, data validation, data management, and reporting aspects of a system to determine whether QA/QC and technical activities are being conducted as planned and whether these activities will effectively achieve quality objectives.

Batch: A group of samples that are prepared and/or analyzed together by the same personnel and using the same lot(s) of reagents. A **preparation** or **extraction batch** is a specified number of samples (often 10 or 20) of the same matrix which are processed together, along with certain QC samples processed at the same time. An **analytical batch** is a set of prepared samples and associated QC samples that are analyzed as a group. The samples in an analytical batch may differ in matrix, and may exceed 20 in number. A **LIMS batch** is usually equivalent to a preparation batch but may exceed the typical time limitation. Individual samples analyzed over the course of several days may be batched together if the associated QC is required only once per week.

Bias: The systematic deviation of a measured value from the true value. Bias is inherent in a method or in the measurement system, or caused by matrix effects. Matrix spike results are a key indicator of matrix bias. At WPCL, sample results are not bias-corrected.

Blank: See **Method Blank** and **Reagent Blank**.

Blank Spike: Another name for Laboratory Control Sample. The term **Blank Spike** is commonly used in organics and nutrients analysis.

Blind QC Sample: A sample with an established concentration of target analyte that is known to the submitter but not known to the analyst. The analyst may or may not be aware that the sample is a QC sample. A blind QC sample is used to test the analyst's analytical proficiency.

Calibration: A procedure that establishes the relationship between analyte concentration and analytical response. The term is most commonly used in reference to instrument response to standard solutions of known concentrations (calibration standards).

Calibration Blank: A zero standard, used in metals analysis. The Cal Blank is prepared using the same matrix of acidified water as for Calibration Standards, except no target elements are added.

Calibration Standards: Solutions of known concentrations which are used to standardize the measurement procedure. Calibration standards are used to establish the relationship between analyte concentration and analytical response.

Calibration Curve: A graphical plot of the concentrations of the calibration standards *versus* analytical response (e.g., peak area, counts, absorbance). The curve must meet certain correlative criteria in order for the calibration to be considered acceptable.

Certification: A documented statement that an analyst is fully trained to perform an analytical method. Certification requires a Demonstration of Capability, and agreement among the trainee, the trainer, and QA/QC Coordinator that the trainee understands the method and is capable of performing it accurately and precisely.

Certified Reference Material (CRM): A reference standard traceable to NIST, and documented as traceable in an accompanying certificate.

Chain-of-Custody Form: A paper record that documents the collection and possession of samples. It generally also includes the requested analyses.

Check Standard: Another name for Laboratory Control Sample. The term **Check Standard** is commonly used in wet chemistry methods.

Comparability: The degree to which one data set can be compared to another. Comparability is achieved by use of consistent analytical methods and by traceability of standards to a reliable source.

Confirmation: Qualitative verification of an analyte by use of an alternative analytical practice. Examples include a second chromatographic column, an alternative wavelength or detector, or an alternative analytical procedure.

Continuing Calibration Blank (CCB): A zero standard (matrix-matched blank) run periodically throughout an analytical batch in metals analysis, usually directly after each CCV. If target elements are detected in the CCB above the reporting limit, the run must be stopped and evaluated for contamination.

Continuing Calibration Verification (CCV): A single standard, usually at the mid-point concentration of the calibration range, used to verify calibration throughout an analytical batch and/or quantify drift in instrument response. The CCV solution may be one of the same solutions used for the calibration curve. CCV analysis is generally required after every 10 samples in the analytical batch. The typical response requirement is ±10% of the true value. (Also see **Low Level Calibration Verification**.)

Control Chart: A graphical representation of accuracy or precision data, allowing for visual detection of trends and biases. The chart includes statistical evaluations of the data, marking upper and lower control limits (see Warning Limit and Control Limit) that are based on the standard deviation of responses or statistics.

Control Limits: Acceptance limits determined on a control chart, usually ±3s distant from the mean value. When a QC result falls outside the control limits, steps must be taken to identify the source of the problem.

Corrective Action: The action taken to eliminate the cause of a nonconformance and prevent its recurrence. Corrective actions are usually taken in response to failed quality control results. They sometimes require a significant investigation and should be documented using a Corrective Action Report (CAR) form.

Data Audit: A review of the documentation and procedures associated with an analysis to verify that they comply with the stated protocols and the QC results meet the specified acceptance criteria.

Data Reduction: The process of transforming a number of data items by arithmetic or statistical calculation, standard curves, and concentration factors, and collating them into a more useful form.

Demonstration of Capability (DOC): A procedure to establish the ability of an analyst to generate data of acceptable accuracy and precision. The DOC usually consists of analysis of four replicates of an LCS containing all target analytes for the method, with acceptable accuracy and precision.

Detection Limit: See Method Detection Limit

Deionized (DI) Water: Water that has been treated in a specific way in order to remove impurities to a level that no positive or negative interferences are detectable when subjected to defined analytical procedures for target analytes. At WPCL, four types of DI water are generated: **Gray tap** is tap water that is passed through a series of resin beds, charcoal, and filters. This DI water is plumbed throughout the laboratory, dispensed from gray taps at sinks and also plumbed into some dishwashers for final rinsing. **Nanopure DI** water starts as gray tap water and is further purified through Barnstead Nanopure systems that consist of more resin beds. The types of resin beds vary depending on the intended use of the water (organic or inorganic analysis). **Milli-Q RO** water is prepared from tap water that is treated in a Millipore water purification system that utilizes reverse osmosis (RO). **Elix** (e-pod) water is also treated by the Millipore system, though without the final filtration of Milli-Q RO water. E-pod water is similar to gray tap and may be used for the same applications. **Nanopure DI** water and **Milli-Q RO** water serve as reagent water for all analytical tests performed. **Organic Free Reagent (or DI) Water** is DI water that has been passed through a special final filter to remove organic contaminants.

Duplicate: A separate aliquot of sample, treated and analyzed identically to the original aliquot. Comparison of duplicate results is the basis for precision measurement. Laboratory duplicates (or replicates) are aliquots taken from the same sample bottle. Field duplicates are from the same sample source but are labeled, stored, and analyzed as discrete samples.

Field of Accreditation: A matrix, technology/method, and analyte combination for which the accreditation body offers accreditation.

Field of Proficiency Testing (FoPT): Analytes for which the laboratory is required to successfully analyze a PT sample in order to obtain or maintain accreditation, collectively defined as: matrix, technology/method, analyte.

Finding: An assessment conclusion referenced to a laboratory accreditation standard and supported by objective evidence that identifies a deviation from a laboratory accreditation standard requirement; a conclusion from laboratory assessment or audit activities that a non-conformance exists.

Holding Time: The maximum time that a sample may be held prior to analysis and still be considered not compromised. WPCL uses EPA-established holding times. The holding time is based on the assumption of proper sample preservation, if applicable.

Initial Calibration Verification (ICV): A standard prepared independently of the calibration standards, used to verify the accuracy of the calibration before any samples are analyzed. The ICV concentration may be different from any of the calibration standards but is within the calibration range. The typical response requirement is ±5% of the true value.

Interference: A substance in a sample (or added during sample analysis) that produces a bias in the analytical result. Interferences are often referred to as Matrix Effect.

Internal Standard (IS): An analyte added to a prepared sample which is used as a basis for quantification. Target analytes are quantified based on their analytical response relative to the Internal Standard response.

Laboratory Control Sample (LCS): A clean matrix spiked with a known amount of analyte, or a material containing a known, verified amount of an analyte. **LCS** is the general term for a sample prepared and analyzed identically to other samples in order to evaluate analytical accuracy (as % Recovery) without consideration of matrix interference. Other commonly used terms that represent QC samples with the same purpose are **Blank Spike, Check Standard,** and **LFB.**

Laboratory Fortified Blank (LFB): Another name for Laboratory Control Sample. The term **LFB** is commonly used in metals analysis.

Laboratory Information Management System (LIMS): A computer database used to track samples and store the associated data. Sample information such as collection date and time, collector, project association, matrix, and analysis request are logged into the LIMS at the time of sample receipt. Results are entered as they are available. At WPCL, every effort is made to assure the accuracy of data in the LIMS; however, the original chain-of-custody forms, laboratory notebooks, and instrument-generated analytical data are the official sources of sample information and data.

Limit of Detection (LOD): The laboratory estimate of the minimum amount of an analyte in a given matrix that an analytical process can reliably detect. At WPCL, this term is equivalent to **Method Detection Limit (MDL)**.

Limit of Quantitation (LOQ): The minimum concentration of a target analyte that can be reported with a specified degree of confidence. At WPCL, this term is equivalent to **Method Reporting Limit (MRL)**.

Low Level Calibration Verification (LLCV): A standard at or near the reporting limit, used to verify adequate response and calibration at low concentrations. The LLCV is similar to a CCV but is prepared at a lower concentration, has wider acceptance limits (in %R), and may be analyzed only once during an analytical batch.

Matrix: The component or substrate of a sample (e.g., wastewater, surface water, sludge, soil) which is to be analyzed for target analytes.

Matrix Duplicate: A replicate matrix prepared in the laboratory and analyzed to obtain a measure of precision. Also see **Duplicate**.

Matrix Spike (MS): An aliquot of sample which has been spiked (fortified) with a known concentration of target analyte(s) prior to sample preparation. Preparation and analysis of matrix spike is identical to samples in all respects unless otherwise noted in the referenced method. A matrix spike is used to determine the effect of matrix on a method's recovery efficiency.

Matrix Spike Duplicate (MSD): A replicate matrix spike used to obtain a measure of the precision of recovery for each analyte.

Measurement System: A method, as implemented by the laboratory, and which includes the equipment used to perform the test and the analysts(s).

Method: A body of procedures and techniques for performing an activity, systematically presented in the order in which they are to be executed.

Method Blank (MB): A sample of a matrix similar to the batch of associated samples, that is free of the target analytes. The method blank is processed and analyzed simultaneously and identically to the samples in all respects, and the results are evaluated for possible contamination or interferences resulting from the analytical process.

Method Detection Limit (MDL): A statistically-determined concentration that estimates the minimum concentration of an analyte that can be measured and reported with 99% confidence that the analyte concentration is greater than zero. The MDL is matrix-specific.

Method Detection Limit Study (MDL Study): An MDL determination. A standard MDL study involves the analysis of 7 replicates of a low-level spike in the matrix.

Method Reporting Limit (MRL): The concentration that is the minimum reportable amount of target analyte, based on precision at low concentrations in the given matrix. If detected below the MRL, the analyte is not reported as being present in the sample unless flagged as an estimate. The MRL is generally 3 to 5 times the MDL. The MRL is a laboratory-estimated limit of quantitation.

Nonconformance: An event that does not meet the applicable QA/QC requirements. Examples include low recovery on an LCS, failure to analyze a sample within the holding time, a contaminated Method Blank.

Percent Recovery (%R): A measured concentration value converted to a percent of the true or accepted value.

The calculation for %R for a standard or blank spike is:

$$\%R = \frac{X}{T} \times 100$$

where X = concentration determined for standard or blank spike
T = true or expected value, in concentration units

The general calculation for %R for a matrix spike sample is:

$$\%R = \frac{A - B}{T} \times 100$$

where A = concentration determined for the spiked sample
B = concentration determined for the non-spiked sample
T = true or expected value, in concentration units

Post-Digestion Spike (PDS): A known amount of target analyte added to a prepared sample digestate. The purpose is to determine the amount recoverable by the analysis procedure independent of sample preparation. This protocol is used mainly in metals analysis to verify that low recovery is due to sample matrix or loss during preparation, and not due to instrument problems.

Precision: The degree of agreement among a set of measurements, independent of knowledge of the true value. Precision is estimated by means of duplicate/replicate analyses of a sample (native or spiked) containing the target analyte at a concentration above the MRL. Precision is expressed in terms of Relative Percent Difference (RPD) for 2 values, or as Relative Standard Deviation (RSD) for 3 or more values.

Preparation Blank (PB): Synonymous with **Method Blank**, this term is commonly used in metals analysis.

Preservation: A means of maintaining the chemical or biological integrity of a sample prior to analysis. The most common types of preservation are refrigeration and the addition of reagents that change the pH or prevent chemical changes to the target analytes.

Procedure: A generic term for specific laboratory operations amenable to reduction to a set of steps. May include simple operations, such as taking the temperature of a refrigerator, to highly complex operations, such as the analysis of samples by gas chromatography – mass spectrometry. Synonymous with protocol or method.

Proficiency Testing and PT Samples: Proficiency Testing is a means of evaluating analytical performance by the analysis of unknown samples provided by an external source. PT Samples are single-blind QC samples of matrix and concentration similar to everyday samples.

Protocol: See **Procedure**.

Quality Assurance Program: A system of activities and protocols designed to integrate planning, quality control, quality assessment, documentation, and quality improvement, with the purpose of defining and implementing standards of data quality and validity that meet the needs of data users.

Quality Control (QC): A system of technical laboratory activities designed to evaluate and control data quality through the use of known concentration samples.

Quality Control Sample: A sample that is analyzed for purposes of evaluating data quality based on a particular QA/QC parameter such as accuracy or precision. A routine QC sample is one that is prepared by the analyst in the course of analyzing a batch of samples. A blind QC sample is one for which the true concentration of the target analyte is not known by the analyst. A double blind QC is one that is submitted for analysis without informing the analyst of its identity as a QC sample.

Quality Manual: A document that describes the laboratory quality program.

Quality System: See **Quality Assurance Program**.

Raw Data: Any original documented information from analytical activity, including manual written entries and computer-generated values, that contributes to the construction of a result or conclusion.

Reagent Blank (RB): A sample consisting of reagents, without the sample matrix or target analyte(s). A reagent blank is used to determine the contribution of the reagents to the analytical results.

Reagent Water: See **Deionized (DI) Water**.

Reference Material: A natural substance, such as a soil or type of biota, that has been analyzed for a particular set of constituents by a recognized authority (e.g., NIST or CANMET) using several independent analytical methods. An analysis certificate is supplied by the authority.

Reference Standard: A prepared sample in which one or more constituents are added and then analyzed by an established protocol. May be offered by either a recognized governmental authority (e.g., NIST) or commercial entity (e.g., NELAC accredited performance test sample provider).

Relative Percent Difference (RPD): The difference between two determined concentration values, converted to percentage of the average value of the two determinations. RPD is used as a standard representation of precision. The calculation for RPD is:

$$RPD = \frac{|A1 - A2|}{(A1+A2)/2} \times 100$$

where A1 = first determined concentration
A2 = second determined concentration

Relative Standard Deviation (RSD or %RSD): The standard deviation of three or more determined values, converted to percentage of the mean of the multiple determinations. RSD is used as a representation of precision, or as a measure of agreement among the response factors for points on a calibration curve. The calculation for RSD is:

$$RSD = \frac{s}{A} \times 100$$

where s = standard deviation of multiple determined concentrations or response factors
A = mean of multiple determined concentrations

Replicates: Two samples taken from and representative of the same population and carried through all steps of sampling and analytical procedures. The results from duplicate analyses are used to assess variance of the total method.

Representativeness: The degree to which data accurately and precisely represent the condition which is being measured. Sampling design and sub-sampling for analytical aliquots are key factors in establishing representativeness.

Root Cause: The fundamental reason for a particular observed phenomenon. An example is an improperly prepared calibration standard causing the failure of an instrument to properly calibrate.

Sample: Any substance provided to a laboratory for examination for one or more environmental parameters. An example is a jar of soil to be analyzed for metals.

Sampling: The act of taking a subset of a larger whole for subsequent environmental analysis. An example is collecting a volume of river water in a container for analysis of organic compounds.

Selectivity: The ability of an analytical technique to distinguish between different constituents with closely similar chemical or physical properties.

Sensitivity: The degree to which an analytical system can discriminate between measured values or detect low concentrations of an analyte. Sensitivity is often used as a relative term rather than a quantified parameter.

Spike: A known amount of target analyte added to a blank or sample aliquot. The purpose is to determine the amount of analyte recoverable by the analytical procedure.

Standard: A solution of known concentration, used to calibrate or verify calibration of an analytical system.

Standard Operating Procedure (SOP): A detailed written description of a procedure, designed to systematize (standardize) the performance of that procedure. The purpose of laboratory method SOPs is to ensure a consistent methodology among different analysts.

Standard Reference Material (SRM): A certified reference material produced by NIST, characterized for absolute content of target analyte(s) independent of analytical methodology.

Surrogate Compound (or System Monitoring Compound, SMC): A compound that is similar in chemical composition and analytical behavior to target analytes, but which is not normally found in environmental samples. SMCs are added to a sample before preparation and analysis begin, and %R is calculated for each compound. SMC recoveries provide a measure of bias for each individual sample analyzed, much like a matrix spike. SMCs are used mainly for trace organics analyses. They are also called System Monitoring Compounds.

Target Analyte: A compound, element, or aggregate property (e.g., COD, solids, alkalinity) for which a sample is analyzed.

Tentatively Identified Compound (TIC): In GC/MS analysis, a sample contaminant that is not on the target analyte list but is tentatively identified by comparison of the mass spectrum to those in a mass spectral library.

Traceability: The ability to relate a measurement to a standard reference material through an unbroken chain of comparisons.

Trip Blank: A sample of laboratory reagent water used to monitor for contamination during the transportation of samples, used when samples will be tested for volatile organic compounds. A trip blank is typically reagent water collected into an appropriate sample container, which then accompanies the containers used for field samples, both before and after sample collection.

Validation: Evaluation of available data and other information to confirm that results meet the quality requirements for their intended use.

Verification: The independent affirmation of a particular property. An example is the verification of instrument calibration via the analysis of an independent standard.

Warning Limits: Statistical limits determined on a control chart, usually $\pm 2s$ distant from the mean value. When results fall outside the warning limits too frequently, steps must be taken to identify the source of the problem. A single value outside the warning limits does not require action but should prompt attention as a possible problem.

Appendix F

Laboratory Accreditation/Certification/Recognition

The Water Pollution Control Laboratory maintains the following certifications and accreditations with state and national entities:

No formal accreditations are currently in effect. Based on successful performance of the annual DMR-QA study, the EPA and Oregon DEQ accept WPCL results for NPDES-regulated analysis. The parameters are those listed in the NPDES permits of the City of Portland and other clients (municipalities) for whom NPDES work is performed.

If accreditation or other approval is terminated or suspended, the laboratory will immediately cease to use the certificate number reference in any way and inform clients impacted by the change.

Appendix G

Data Qualifiers

The list of data qualifiers, current as of 12/19/12, is provided in Table G-1, below. Additional data qualifiers may be added to the LIMS at any time by a LIMS administrator. Qualifiers are not deleted from the list.

Qualifier statements shown as "[Custom Value]" are variable. A comment is written at the time the qualifier is applied.

Qualifiers designated "Retained" appear in the result field rather than as a qualifier flag. This allows non-numeric results to be reported.

Qualifiers designated "Comment" are only viewable in the LIMS and do not appear on reports to clients. They provide a means of internal communication between analyst and data reviewer.

QUALIFIER	QUALIFIER STATEMENT	RETAINED	COMMENT
>140	>140	X	
>14000	>14000	X	
>18	>18	X	
>220	>220	X	
>2400	>2400	X	
>24000	>24000	X	
>240000	>240000	X	
>350	>350	X	
>42000	>42000	X	
>70	>70	X	
>700	>700	X	
>760000	>760000	X	
>8	>8	X	
0	0	X	
0	0	X	
0	0	X	
A2	Result is the average of duplicate analysis.		
A3	Result is the average of triplicate analysis.		
A4	Result is the average of 4 analyses.		
ALK	Because the pH of the sample is less than 8.3, the total alkalinity result is equal to the bicarbonate alkalinity.		
AR0	[Custom Value]		
AR1	PCB quantified as Aroclor 1260 may be a mixture of 1260 and 1254.		
AR10	Quantification may be affected by overlapping Aroclor pattern.		
AR11	Identified Aroclor pattern differs somewhat from the reference standard, affecting quantification.		
AR2	PCB quantified as Aroclor 1254 may be a mixture of 1254 and 1260.		
AR3	PCB quantified as Aroclor 1254 may be a mixture of 1254 and 1248.		
AR4	PCB quantified as Aroclor 1248 may be a mixture of 1248 and 1254.		
AR5	PCB quantified as Aroclor 1260 may be a mixture of 1260 and 1262.		
AR6	PCB quantified as Aroclor1248 may be a mixture of 1248 and 1016/1242.		
B1	Analyte was detected in the Method Blank at a concentration greater than one tenth the amount in the sample. Sample result may be a high estimate.		
B2	Analyte was detected in the Method Blank, but at a concentration less than one tenth the amount in the sample(s).		
B3	This analyte was detected in the Method Blank but not in the samples; results are not affected.		
BL	This blank was carried through the leaching process.		
C1	Sample was submitted in a container that does not comply with analytical method requirements.		
C2	The sample was not preserved according to analytical method requirements.		
C3	VOA vial had headspace; target analytes may have volatilized prior to analysis.		
C4	VOA vial was not sufficiently acidified for preservation for 14-day holding time. The 7-day non-preserved holding time was exceeded.		
D1	The sample required dilution due to non-target matrix interferences, resulting in raised reporting limits.		
D2	The sample required dilution due to high levels of target analytes.		
D3	Reporting limits are raised for this sample due to the low % solids.		
D4	Reporting limit is raised for this analyte due to non-target matrix interference.		
D5	Reporting limits are raised for this sample due to non-target matrix interference.		
E	Sample result exceeded the calibration range for the analyte.		
F0	[Custom Value]		
F1	Result for diesel-range hydrocarbons is primarily due to overlap from the heavy oil range.		
F10	Identified product appears to be weathered gasoline.		

QUALIFIER	QUALIFIER STATEMENT	RETAINED	COMMENT
F2	Result for heavy oil is primarily due to overlap from diesel-range hydrocarbons.		
F3	Result for diesel-range hydrocarbons is primarily due to overlap from gasoline range.		
F4	Result for gasoline is primarily overlap from diesel-range hydrocarbons.		
F5	Detected components do not resemble a fuel pattern but the quantity exceeds the reporting threshold.		
F6	Surrogate recovery could not be determined due to the high concentration of hydrocarbons in the sample.		
F7	This sample underwent silica gel clean-up.		
F8	Hydrocarbons quantified as Diesel and Lube Oil appear to be a single petroleum product that is heavier than Diesel #2 and lighter than the reference Lube Oil.		
F9	Hydrocarbons were detected in one replicate but not in its duplicate. By method protocol, the sample result is DETECTED.		
FO1	The result for this field parameter is an estimate because post-measurement check of the field instrument was outside the acceptance range.		
FO2	Dissolved oxygen is not reportable because it exceeds 200% of saturation concentration.		
H1	Holding time was exceeded for this analysis due to laboratory error.		
H2	Holding time was exceeded for required re-analysis.		
H3	Holding time was exceeded due to delayed sample delivery.		
H4	Compliance with holding time requirement could not be verified because sample collection time was not available.		
H5	Holding time was exceeded due to delayed request for analysis.		
H6	Holding time verification is based on collection time of the earliest field sample.		
H7	Holding time was exceeded for required dilution.		
H8	Holding time exceedance for Total Solids does not adversely affect its use for calculating other results on a dry weight basis.		
I1	One or more internal standard responses were outside the acceptance range due to matrix effect. Re-analysis confirmed the effect. Results should be considered estimates.		
I2	One or more internal standard responses were outside the acceptance range due to matrix effect. No sample remained for re-analysis. Results should be considered estimates.		
J	Analyte was detected but at a concentration below the reporting limit; the result is an estimate.		
K1	BOD result is a minimum because the seed value could not be calculated.		
K2	BOD result is a maximum because the seed value could not be calculated.		
K3	BOD result should be considered an estimate due to failed check standard results.		
K4	BOD result is an estimate based on failed duplicate precision (non-homogeneous matrix).		
K5	BOD is not reportable for regulatory purposes due to failed QC results (high blanks).		
K6	Requested BOD analysis is not reportable due to QC failure; a re-sample has been requested.		
K7	Results for multiple BOD dilutions indicate sample toxicity; reported result may be a low estimate.		
K8	One or more blanks in the batch are acceptable; sample results are reportable.		X
L1	Recovery for this analyte in the laboratory control sample was outside the acceptance range (low). Sample results may be low estimates.		
L2	Recovery for this analyte in the laboratory control sample was outside the acceptance range (high). Sample results may be high estimates.		

QUALIFIER	QUALIFIER STATEMENT	RETAINED	COMMENT
L3	LCS recovery for this analyte was high; the analyte was not detected in the samples and results are not affected.		
L4	Recovery was low for this analyte in the laboratory control sample but acceptable in the matrix spike(s).		
L5	High recovery in the Standard Reference Material is due to use of an alternate sample preparation procedure.		
M0	[Custom Value]		
M1	Matrix duplicate precision measurement indicates non-homogeneous sample matrix. Sample result should be considered an estimate.		
M10	RPD exceeds the advisory limit. Duplicate microbiology results may vary due to matrix factors and the nature of biological analysis.		
M11	Matrix spike recovery for this analyte was high; the analyte was not detected in the sample and results are not affected.		
M12	High matrix spike recovery is due to low spike amount and a trace level of target analyte not accounted for in the % recovery calculation.		
M13	Dissolved metal result greater than total metal result was verified as probable bottle contamination.		
M14	Dissolved metal result greater than total metal result was verified as probable laboratory contamination.		
M15	The result is an estimate due to chromatographic interference that affected quantitation.		
M16	MS/MSD RPD is high for this analyte; recoveries are acceptable.		
M17	Matrix spike recovery could not be determined due to high concentration of analyte in the sample.		
M18	Matrix spike recovery(ies) could not be determined due to required sample dilution.		
M19	Matrix spike recovery is outside the acceptance limits due to low spiking level and matrix interference.		
M2	Matrix duplicate precision measurement indicates non-homogeneous sample matrix.		
M20	The TCLP leachate was prepared using less than the method-specified 100 gram aliquot, due to the limited quantity of sample received. Proportionately less leaching solution was used.		
M21	Volatile organic compound Acrolein was not recoverable from this sample due to required de-chlorination using sodium thiosulfate.		
M22	Volatile organic compound 2-chloroethylvinyl ether was not recoverable from this sample due to acid preservation.		
M3	Inconsistent results for matrix QC (duplicates and/or matrix spikes) indicate non-homogeneous sample matrix. Sample results should be considered estimates.		
M4	Based on low matrix spike recovery, the sample result may be a low estimate due to matrix interference.		
M5	Based on high matrix spike recovery, the sample result should be considered an estimate due to matrix effect and/or non-homogeneous matrix.		
M6	Based on low matrix spike recovery, sample results may be low estimates due to matrix interference.		
M7	Based on high matrix spike recovery, sample results should be considered estimates due to matrix effect and/or non-homogeneous matrix.		
M8	The matrix duplicate control limit is not applicable at concentrations less than 5 times the reporting limit.		
M9	Matrix spike recovery control limits are not applicable because the sample concentration is greater than 4 times the spike amount.		
N	Refer to case narrative.		
NR	NR	X	
OG0	[Custom Value]		
OG1	Based on Total Oil & Grease result <5 mg/L, Non-polar Oil & Grease is also <5 mg/L.		
OG2	Based on Total Oil & Grease result <10 mg/L, Non-polar Oil & Grease is also <10 mg/L.		
Q0	[Custom Value]		X
Q1	Analyte in blank but samples >10x amount in blank.		X
Q10	Hg 201 is reported due to Tungsten interference on Hg 202.		X
Q11	This data is not reportable but should not be deleted.		X
Q12	This Aroclor was quantitated using less than 5 peaks due to interference or overlap.		X
Q13	Overlying water was removed from the sample prior to mixing for prep.		X
Q2	RPD out but results are <5x MRL.		X
Q3	MS recovery out but sample concentration is >4x the spike amount.		X
Q4	All analytical criteria were met for this analysis.		X
Q5	Analyte detected in blank >1/2 MRL but samples are < MRL.		X
Q6	Analyte detected in blank >1/2 MRL but analysis of the results do not indicate contamination in the sample.		X
Q7	Dup or MS out; re-analysis of QC sample passed.		X
Q8a	Extract cleaned up with H2SO4.		X
Q8b	Extract cleaned up with H2SO4 and copper.		X

QUALIFIER	QUALIFIER STATEMENT	RETAINED	COMMENT
Q8c	Extract cleaned up with Florisil.		X
Q9	Holding time not applicable. Sample is a PT or other QC sample.		X
R	Revised result(s).		
RE1	Result is reported from re-analysis; all QA/QC criteria were met.		
RE2	Results are reported from re-analysis; all QA/QC criteria were met.		
RE3	Required re-analysis was done outside the holding time; both results are reported.		
RE4	The result was confirmed by re-analysis.		
SU1	Recovery for one or more surrogate compounds was outside the acceptance range (low). Sample results may be low estimates.		
SU2	Recovery for one or more surrogate compounds was outside the acceptance range (high). Sample results may be high estimates.		
SU3	Recovery for one or more acidic surrogates was outside the acceptance range (low). Results for acidic compounds may be low estimates.		
SU4	Recovery for one or more acidic surrogates was outside the acceptance range (high). Results for acidic compounds may be high estimates.		
SU5	Surrogate recovery could not be determined due to required dilution of the sample extract.		
SU6	Recovery for surrogate compound was high. No associated target analytes were detected and results are not affected.		
SU7	High surrogate recovery is due to co-eluting matrix interferent.		
SU8	Low surrogate recovery is due to matrix interference.		
SU9	Low surrogate recovery is likely due to the high level of suspended solids in the sample.		
T1	The result for Total Suspended Solids should be considered an estimate because the high concentration affects the precision of the analysis.		
T2	The result for Total Dissolved Solids should be considered an estimate because the high concentration of suspended solids affects the precision of the analysis.		
TIC	Refer to case narrative for information on tentatively identified compounds.		
V1	Continuing calibration verification was high; sample results for this analyte may be high estimates.		
V2	Continuing calibration verification was high for this analyte; the analyte was not detected in the sample and results are not affected.		
V3	Continuing calibration verification was low; sample results for this analyte may be low estimates.		
Z0	[Custom Value]		

Appendix H

Equipment & Maintenance

H.1 EQUIPMENT

Equipment purchasing procedures are covered in Section 9. When a major piece of equipment is needed, appropriate lab staff may participate in vendor presentations and follow-up Q&A sessions and are consulted for technical specifications and requirements. They also may be involved in the writing of technical statements of work that are incorporated into formal solicitation documents.

Minor equipment is usually replacement with the same or similar piece of equipment and vendor presentations and technical specifications are not required.

Major equipment is decommissioned when either ongoing maintenance becomes prohibitively expensive or when regulatory and/or technical advances require purchasing new technologies. Lists of major and minor equipment are provided in Tables H-1 and H-2, below. The room numbers and section names are keyed to the laboratory floor plan provided in Appendix C.

H.2 MAINTENANCE

H.2.1 Vendor Maintenance Contracts. Equipment for which the WPCL carries annual vendor maintenance contracts are indicated in Table H-1 with an asterisk (*) following the description. While the degree of service may vary with individual vendors, all contracts provide for at least one annual preventative maintenance visit, a specified call-back time (e.g., within 24 or 48 hours), a specified level-of-service for instrument repair, tuning or calibration, and parts replacement.

H.2.2 Third-Party Maintenance. The WPCL maintains the OI/Perstorp flow injection analyzer using the services of EZChem (Hood River, OR) because the vendor no longer supports this particular instrument. This is noted with a double asterisk (**) following the description in Table H-1.

H.2.3 Balances and Spectrophotometers. The WPCL contracts with Quality Control Services (Portland, OR) for the annual calibration and servicing of the two platinum digital thermometers, two spectrophotometers, and nine balances listed in Tables H-1 and H-2. WPCL is provided with written certificates of service and calibration, including an attestation that calibrations are done using test standards traceable to NIST standards.

H.2.4 Ongoing Internal Maintenance & Calibrations. Tables H-3a through H-3e summarize by section the routine maintenance and calibrations done by WPCL staff and instrument vendors. Note that the laboratory's two CEM microwave systems (one each in Metals and Organics) are covered in Table H-3f.

Table H-1: WPCL Major Equipment

SECTION	ROOM	INVENTORY #	DESCRIPTION	DATE	MANUFACTURER	MODEL	SERIAL #
MAJOR EQUIPMENT							
Metals	139	A23681	Laminar Flow Hood		Microzone	V8-PP-36-FX	806-1026
	138	A22864	ICP System *	2005	PerkinElmer	Optima 5300DV	077N5092302
	138	A22322	ICP/MS System *	2003	Thermo V.G.	X-7	X0241
	138	A21246	Microwave Sample Digestion System *	2000	CEM	Mars-5	DS6335
Micro	141	A14100	Autoclave (Sterilizer) *	1994	Steris	Renaissance-38	R8133792-03
Organics	140	--	Automated Sep Funnel Shaker (small)	2008	LabLine	6000	1047829
	140	--	Automated Sep Funnel Shaker (small)	2008	LabLine	6000	1458080397684
	140	--	Automated Sep Funnel Shaker (small)	2003	LabLine	6099-1	1458080401702
	140	A23447	Extraction Solvent Evaporator #1	2002	Zymark	Turbovap II	TV0238N11184
	140	A23047	Extraction Solvent Evaporator #2	2004	Zymark	Turbovap II	TV0428N12425
	139	A23125	VOA Gas Chromatograph *	2007	Agilent	7890A	CN10731014
	136	A22109	GC-ECD System *	2002	Agilent	6890N	US10148038
	136	A22240	Gas Chromatograph *	2003	Agilent	6890N	US10224107
	136	A22247	Mass Spectrometer*	2003	Agilent	5973N	US21853222
	136		Large Volume Injector*	2008	ATAS	Optic-3	H0504294
	136	A23371	Gas Chromatograph w/ FID*	2008	Agilent	7890A	CN10832147
	136		Mass Spectrometer*	2008	Agilent	5975C	US83120211
	136		Large Volume Injector*	2012	ATAS	Optic-4	400168
	136	A22209	Microwave Sample Digestion System*	2003	CEM	Mars-X	XM3056
Nutrients	134	A22479	Ion Chromatograph System*	2004	Dionex	ICS-2000	3080225
	134	A23767	Discrete Analyzer*	2011	Astoria-Pacific	2900	2960-6021
	134	A23046	Flow Injection System**	2004	Perstorp/OI	FS-3000	429804469
	134	A23747	Segmented Flow Analyzer*	2011	Astoria-Pacific	Astoria 2	200265
Process/	142	A23705	TOC Analyzer*	2011	Shimadzu	TOC-L CSH E100	H54204900104
Gen. Chem.	142	A22444	UV/VIS Spectrophotometer	2004	Perkin-Elmer	EZ-301	5850089
	143	A12994	Spectrophotometer		Hach	DR/3000	930600004079
Other	--		Promium Element LIMS Software	2010	Promium	Element	---

Table H-2: WPCL Minor Equipment

SECTION	ROOM	INVENTORY #	DESCRIPTION	DATE	MANUFACTURER	MODEL	SERIAL #
MINOR EQUIPMENT							
Metals	139	--	Block Digester		Env. Express	--	
	139	A22241	Subboiling Distillation System	2003	Milestone	Duopur	2070114
	139		Analytical Balance		Sartorius	A120S	36110191
	139		Top Loading Balance		AND	FA2000	5233143
	139	A11574	Rotary Extractor (TCLP) System #1	1992	Lars Lande	--	--
	139	--	Rotary Extractor (TCLP) System #2		Env. Express	--	575-12-355
			Milli-Q Water Purification System #2 *		Millipore		
Micro	141	--	Water Bath "IG"	2005	Precision Instr.	2862	200603-37
	141	--	Water Bath "IH"	2006	Precision Instr.	2862	201740-117
	141	A10240	Incubator "M"	1991	VWR	1545	600791
	141	A10241	Incubator "IC"	1991	VWR	1545	600491
	141	--	Sealer Unit #1	2001	IDEXX Labs	Quantitray-2X	1687
	141	--	Sealer Unit #2	2002	IDEXX Labs	Quantitray-2X	1803
	141	--	Motorized Syringe Sample Delivery System		Sci. Equip. Co.	40A	1875
	141	A17712	Digital Thermometer For Water Baths		Guildline	9540	60580
	141	--	Autoclave (Sterilizer)		Equatherm		9408-304
	141	--	Blender	1985	Waring	7012	31BL42
	141	--	Incubator "IF"	2005	VWR	1545	
Organics	140	--	Top Loading Balance		Sartorius	L610	36060009
	140	--	Glass Drying Oven		Labline Imperial IV	3475M	0291-1966
	140	--	Wrist Action Shaker	2010	Burrell	75	183071777
	139	--	Ductless Fume Hood	2008	Terra Universal	79000-13A	14882411
Process/	143	--	Oil & Grease Vacuum Manifold, 7-Place	2006	Env. Express	G1260	---
Gen. Chem.	143	--	Oil & Grease Vacuum Manifold, 3-Place	2006	Env. Express	G1270	---
	143	--	Analytical Balance		AND	FR-200 Mk-II	50031
	143	--	Conductivity Meter	2006	Thermo Orion	Three Star	14642
	142	--	Benchtop Centrifuge		Hermle	Z200A	44010393
	142	A12172	pH Meter		Orion	420A	005570
	142	A5659	Analytical Balance	1987	Sartorius	A200-S	30110191
	142	--	Analytical Balance	2009	Sartorius	CPA224S	24151051
	135		BOD Incubator "IB"	2011	VWR/Sheldon	2020	1035411
	135	--	BOD Incubator "IA"	2007	VWR	2020	02069107
	135	BES005-000004	Drying Oven "OA"		LabLine	3609M	1068
	135	--	Drying Oven "OE"	2010	Thermo/Lindberg	6966	221591
	135	---	Drying Oven	2011	VWR	Air Flux Four	00411305109T012
	135		Analytical Balance		Ohaus	AR3130	H0451202480311
	135	--	Chlorine Amperometric Titrator	1997	Hach	19299-00	960900001092
	135	A9961	pH Meter		Orion	EA940	2501
	135	--	Muffle Furnace	2003	Fisher		
	135	A11470	DO Meter #1 & Probe		YSI	59	920037512
	135	--	DO Meter #2 & Probe	2006	YSI	5905	93F06388
	135	--	LDO Meter & Probe	2009	Hach	HQ-40d	
	135	--	LDO Probe	2009	Hach		
	135	--	DO Meter, Dual Input (LIMS compatable)	2010	Hach	HQ-40d	100800045288
	143	A17858	Cyanide Distillation System	1995	Andrews Glass	110-10-R	A-4-R-0709
	143	--	COD Reactor System #1		Hach	45600	950500012562
	143	--	COD Reactor System #2		Hach	45600	930400008840
	143	A10592	Flash Point Tester		Boekel	152800	1031
	143	A12534	Turbidimeter		Orbeco-Hellige	965-10	2383
Nutrients	134	--	Block Digester #1		Fisher	BD20	
	134	--	Block Digester #2		Tecator	2040	
	134	--	Vapor Collector Assembly	2009	Tecator	2540	40836963
	134		Top Loading Balance		AND	FA2000	5229763
	134		Digital Thermometer		Fluke	52 II	10350072
	134	A23509	Milli-Q Water Purification System #1 *	2009	Millipore	Integral-5	F8NN17500E
Lab Main	--	--	Benchtop Centrifuge w/ Model 10/156 Rotor	2010	Hermle	Z400	48105031
Corridor							
Other	151	A23735	Milli-Q Water Purification System #3	2011	Millipore	Integral-10	F1EA65441A

Table H-3a. Nutrients Section Routine Maintenance

INSTRUMENT	PROCEDURE	INTERNAL/ VENDOR	FREQUENCY
Ion Chromatograph	piston flush	internal	daily
	check eluent volume	internal	daily
	check conductivity	internal	daily
	check Retention times	internal	daily
	check pressure	internal	daily
	new/clean column	internal	quarterly or as needed
	new/clean suppressor	internal	quarterly or as needed
	check/replace pump seals	vendor	semi-annual
	check valves	vendor	semi-annual
	check backup seals	vendor	semi-annual
	check autosample wear	vendor	semi-annual
	check inlet/outlet check valve	vendor	semi-annual
	check/replace line end eluent filter	vendor or internal	semi-annual
Astoria Pacific SFA	clean sampler	internal	daily
	check all tubing	internal	daily
	clean inside colorimeter	internal	daily
	record manifold temperature	internal	daily
	clean wash fluid recepticle	internal	daily
	change pump tubing	internal	monthly or as needed
	check/replace lamp	internal	as needed
OI/Perstorp FIA	clean sampler	internal	daily
	check all tubing	internal	daily
	clean inside colorimeter	internal	daily
	clean wash fluid recepticle	internal	daily
	change pumptubing	internal	monthly or as needed
	check/replace lamp	internal	as needed
	replace membrane	internal	monthly or as needed
Astoria Pacific DA	wipe down	internal	monthly
	check alignment	internal	semi-annual
	start of day procedure	internal	daily
	cleaning with HCL (5x at beginning and end of day.)	internal	daily
	cleaning with Chemwash (5x at beginning and end of day.)	internal	daily
	syringe priming	internal	daily or as needed
	end of day procedure	internal	daily
	check/change lamp	internal	as needed
Block Digester	temperature check	internal	annually
Milli-pore DI System	change filters	vendor	semi-annual
	check/replace UV lamp	vendor	annually
	saniize	vendor	annually
	check dispense volume	vendor	semi-annual

Table H-3b. Organics Section Routine Maintenance

INSTRUMENT	PROCEDURE	INTERNAL/ VENDOR	FREQUENCY
Agilent FID-GC	check temp. of detector, inlet, column oven	internal	as required
	septum replacement	internal	as required
	bake injector/column	internal	as required
	change/remove sections of guard column	internal	as required
	replace connectors and liners, septa, goldseal	internal	as required
	replace column	internal	as required
	wipe clean autosampler syringe-guide shaft	internal	as required
	replace syringe	internal	as required
Agilent ECD-GC	check carrier gas flow rate in column	internal	as required
	check temp. of detector, inlet, column oven	internal	as required
	septum replacement	internal	as required
	bake injector/column	internal	as required
	change/remove sections of guard column	internal	as required
	replace connectors and liners, septa, goldseal	internal	as required
	replace column	internal	as required
	detector wipe test (Ni-63)	vendor	semi-annually
	clean autosampler syringe guide shaft	internal	as required
	replace split valve air filter	vendor	as required
Agilent BNA & VOA GCs (3)	replace syringe in autosampler	internal	as required
	clean syringe guide	internal	as required
	bake injector/column	internal	as required
	change/remove sections of guard column	internal	as required
	replace connectors and liners, septa, goldseal	internal	as required
	trim or replace column	internal	as required
Agilent MSDs (3)	foreline pump oil check	internal	before each run
	clean MS source	internal	as required
	change filament	internal	as required
	foreline pump oil change	vendor	biannual
	replace vacuum guage	vendor	as required
VOA GC-MS P&T Concentrator	leak check	internal	as required
	flow check	internal	as required
	replace sparging vessel	internal or vendor	as required
	condition/bake traps	internal	as required
	replace traps	internal or vendor	as required
VOA GC-MS Autosampler	axis calibration for water or soils	internal or vendor	as required
	check displayed pressure	internal	as required
	refill & prime internal standards	internal	as required
	injector & sampling syringe leaks	internal	as required
	check/refill water reservoir	internal	as required
	empty waste container	internal	as required

Table H-3c. Metals Section Routine Maintenance

INSTRUMENT	PROCEDURE	INTERNAL/ VENDOR	FREQUENCY
Perkin Elmer ICP	flush sample introduction system for 5 minutes with the plasma on at the end of the run	internal	daily
	check air supply for RF coil cooling	internal	daily
	check chiller coolant fluid level	internal	daily
	check vent system flow rate	internal	daily
	inspect/clean torch, glassware and injector tube	internal	daily
	inspect/clean nebulizer and capillary tubing	internal	daily
	flush nebulizer with DI water	internal	daily
	inspect/replace pump tubing	internal	daily
	inspect/clean drain tubing, empty drain bottle	internal	daily
	inspect RF coil for deformations or carbon build up	internal	as needed
	Check the window or purge tube for deposits. If there is a sign of UV performance drop, clean or replace the windows	internal	as needed
	inspect/replace the nebulizer	internal	as needed
	Inspect the spray chamber for deposits and check the condition of the O-rings	internal	as needed
	Check the pump rollers are clean and move freely. Remove and clean the pump head if necessary. Replace the pump roller if necessary	internal	as needed
	check/replace spray chamber drain fittings, tubing and connection	internal	as needed
	clean/replace spectrometer and generator air filters	internal	as needed
	check for pitting of RF coil	vendor	as needed
Thermo X-7 ICP/MS	complete instrument log	internal	daily
	inspect/clean cones	internal	daily
	prepare fresh performance monitoring solution	internal	weekly
	clean/replace ICP glassware	internal	weekly
	replace peristaltic pump tubing	internal	as needed
	clean spray chamber drain plug & nebulizer	internal	weekly
	inspect/clean RF contact strip between torch box & faraday cage	internal	weekly
	check/clean air filter	internal	weekly
	check multiplier voltages & do cross calibration	internal	weekly
	replace sample uptake tubing	internal	monthly
	check rotary pump oil & oil mist filters	internal	monthly
	check chiller reservoir water level	internal	monthly
	check/clean lens system & penning gauge	vendor	biannual
	change rotary pump oil	vendor	biannual
	replace work o-rings	vendor	annual

Table H-3d. General Chemistry/Process Sections Routine Maintenance

INSTRUMENT	PROCEDURE	INTERNAL/ VENDOR	FREQUENCY
CN distillation block	replace tubing	internal	as needed
	clean vacuum valves, replace if needed	internal	as needed
	replace rubber gasket	internal	as needed
COD spectrophotometer	calibration and PM	QC Services	annual
	lamp adjustment	internal	as needed
	lamp replacement	internal	as needed
PE spectrophotometer	calibration and PM	QC Services	annual
BOD LDO probe	replace sensor cap and iCal control button	internal	as needed
pH probe	refill with appropriate filling solution	internal	as needed
	flush crystals from probe interior	internal	as needed
	clean probe exterior	internal	as needed
residual chlorine probe	clean probe	internal	as needed
TOC analyzer	refill rinse water bottle, analysis acid, humidifier water	internal	as needed
	autosampler tubing replacement	internal	12-24 months or as needed
	replacing 8-port valve rotor	internal	as needed
	replace syringe and/or syringe plunger	internal	as needed
	regenerate,wash,and/or replace catalyst	internal	as needed
	replace halogen scrubber	internal	as needed
	replace CO_2 absorber	internal	as needed

Table H-3e. Microbiology Section Routine Maintenance

INSTRUMENT	PROCEDURE	INTERNAL/ VENDOR	FREQUENCY
Steris Autoclave	general cleaning	internal	weekly
	check temperature maximum	internal	weekly
	spore strips	internal	monthly
	check timer	internal	quarterly
	replace safety valve	vendor	annual
	calibrate temperature & pressure	vendor	annual
	check/replace piping, valve, other parts	vendor	annual
Laminar Flow Hood	check pressure across HEPA filter	internal	monthly
	clean HEPA filter	internal	monthly
Incubators	general cleaning	internal	monthly
Water Baths	clean & add algacide	internal	monthly
Refrigerators	clean	internal	monthly
Sepco Pipet	lubricate parts & check volume	internal	monthly
Quantitray Sealer	clean	internal	monthly
	check sealing performance with dye test	internal	monthly

Table H-3f. CEM Microwave Systems Routine Maintenance

INSTRUMENT	PROCEDURE	INTERNAL/ VENDOR	FREQUENCY
CEM Mars X Microwave (organics)	clean pressure control cable contacts	internal	as needed
	inspect/replace vessel insulator sleeve	internal	as needed
	inspect/replace vessel cap assembly	internal	as needed
	replace vessel cap pressure safety membrane	internal	every 2 months
	replace fiber optics cable	internal	as needed
	magnetron leak test	vendor	annual
	cavity vent leak test	vendor	annual
	door leak test	vendor	annual
	waveguide leak test	vendor	annual
	blower leak test	vendor	annual
	I/O port leak test	vendor	annual
	temperature sensor check	vendor	annual
	check power @ 300, 600, 1200 W	vendor	annual
CEM Mars 5 Microwave (metals)	clean pressure control cable contacts	internal	as needed
	inspect/replace vessel insulator sleeve	internal	as needed
	inspect/replace vessel cap assembly	internal	as needed
	replace vessel cap pressure safety membrane	internal	every 2 months
	replace fiber optics cable	internal	as needed
	magnetron leak test	vendor	annual
	cavity vent leak test	vendor	annual
	door leak test	vendor	annual
	waveguide leak test	vendor	annual
	blower leak test	vendor	annual
	I/O port leak test	vendor	annual
	temperature sensor check	vendor	annual
	check power @ 300, 600, 1200 W	vendor	annual

Appendix I

Table I-1. WPCL Policy Statements

WPCL policy statements are tabulated below and available on the Group 100 common drive at

GROUP 100 (\\OBERON) S:\LAB\Policy Statements.

#	TYPE	ORIGINATED	UPDATED	TITLE/SUBJECT
1	operations	08/01	04/13	Lab Automobile
4	QA*	03/02	---	Compromised Samples
5	operations	03/02	---	Lab Tours
6	operations	04/02	---	Archive Room Access
10	QA*	10/02	04/13	Late-Arriving Samples
11	QA*	01/02	---	Sample Receiving
12	QA*	08/03	04/13	Method Appropriateness
13	QA*	03/04	---	Indirectly Relinquished Samples
14	QA	04/04	---	Data Entry: MDL vs PQL
15	operations	09/04	04/13	Training Opportunities
18	operations	10/10	---	Standby
19	operations	08/12	---	Prohibition Against Pro Bono Work
20	QA*	08/12	---	Lab Access
21	QA*	08/12	---	Non-Capital Purchasing
22	QA*	04/99	---	Documentation of Reagents, Standards, and Minor Equipment
23	operations	11/12	---	Prohibition Against Using Flash Drives on the Lab Network
30	QA	07/98	---	Sample Dilution
33	QA	05/03	03/08	Trip Blank Identification and Log-In
34	QA*	02/03	10/12	Emergency Sample Receiving Instructions

* Referenced in Quality Manual.

Appendix J

Significant Figures and Rounding

The number of significant figures reported for a sample result depends on the precision of the measurement system. Different analyses have different levels of precision. This document states the determined number of significant figures to be reported for the various analyses performed at WPCL, and also clarifies the protocol for rounding off to significant figures for final reporting and QC calculations.

The standard laboratory criterion is used for assigning significant figures: The measurement with the least number of significant figures determines the significant figures in the final reported result. That still leaves questions about the precision of some measurements, and sample matrix can affect the precision of measurements applied to the sample. When matrix effects are a consideration, fewer significant figures should be reported.

The number of significant figures reported for a given analysis also depends upon how close the result is to the reporting limit. Lower results commonly have fewer significant figures reported because the significance of digits that are lower than the reporting limit is questionable. Sample results are generally reported to no more than one decimal place past the reporting limit places, and may be limited to the same number of places as in the reporting limit.

The following table lists significant figures for reporting results at WPCL. The LIMS is programmed to round final results to the appropriate significant figures and decimal places. Method SOPs address any special significant figure reporting issues, such as TSS. For QC results an extra significant figure is usually reported, to increase precision in calculated spike recoveries and RPD values.

Analysis	Significant Figures Reported
Alkalinity	3 generally, but 2 for results <10.0
Ammonia	3
Anions (F,Cl,NO_3,Br,SO_4)	2
BOD	up to 3, whole numbers only
Chlorophyll-*a*	3 generally, but 2 for results <10.0
COD	2
Conductivity	3
Cyanide	3
E.coli/total/fecal coliforms	2
Flashpoint	up to 3, whole numbers only
Hardness (by ICP)	3
Metals by ICP	3 (ppm)
Metals by ICP-MS, water	3 (ppb)
Metals by ICP-MS, soil	3 (ppm)
NWTPH-Dx	2
Nitrite	3
Oil & Grease	3
ortho-Phosphate	3

PAH	2
PCBs	3
pH	report to the tenths place
Phosphorus, Total	3
Residual chlorine	2 generally, but 3 for results >1.00
Semivolatile Organics	2
Sulfide	2
TOC	3
TKN	3 generally, but 2 for results <1.00
TDS	3, whole numbers only
TS-waters	3, whole numbers only
TS-solids	3 generally, but 2 for results <1.00
TSS	3, whole numbers only
Volatile Acids	2
Volatile Organics	3

The basic protocol for rounding off is: above 5 rounds up, below 5 rounds down, and 5 rounds to the nearest even number. Thus, 8850 rounds to 8800. There are two specific points that need clarification. The first is, when there are non-zero digits following a 5, you do consider those digits and round up. For example, if a calculated result is 8851 and you are rounding to two significant figures, round up to 8900 because "51" is greater than 50.

The second common question concerns *when* to do the rounding. Always use more significant figures in the calculations than will be used for the final reported result. If, for example, a sample is diluted, applying the rounding too early will affect the final result:

Analysis result = 156	Rounded analysis result = 160
Dilution factor = 2	Dilution factor = 2
Final result = 312, rounded to **310**	**Final result = 320**

When calculating QC statistics, very different values may be attained when working at the high or low end the result range. For spike recoveries, if the sample result is above the spike amount, the calculated spike recovery can be significantly affected by rounding:

Sample result = 116 mg/L	Rounded sample result = 120
Spike amount = 50 mg/L	Spike amount = 50 mg/L
Spike result = 164	Rounded spike result = 160
Spike recovery = 96%	**Spike recovery = 80%**

For duplicate RPD, the effect is especially evident at the low end of the reporting range when fewer significant figures are reported at the low end:

TSS Result 1 = 7.6	Rounded result 1 = 8
TSS Result 2 = 6.4	Rounded result 2 = 6
RPD = 17	**RPD = 29**

These two QC examples both show situations that favor the analyst by not rounding too early. There are other situations where rounding would bring unacceptable QC results into range, but it is not allowable to use rounding to make the data look better.

The WPCL policy is to always use at least one extra significant figure in calculations, leaving the rounding until the end.

Appendix K

Table K-1. WPCL List of Analyses

This list of analyses performed at WPCL is current as of 12/18/12.

Analysis Description	Matrix	Specific Method	Instrument
Ammonia-Nitrogen	Solid	EPA 350.1	-
Ammonia-Nitrogen	Water	EPA 350.1	-
Ash (fixed solids)	Solid	SM 2540G	-
Ash (fixed solids)	Water	EPA 160.4	-
Bicarbonate Alkalinity	Water	SM 2320B	-
Biochemical Oxygen Demand (BOD)	Water	SM 5210B/ H10360	-
Bromide	Solid	EPA 300.0	-
Bromide	Water	EPA 300.0	-
Carbonaceous BOD	Water	SM 5210B/ H10360	-
Chemical Oxygen Demand (COD)	Water	SM 5220D	-
Chloride	Solid	EPA 300.0	-
Chloride	Water	EPA 300.0	-
Chlorophyll a	Water	SM 10200H	-
Conductivity	Water	SM 2510B	-
Cyanide, amenable*	Water	SM 4500-CN HK	-
Diesel/Oil Hydrocarbons	Solid	NWTPH-Dx	GC-FID
Diesel/Oil Hydrocarbons	Solid as rcvd	NWTPH-Dx	GC-FID
Diesel/Oil Hydrocarbons	Water	NWTPH-Dx	GC-FID
Diesel/Oil Hydrocarbons SPLP	Solid	NWTPH-Dx	GC-FID
Diesel/Oil Hydrocarbons SPLP	Solid as rcvd	NWTPH-Dx	GC-FID
Dissolved BOD	Water	SM 5210B/ H10360	-
Dissolved COD	Water	SM 5220D	-
Dissolved Metals	Water	EPA 200.7	ICP
Dissolved Metals	Water	EPA 200.8	ICPMS
Dissolved Organic Carbon	Water	SM 5310B	-
Dissolved Oxygen*	Water	H10360	-
Dissolved Sulfide*	Water	SM 4500-S BD	-
E. coli	Solid	SM 9221F	MPN
E. coli	Water	Colilert QT	Colilert QT
E. coli*	Water	SM 9221F	MPN
Fecal Coliform Bacteria	Solid	SM 9221E	MPN
Fecal Coliform Bacteria	Water	SM 9221E	MPN
Flashpoint	Solid	EPA 1010	-
Flashpoint	Water	ASTM D93-66	-
Flocculated COD*	Water	SM 5220D	-
Fluoride	Solid	EPA 300.0	-
Fluoride	Water	EPA 300.0	-
Hydrocarbon Scan	Solid	NWTPH-HCID	GC-FID

Hydrocarbon Scan	Solid as rcvd	NWTPH-HCID	GC-FID
Hydrocarbon Scan	Water	NWTPH-HCID	GC-FID
Nitrate	Solid	EPA 300.0	-
Nitrate	Water	EPA 300.0	-
Nitrite	Water	EPA 353.2	-
Oil & Grease (Non Polar)	Solid	EPA 1664	-
Oil & Grease (Non Polar)	Solid as rcvd	EPA 1664	-
Oil & Grease (Non Polar)	Water	EPA 1664	-
Oil & Grease (Total)	Solid	EPA 1664	-
Oil & Grease (Total)	Solid as rcvd	EPA 1664	-
Oil & Grease (Total)	Water	EPA 1664	-
Organic Matter	Solid	SM 2540G	-
Organic Matter	Water	SM 2540E	-
ortho-Phosphate-P	Water	EPA 365.1	-
PCB Aroclors	Solid	EPA 8082	GC-ECD
PCB Aroclors	Solid as rcvd	EPA 8082	GC-ECD
PCB Aroclors	Water	EPA 8082	GC-ECD
PCB Aroclors	Wipe	EPA 8082	GC-ECD
Pentachlorophenol	Solid	EPA 8270-SIM	GCMS-SIM
Pentachlorophenol	Water	EPA 8270-SIM	GCMS-SIM
pH	Solid	EPA 9045	-
pH	Solid as rcvd	EPA 9045	-
pH	Water	SM 4500-H B	-
Polynuclear Aromatic Hydrocarbons	Solid	EPA 8270-SIM	GCMS-SIM
Polynuclear Aromatic Hydrocarbons	Solid as rcvd	EPA 8270-SIM	GCMS-SIM
Polynuclear Aromatic Hydrocarbons	Water	EPA 8270-SIM	GCMS-SIM
Polynuclear Aromatics & Phthalates	Solid	EPA 8270-SIM	GCMS-SIM
Polynuclear Aromatics & Phthalates	Solid as rcvd	EPA 8270-SIM	GCMS-SIM
Polynuclear Aromatics & Phthalates	Water	EPA 8270-SIM	GCMS-SIM
Polynuclear Aromatics, PCP, & Phthalates	Solid	EPA 8270-SIM	GCMS-SIM
Polynuclear Aromatics, PCP, & Phthalates	Water	EPA 8270-SIM	GCMS-SIM
Pyrene	Water	EPA 8270-SIM	GCMS-SIM
Residual Chlorine	Water	SM 4500-Cl D	-
Semivolatile Organic Compounds	Water	EPA 625	GCMS
Semivolatile Organic Compounds	Water	EPA 8270	GCMS
Semivolatile Organic Compounds SPLP	Solid	EPA 8270	GCMS
Semivolatile Organic Compounds, Acids	Water	EPA 625	GCMS
Settleable Solids*	Water	SM 2540F	-
SPLP Metals	Solid	EPA 6010	ICP
SPLP Metals	Solid	EPA 6020	ICPMS
Sulfate	Solid	EPA 300.0	-
Sulfate	Water	EPA 300.0	-
Sulfide*	Water	SM 4500-S D	-
TCLP Metals	Solid	EPA 6010	ICP
TCLP Metals	Solid	EPA 6020	ICPMS
TCLP Metals	Solid as rcvd	EPA 6010	ICP
TCLP Metals	Solid as rcvd	EPA 6020	ICPMS
Total Alkalinity	Water	SM 2320B	-
Total Coliform Bacteria	Water	SM 9223B	Colilert QT

Total Cyanide	Solid	SM 4500-CN E	-
Total Cyanide	Water	SM 4500-CN E	-
Total Dissolved Solids	Water	SM 2540C	-
Total Kjeldahl Nitrogen	Solid	PAI-DK03	-
Total Kjeldahl Nitrogen	Water	PAI-DK03	-
Total Metals	Solid	EPA 6010	ICP
Total Metals	Solid	EPA 6020	ICPMS
Total Metals	Solid as rcvd	EPA 6010	ICP
Total Metals	Solid as rcvd	EPA 6020	ICPMS
Total Metals	Water	EPA 200.7	ICP
Total Metals	Water	EPA 200.8	ICPMS
Total Metals	Water	WPCLSOP M-10	ICPMS
Total Metals	Wipe	EPA 6020 mod	ICPMS
Total Organic Carbon	Water	SM 5310B	-
Total Phosphorus	Solid	EPA 365.4	-
Total Phosphorus	Water	EPA 365.4	-
Total Solids	Solid	SM 2540G	-
Total Solids	Water	SM 2540B	-
Total Suspended Solids	Water	SM 2540D	-
Total Suspended Solids, whole volume*	Water	SM 2540D Mod	-
Volatile Acids*	Water	SM 5560	-
Volatile Organic Compounds	Water	EPA 624	GCMS
Volatile Organic Compounds	Water	EPA 8260	GCMS
Volatile Organics, BTEX	Water	EPA 624	GCMS
Volatile Organics, BTEX	Water	EPA 8260	GCMS
Volatile Solids	Solid	SM 2540G	-
Volatile Solids	Water	SM 2540E	-
Volatile Suspended Solids*	Water	SM 2540E	-

* not NELAC accredited

Appendix L

Containers, Preservation, and Holding Times

☼ In addition to required chemical preservation, samples are refrigerated per method requirements.

Analysis	Container	Chemical Preservation ☼	Holding Time
GENERAL CHEMISTRY/NUTRIENTS			
Anions (F, Cl, Br, SO_4)	½ Pint[1] Plastic	none	28 days
Ammonia-N	½ Pint[2] Plastic	H_2SO_4 to pH 1.8-2.0	28 days
Alkalinity	Pint Plastic	none	14 days
BOD	Quart Plastic	none	48 hours
COD	½ Pint Plastic	H_2SO_4 to pH <2.0	28 days
Chlorophyll a	Liter Glass amber	none	filter 24 hrs, frozen filter 30 days
Conductivity	½ Pint Plastic	none	28 days
Cyanide, Total	Pint Plastic	NaOH to pH >12.0	14 days
Cyanide, Amenable	Pint Plastic	NaOH to pH >12.0	14 days
DOC	250 mL Glass amber	HCl to pH 2-3	28 days
Flash Point	½ Pint[5] Glass	none	7 days
*Grain Size	8 oz. glass jar (or 2 x 4 oz.)	none	14 days
Hardness	½ Pint Plastic	HNO_3 to pH <2.0	6 months
*MBAS Surfactants	Pint Plastic	none	48 hours
Nitrate -N	½ Pint[1] Plastic	none	48 hours
Nitrite-N	½ Pint[3] Plastic	none	48 hours
Oil & Grease, industries	400 mL Glass wide-mouth	HCl to pH <2.0	28 days
Oil & Grease, environmental	Liter Glass	HCl to pH <2.0	28 days
*Particle Size	Liter Plastic	none	14 days
pH	½ Pint Plastic	none	2 hours
ortho-Phosphate-P	½ Pint[3] Plastic	none	48 hours
Phosphorus, Total	½ Pint[2] Plastic	H_2SO_4 to pH <2.0	28 days
Residual Chlorine	Pint Plastic	none	6 hours
Solids (Residue)			
Dissolved	Pint[4] Plastic	none	7 days
Suspended	Pint[4] Plastic	none	7 days
Total	Pint[4] Plastic	none	7 days
Sulfide	40 mL vial[5] Glass amber	ZnAce/NaOH	7 days
TKN	½ Pint[2] Plastic	H_2SO_4 to pH <2.0	28 days
TOC	250 mL Glass amber	HCl to pH 2-3	28 days
*Turbidity	½ Pint Plastic	none	48 hours
Volatile Acids	Pint Plastic	none	14 days
METALS in Water			
ICP-MS Total Metals	Pre-cleaned Pint Plastic	HNO_3 to pH <2.0	6 months
Mercury	Pre-cleaned Pint Plastic	HNO_3 to pH <2.0	28 days
ICP Total Metals	Pint Plastic	HNO_3 to pH <2.0	6 months
Dissolved Metals	Pre-cleaned Pint Plastic	filter immediately, then HNO_3 pH <2.0	6 months

Analysis	Container	Chemical Preservation ☼	Holding Time
ORGANICS in Water			
*Dioxins/Furans	Liter Glass amber	none	7/40 days
*Herbicides	varies	varies	7 or 14 days
HCID, Dx	500 mL Glass amber	HCl to pH <2.0	7/40 days
*Organotins	Liter Glass amber	none	14/40 days
PAH/phthaltes/PCP	Liter Glass amber	none	7/40 days
PCB	Liter Glass amber	none	180/40 days
*Pesticides / PCB	Liter Glass amber	none	7/40 days
*Phenols	500mL or Liter Glass amber	H_2SO_4 to pH <2.0	28 days
Semi-Volatiles (EPA 625, 8270)	Liter Glass amber	none	7/40 days
Volatiles – BTEX (EPA 624, 8260)	3 x 40 mL vials[5] Glass	HCl to pH <2.0	14 days
Volatiles - EPA 624 Grab	4 x 40 mL vials[5] Glass	3 HCl to pH <2.0[6]	14 days
Volatiles - EPA 624 Composite[7]	4-7 x 125 mL vials[5] Glass	none or $Na_2S_2O_3$[7]	14 days
Volatiles - EPA 8260	3 x 40 mL vials[5] Glass	HCl to pH <2.0	14 days
MICROBIOLOGY in Water			
Total Coliforms	250 mL[8] Plastic sterile	none or $Na_2S_2O_3$ [9]	8 or 24 hours
Fecal Coliforms	250 mL[8] Plastic sterile	none or $Na_2S_2O_3$ [9]	8 or 24 hours
E. coli	250 mL[8] Plastic sterile	none or $Na_2S_2O_3$ [9]	8 or 24 hours
SOIL, SLUDGE SAMPLES			
E.coli or Fecal coliforms	Whirlpack bag sterile	none	24 hours
Metals, except Mercury	1 x 4 oz jar [10]	none	6 months
Mercury	1 x 4 oz jar [10]	none	28 days
Nutrients (N or P species)	1 x 4 oz jar or plastic bag	none	28 days
Organic Analyses, various	1 x 4 oz jar per test [10]	none	14 days most
TCLP or SPLP	1 x 4 oz jar [10]	none	refer to analyte HT
Total Solids	1 x 4 oz jar [10]	none	14 days
Total Solids/Volatile Solids, Ash, Organic Matter	1 x 4 oz jar or plastic bag	none	14 days

* Analysis performed by a contract laboratory
[1] If collecting for Nitrate and other Anions, a single ½ Pint is enough.
[2] If collecting for Ammonia, total Phosphorus, and TKN, collect a single sample of 1 pint.
[3] If collecting for ortho-Phosphate and Nitrite, a single ½ Pint is enough.
[4] If collecting for 2 or 3 Solids analyses, collect a single sample of 1 quart. For low-level TSS, collect a separate quart.
[5] Sample must be collected with no headspace or air bubble remaining in the vial.
[6] Method 624 requires 3 HCl-preserved vials + 1 non-preserved vial for 2-chloroethyl vinyl ether
[7] For VOA composites, several grab samples are collected in 125-mL bottles, composited by the laboratory into HCl-preserved 40-mL vials + at least 1 non-preserved 40-mL vial for 2-chloroethyl vinyl ether. For chlorinated effluent samples, the 125-mL bottles contain $Na_2S_2O_3$ for dechlorination.
[8] One 250 mL bottle is sufficient for multiple tests.
[9] For chlorinated effluent samples, $Na_2S_2O_3$ is added for dechlorination.
[10] Sample jars may be shared to some extent. One jar may provide enough volume for up to 3 tests + total solids. However, it is preferable to have separate jars for organics and metals.

Appendix H

DEQ “Mercury Monitoring Requirements for Willamette Basin Permittees” Memo

State of Oregon
Department of Environmental Quality Memorandum

To: Willamette Basin Permit Writers **Date:** 12/23/10

From: Agnes Lut, Willamette Basin Phase 2 Hg TMDL Coordinator

Section: Watershed Management, Water Quality Division, HQ

Subject: Mercury Monitoring Requirements for Willamette Basin Permittees

Mercury (Hg) data is needed from permitted sources in the Willamette Basin in order to fill critical data gaps identified during Phase 1 and to complete Phase 2 of the Willamette Hg Total Maximum Daily Load (TMDL). In-river ambient Hg data is being collected by the Department to be used with the Hg data collected by the permitted sources to develop the Phase 2 Willamette Basin Hg TMDL. Any questions regarding this requirement are to be directed to Agnes Lut, 503-229-5247, Phase 2 Willamette Hg TMDL Coordinator.

This memo outlines the mercury monitoring requirements that are to be added to Willamette Basin permits as they are issued or renewed. The permit types in the Willamette Basin that will monitor for mercury and methyl mercury were selected based on their potential to be a source of mercury or methyl mercury. The specific permit types are:

- Major Industrial
- Major Municipal
- Specific Minors:
  - NPDES-IW-B08
  - NPDES-IW-B15
  - NPDES-IW-B16
  - NPDES-IW-B19
  - NPDES-IW-B20
  - NPDES-IW-B21
- MS4 Phase I Stormwater

Each point source permit type identified above is required to monitor for total and dissolved mercury and methyl mercury. Point sources are required to use the following methods for sample collection and analysis:

- EPA Method 1669 ultra clean sampling protocol to collect samples
- EPA Method 1631E for mercury analyses
- EPA Method 1630 for methyl mercury analyses

The following Level of Quanitation (LOQ) shall be achieved but may vary slightly depending on effluent quality and matrix interference. The reason for stating the acceptable LOQ is to assure that the analysis is conducted to environmentally relevant concentrations for non-detects.

- Mercury, total <u>and</u> dissolved: LOQ = 0.5 ng/l;
- Methyl mercury, total <u>and</u> dissolved: LOQ = 0.05 ng/l.

The point sources will be required to collect samples during a time that would be representative of typical effluent flow and mercury removal efficiency. Sample collection will occur during day light hours, typically between the hours of 2pm and 7pm. Samples will be collected from the effluent.

The effluent discharge flow rate will be recorded at the time the mercury sample is collected. Flow or rainfall will be collected, estimated or modeled for each stormwater monitoring event.

This data will be used by DEQ to develop the Phase 2 Willamette Mercury TMDL, calculate the mercury loading capacity and set load allocations. During the Phase 1 TMDL DEQ did not have sufficient Willamette specific mercury data to conduct a thorough source identification. Additionally, the data is needed to verify or revise the modeling that was used to develop the interim water-column guidance value of 0.92 ng/L total mercury that was set for protecting beneficial uses in the Phase 1 mercury TMDL.

Determining how the mercury and methylmercury monitoring will be implemented by permittees is up to the discretion of the permit writer with consultation with the TMDL coordinator, Agnes Lut.

Major Industrial and Municipal:

The following mercury and methyl mercury requirements are to be specified in each **major industrial and municipal permit** issued or renewed in the Willamette Basin, using the EPA methods and limits of quanitation identified above :

Sample Parameters	Sampling Frequency	Sampling Type
Total mercury Dissolved mercury	2 times / year, for **2** years September and February, (*See Note 1*)	Grab, during the daylight hours
Total methyl mercury Dissolved methyl mercury	2 times / year, for **2** years September and February, (*See Note 1*)	Grab, during the daylight hours

Below is the language referencing Note 1 to include in the permit. After two years of monitoring is fulfilled, creating a minimum of 4 samples, the permit writer shall review the data and contact the TMDL Coordinator, Agnes Lut, to determine whether additional monitoring is warranted. If additional monitoring is not warranted, the Department may eliminate the mercury monitoring from the permit.

Note 1: After 2 years of monitoring (minimum of 4 samples), the permittee may request in writing to the Department that the mercury and methyl mercury monitoring be eliminated. The monitoring may be eliminated only after written approval by the Department. Monitoring for total and dissolved mercury must be performed according to US EPA method 1631E with a quanitation limit of 0.5 ng/L. Monitoring for total and dissolved methyl mercury must be performed according to US EPA method 1630 with a quanitation limit of 0.05 ng/L. The effluent discharge flow rate will be recorded at the time the mercury sample is collected.

Minor Industrial:

The following 27 identified **minor industrial** facilities are to include mercury and methyl mercury monitoring (source: SIS download 1/24/11):

Common Name	Region	Permit Nbr	Permit Type	Permit Writer
EVRAZ OREGON STEEL	NWR	101007	NPDES-IW-B08	Burkhart
J.H. BAXTER & CO., INC.	WR	102432	NPDES-IW-B15	
KOPPERS	NWR	101642	NPDES-IW-B15	Burkhart
MCFARLAND CASCADE POLE & LUMBER CO	WR	102392	NPDES-IW-B15	
OREGON STATE UNIVERSITY	WR	102735	NPDES-IW-B15	Pfauth
SLLI	NWR	101180	NPDES-IW-B15	Burkhart
SUNSTONE CIRCUITS	NWR	101015	NPDES-IW-B15	Burkhart
ARCLIN	WR	101235	NPDES-IW-B16	
CASCADE STEEL	WR	101487	NPDES-IW-B16	Schnurbusch
COVANTA MARION, INC	WR	101240	NPDES-IW-B16	Graybill
GEORGIA-PACIFIC CHEMICALS LLC	WR	101474	NPDES-IW-B16	Schnurbusch
GP MILLERSBURG RESIN PLANT	WR	102603	NPDES-IW-B16	Graybill
OREGON-CANADIAN FOREST PRODUCTS - NORTH PLAINS	NWR	101634	NPDES-IW-B16	Wiren
COTTAGE GROVE LUMBER	WR	101449	NPDES-IW-B19	Schnurbusch
FRANK LUMBER CO. INC.	WR	101583	NPDES-IW-B19	Graybill
HULL-OAKES LUMBER CO.	WR	101466	NPDES-IW-B19	
RSG FOREST PRODUCTS - LIBERAL	NWR	100929	NPDES-IW-B19	Burkhart
SENECA SAWMILL COMPANY	WR	101893	NPDES-IW-B19	McFetridge
DURAFLAKE	WR	100668	NPDES-IW-B20	Schnurbusch
FOSTER ENGINEERED WOOD PRODUCTS (EWP)	WR	101777	NPDES-IW-B20	Graybill
KINGSFORD MANUFACTURING COMPANY -	WR	102153	NPDES-IW-B20	Wiltse
ROSBORO	WR	101467	NPDES-IW-B20	Ullrich
STIMSON LUMBER COMPANY - FOREST GROVE	NWR	101480	NPDES-IW-B20	Burkhart
JASPER WOOD PRODUCTS, LLC	WR	101427	NPDES-IW-B21	Graybill
PACIFIC WOOD PRESERVING OF OREGON, INC.	WR	101267	NPDES-IW-B21	Graybill
PERMAPOST	NWR	101489	NPDES-IW-B21	Burkhart
ROYAL PACIFIC INDUSTRIES INC	WR	101213	NPDES-IW-B21	Graybill

The following mercury and methyl mercury requirements are to be specified using the above identified EPA methods and limits of quanitation for minor industrials:

Sample Parameters	Sampling Frequency	Sampling Type
Total mercury Dissolved mercury	2 times / year, for **1** year, September and February (*See Note 2*)	Grab, during the daylight hours
Total methyl mercury Dissolved methyl mercury	2 times / year, for **1** year, September and February (*See Note 2*)	Grab, during the daylight hours

Below is the language referencing Note 2 to be included in the permit. After one year of monitoring is fulfilled, creating a minimum of 2 samples, the permit writer shall review the data and contact the TMDL Coordinator, Agnes Lut, to determine whether additional monitoring is warranted. If additional monitoring is not warranted, the Department may eliminate the mercury monitoring requirement from the permit.

> *Note 2*: After 1 year of monitoring (minimum of 2 samples), the permittee may request in writing to the Department that the mercury and methyl mercury monitoring be eliminated. The monitoring may be eliminated only after written approval by the Department. Monitoring for total and dissolved mercury must be performed according to US EPA method 1631E with a quanitation limit of 0.5 ng/L. Monitoring for total and dissolved methyl mercury must be performed according to US EPA method 1630 with a quanitation limit of 0.05 ng/L. The effluent discharge flow rate will be recorded at the time the mercury sample is collected.

<u>MS4 Phase 1 Stormwater:</u>

The following mercury and methyl mercury requirements are to be specified using the above identified EPA methods and limit of quanitation in each **MS4 Phase 1** Stormwater permit issued or renewed in the Willamette Basin:

Sample Parameters	Sampling Frequency	Sampling Type
Total mercury Dissolved mercury	2 times / year, for **2** years, Wet and Dry storm season (*see Note 3*)	Grab, during the storm event
Total methyl mercury Dissolved methyl mercury	2 times / year, for **2** years, Wet and Dry storm season (*see Note 3*)	Grab, during the storm event

The mercury and methyl mercury samples must be collected from a representative set of stormwater outfalls during significant runoff events.

Below is the language referencing Note 3 to include in the permit. A summer event is considered to be equivalent to a dry season storm event (May 1-September 30), and a winter event is equivalent to a wet season storm event (October 1-April 30). After two years of monitoring is fulfilled, creating a minimum of 4 samples, the permit writer shall review the data and contact the TMDL Coordinator, Agnes Lut, to determine whether additional monitoring is warranted. If additional monitoring is not warranted, the Department may eliminate mercury monitoring requirements from the permit.

Note 3: After 2 years of monitoring (minimum of 4 samples), the permittee may request in writing to the Department that the mercury and methyl mercury monitoring be eliminated. The monitoring may be eliminated only after written approval by the Department. Monitoring for total and dissolved mercury must be performed according to US EPA method 1631E with a quanitation limit of 0.5 ng/L. Monitoring for total and dissolved methyl mercury must be performed according to US EPA method 1630 with a quanitation limit of 0.05 ng/L.

Sample Shipment and Analysis:

Mercury sampling requirements in the permits must specify that samples be shipped within 24 hours of collection and processed at the analytical laboratory within 48 hours of collection. The analytical lab must be NELAC certified for mercury and methyl mercury analysis. If the analytical lab can perform the mercury analysis as specified in this memo, utilizing the specific EPA Methods and also able to achieve the stated LOQs, then the lab does not have to be NELAC certified. Samples will be chilled to 4ºC in the field and for transport to the analytical laboratory. Preservation acid is to be added at the analytical laboratory in order to avoid contamination during field sampling. Filtering for dissolved mercury and methyl mercury is to occur at the analytical lab when processing the samples.

A partial list of analytical labs that are able to achieve the LOQ's is below, however, this is not an endorsement of these labs:

Mercury and Methyl Mercury Analytical Labs	Phone
Battelle Marine Science Laboratory 1529 West Sequim Bay Road Sequim, WA 98382	360-681-3650
Frontier GeoSciences 414 Pontius Ave N Seattle WA 98109 http://www.frontiergeosciences.com	206-622-6960
Brooks-Rand 3958 6^{th} Ave N.W. Seattle WA 98107 http://www.brooksrand.com	206-632-6206

If you have questions regarding this monitoring requirement please contact Agnes Lut, 503-229-5247.

Distribution and Updates:

Memo sent via Email, 12/23/10: [WQ] Permit Writers;
[WQ] Willamette Basin;
[WQ] Permit Managers;
FOSTER Eugene P;
LUT Agnes

Memo sent via Email, 01/26/11: [WQ] Permit Writers;
[WQ] Willamette Basin;
[WQ] Permit Managers;
FOSTER Eugene P;
LUT Agnes

Memo was emailed to update the specific minor permit types that shall monitor for mercury. Originally the following permit types were identified:

- Specific Minors:
    - NPDES-IW-G
    - NPDES-IW-N
    - NPDES-IW-O

This list was updated to reflect the permit type designation change that occurred in 2006 to the following permit types:

- Specific Minors:
    - NPDES-IW-B08
    - NPDES-IW-B15
    - NPDES-IW-B16
    - NPDES-IW-B19
    - NPDES-IW-B20
    - NPDES-IW-B21

A table of the 27 affected minor industrial permits was added, source SIS download 1/24/11.

Memo sent via Email, 02/23/11: [WQ] Permit Writers;
[WQ] Willamette Basin;
[WQ] Permit Managers;
FOSTER Eugene P;
LUT Agnes

Seperate email sent to: Frank Wildensee, Krista Reininga, Torrey Lindbo, Roy Iwai, Jon Nottage, Rajeev Kapur, Thomas Mendes, Andrew Swanson, Dave Gilbey, Dennis Ades, Annette Liebe, Benjamin Benninghoff, Agnes Lut, Gene Foster

Memo was emailed to update the following:

- Page 2: Text Added = "Determining how the mercury and methylmercury monitoring will be implemented by permittees is up to the discretion of the permit writer with consultation with the TMDL coordinator, Agnes Lut."
- Page 2: Text Added = "Flow or rainfall will be collected, estimated or modeled for each stormwater monitoring event."
- Page 4: Text Change = Change sampling frequency from "Summer and Winter" to "Wet and Dry", as defined in the permit. Wet Oct. 1 – April 30.
- Page 4: Text Change = Change "daylight" to "storm event".
- Page 4: Text Added = "A summer event is considered to be equivalent to a dry season storm event (May 1-September 30), and a winter event is equivalent to a wet season storm event (October 1-April 30)."
- Page 5: Text Added = "If the analytical lab can perform the mercury analysis as specified in this memo, utilizing the specific EPA Methods and also able to achieve the stated LOQs, then the lab does not have to be NELAC certified."

Appendix I

Gresham Solids Tracking Investigation Study Design

Debris Characterization Study

Background

This Debris Characterization Study is intended to address questions that arise from both the City's National Pollutant Discharge Elimination System (NPDES) municipal stormwater permit and a future Water Pollution Control Facility (WPCF) permit for drywells (Underground Injection Control systems, or UICs). These permits are both issued by the Oregon Department of Environmental Quality; they address stormwater discharges to surface and groundwater, respectively. This study was designed to determine if the debris removed by various maintenance BMPs (street sweeping, catch basin cleaning, drywell cleaning) has attached pollutants that would leach some soluble fraction into stormwater if not removed through maintenance activities.

<u>Stormwater that Drains to Surface Waterbodies</u>: The City of Gresham and its NPDES co-permittees must submit estimates to DEQ of the quantity of pollutants that are anticipated to enter surface waters in stormwater runoff from the City's stormwater system. The estimates must account for local land uses and practices designed to minimize pollution (called best management practices, or BMPs). Such estimates can be derived from either monitoring data or models based on monitoring data, or a combination of both.

Use of monitoring data without models is impractical in the near term due to the extreme variability of stormwater quality data. Such variability requires large numbers of samples in order to support statistically valid conclusions. For example, Geosyntec consultants have shown that about 75 paired influent/effluent storm samples would be required to characterize the pollutant removal effectiveness of a single water quality facility.

Collecting large numbers of samples is feasible over a period of many years and/or through collaboration among a number of parties, but may not provide adequate data for estimates that must be updated every five years as required by the City's permit. The co-permittees' strategy, therefore, has been to use datasets that include local data, as well as data from others' studies to support a model. The model used by the co-permittees has varied over time, from P8 (Part II of NPDES permit application, 1993) to PLOADs (Interim Evaluation Report, May 1, 2006), to a GIS-supported Excel spreadsheet (July, 2008). These models are all based on the Simple Method, which multiplies land-use-based runoff coefficients by acreage, by annual rainfall, by pollutant concentrations to generate loads. PLOADs and the GIS-supported Excel spreadsheet allow for inclusion of BMPs and associated pollutant load reductions.

<u>Stormwater that Drains to the Ground</u>: The City of Gresham and other jurisdictions that own more than 50 drywells have applied for WPCF permits and rule authorization under Oregon Administrative Rule (OAR) 340-44 to cover their stormwater discharges to the ground. Since 2002, a collaborative monitoring program has existed to collect data from two to three storms per year at several drywells around the state. The monitoring has focused on the quality of stormwater as it enters the drywells. The water has typically passed through a structural BMP

prior to entry to the drywell. Additionally, the City of Portland began sampling 30 drywells per year in 2006-07 to comply with their WPCF permit. Based on the data to date, it appears that bacteria, lead, phthalates, and pentachlorophenol (PCP) can occur at levels that exceed drinking water standards, which are the relevant standards for protecting groundwater.

Problem Statement

Stormwater that Drains to Surface Waters: BMP effectiveness data is limited to certain types of structural facilities. Many of the BMPs implemented by permittees to reduce stormwater pollution are non-structural. Examples include catch basin cleaning, street sweeping, and public education. This study focuses on catch basin cleaning and street sweeping.

In the past, the City of Gresham has reported the volume of debris removed by cleaning catch basins and sweeping streets, but has had no way to relate debris removal to water quality improvement. This study will serve as a beginning effort to quantify the concentration of pollutants that would be expected to transfer to rainwater as it passes through the debris, with the assumption that by removing the debris, that load of pollutants is no longer transferred to runoff that flows over a street or through a catch basin into the stormwater system. (Additional evaluation is needed to refine this assumption, since laboratory extraction methods don't exactly simulate the real world.)

Stormwater that Drains to the Ground: It is not known whether, and to what degree, concentrations that exceed drinking water standards in influent to drywells extend into the surrounding soil. Studies of groundwater in urban areas of Oregon that use drywells have shown no problems that have been attributed to stormwater from typical runoff.

In September 2007, Multnomah County crews retrofit about ten drywells by removing the rocks and soil surrounding the drywells and replacing them with clean materials. This presents an opportunity to determine whether, and to what degree, the pollutants of concern are found in the used materials.

Literature Review

Stormwater that Drains to Surface Waters: Several online searches using Google and Google Technical as the search engine were performed using the words "catch basin" [and/or] "street sweeping debris characterization." No study was found that attempted to meet the goals of this study. However, Clean Water Services (CWS), another NPDES permittee in western Oregon, is conducting a similar study. The CWS study plan was obtained, reviewed, and used as something of a model for this study.

Several studies were found that dealt with the leachability of pollutants in road and catch basin debris bound for landfills. The City of Gresham also has several years of data on the leachate qualities of a mix of debris from catch basins, street sweeping, and manholes bound for landfills. However, none of these studies provide the results sought by this study because of the extraction procedure used. Leachate studies conducted prior to disposal in landfills assume that the debris will be bathed in acetic acid from the decomposition of organic matter, and pollutants are extracted using the acetic-acid-based TCLP procedure. Acetic acid has a pH of about 4.93. Data from the National Atmospheric Deposition Program for NW Oregon/SW Washington indicate typical rainwater pHs in that range, but the likely source of the low pHs is nitrogen and sulfur compounds, rather than acetic acid (an organic acid). An alternative procedure, the SPLP procedure, uses an acidic solution based on those compounds, which better simulates the chemistry of rainfall.

Stormwater that Drains to the Ground: No additional literature review was conducted specific to drywells. The rain that falls in areas with pervious soils is likely to be the same as rainfall that falls on areas with impervious soils, if the surrounding land uses are the same.

Copies of the studies and information reviewed are attached as Appendix A.

Methodology:

Collection of General Information: Maps designating the area of the City from which street sweeping debris has been collected for sampling will be created, and the land uses of the drainage area will be noted. The section of the City street sweeping samples were collected from was selected based on the mixture of land, which was approximately the same as that of the entire City, so the sample was assumed to be representative. Catch basin debris is stockpiled in one location, and composite samples will be drawn from across the pile to represent the City as a whole. The location of drywells being retrofitted will also be noted on a map, and staff will drive by the drywells to look for potential sources of pollutants that may distinguish the drywells from drywells throughout the City.

Sample collection for Stormwater that Drains to Surface Waters:

Parameters to be Measured: **Table 1** shows the pollutants for which tests will be conducted, and the test procedure to be used. In some cases, suites of pollutants are listed, since the same test provides results for a range of pollutants. Where a DEQ standard exists, the criteria are shown; and drinking water criteria are distinguished from those set to protect aquatic life.

Number of Samples: Two composite samples each will be taken of debris from street sweeping and catch basin cleaning (for a total of four composite samples). Street sweeping is conducted on a monthly basis, year round in Gresham, except during winter. The catch basin debris samples will be taken during fall, because that is when catch basins are cleaned. An attempt will be made to take one sample of debris prior to leaf-fall, and the other after leaf fall. Street sweeping debris will be collected in the Spring and Summer to compare results during rainy and dry weather. This number of samples will not allow for statistical analysis, but should provide ballpark values, and indicate whether additional study is warranted. (All leachate values could be non-detects.)

Protocol for Taking Samples:

Catch Basins: Debris from around the City is dumped onto a covered drying pad. When dry, it is transported to a covered dock. During the transport process, it is mixed.

Street Sweeping: Debris from specified sections of the City is placed in a dumpster and left outside in the elements. Street sweeping samples were collected the same day as they were deposited in the dumpster, after scraping away the surface debris to reveal debris that was still wet. The spring 2008 sample (collected May 7, 2008) was a warm day preceded by 3+ days of dry weather; the sample contained a large amount of organic material, particularly conifer needles. The summer 2008 sample (collected August 7, 2008) was preceded by 5+ days of no rain; this sample also contained a large amount of organic material, as well as coarse inorganic materials (sand and small gravel).

Street sweeping areas were selected in an effort to be representative of the land uses within the entire city. **Table 1** list the land uses within the two sections of the city street sweeping samples were collected from (sections 5 and 11) and compares those percentages to the land use areas used in the TMDL benchmark process for the entire City of Gresham draining into the municipal storm sewer system (MS4). Percentages for industrial and commercial land uses are higher than the city as a whole since both street sweeping sections are within more developed areas, while much of the vacant land in the benchmark values is on the periphery of the city. Land use within the drywell/UIC area is assumed to be similar.

Table 1: Land uses within street sweeping areas and within MS4 area

Land Use	**Street Sweeping**	***2008 Benchmarks***	***2005 Benchmarks***
Commercial	16.9%	*10.1%*	*13.3%*
Industrial	24.8%	*9.5%*	*9.9%*
Parking	0.6%	*NA*	*NA*
Residential	30.5%	*40.2%*	*41.4%*
Multi-Residential	9.0%	*6.5%*	*8.3%*
Open Space	12.7%	*16.5%*	*12.0%*
Vacant	5.0%	*16.0%*	*12.2%*
<blank>	0.5%	*NA*	*NA*

Drywell rock: The renovation of drywells is not routinely done, so the following description reflects what happened during sample collection: The material surrounding the drywells was dumped in two piles near the dumpster with street sweeping debris. Composite samples were taken across the piles, with samples from each pile composited separately. One pile was dark grey and the other more golden colored. Operations staff said that dark grey material came from closer to the drywell, and golden colored material came from father away.

A stainless steel spoon will be/was used to collect a composite sample that draws from at least five sites across the debris pile. The samples will be/were deposited in a large stainless steel bowl and mixed with a stainless steel spoon. Rocks and gravel in excess of 1/2" diameter will be/were removed using the spoon. Subsamples of the material in the bowl will be/were put into 12 four ounce jars provided by the City of Portland Water Pollution Control Laboratory.

<u>Sample collection for Stormwater that Drains to the Ground</u>:

Parameters to be Measured: **Table 2** shows the pollutants for which tests will be conducted, and the test procedure to be used. The pollutants are the same as for the catch basin and street sweeping protocol.

Number of Samples: Two composite samples will be taken from materials stockpiled beside the street near where the drywells are being retrofitted.

Protocol for Taking Samples: The protocol for taking samples will be the same as that for the catch basin and street sweeping debris.

<u>Constituents to be Monitored:</u>

Table 2. Summary of Pollutants and Procedures

SYNTHETIC PRECIPITATE LEACHATE (SPLP)				
Parameter	**Extraction Procedure**	**Lab Procedure**	**MRL (µg/L)**	**DEQ Standard* (aquatic or DW) µg/L**
Dissolved Metals (**Zn**, **Hg,** **Pb**, **Cu, Ba,** Ni, Ag, Cd, As, Cr, Fe, Se, Mg, Ca)	SPLP to analyze pollutants that wash off with rainfall (EPA 1312)	EPA 6000 series	Zn = 10 Hg = 0.025 Pb = 5 Cu = 10 Ba = 10 Ni = 10 Ag = 5 Cd = 5 As = 5 Cr = 10 Fe = 20 Se = 10 Mg = 50 Ca = 100	Zn = 110c/5000 Hg = 0.012c/2 Pb = 3.2c/50 (15) Cu = 12/1000 (1300) Ba = 1000 (2000) Ni = 160c Ag = 0.12c/50 Cd = 1.1c/10 (5) As = 48c/50 (10) Cr3 = 210c/50 (100 for total Cr) Cr6 =11c/50 Fe = 1000c/300 Se = 35c/10 Mg = Ca =
Hardness				
pH				6.5-8.5
VOCs				
Semivolatile OCs (**PCP**)		GCMS (EPA 8270)	1.0	PCP = 13c/1.0
Phthalates				3c
Pesticides (**DDT, dieldrin**, trichlopyr,		EPA 8081	DDT = 0.10 Dield = 0.10	DDT = 0.001c Dield = 0.0019c

chlorpyrifos)				
Herbicides (2,4-D; glyphosate)		EPA 8151	3.00	2,4-D = 70 Glyphosate = 700
E. coli				406/100 ml
TPH				
COD				
Total Phosphorus		EPA 365.4	30 ug/L	100
Nitrate N				10000

SOIL ANALYSIS

Parameter	Lab Procedure	Detection Limit (mg/Kg dry wt)	DEQ Standard* (aquatic or DW)
Particle size	ASTM D421/422	0.1 Fract %	
Density			
Total Metals (**Zn, Hg, Pb, Cu, Ba,** Ni, Ag, Cd, As, Cr, Fe, Se)	ICP-MS (EPA 6020) EPA 6010	Zn = 0.50 Hg = 0.01 Pb = 0.10 Cu = 0.25 Ba = 0.10 Ni = 0.25 Ag = 0.10 Cd = 0.10 As = 0.50 Cr = 0.50 Se = 1.00 Fe = 2.5	
Hardness?			
pH?			
VOCs			
Semivolatile OCs **(PCP)**	EPA 8270B	Varies PCP = 5.51	
Phthalates			
Pesticides (**DDT, Dieldrin**, chlorpyrifos, trichlopyr)	EPA 8081	DDT = 0.102 Dield = 0.102	
Herbicides (2,4-D, glyphosate)	EPA 8081	0.102	
TOC	EPA 9060 MOD	100	
E. coli			
TPH			
COD			

Total Phosphorus	EPA 365.4	30 ug/L	100
Nitrate N			
Hydrocarbons	NWTPH-HCID	Diesel = 50 Gas = 20 Fuel, Lube and Other Oil = 100	
	NWTPH-Dx NWTPH-Gx	Diesel = 28.5 Heavy Oil = 56.9 Gas = 6.06	

*Aquatic life criteria depend on hardness. The values listed here are for total metals and correspond to a hardness of 100 mg/L.
Aquatic life standards are in black. Small c indicates use of the chronic criterion.
DW=Drinking water standard MCLs in red. Values in (parenthesis) are EPA listed values that differ from DEQ.
Risk-Based Concentrations from Appendix A are in green.
Boldface pollutants are higher priority than others.

Questions to answer:

- Types of street sweepers used (brushes, vacuum, etc)?
- Do we want to try to differentiate by land use type? (COM, IND, RES)

References

Liebens, J. 2001. Contamination of sediments in street sweepings and stormwater systems: Pollutant composition and sediment reuse options. Dept of Environmental Studies, University of West Florida, http://www.uwf.edu/environmental/facultystaff/liebens/Microsoft%20Word%20-%20new_final_report%20revision.pdf

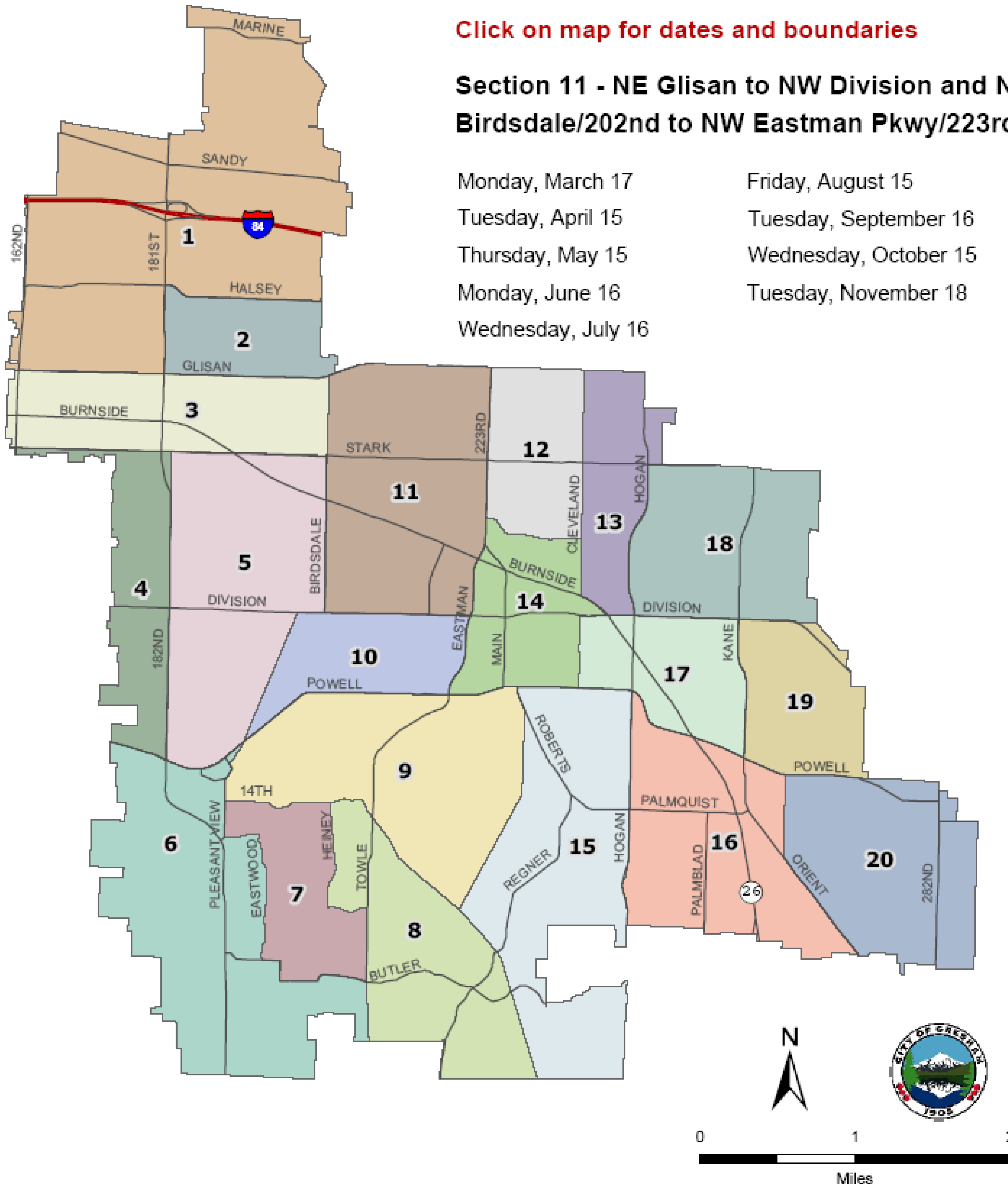
Walch, M. 2006. Monitoring contaminants in Delaware street sweeping residuals and evaluation of recycling/disposal options. Presentation at 21st Inter. Conf. On Solid Waste Technology and Management, Philadephia, PA, March 26-29, 2006.

City of Gresham
Street Sweeping 2008

Click on map for dates and boundaries

Section 11 - NE Glisan to NW Division and NW Birdsdale/202nd to NW Eastman Pkwy/223rd

Monday, March 17
Tuesday, April 15
Thursday, May 15
Monday, June 16
Wednesday, July 16
Friday, August 15
Tuesday, September 16
Wednesday, October 15
Tuesday, November 18



Appendix J

Intergovernmental Agreement between Multnomah County and the City of Gresham

INTERGOVERNMENTAL AGREEMENT
BETWEEN MULTNOMAH COUNTY AND THE CITY OF GRESHAM
FOR JOINT SERVICES RELATED TO NPDES MUNICIPAL SEPARATE STORM SEWER PERMIT AND TMDL PROGRAM IMPLEMENTATION
County No. 4600008715
City of Gresham No. 5232

This Agreement is between the City of Gresham, Oregon (Gresham), and Multnomah County, Oregon (County), hereinafter collectively referred to as the Parties.

RECITALS

WHEREAS, the Parties' goal is to work cooperatively through this Agreement to comply with existing federal and state National Pollutant Discharge Elimination System (NPDES) and Total Maximum Daily Load (TMDL) laws and regulations; and

WHEREAS, the Gresham City Council and the Board of Multnomah County Commissioners recognize the need to identify and control pollutants entering the municipal separate storm sewer systems (hereinafter "MS4") through the application of best management practices established and implemented by each jurisdiction; and

WHEREAS, it has been determined that urban stormwater runoff transports pollutants into our rivers and streams; and

WHEREAS, pollutant allocations for streams within the jurisdictions of Gresham and the County are identified in the Total Maximum Daily Loads (TMDL) for the respective streams; and

WHEREAS, Gresham and the County are authorized to implement stormwater management programs to reduce the contribution of pollutants in stormwater to the maximum extent practicable and to discharge stormwater to public waters in conformance with the requirements and conditions set forth in the municipal permit conditions of their respective NPDES permits issued by Oregon Department of Environmental Quality (DEQ); and

WHEREAS, Gresham and the County are Designated Management Agencies responsible for developing and implementing pollutant reduction plans for TMDL streams; and

WHEREAS, the development of a consistent and comprehensive stormwater monitoring plan that satisfies Gresham and Multnomah County's federal NPDES stormwater requirements can best be realized by a coordinated monitoring approach between Gresham and the County within the Urban Services Boundary.

NOW, THEREFORE, the Parties agree as follows:

A. PARTIES' EXISTING PERMITS.

1. Gresham has a five-year municipal MS4 NPDES permit as required under 40 CFR Section 122.26; and permitted by Oregon DEQ Municipal NPDES Permit #101315, dated December 30, 2010. This permit serves as the TMDL implementation plan for the waste load allocations for stormwater within the permit boundary.

2. The County has a five-year municipal MS4 NPDES permit as required under 40 CFR Section 122.26; and permitted by Oregon DEQ Municipal NPDES Permit #103004 dated December 30, 2010. This permit serves as the TMDL implementation plan for the waste load allocations for stormwater covered by the permit boundary.

3. Each Party is responsible for complying with its own permit conditions relating to stormwater discharges from those parts of the respective MS4 that the Party continues to operate or own. No Party is responsible for another Party's non-compliance with its respective permit.

B. PARTIES' OBLIGATONS.

1. The County.

1.1 The County shall assist Gresham in developing procedures to best implement the monitoring and compliance actions in the areas subject to the County's MS4 NPDES permit under Section A. 3 above.

1.2 The County may undertake tasks to assist Gresham with monitoring activities in the compliance areas subject to the County's MS4 NPDES permit under Section A.3 above. The County will only perform such work based upon a mutual written agreement of the County and Gresham which shall be in the form of a "Notice to Proceed," signed by the County and Gresham, which expressly identifies the dates and specific tasks the County is to perform.

2. Gresham.

2.1 Gresham shall perform the monitoring services required by its own NPDES MS4 Permit under Section A.1 above and any other TMDL requirements set forth in the Scope of Work in Exhibit A.

2.2 Gresham shall compile and report the relevant and applicable water quality data collected for all of the Parties' permitted areas identified in Section A and provide the monitoring data directly to Troutdale and the County annually, or as otherwise agreed to by the Parties.

C. PERIODIC REVIEW. Every five years, or more frequently if the Parties desire, the County and Gresham will update and/or prepare projected annual budgets for the next five fiscal years for the monitoring tasks conducted by Gresham. Upon written approval of the budgets by the MS4 permit compliance representative for each Party, Exhibit A will be updated and will be subject to the payment terms of Section E. Budget projections are understood to be estimates only, subject to the oversight and appropriation authority of the Parties' respective governing bodies, and shall not be binding.

D. EFFECTIVE AND TERMINATION DATES. This Agreement shall be effective on July 1, 2011, and shall continue indefinitely, unless otherwise terminated in accordance with Section F.

E. INVOICING PROCEDURE AND COSTS.

1. Not later than June 30th of each calendar year during the term of this Agreement, Gresham shall submit invoices for work performed during the preceding fiscal year (July 1 to June 30) to the County for the cost of the services performed.

2. Each Gresham invoice shall be on City letterhead and shall include the total amount due and shall include the specific dates, times, services, employees' hourly rates, services performed and/or product being invoiced, as needed, to satisfy the County's fiscal and financial reporting requirements.

3. The County's payment to Gresham shall be full compensation for services rendered, including all labor, materials, supplies, equipment, and authorized incidental costs necessary to perform the work and services.

4. Invoiced payments that are payable to the City of Gresham are due within 60 days of the invoice date. Payments to Gresham shall be made payable to the City of Gresham and delivered to City of Gresham, Financial Services Division, 1333 NW Eastman Parkway, Gresham, Oregon, 97030.

5. The Cost Estimate for the work and scope of services to be performed under this Agreement is set forth in Exhibit A.

F. EARLY TERMINATION OF THE AGREEMENT.

1. The Parties may mutually agree to terminate the Agreement in writing. A Party may terminate its participation in this agreement unilaterally for any reason on 90 days' written notice to the other Party.

2. Any Party may terminate its participation in this Agreement in the event of a breach of the Agreement by the other Party. Prior to such termination, however, the Party seeking the termination shall give to the other Party written notice of the breach and of the Party's intent to terminate. If the breach is not cured within thirty (30) days of the notice, then the Party giving the notice may immediately terminate the Agreement at any time thereafter by giving a written notice of termination.

G. THIS IS THE ENTIRE AGREEMENT. This Agreement constitutes the entire Agreement between the Parties. This Agreement may be modified or amended only by the written agreement of the Parties.

H. INDEMNIFICATION. To the extent permitted by the Oregon Tort Claims Act, Gresham agrees to indemnify, defend, and hold harmless Multnomah County from any and all claims, demands, suits, and actions (including attorney fees and costs) resulting from or arising out of the acts of Gresham and its officers, employees, and agents in performance of this intergovernmental agreement. To the extent permitted by the Oregon Tort Claims Act, Multnomah County agrees to indemnify, defend, and hold harmless Gresham from any claims, demands, suits, and actions (including attorney fees and costs) resulting from or arising out of the acts of Multnomah County and their officers, employees, and agents in performance of this intergovernmental agreement.

I. DISPUTE RESOLUTION. If disputes arise under this Agreement, the parties agree to negotiate in good faith to resolve the disputes in a cost effective manner. If the parties cannot resolve the dispute by negotiation, the parties agree to submit the dispute to mediation before a mediator agreed upon by the parties. If the parties cannot agree upon a mediator, either party may ask the Presiding Judge in Multnomah County Circuit Court to designate a neutral mediator. That designation shall be binding upon the parties. Regardless of the outcome of the mediation, the parties shall share the costs of the mediator equally. If mediation fails to resolve the dispute, the parties may agree to submit the dispute to arbitration, or either party may initiate litigation in an appropriate court to resolve the dispute.

J. NON-APPROPRIATION CLAUSE. This agreement is subject to future appropriations by any future City Council or Board of County Commissioners.

K. ASSIGNMNENT. This Agreement is binding on each Party, its successors, assigns, and legal representatives and may not, under any condition, be assigned or transferred by the Parties without prior written approval by the other Parties.

L. SEVERABILITY. If any portion of this Agreement is found to be illegal or unenforceable, this Agreement nevertheless shall remain in full force and effect and the offending provision shall be stricken.

M. ADHERENCE TO LAW. Each party shall comply with all federal, state, and local laws and ordinances applicable to this agreement.

N. NON-DISCRIMINATION. Each party shall comply with all requirements of federal and state civil rights and rehabilitation statutes and the Parties' respective local non-discrimination ordinances.

O. ACCESS TO RECORDS. Each party shall have access to the books, documents, and other records of the other which are related to this agreement for the purpose of examination, copying, and audit, unless otherwise limited by law.

CITY OF GRESHAM

By: [signature]
Erick Kvarsten, City Manager

Date: 7/15/11

APPROVED AS TO FORM:

By: David R Ris
David Ris, City Attorney for City of Gresham

Date: 7/11/11

BOARD OF COUNTY COMMISSIONERS FOR MULTNOMAH COUNTY, OREGON

By: Jeff Cogen / JT
Jeff Cogen, Chair

Date: June 30, 2011

REVIEWED:

HENRY H. LAZENBY, JR., COUNTY ATTORNEY
FOR MULTNOMAH COUNTY, OREGON

By: /s/ Matthew O. Ryan
Matthew O. Ryan, Assistant County Attorney

Date: May 31, 2011

EXHIBIT A

A. GRESHAM'S SCOPE OF WORK.

1. Each quarter of each calendar year of the term of this Agreement Gresham shall complete in-stream monitoring and annual macro invertebrate monitoring at two (2) sites on Beaver Creek. The sites shall be selected by mutual agreement of the Parties. In-stream monitoring includes sampling and/or analyses of the following, as per the Gresham Stormwater Monitoring Plan:
   a. Total metals (Copper, Lead, Nickel, Zinc)
   b. Dissolved metals (Copper, Lead, Nickel, Zinc)
   c. Mercury
   d. E. coli
   e. Nutrients (Chloride, Ammonia-Nitrogen, Nitrate-Nitrogen, o-Phosphate-Phosphorus-Dissolved, Total Kjeldahl Nitrogen, Total Phosphorus)
   f. Conventionals (BOD5, Total Suspended Solids, Chlorophyll-a, Total Hardness)
   g. Field parameters (pH, Temperature, Dissolved Oxygen)

2. Following the requirements of the County's stormwater mercury monitoring requirement, Gresham shall complete monitoring for mercury and methyl mercury from a regional stormwater source.

B. COST ESTIMATE. Monitoring cost estimate for quarterly in-stream monitoring and annual macro invertebrate monitoring at two (2) sites on Beaver Creek are included as Task 1 below. Annual mercury monitoring in stormwater at one site is included as Task 2 below.

	Task 1. Beaver Creek	**Task 2. Mercury - Stormwater**
FY 2011/12	$10,000	$1,500
FY 2012/13	$10,250	$1,600
FY 2013/14	$10,500	$1,700
FY 2014/15	$10,750	$1,800
FY 2015/16	$11,000	$1,900
Estimated 5-year Total	**$52,500**	**$8,500**

1. Multnomah County shall reimburse Gresham for the cost of laboratory, taxonomic identification, equipment use, and sampling personnel services at two sites on Beaver Creek.
2. Multnomah County shall reimburse Gresham for the cost of laboratory equipment and personnel services for stormwater mercury monitoring at one location according to the requirements in the Multnomah County NPDES permit.
2. The Parties stipulate that the cost estimates provided herein are solely for the purpose of budget planning; actual costs may vary depending upon laboratory costs, staff time, and vehicle/equipment required for acquiring and delivering samples provided, however, that actual costs exceeding 20% of the estimated costs set forth herein shall require an update of Exhibit A, and any such cost increase shall be reimbursed only if agreed to in writing by the affected Parties.

MULTNOMAH COUNTY, OREGON

EXECUTIVE RULE NO. 351

Delegation of Signing Authority

a. Under section 6.10(7) of the Multnomah County Home Rule Charter, the Chair may delegate administrative powers but shall retain full responsibility for the acts of subordinates.

b. The efficient carrying out of the County's business occasionally requires the Chair's signature on official documents in the Chair's absence or unavailability.

The following Executive Rule is adopted:

1. Joanne Fuller and Marissa Madrigal are authorized to sign the Chair's name to orders, contracts and other official documents requiring the Chair's signature.

2. Authorized signature will appear as the signature of the Multnomah County Chair followed by initials of the delegate.

3. This Executive rule shall remain in effect until rescinded or modified.

Dated this 13 day of January 2011.

Jeff Cogen, Multnomah County Chair

REVIEWED:
Henry H. Lazenby, Jr., County Attorney
for Multnomah County, Oregon

Appendix K

Pesticide Assessment for Stormwater Monitoring

Pesticide Assessment for Stormwater Monitoring

Prepared by the Cities of Gresham and Fairview
Submitted to Oregon Department of Environmental Quality
November 1, 2011

Background
The NPDES MS4 permit issued to the City of Gresham and City of Fairview by the Oregon Department of Environmental Quality (DEQ) on December 30, 2010 required the co-permittees to begin monitoring pesticides as part of the environmental monitoring program. In the Stormwater Monitoring-Storm Event requirement of Table B-1, DEQ specified monitoring for 2,4-D (the most widely used herbicide) and pentachlorophenol (a fungicide used to treat utility poles) in stormwater during the 5-year permit term. DEQ also added the following special condition in Table B-1:

Additional pesticide pollutant parameters that must be considered for purposes of stormwater monitoring – storm event include any pesticide currently used by the co-permittees within their jurisdictional areas and the following: <u>Insecticides</u>: Bifenthrin, Cypermethrin or Permethrin, Imidacloprid, Fipronil, Malathion, Carbaryl; <u>Herbicides</u>: Triclopyr, 2,4-D, Glyphosate & degradate (AMPA), Trifluralin, Pendamthalin; and, <u>Fungicides</u>: Chlorothananil, Propiconazole, Myclobutanil.

The co-permittees have been collecting information on pesticides; this report contains the current status of this assessment, which will be adaptively managed as additional information is considered.

Method
The first step in conducting the pesticide evaluation was developing a list of pesticides to consider. The sources of information considered for developing the list of pesticides included:

- List of pesticides (20 total) used by Gresham and Fairview public works/operations crews (including facilities, parks, stormwater, wastewater, water and transportation);
- The list of 15 pesticides DEQ included in the 2010 NPDES MS4 permit;
- Pesticides included on Oregon's 2009 Public Use Reporting System (PURS) list that were indicated as having a residential or urban use (12 pesticides);
- Pesticides available in pet, home, and garden stores in the Portland Metro area collected during a Metro shelf survey conducted in 2008 (122 pesticides);
- Pesticides identified by the Oregon Water Quality Pesticide Management Team (WQPMT 2011) as being either a Pesticide of Interest (POI), an Oregon Pesticide of Interest (POI-OR), a DEQ Priority Persistent Pollutant (P3), or on the DEQ Priority Toxic List (PTL) (74 pesticides)

The lists above have many pesticides in common and therefore the total number evaluated from all lists was 115.

Evaluation of pesticides was based on multiple criteria, including:

- Mobility (movement from soil to water),
- Persistence (based on half life in soil),
- Toxicity to humans,
- Toxicity to aquatic life,
- Use by the Co-permittees
- Availability for purchase in the permit area,
- Known widespread use by residents or businesses

- Of interest to Water Quality Pesticide Management Team (WQPMT) and labeled for non-agricultural use, and
- Whether or not DEQ has detected the pesticide in Oregon streams

The criteria used to evaluate pesticides fell into two broad categories – one related to environmental characteristics and the other related to introduction into the environment. The characteristics that determine how a pesticide moves through the environment and the risk posed to human or aquatic life are important, but these criteria only become important if the pesticide is available for use within the permit area. To this end, both categories were assumed to be equally important and the potential maximum score available for environmental characteristics was set equal to those related to availability and use.

Environmental Characteristics – Mobility, Toxicity and Persistence

Information on mobility, toxicity and persistence was obtained primarily from a literature review. The references section lists the sources of information used to obtain a rating for each pesticide.

In order to convert mobility, toxicity and persistence information to a value that could be evaluated for ranking, the ratings were converted using the following: Very Low (1), Low (2), Low to Moderate (3), Moderate (4), Moderate to High (5), High (6), Very High (7). Once converted to numeric scores, the weighting factor each of these parameters was: Mobility * 2, Persistence * 1.5, Human Toxicity *1, Aquatic Life Toxicity * 1.5. Since toxicity was considered separately for human and aquatic life, the maximum weighted score for toxicity is 17.5, the maximum for mobility is 14, and the maximum for persistence is 10.5. The maximum score a pesticide could receive for environmental characteristics is 42.

The logic behind the environmental characteristic weightings is as follows: Toxicity is key since the goal is to protect beneficial uses, and the other factors become less important if the pesticide isn't very toxic. Within the toxicity criteria, aquatic life toxicity was judged more important than human toxicity because human exposure to pesticides via water is typically through ingestion, and treatment of drinking water is presumed, unless the source of the water is groundwater—in which case soil provides some filtration/adsorption. Mobility was judged the next most significant criterion because pesticides need to leave the soil and enter water in order to cause water quality problems. Persistence was given the next highest weight because the half-life determines how far the pesticide moves before attenuating below levels of concern.

Use and Availability

The inventory of pesticides used by the City of Gresham was compiled from those reported for the annual NPDES MS4 report. An inventory of pesticides used by the City of Fairview during 2011 was obtained from the City of Fairview. Because DEQ specifically requested consideration of *any pesticide currently used by the co-permittees within their jurisdictional areas,* all pesticides used by either Co-Permittee were given a score of 15.

Pesticides available for purchase by residents in the permit area were identified by obtaining study data collected by Metro in 2008 assessing pesticides available on the shelf of local box retail locations, home and garden centers, and veterinary supply stores. The shelf survey contained brand names, as well as the active ingredients, in products available for use on pets, around the home, or in the garden. Because the frequency data for some products was skewed based on the variety available (e.g. pet shampoos containing the same active ingredient were available in multiple scents and container sizes), the data were sorted so that active ingredients in products available for pet and home use were given a value of 1, ingredients available in products for use in the garden or outdoors were given a score of 5, and ingredients available in both were given a score of 6. More weight was given to products used in the garden or outdoors, since the exposure to precipitation and potential for runoff to groundwater or surface water is greater than for products designed for pet or indoor use.

In addition to availability data accessible through Metro, a “known widely used” pesticide criteria was also used in the assessment. Based on feedback from Gresham outreach staff conducting outreach visits with homeowners related to lawn care, the two most highly used pesticides (2,4-D and Glyphosate) were identified and scored a 10 for this criteria. Based on data from the City of Portland’s UIC monitoring program, Pentachlorophenol was identified as widely used based on the density of treated utility poles within the urban environment.

The criterion associated with Oregon’s Water Quality Pesticide Management Team (WQPMT) is a composite of two measures (or sub-criteria): number of lists, and urban use. The WQPMT created four lists (POI, POI-OR, P3, PTL); a pesticide received one point for each list upon which it appeared, for a maximum potential score of four points. The WQPMT also evaluated uses for each pesticide, identifying eight non-agricultural uses (lawns, turf, etc.). A pesticide was given one point for each of the eight uses the WQPMT associated with that pesticide, and a weighting factor of 0.5 was then applied to the total. A maximum score of 4 was therefore possible for a pesticide used in all 8 non-agricultural uses identified by the WQPMT. Considering both the number of lists and urban use sub-criteria, a pesticide could accrue up to 8 points total for the WQPMT criterion.

DEQ provided a list of pesticides detected in Oregon streams; however, the stream samples were located primarily in agricultural areas. Pesticides which have been detected in statewide stream sampling conducted by DEQ between 2007-2010 were given a score of 3. Pesticides which have either not been detected or not evaluated received a zero (0) for this criteria. The overall score for this criterion was lower than for other criteria in the use/availability category since little to none of the data was collected from streams with an urban stormwater influence.

Other than the weighting factor used within the WQPMT criterion, all use and availability criteria were given the same weight with respect to one another. Implicit weighting was achieved through the potential amount of points that could be awarded for each criterion.

Possible score

Based on the criteria descried in the methods section, the lowest and highest possible scores are listed in Table 1.

Table 1. Minimum and maximum scores for criteria used to assess pesticides

	Environmental Characteristics			Use and Availability						
	Mobil-ity	Toxic-ity	Persis-tence	Use by permit-tees	Avail-ability - Metro	Widely Used	WQPMT		DEQ in-stream	Total
							Lists	Non-ag Use		
Max Score	14	17.5	10.5	15	6	10	4	4	3	84
Min Score	2	2.5	1.5	0	0	0	0	0	0	6

As previously explained, environmental characteristics and availability and use characteristics each had equal potential to influence the total rating for a given pesticide, since a maximum of 42 points is possible for each category.

Results

Of the 115 pesticides assessed, the highest ranked pesticide was the herbicide 2,4-D, which scored 57 out of 84. In addition to 2,4-D, three other pesticides scored >50 points.   Table 2 shows the top 10 pesticides from the assessment. Table 3 contains the ranked scores and complete set of criteria considered for the 155 pesticides considered in this assessment.

Table 2: Top 10 pesticides identified in assessment

Pesticide	Type	Mobility (*2)	Toxicity (human; *1)	Toxicity (aquatic life, *1.5)	Persistence (* 1.5)	Use by co-permittees (*15)	Availability (Metro)	Widely Used	WQPMT Lists	WQPMT non-ag uses	Detected in-stream by DEQ (*3)	Total
2,4-D *	**Herbicide**	**10**	**2**	**4.5**	**4.5**	**15**	**5**	**10**	**2**	**4**	**0**	**57**
Trifluralin *	Herbicide	4	2	12	7.5	15	5	0	1	4	3	53.5
Triclopyr *	Herbicide	12	2	6	6	15	5	0	1	4	0	51
Dicamba *	**Herbicide**	**14**	**2**	**3**	**6**	**15**	**5**	**0**	**1**	**4**	**0**	**50**
Dichlorbenil *	Herbicide	12	2	4.5	9	15	5	0	0	0	0	47.5
Glyphosate	**Herbicide**	**2**	**2**	**3**	**4.5**	**15**	**5**	**10**	**1**	**4**	**0**	**46.5**
Mecoprop (MCPP) *	Herbicide	12	2	3	6	15	5	0	0	0	0	43
Pentachloro-phenol *	**Fungicide**	**10**	**4**	**9**	**6**	**0**	**0**	**10**	**1**	**0**	**0**	**40**
Imidacloprid *	Insecticide	8	4	6	7.5	0	6	0	1	3.5	3	39
Isoxaben *	Herbicide	8	2	7.5	6	15	0	0	0	0	0	38.5

Pesticides highlighted in gray are those DEQ listed in Schedule B of the NPDES MS4 permit.
Pesticides in bold are those the co-permittees plan to monitor during the permit term.
* Pesticides with an asterisk are included in Pacific Agricultural Laboratory's Multi-residue screen.
Primary data used to assign points is provided in the attached spreadsheet, labeled Table 3: Pesticide Assessment

Conclusions
Based on widespread use, mobility and other environmental characteristics, the co-permittees plan to collect wet weather stormwater samples for the two pesticides (2,4-D and Pentachlorophenol) listed in Table B-1 of the NPDES MS4 permit during the permit term.[1] Environmentally relevant[2] results (e.g. method known to produce measurable results; MRL lower than EPA or other benchmark; MRL lower than values expected based on DEQ in-stream testing) for these two pesticides can be obtained through Test America's analysis using the chlorinated acid herbicide method (EPA 515.3). In addition to 2,4-D and pentachlorophenol, the chlorinated acid herbicide panel includes: 2,4,5-T, 2,4,5-TP (Silvex), 2,4-DB, 3,5-Dichlorobenzoic acid, Aciflurofen, Bentazon, Dicamba, Dichloprop, Dinoseb, and Picloram.

Because Glyphosate is included in the draft of the WPCF permit, the Co-Permittees anticipate that this pesticide will be monitored during at least one year of the permit term. The draft WPCF permit also includes Diazinon, which the Co-Permittees will likely ask to have replaced with one of the pesticides identified in this assessment. Because Diazinon is a restricted use pesticide not used by the Co-Permittees or available for purchase or use by residents, it is not anticipated to be present at detectable levels. Monitoring for Trifluralin or Triclopyr would be a more effective use of limited monitoring resources.

Additional monitoring beyond that required for NPDES MS4 or WPCF permit compliance requires a large amount of resources subject to the maximum expent practicable (MEP) standard. Most analyses cost between $100-200 per sample. The cost of additional information on presence of pesticides competes with the same finite pool of resources used to provide educational programs targeted at reducing use or other BMPs that prevent or reduce the amount of pesticides or other pollutants entering our local waterways.

During the permit term, the Co-Permittees will evaluate the cost, feasibility, and relevance of data obtained through monitoring some or all of the pesticides listed in Table 2. Pacific Agricultural Laboratory (PAL)[3] in Portland, OR offers a multi-residue screen (MRS) that includes many of the pesticides contained in Table 2 (asterisks next to all of the pesticides contained within this screen). While the broad nature of PAL's MRS is appealing, an evaluation of the method reporting limits (MRLs) available for each pesticide in the MRS versus the maximum value detected in-stream by DEQ determined that most of the pesticides would yield no detectable result, as the majority of MRLs were higher than the maximum value DEQ had detected in the environment. Based on verbal communication with Steve Thun at PAL, their analytical capabilities are improving, so the co-permittees will check with PAL to see if lower detection limits that would be environmentally relevant could be attained for some or all of the highest rated pesticides identified in this assessment.

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[1] Explanation of the decision to analyze for these two pesticides is provided in the monitoring plans for the NPDES and UIC-related WPCF permits, respectively.

[2] "Environmentally relevant" as used here means that the method reporting limit for a pesticide is low enough to detect its presence in stormwater, groundwater, or surface waters. Pollutant levels expected to occur in these waters are based on sampling results from studies conducted within Oregon.

[3] The co-permittees have most water quality samples analyzed by the City of Portland's Water Pollution Control Laboratory, except that Portland outsources specialty constituents to outside contract labs. Test America is often used, although Pacific Agricultural Laboratory (PAL) is a local lab that specializes in pesticide analysis and is capable of achieving low level analyses. Test America contracts with PAL for some low level pesticide analyses.

The co-permittees will report any additional pesticide testing performed to DEQ in the annual report that follows a decision to add analytes.

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Table 3: Pesticide Assessment

Pesticide	Type	Products	Screen	NPDES MS4 permit (2010)	PURS (2009)	Gresham (2011)	Fairview (2011)	Wide Use	Resident use ranking (Metro)	Metro (6 for all, 5 for garden only, 1 for P&H)	WQPMT Lists (2011)	Non-ag label categories (WQPMT 2011)	Detectable in water column (WQPMT)	Mobility (soil to water)	Mobility score	Persistence (in soil). Half-life in parenthesis	Persistence score	Toxicity (Human)	Toxicity (Human) score	Toxicity (aquatic life)	Toxicity (aq) score	EPA Risk-based conc or Benchmark	EPA Risk-based water concentration (ug/L)	EPA MCL (ug/L)	Acute fish EPA Benchmark (ug/L)	Acute invert EPA benchmark (ug/L)	DEQ Detected in 2007-10 ambient monitoring	DEQ Detected over standard or benchmark	DEQ Detection Freq (%, instream Clackamas)	DEQ Detection Max (ug/L)	Part of PAL MR Screen	Lab Reporting Limit, PAL MRS (ug/L)	Mobility (*2)	Toxicity (humans *1)	Toxicity (aq life *1.5)	Persistence (* 1.5)	Use in Gresham/ Fairview (*15)	Availability (Metro)	Widely Used	OR WQPMT Lists	WQPMT non-ag uses	Detected instream by DEQ (*3)	**Total**
2,4-D	Herbicide	Crossbow, Tordon	Chlorinated Acid	1	1	1	1	1	50	5	2	8	Y	(5) Moderate to Hig	5	(3) Low-Mod (1-14	3	(2) Low	2	(3) Low to Moderat	3	X	365	70	101000		NM	N			X	0.08	10	2	4.5	4.5	15	5	10	2	4	0	57
Trifluralin	Herbicide	Snapshot	Halogenated	1		1	1		20	5	1	8	Y	(2) Low	2	(5) Moderate to Hig	5	(2) Low	2	(8) Very High	8	X	8.73		20.5	280	Y	N			X	0.12	4	2	12	7.5	15	5	0	1	4	3	53.5
Triclopyr	Herbicide	Crossbow, Garlon	Chlorinated Acid	1		1	1		30	5	1	8	Y	(6) High	6	(4) Moderate (1-90	4	(2) Low	2	(4) Low to High	4				180	850	N	N			X	0.08	12	2	6	6	15	5	0	1	4	0	51
Dicamba	Herbicide		Chlorinated Acid		1	1			40	5	1	8	Y	(7) Very High	7	(4) Moderate (4-55	4	(2) Low	2	(2) Low	2	X	1100		14000	17300	NM	NM			X	0.08	14	2	3	6	15	5	0	1	4	0	50
Dichlorbenil	Herbicide	Casoron 4G, Root :	Halogenated			1	1		15	5				(6) High	6	(6) High	6	(2) Low	2	(3) Low to Moderat	3						NM	NM			X	0.12	12	2	4.5	9	15	5	0	0	0	0	47.5
Glyphosate	Herbicide	Roundup, Rodeo, Ranger Pro, Cleanup		1	1	1		1	45	5	1	8	Y	(1) Extremely Low	1	(3) Low-Med (2-197	3	(2) Low	2	(2) Low	2	X	3650	700	21500	26600	NM	NM					2	2	3	4.5	15	5	10	1	4	0	46.5
Mecoprop (MCPP)	Herbicide	MCPP	Chlorinated Acid			1			15	5				(6) High	6	(4) Moderate (2 mo	4	(2) Low	2	(2) Low	2	X	36.5				NM	NM			X	0.08	12	2	3	6	15	5	0	0	0	0	43
Pentachlorophenol	Fungicide		Chlorinated Acid					1			1	0	Y	(5) Moderate to Hig	5	(4) Moderate (45 d	4	(4) Moderate	4	(6) High	6	X	0.168				NM	NM			X	0.08	10	4	9	6	0	0	10	1	0	0	40
Imidacloprid	Insecticide		Organonitrogen	1			1		182	6	1	7	Y	(4) Moderate	4	(5) Mod-High (48-1	5	(4) Moderate	4	(4) Low to High	4				41500	35	Y	N	7	0.048	X	0.3	8	4	6	7.5	0	6	0	1	3.5	3	39
Isoxaben	Herbicide	Gallery, Snapshot	Organonitrogen			1	1		0					(4) Moderate	4	(4) Moderate (205	4	(2) Low	2	(5) Moderate to Hig	5	X	1830				NM	NM			X	0.12	8	2	7.5	6	15	0	0	0	0	0	38.5
Malathion	Insecticide		Organophosphorus	1					5	5	2	4	Y	(6) High	6	(2) Low (1-17 days)	2	(2) Low	2	(6) High	6	X	730		16.4	0.3	Y	Y	15	0.22	X	0.3	12	2	9	3	0	5	0	2	2	3	38
Chlorsulfuron	Herbicide	Telar XP				1								High	6	Moderate	4	Low	2	Low	2												12	2	3	6	15	0	0	0	0	0	38
Imazapyr	Herbicide								5	5	1	4	Y	High	6	High (60-436 days))	6	Low	2	Low	2				50000	50000	Y	N					12	2	3	9	0	5	0	1	2	3	37
Metaldehyde	Molluscicide	Deadline				1			40	5				(4) Moderate	4	(2) Low (several day	2	(3) Low to Moderat	3	(2) Low	2						NM	NM					8	3	3	3	15	5	0	0	0	0	37
Bifenthrin	Insecticide		Halogenated	1	1				77	6	2	8	Sed	(2) Low	2	(4) Low to High (7 d	4	(4) Moderate	4	(7) High to Very Hig	7	X	548		0.075	0.8	NM	NM			X	0.12	4	4	10.5	6	0	6	0	2	4	0	36.5
Pelargonic acid	Herbicide	Scythe				1			5	5				(4) Moderate	4	(2) Low	2	(2) Low	2	(2) Low	2						NM	NM					8	2	3	3	15	5	0	0	0	0	36
Chlorpyrifos	Insecticide		Organophosphorus						2	1	3	5	Y	Low	2	Moderate	4	Moderate	4	Very High	8				0.083	0.05	Y	Y	7	0.98	X	0.3	4	4	12	6	0	1	0	3	2.5	3	35.5
Copper sulfate	Fungicide										1	3	Y	Low to High	4	Very High	8	Low to High	4	High	6				14.55	1.8	NM	NM					8	4	9	12	0	0	0	1	1.5	0	35.5
Disulfoton	Insecticide		Organophosphorus						5	5				Moderate	4	Low to Moderate	3	Very High	8	High	6						NM	NM			X	0.3	8	8	9	4.5	0	5	0	0	0	0	34.5
Oryzalin	Herbicide	Surflan	Organonitrogen		1	1			0					(2) Low	2	(3) Low to Moderat	3	(2) Low	2	(6) High	6	X	1830				NM	NM			X	0.3	4	2	9	4.5	15	0	0	0	0	0	34.5
Chlorothalanil	Fungicide		Halogenated	1	1				5	5	2	6	Y	(2) Low	2	(4) Moderate (1 to	4	(2) Low	2	(6) High	6	X	21.7		5.25	1.8	Y	N			X	0.12	4	2	9	6	0	5	0	2	3	3	34
Diazinon	Insecticide		Organophosphorus								3	0	Y	Moderate	4	Moderate	4	Low	2	Very High	8				45	0.11	Y	Y			X	0.3	8	2	12	6	0	0	0	3	0	3	34
Diuron	Herbicide		Phenylurea		1						2	3	Y	(4) Moderate	4	(5) Moderate to Hig	5	(4) Moderate	4	(5) Moderate to Hig	5	X	73		200	80	Y	Y	63	0.26	X	0.12	8	4	7.5	7.5	0	0	0	2	1.5	3	33.5
Lindane	Insecticide										2	0	Y	Moderate	4	High (15 mos)	6	Moderate	4	High to Very High	7				0.85	0.5	N	N					8	4	10.5	9	0	0	0	2	0	0	33.5
Acetochlor	Herbicide		Halogenated								1	0	Y	Low	2	High	8	High	6	Moderate to High	7				190	4100	NM	NM			X	0.3	4	6	10.5	12	0	0	0	1	0	0	33.5
Mefluidide	Plant growth	Embark 2S				1			0					(5) Moderate to Hig	5	(2) Low (2 days)	2	(2) Low	2	(2) Low	2						NM	NM					10	2	3	3	15	0	0	0	0	0	33
Aldicarb	Insecticide		Carbamate								1	0	Y	High	6	Moderate	4	Very High	8	Moderate	4						NM	NM			X	0.12	12	8	6	6	0	0	0	1	0	0	33
Carbofuran	Insecticide		Carbamate								1	0	Sed	High	6	Moderate (30-120	4	Moderate to High	5	High	6				44	1.12	NM	NM			X	0.12	12	5	9	6	0	0	0	1	0	0	33
Atrazine	Herbicide		Organonitrogen								2	8	Y	Moderate	4	High	6	Moderate	4	Low	2				2650	360	Y	N	6	0.01	X	0.3	8	4	3	9	0	0	0	2	4	3	33
Permethrin	Insecticide		Halogenated	1					420	6	2	8	Sed	(2) Low	2	(3) Low to Moderat	3	(3) Low to Moderat	3	(6) High	6	X	1830		0.395	0.01	N	N			X	1.2	4	3	9	4.5	0	6	0	2	4	0	32.5
Sodium metaborate	Herbicide	Bare Spot				1			0	6				Low-Mod	3	Very Low	1	Very Low	1	Low	2						NM	NM					6	1	3	1.5	15	6	0	0	0	0	32.5
Myclobutanil	Fungicide		Organonitrogen	1					20	5	1	1	Y	(6) High	6	(6) High (198-224 d	6	(2) Low	2	(2) Low	2				1200	5500	NM	NM			X	0.6	12	2	3	9	0	5	0	1	0.5	0	32.5
Endosulfan II	Insecticide		Halogenated								1	0	Y	Low	2	Moderate High (15	5	Mod to High	5	Very High	8				0.05	0.3	Y	N			X	0.12	4	5	12	7.5	0	0	0	1	0	3	32.5
Methoprene	Insecticide								203	6				(6) High	6	(2) Low	2	(2) Low	2	(6) High	6						NM	NM					12	2	9	3	0	6	0	0	0	0	32
Allethrin	Insecticide								98	6				Low	2	High	6	Low	2	High	7						NM	NM					4	2	10.5	9	0	6	0	0	0	0	31.5
Carbaryl	Insecticide	Sevin	Carbamate	1					15	5	2	7	Y	(2) Low	2	(2) Low (4-72 days,	2	(2) Low	2	(6) High	6	X	3650		110	0.85	Y	N			X	0.12	4	2	9	3	0	5	0	2	3.5	3	31.5
Dichlorvos	Insecticide		Organophosphorus						2	1				High	6	Low (7 days)	2	High	6	High	6						NM	NM			X	0.3	12	6	9	3	0	1	0	0	0	0	31
Zinc sulfate	Herbicide								10	5				(6) High	6	(4) Moderate	4	(2) Low	2	(4) Moderate	4						NM	NM					12	2	6	6	0	5	0	0	0	0	31
Aminopyralid	Herbicide	Milestone VM				1			0					(4) Moderate	4	(2) Low (20-32 days	2	(2) Low	2	(2) Low	2						NM	NM					8	2	3	3	15	0	0	0	0	0	31
Sodium chlorate	Herbicide	Bare Spot				1			0					N/A	0	(6) High	6	(4) Moderate	4	(2) Low	2						NM	NM					0	4	3	9	15	0	0	0	0	0	31
Endosulfan I	Insecticide		Halogenated								1	0	Y	Low	2	Moderate (35 days)	4	Mod to High	5	Very High	8				0.05	0.3	Y	N			X	0.12	4	5	12	6	0	0	0	1	0	3	31
Dithiopyr	Herbicide	Dimension	Halogenated											(6) High (Koc>1000	6	(6) High (871 days)	6	(2) Low	2	(5) Moderate to Hig	5						NM	NM			X	0.12	12	2	7.5	9	0	0	0	0	0	0	30.5
Pendimethalin	Herbicide	Pendulum	Organonitrogen	1	1						3	7	Y	(2) Low	2	(4) Moderate (40 d	4	(2) Low	2	(6) High	6	X	1460		69	140	Y	N	13	0.103	X	0.12	4	2	9	6	0	0	0	3	3.5	3	30.5
Fipronil	Insecticide		Organonitrogen	1					20	1	2	2	Sed	(2) Low	2	(5) Mod-High (122-	5	(4) Moderate	4	(7) High to Very Hig	7				41.5	0.11	NM	NM			X	0.6	4	4	10.5	7.5	0	1	0	2	1	0	30
Dichlorprop (2,4-DP)	Herbicide		Chlorinated Acid						5	5				(5) Mod-High	5	(2) Low	2	(3) Low to Moderat	3	(6) High	6	X	292				NM	NM			X	0.08	10	3	9	3	0	5	0	0	0	0	30
Propiconazole	Fungicide		Halogenated	1							1	5	Y	(4) Moderate	4	(6) High	6	(2) Low	2	(3) Low to Moderat	3	X	475		425	2400	Y	N	2	4.04	X	0.3	8	2	4.5	9	0	0	0	1	2.5	3	30
Tralkoxydim	Herbicide										1	0	Y	Very High	8	Moderate (1-35 day	4	Moderate	4	Low	2				3750	87000	NM	NM					16	4	3	6	0	0	0	1	0	0	30
Terbacil	Herbicide		Halogenated								1	0	Y	High	6	High (50-180 days)	6	Low	2	Low	2				23100	32500	Y	N			X	0.12	12	2	3	9	0	0	0	1	0	3	30
Sulfometuron-methyl	Herbicide	Oust				1			0		1	0	Y	(2) Low	2	(3) Low to Moderat	3	(2) Low	2	(2) Low	2						NM	NM					4	2	3	4.5	15	0	0	1	0	0	29.5
Esfenvalerate	Insecticide		Halogenated								2	3	Sed	Low	2	Moder (15d to 3mo	4	Moderate	4	Very High	8				0.035	0.025	NM	NM			X	0.12	4	4	12	6	0	0	0	2	1.5	0	29.5
Azinphos-methyl	Insecticide		Organophosphorus								1	0	Y	Low	2	Moderate	4	Mod-High	5	Mod to Very High	7				0.18	0.08	Y	Y			X	0.3	4	5	10.5	6	0	0	0	1	0	3	29.5
MSMA	Herbicide										1	5	Y	Low	2	Very High	8	Moderate	4	Moderate	4						NM	NM					4	4	6	12	0	0	0	1	2.5	0	29.5
Acephate	Insecticide	Orthene							20	5				(6) High	6	(2) Low (3-6 days)	2	(4) Moderate	4	(3) Low to Moderat	3	X	7.73				NM	NM					12	4	4.5	3	0	5	0	0	0	0	28.5
Hexazinone	Herbicide		Organonitrogen								1	3	Y	High	6	Moderate (30-180)	4	Low	2	Low	2				137000	75800	Y	N	7	0.099	X	0.3	12	2	3	6	0	0	0	1	1.5	3	28.5
Prometon	Herbicide		Organonitrogen								1	5	Y	Moderate	4	High (500 days)	6	Low	2	Low	2				6000	12850	Y	N			X	0.6	8	2	3	9	0	0	0	1	2.5	3	28.5
Lambda-cyhalothrin	Insecticide								20	1	2	7	Sed	Low	2	Low	2	Moderate	4	High	7				0.105	0.0035	NM	NM					4	4	10.5	3	0	1	0	2	3.5	0	28
Dinoseb	Herbicide		Chlorinated Acid											(5) Mod to High	5	(2) Low (5-31 days)	2	(6) High	6	(6) High	6	X	36.5	7			NM	NM			X	0.08	10	6	9	3	0	0	0	0	0	0	28
Tebuthiuron	Herbicide		Organonitrogen								1	0	Y	High	6	High (12-15 months	6	Low to Moderate	3	Low	2				53000	148500	NM	NM			X	0.6	12	3	3	9	0	0	0	1	0	0	28
Clopyralid	Herbicide		Chlorinated Acid								1	5	Y	High	6	Mod-High	5	Low	2	Low	2				984000		NM	NM			X	0.08	12	2	3	7.5	0	0	0	1	2.5	0	28
Bromacil	Herbicide		Organonitrogen								1	3	Y	Mod-High	5	Mod-High	5	Low	2	Low	2				18000	60500	Y	N			X	0.3	10	2	3	7.5	0	0	0	1	1.5	3	28
Isoxaflutole	Herbicide										1		Y	Low to high	4	Moderate to High	5	Moderate to High	5	Moderate	4						NM	NM					8	5	6	7.5	0	0	0	1	0	0	27.5
Dikegulac sodium	Plant growth	Atrinal				1			0					(2) Low	2	(2) Low (15 days)	2	(2) Low	2	(2) Low	2						NM	NM					4	2	3	3	15	0	0	0	0	0	27
Thiamethoxam	Insecticide										1	4	Y	Moderate	4	Low	2	Moderate	4	High	6						NM	NM					8	4	9	3	0	0	0	1	2	0	27
Pyraclostrobin	Fungicide		Organonitrogen								1	3		Very low	1	Moderate to High	5	Low to Moderate	3	Very High	8						NM	NM			X	0.12	2	3	12	7.5	0	0	0	1	1.5	0	27
Benefin	Herbicide								10	5				Low	2	Moderate	4	Very Low	1	High	7						NM	NM					4	1	10.5	6	0	5	0	0	0	0	26.5
Picloram	Herbicide	Tordon RTU	Chlorinated Acid								1	3	Y	(5) Moderate to Hig	5	(5) Moderate to Hig	5	(2) Low	2	(3) Low to Moderat	3	X	2560	500	6500	34150	NM	NM			X	0.08	10	2	4.5	7.5	0	0	0	1	1.5	0	26.5
Fenbutatin oxide	Insecticide										1	0	Y	Low	2	Moderate to high	5	Low	2	Very High	8				0.85	15.5	NM	NM					4	2	12	7.5	0	0	0	1	0	0	26.5
Oxyfluorfen	Herbicide		Halogenated								2	2	Y	Very Low	1	Moderate (30-40 d	4	Low	2	High	7				102	40	Y	N			X	0.12	2	2	10.5	6	0	0	0	2	1	3	26.5
Avermectin	Insecticide								8	1				(2) Low	2	(2) Low	2	(6) High	6	Extremely High	8						NM	NM					4	6	12	3	0	1	0	0	0	0	26
Pentachloronitrobenzene	Fungicide				1									(3) Low to Moderat	3	(6) High (213 - 699	6	(2) Low	2	(6) High	6	X	0.259				NM	NM					6	2	9	9	0	0	0	0	0	0	26
Dimethenamid	Herbicide		Organonitrogen								1	0	Y	High	6	Moderate (31 days)	4	Moderate	4	Low	2				3150	6000	NM	NM			X	0.3	12	4	3	6	0	0	0	1	0	0	26
Ethoprop	Insecticide		Organophosphorus								1	0	Y	Low	2	Low to mod (10-40	3	High	6	Mod to High	5				150	22	Y	N			X	0.3	4	6	7.5	4.5	0	0	0	1	0	3	26
Simazine	Herbicide	Clean Crop	Organonitrogen								1	5	Y	(4) Moderate	4	(4) Moderate (28-1	4	(2) Low	2	(2) Low	2	X	0.56	4	3200	500	Y	N	57	0.08	X	0.6	8	2	3	6	0	0	0	1	2.5	3	25.5
Metalaxyl	Fungicide		Organonitrogen								1	3	Y	High	6	Moderate (7 to 170	4	Low	2	Low	2				65000	14000	NM	NM			X	0.3	12	2	3	6	0	0	0	1	1.5	0	25.5
DEET	Insecticide								259	6			Y	Moderate	4	Moderate	4	Low	2	Low	2						NM	NM	4	0.0096			8	2	3	6	0	6	0	0	0	0	25
Bentazon	Herbicide		Chlorinated Acid								1	0	Y	High	8	Low (<2 weeks)	2	Low	2	Low	2				50000	50000	NM	NM			X	0.08	16	2	3	3	0	0	0	1	0	0	25
Metribuzin	Herbicide		Organonitrogen								1	0	Y	Moderate to High	5	Moderate (30-60 d	4	Low	2	Low	2				21000	2100	Y	N			X	0.6	10	2	3	6	0	0	0	1	0	3	25
Deltamethrin	Insecticide		Halogenated								2	3	Sed	Low	2	Moderate (1-2 wee	4	Moderate	4	Mod to High	5				0.29	0.055	NM	NM			X	1.2	4	4	7.5	6	0	0	0	2	1.5	0	25
Cypermethrin	Insecticide		Halogenated	1					16	1	1		Y	(1) Extremely Low	1	(4) Moderate (30 d	4	(4) Moderate	4	(7) High to Very Hig	7	X	365				NM	NM	0.195	0.21	X	1.2	2	4	10.5	6	0	1	0	1	0	0	24.5
Aliphatic petroleum hydrocarb	Insecticide				1				122	5				(2) Low	2	(6) High	6	(2) Low	2	(3) Low to Moderat	3						NM	NM					4	2	4.5	9	0	5	0	0	0	0	24.5
Norflurazon	Herbicide		Halogenated								1	0	Y	Moderate	4	Moderate (90 days)	4	Low	2	Low to moderate	3				4050	7500	Y	N			X	0.12	8	2	4.5	6	0	0	0	1	0	3	24.5
Propargite	Insecticide		Organophosphorus								1	0	Y	Low	2	Moderate to High	5	Low to Moderate	3	High	6				59	37	NM	NM			X	0.6	4	3	9	7.5	0	0	0	1	0	0	24.5

Table 3: Pesticide Assessment

D-limonene	Cleaner/degr	Propower II Red							49	6				(2) Low	2	(6) High	6	(2) Low	2	(2) Low	2						NM	NM						4	2	3	9	0	6	0	0	0	0	24
Prometryn	Herbicide		Organonitrogen								1	0	Y	Low to Moderate	3	Moderate (60 days	4	Low to Moderate	3	Low to moderate	3				1450	9295	Y	N			X	0.3		6	3	4.5	6	0	0	0	1	0	3	23.5
Methyl anthranilate	Bird deterrer	Goose Blocker												(6) High	6	(2) Low	2	(2) Low	2	(4) Moderate	4						NM	NM						12	2	6	3	0	0	0	0	0	0	23
Alachlor	Herbicide		Halogenated								1	0	Y	Moderate	4	Low (8 days)	2	Low	2	Moderate	4				900	1250	Y	N			X	0.3		8	2	6	3	0	0	0	1	0	3	23
Ethalfluralin	Herbicide		Halogenated								2	0	Y	Low	2	Low	2	Low	2	Very High	8				16	30	NM	NM			X	0.12		4	2	12	3	0	0	0	2	0	0	23
Metolachlor	Herbicide		Halogenated								1	2	Y	Low	2	Moderate (15-70 da	4	Low	2	Moderate	4				1600	550	Y	N	35	0.275	X	0.3		4	2	6	6	0	0	0	1	1	3	23
Phosmet	Insecticide		Organophosphorus								1	0	Y	Low	2	Low (4 to 20 days)	2	Moderate	4	High to Very High	7				35	1	N	N			X	0.3		4	4	10.5	3	0	0	0	1	0	0	22.5
MCPA	Herbicide		Chlorinated Acid						10	5				(4) Low to High	4	(2) Low (5-6 days)	2	(3) Low to Moderat	3	(2) Low	2	X	18.3				NM	NM			X	0.08		8	3	3	3	0	5	0	0	0	0	22
Linuron	Herbicide		Phenylurea								2	0	Y	Low-Mod	3	Moderate (30-150 d	4	Low	2	Low	2				1500	60	Y	N			X	0.3		6	2	3	6	0	0	0	2	0	3	22
Triallate	Herbicide		Thiocarbamate								1	0	Y	Low	2	Moderate (80 days	4	Low	2	High	6				600		NM	NM						4	2	9	6	0	0	0	1	0	0	22
Dicofol			Halogenated								1	2	Y	Very Low	1	Moderate (60 days	4	Low to Moderate	3	High	6				26.5	70	NM	NM			X	0.3		2	3	9	6	0	0	0	1	1	0	22
Clethodim	Herbicide	Envoy												(5) Mod-High	5	(2) Low (3 days)	2	(4) Moderate	4	(3) Low-Mod	3						NM	NM						10	4	4.5	3	0	0	0	0	0	0	21.5
Dacthal	Herbicide	DCPA	Halogenated								1	0	Y	Low	2	Mod-High	5	Low to mod	3	Low	2				15000	13500	Y	N			X	0.12		4	3	3	7.5	0	0	0	1	0	3	21.5
Propazine	Herbicide		Organonitrogen								1	0	Y	Low to Moderate	3	High (35 to 231 day	6	Low	2	Low	2						N	N			X	0.3		6	2	3	9	0	0	0	1	0	0	21
Triadimefon	Fungicide		Organonitrogen								1	0	Y	Moderate	4	Low to Moderate (1	3	Moderate	4	Low	2						NM	NM			X	0.6		8	4	3	4.5	0	0	0	1	0	0	20.5
Napropamide	Herbicide		Amide								1	0	Y	Low	2	Moderate (56 to 84	4	Very Low to Low	2	Low to Moderate	3				3200	7150	Y	N						4	2	4.5	6	0	0	0	1	0	3	20.5
Amitrole	Herbicide	Amitrol T												(6) High	6	(2) Low (14 days)	2	(2) Low	2	(2) Low	2						NM	NM						12	2	3	3	0	0	0	0	0	0	20
Monoethanolamine	Fungicide	Monterey Super 7												(6) High	6	(2) Low	2	(2) Low	2	(2) Low	2						NM	NM						12	2	3	3	0	0	0	0	0	0	20
Proprionic acid	Fungicide/He	Monterey Super 7, LI 700												(6) High	6	(2) Low	2	(2) Low	2	(2) Low	2						NM	NM						12	2	3	3	0	0	0	0	0	0	20
Metham sodium	Fumigant	Sanafoam Vaporooter												(2) Low	2	(2) Low	2	(4) Moderate	4	(6) High	6						NM	NM						4	4	9	3	0	0	0	0	0	0	20
Folpet	Fungicide		Halogenated								1	0	Y	Very Low	1	Low (2.5 days)	2	Low to Moderate	3	High to Very High	7						NM	NM			X	0.3		2	3	10.5	3	0	0	0	1	0	0	19.5
Cyfluthrin	Insecticide		Halogenated		1				63		1	0	Sed	(1) Very Low	1	(2) Low (48-72 hou	2	(4) Moderate	4	(6) High	6				0.034	0.013	NM	NM			X	0.6		2	4	9	3	0	0	0	1	0	0	19
Imazamethabenz	Herbicide	Assert									1	0	Y	Moderate	4	Low to Mod (25-36	3	Low	2	Low	2						NM	NM						8	2	3	4.5	0	0	0	1	0	0	18.5
Mesotrione	Herbicide										1	0	Y	Moderate	4	Low	2	Low	2	Low	2						NM	NM						8	2	3	3	0	0	0	1	0	0	17
Benfluralin	Herbicide		Halogenated								1	0	Y	Low	2	Moderate (22-79 days)		Low to Moderate	3	High	6				15.9	1090	NM	NM			X	0.12		4	3	9	0	0	0	0	1	0	0	17
Amitraz	Insecticide		Organonitrogen						2	1				Low to Moderate	3	Very Low (<1 day)	1	Low	2	Moderate	4						NM	NM			X	0.6		6	2	6	1.5	0	1	0	0	0	0	16.5
Boric acid	Insecticide				1				4	1				(5) Moderate to Hi	5	(2) Low	2	(1) Very Low	1	(1) Very Low	1						NM	NM						10	1	1.5	3	0	1	0	0	0	0	16.5
Alkylarylpolyoxykene ether	Surfactant	Chemsurf 90				1			0																									0	0	0	0	15	0	0	0	0	0	15
Azoxystrobin	Fungicide		Organonitrogen								1	4	Y	Low	2	Low (<2 weeks)	2	Low	2	Low	2				235	130	NM	NM			X	0.12		4	2	3	3	0	0	0	1	2	0	15
Flumetsulam	Herbicide	Torpedo									1	0	Y	Very Low	1	Moderate (2 weeks	4	Low	2	Low	2				150000	125000	NM	NM						2	2	3	6	0	0	0	1	0	0	14
Metsulfuron methyl	Herbicide	Headline									1	6	Y	Very Low	1	Low to Moderate (3	3	Very Low	1	Very Low	1						NM	NM						2	1	1.5	4.5	0	0	0	1	3	0	13
AMPA	Herbicide	Glyphosate break-down product		1										(1) Extremely Low	1	(3) Low-Med (2-197	3	(2) Low	2	(2) Low	2						NM	NM						2	2	3	4.5	0	0	0	0	0	0	11.5
Hydroprene	Insecticide	Raid Max Sterilizer							2	1						Very Low (few days	1	Low	2	Low	2													0	2	3	1.5	0	1	0	0	0	0	7.5

TMDL Pollutant Load Reduction Benchmarks and Annual Stormwater Pollutant Load Estimate

City of Gresham
November 2015

1 Introduction

The following report is being submitted to DEQ to meet the TMDL Pollutant Load Reduction Benchmark requirement and the estimate of total annual stormwater pollutant loads specified in NPDES MS4 permit. The permit defines a TMDL Pollutant Load Reduction Benchmark as "*an estimated total pollutant load reduction target for each parameter or surrogate, where applicable, for waste load allocations established under an EPA-approved TMDL. A benchmark is the anticipated pollutant load reduction goal to be achieved during the permit cycle through the implementation of the stormwater management program and BMPs identified in the SWMP. A benchmark is used to measure the effectiveness of the stormwater management program in making progress toward the waste load allocation, and is a tool for guiding adaptive management. A benchmark is not a numeric effluent limit; rather it is an estimated pollutant reduction target that is subject to the maximum extent practicable standard. Benchmarks may be stated as a pollutant load range based upon the results of a pollutant reduction empirical model.*"

Schedule D.3.d. requires:
Establishment of TMDL Pollutant Reduction Benchmarks: A TMDL pollutant reduction benchmark must be developed for each applicable TMDL parameter where existing BMP implementation is not achieving the WLA. The TMDL pollutant reduction benchmark must be submitted with the permit renewal application, as follows:

- *i. The TMDL pollutant load reduction benchmark must reflect:*
  1. *Additional pollutant load reduction necessary to achieve the benchmark estimated for the permit term, if not achieved per Schedule D.3.c.iv.; and*
  2. *The pollutant load reduction proposed to achieve additional progress towards the TMDL WLA during the next permit term.*
- *ii. The TMDL pollutant load reduction benchmark submittal must include the following:*
  1. *An explanation of the relationship between the TMDL waste load allocations 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.*

Schedule B.6.c. requires:
An updated estimate of total annual stormwater pollutant loads for applicable TMDL pollutants or applicable surrogate parameters, and the following pollutant parameters: BOD_5, 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 concentration, including any modeling, data analysis and calculation methods.

Because both of these requirements use similar assumptions for modeling and calculation, they are both being addressed in this document.

Total Maximum Daily Loads (TMDLs) in Gresham

The TMDL parameters that apply to Gresham vary by watershed. The following table shows the current TMDL pollutants along with the current state water quality standard and the Waste Load Allocation (WLA) from the TMDL plan.

Table 1. Total Maximum Daily Loads (TMDLs) by watershed with Waste Load Allocations (WLAs) and current progress towards meeting WLA (based on 2014 TMDL Pollutant Load Reduction Evaluation). Constituents listed as "possibly" meeting the WLA are where the lower margin of error for the pollutant load would meet the WLA.

Waterbody	Constituent	Waste Load Allocation (WLA)	Meeting WLA
Willamette	Mercury*	Interim allocation is a reduction in total mercury loading by 26.4%	N/A
Columbia Slough	DO	BOD_5 load range 198 to 2608 kg/day	No
	Phosphorus	0.1549 mg/L (Upper Slough, spring and fall) 7.7 to 22.1 kg/day	No
	pH	pH < 8.5 (for Total P)	No
	Lead	0.065 to 0.4397 kg/day dissolved lead based on flow and not normalized for area	No
	Bacteria	1.75×10^{11} to 7.51×10^{11}, depending on flow and not normalized for area	No
	Chlorophyll-a	See total phosphorus	No
	DDT/DDE	3.24×10^{-6} kg/day (not normalized for area). A surrogate TSS concentration of 50 mg/L was applied	Possibly
	Dioxin (2,3,7,8 TCDD)	1.31×10^{-9} kg/day (not normalized for area). A surrogate TSS concentration of 50 mg/L was applied	Possibly
	PCBs	5.3×10^{-6} kg/day (not normalized for area). A surrogate TSS concentration of 50 mg/L was applied	Possibly
	Dieldrin	9.6×10^{-6} kg/day (not normalized for area). A surrogate TSS concentration of 50 mg/L was applied	Possibly
Fairview	Bacteria	66% reduction in *E. coli*	No
Johnson	Bacteria	78% reduction in *E. coli*	No
	DDT/DDE	77% reduction in DDT	Possibly
	Dieldrin	77% reduction in DDT**	Possibly
Kelly/ Burlingame/ Beaver	Bacteria	86% reduction in *E. coli*	No

*Even though mercury is a parameter of concern throughout the Willamette Basin, and DEQ's Willamette Basin Mercury TMDL (2006) has an interim allocation recommending a 26.4% reduction in total mercury, a benchmark was not calculated for total mercury. Land use based data is lacking for modeling loads, and since the two primary sources of mercury are air deposition and soil erosion, load reductions would be related to BMPs reducing TSS.

**DDT and Dieldrin are highly correlated in the TMDL data and ensuing studies; therefore the TMDL considers that BMPs which address DDT will also address Dieldrin.

Pollutant load reduction benchmarks are required for TMDL pollutants where existing BMP implementation is not achieving the WLA. In 2014, Gresham submitted the TMDL Pollutant Load Reduction Evaluation document (see **Appendix B**) to DEQ showing that 1) the city had achieved our pollutant load reduction benchmark goals for the 5 year permit term, but 2) cannot definitively say we are achieving the WLA for any of the established TMDLs. Table 1 summarizes the relationship between the TMDL waste load allocations and the TMDL benchmark for each applicable TMDL parameter.

Because the WLA is likely not being achieved for any of the TMDL waterbodies, this document provides the rationale and pollutant load reduction strategies the city will take during the next permit term to achieve additional progress towards the TMDL WLAs.

2 Pollutant Reduction due to SWMP Implementation

Schedule D.3.d.ii.2 requires, *"Description of how SWMP implementation contributes to the overall reduction of the TMDL pollutants during the next permit term."*

The City's Stormwater Management Plan (SWMP) contains a wide variety of BMPs that collectively contribute to reducing the amount of TMDL pollutants entering local watersheds. Many of the BMPs are considered "nonstructural" and are difficult to quantify an exact amount of pollution reduction resulting from their implementation. For example, environmental education, business inspections and enforcement, and illicit discharge investigation. In the past, the City estimated the TSS load reduction from our erosion inspection program, but because of the large number of assumptions that go into estimating reduction, we implement erosion control and other programs knowing they are effectively reducing pollutants even if we don't take credit for them in pollutant load reduction benchmarks.

Other BMPs are required for achieving the pollutant load assumptions for structural BMPs – for example, inspection and maintenance programs for private and public water quality facilities. Some BMPs in the SWMP require updating stormwater development standards or basin master plans, both of which result in construction of structural BMPs that are accounted for in the pollutant load reduction calculations. RC-4.A. is the Water Quality Retrofit BMP, which is the CIP fund through which the additional or modified BMPs in the next section will be accomplished.

3 Additional or Modified BMPs

Schedule D.3.d.ii.3 requires*, "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."*

Rather than try to predict future development and the stormwater BMPs that will be installed to meet the city's development standards for stormwater management, the city is focusing our benchmark assessment purely on BMPs that will be installed to treat existing developed area within the city. These additional BMPs will seek to retrofit existing streets, parking lots, and/or areas draining from currently untreated (or under-treated) areas of Gresham.

While the highest priority areas identified into the Retrofit Strategy and Plan submitted to DEQ in 2014 were high traffic streets (due to the high amount of impervious and high pollutant concentrations generated by vehicles using streets), there are other projects the city is considering for helping reduce pollutant loads. The city plans to do a more extensive retrofit "master plan" in the next couple years which will help prioritize projects designed and constructed using the Low Impact Development Practices Retrofit Program Capital Improvement Program budget. The retrofit master plan will produce a complete list of prioritized projects, but some potential projects that have already been identified are listed below by watershed.

A. Columbia Slough/Fairview Creek

Retrofit opportunities being considered, include:

1. **Cleveland Ave improvements. Gresham Transportation Division planning to add rain gardens to segment of Cleveland between Burnside and Stark.**
2. **Add UICs. Several neighborhoods with MS4 pipes are on edge of designated drywell area/infiltration suitability zone. The city is considering addition of in-line UICs to existing storm lines to provide infiltration for up to 80% of the average annual rainfall.**
3. Greening Rockwood. Multnomah County leading an effort to help identify projects to manage stormwater and add trees in Rockwood area of Gresham. Collaborating partners include the county, city, DePave, Friends of Trees, and East Multnomah Soil and Water Conservation District.
4. Fujitsu Ponds. Gresham is working on regulatory permitting to separate Fairview Creek from in-line ponds. Project would create wetland areas to provide stormwater treatment, while addressing temperature TMDL.
5. Retrofit existing stormwater facilities. As the city has taken public ownership of multi-owner private stormwater facilities and is working to assess and maximize functionality of all existing public facilities, some modifications may be made to improve pollutant load removal efficiency.
6. Downspout disconnection. City will evaluate the cost/benefit of financially incentivizing residents to participate and implement based upon feasibility.
7. Green streets, parking lot retrofits or other projects identified through Retrofit Master Plan process.

While all of these options may be considered, the retrofit projects that the city assumes will occur during the next 5-year permit term are 1) the Cleveland Ave improvement project and 2) additional UICs **bolded** above. The Cleveland Ave project is still under design, but based on current plans, the city estimates 19,000 square feet of impervious area will be treated with infiltration rain gardens. The rationale for selecting this project is because 1) it focuses on treatment of arterial street runoff and 2) it already has approval, funding, and is under design. Since this project only treats about a half acre of residential land use and didn't make a measurable pollutant load reduction, the city is also assuming that an additional 4.5 acres of existing residential development will be treated by adding UICs. Any added UICs would protect groundwater and meet the requirements in the city's WPCF permit. The city believes adding UICs would be a cost effective way to safely decrease stormwater volumes in existing MS4 drainages. The benchmarks assume a total of 5 acres of currently untreated residential land use will be treated using infiltration BMPs (rain gardens and UICs).

B. Johnson Creek

Retrofit opportunities being considered, include:

1. **End of pipe treatment/"ditch to swale" conversions in natural areas and along Springwater Trail.**
2. Downspout disconnection. City will evaluate the cost/benefit of financially incentivizing residents to participate and implement based upon feasibility.
3. Retrofit existing stormwater facilities. As the city has taken public ownership of multi-owner private stormwater facilities and is working to assess and maximize functionality of all existing public facilities, some modifications may be made to improve pollutant load removal efficiency.
4. Green streets/parking lots. Several options in downtown Gresham to add treatment to publicly owned paved areas.
5. Retrofits for "self-cleaning" catch basins. City will evaluate the cost/benefit of retrofitting un-sumped catch basins with a more effective source control structure
6. Green streets, parking lot retrofits or other projects identified through Retrofit Master Plan process.

While all of these options may be considered, the retrofit project that the city will assume occurs during the next 5-year permit term is the end of pipe treatment at outfalls along the Springwater Trail project **bolded** above. The exact location(s) of outfalls has not yet been determined, but for the sake of the benchmark calculations, the city will assume that 5 acres of currently untreated residential area is treated with wetland. The rationale for selecting this project is because residential land use has high bacteria concentrations, wetlands are effective at bacteria removal, and this project would provide treatment for a fairly large catchment area in space that is already publicly owned and maintained.

C. Kelly/Burlingame/Beaver Creek

Retrofit opportunities being considered, include:

1. **Mt Hood Community College campus retrofits. Working collaboratively with Mount Hood Community College, East Multnomah Soil and Water Conservation District, and the Sandy River Basin Council on identifying, designing and implementing some retrofits on campus.**
2. Ditch to swale conversions. Several roadside ditches in Kelly/Beaver/Burlingame watershed
3. Active Transportation Plan opportunities. Add in stormwater treatment while addressing missing sidewalks or bike lanes identified in city.
4. Retrofit existing stormwater facilities. As the city has taken public ownership of multi-owner private stormwater facilities and is working to assess and maximize functionality of all existing public facilities, some modifications may be made to improve pollutant load removal efficiency.
5. Green streets, parking lot retrofits or other projects identified through Retrofit Master Plan process.

While all of these options may be considered, the retrofit project that the city will assume occurs during the next 5-year permit term is the Mount Hood Community College campus retrofits project **bolded** above. The list of potential projects has yet to be developed, but for the sake of the benchmark calculations, the city will assume that 2 acres of currently untreated commercial area (zoning for MHCC) is treated with infiltration rain gardens. The rationale for selecting this project is because it will serve as a visible demonstration project at a public educational institution, while also engaging multiple partners in a collaborative stormwater project.

4 Pollutant Load Reduction Calculations

Schedule D.3.d.ii.4 requires, *"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."*

While the start and end dates for the next permit term are uncertain, the permit term was assumed to be the 5-year period between 2016-2021. The 2021 benchmarks provide a conservative estimate of pollutant loads since they are assuming a reduction from pollutants loads without BMPs in 2013 to a future reduction with BMPs in 2021. If development occurs within the city during that time, the pollutant loads without BMPs would be higher, meaning that the difference between loads with and without BMPs would be greater than the benchmark commitments shown below.

The city's development standards require stormwater management for all new development and redevelopment that occurs during this time, and as mentioned previously, there are numerous non-structural BMPs that are not accounted for in the benchmark modeling process. Non-structural BMPs are considered to be effective at removing pollutants, but the reduction is difficult to quantify and is therefore not currently estimated. Apart from existing structural BMPs, the only additional BMPs being modeled for pollutant reduction during the 5 year permit term are those listed in the above section.

Due to variability in stormwater concentrations, calculations show mean as well as the upper and lower value range (UVR and LVR), which are based on running the model using 95% confidence intervals.

Figure 1. Columbia Slough Toxics

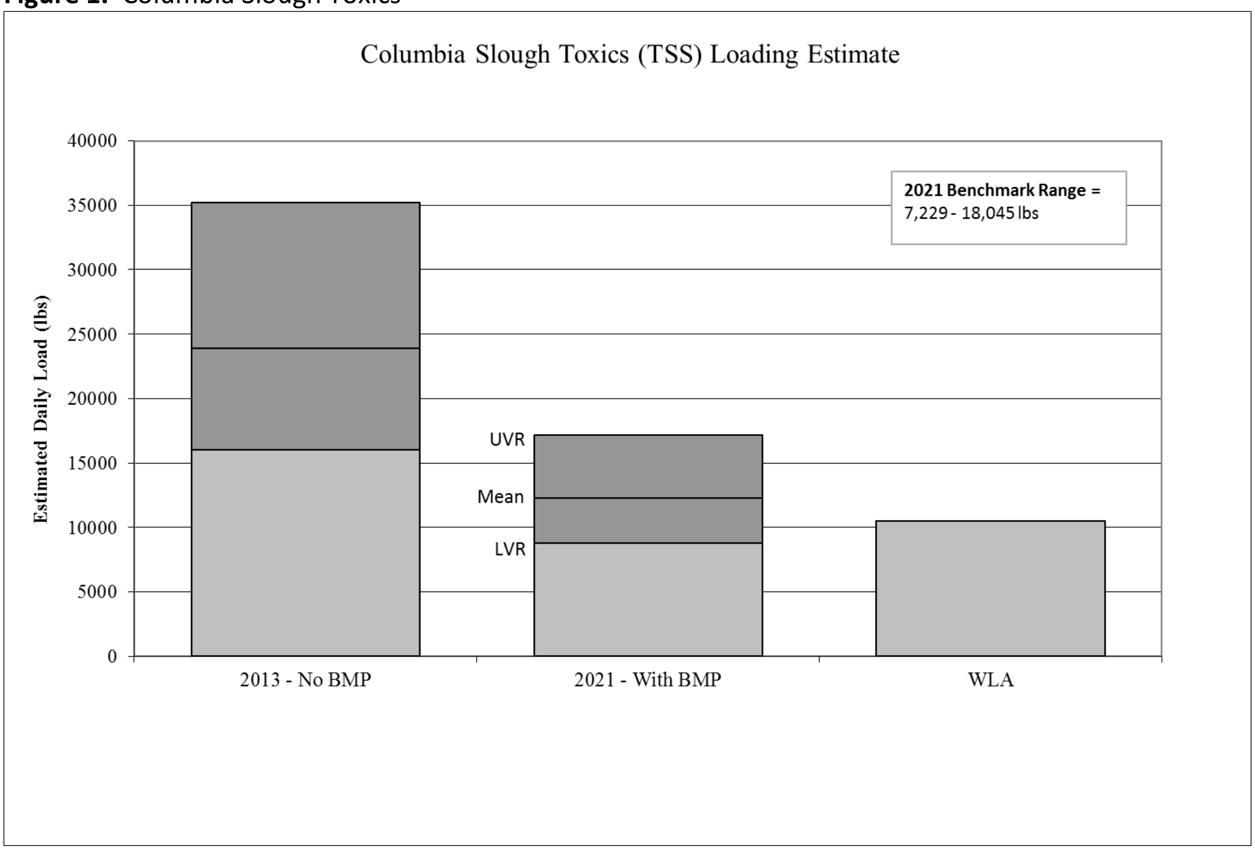


Figure 2. Columbia Slough Bacteria

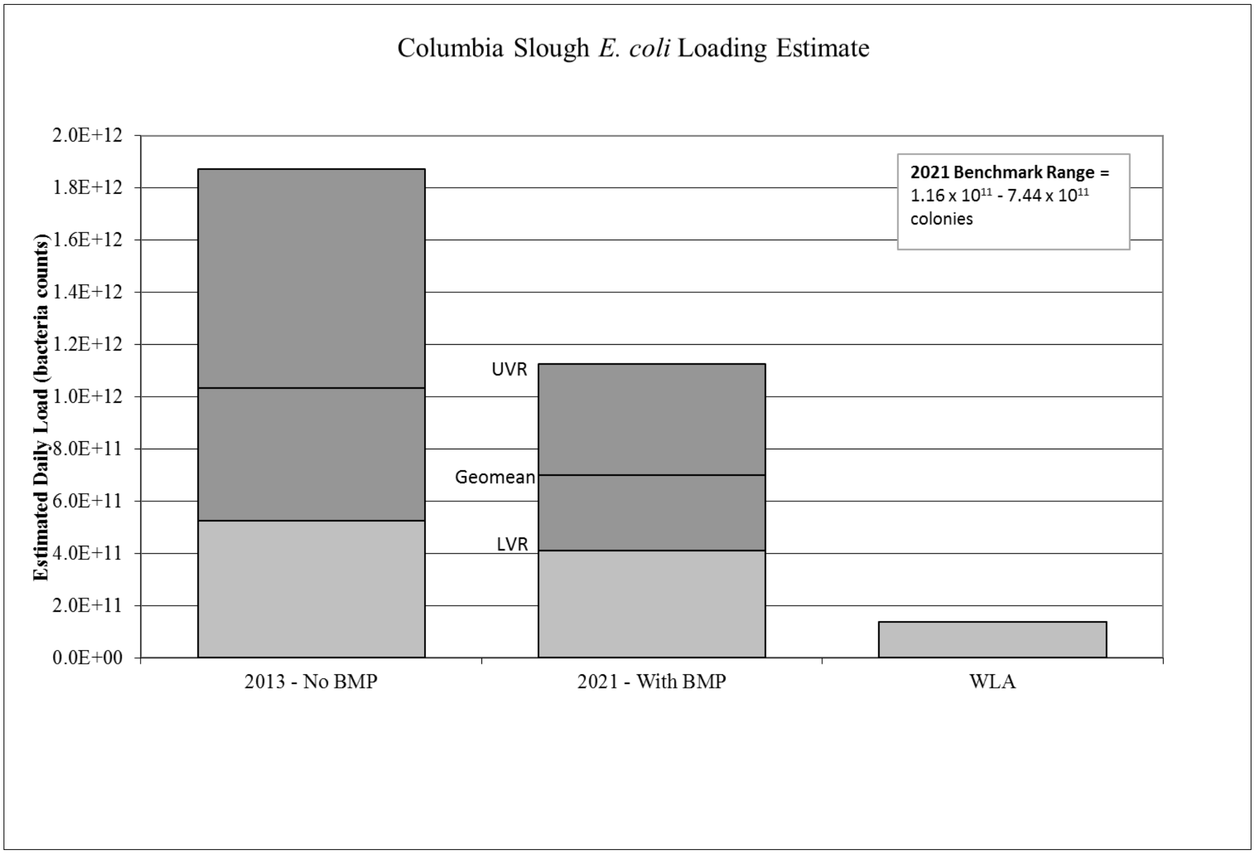


Figure 3. Columbia Slough Total Phosphorus

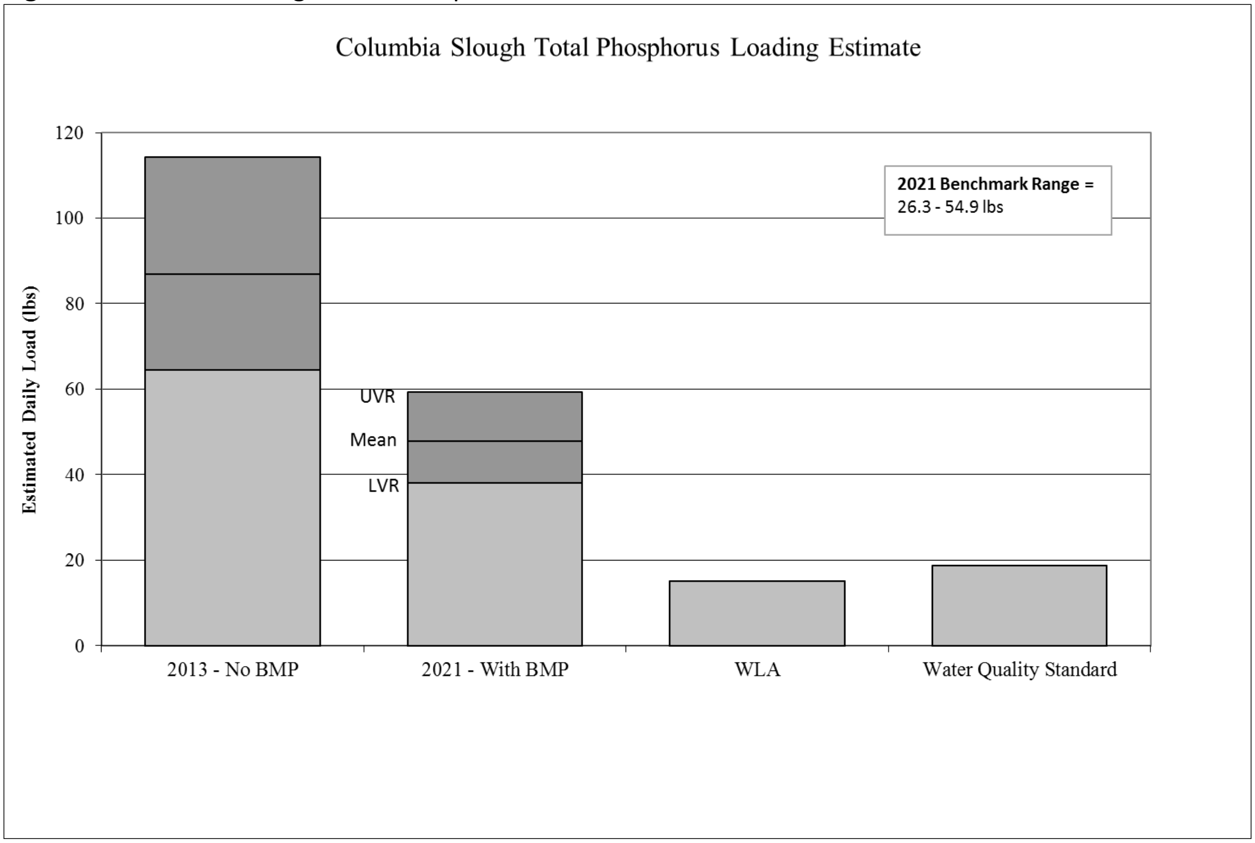


Figure 4. Columbia Slough Dissolved Lead

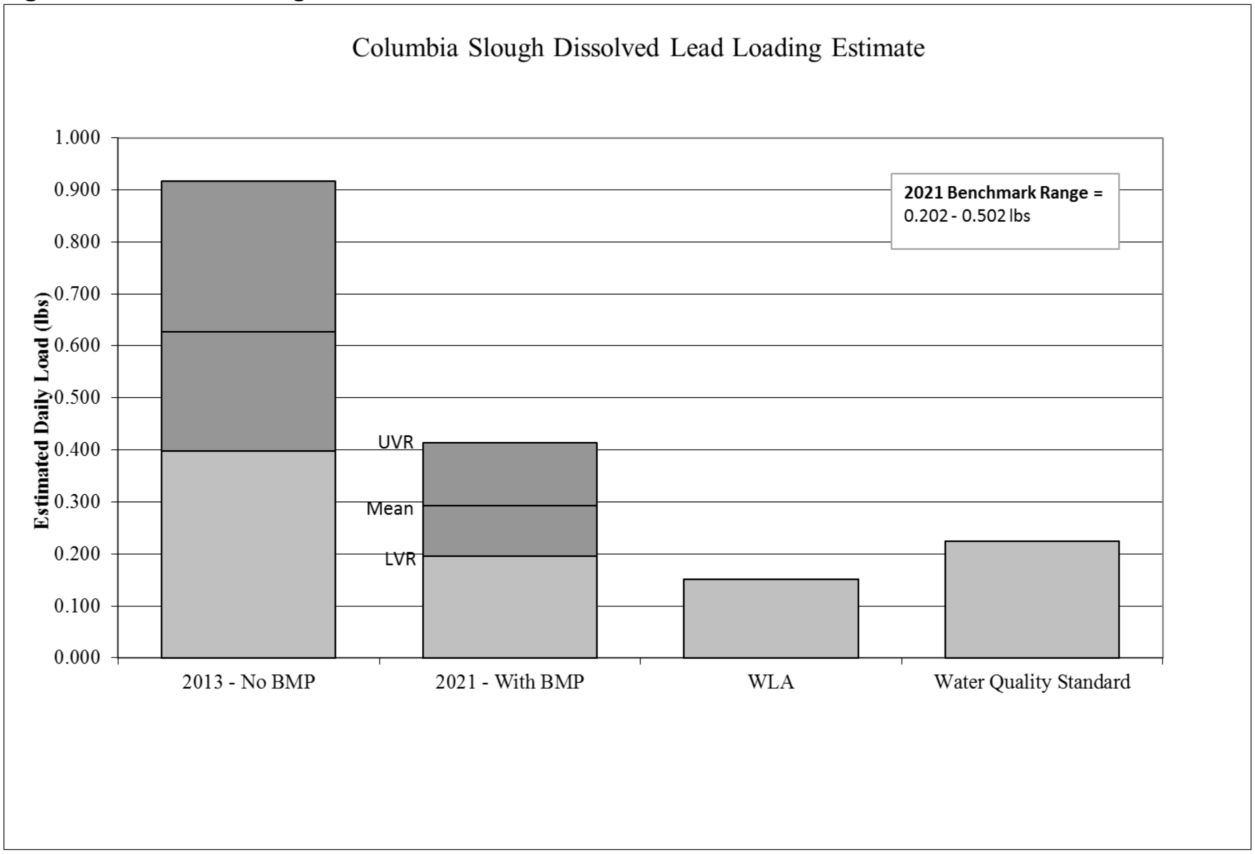


Figure 5. Columbia Slough BOD_5

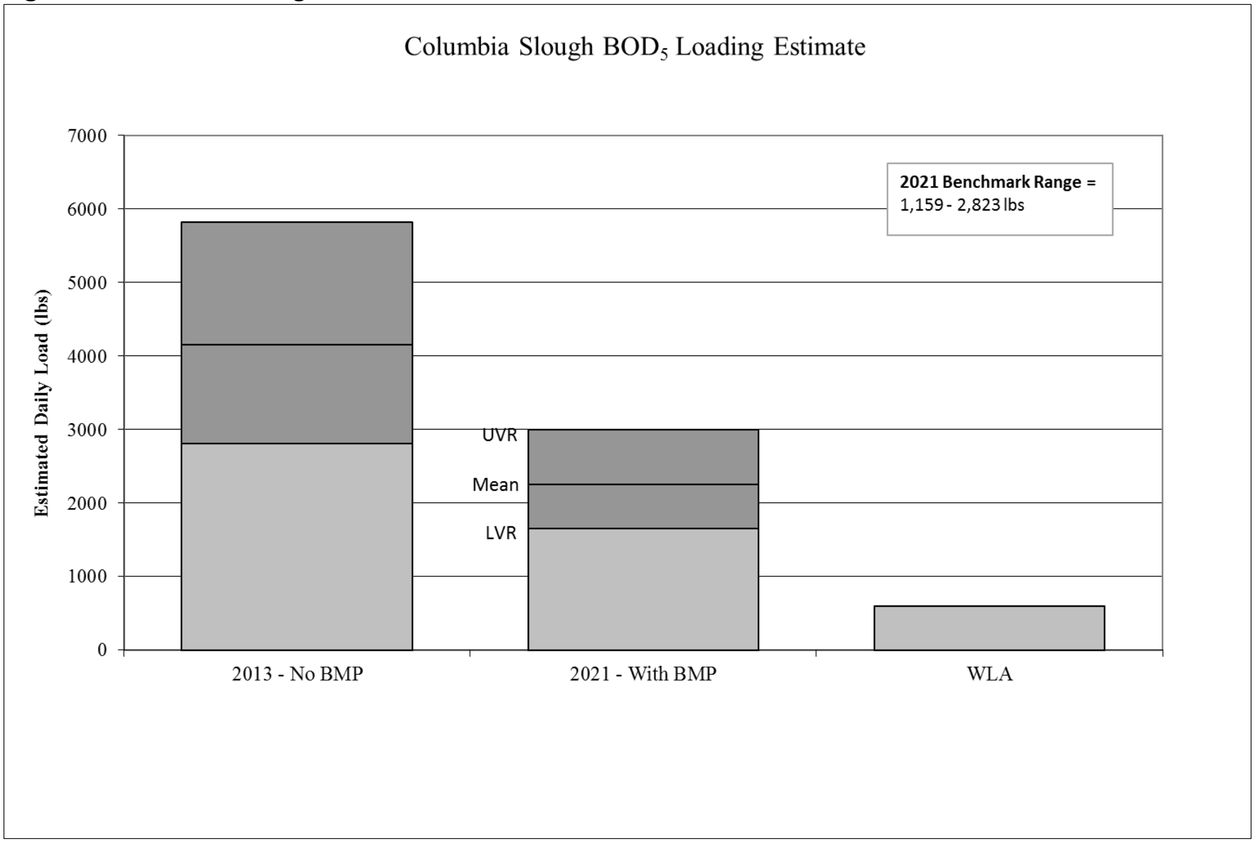


Figure 6. Fairview Creek Bacteria

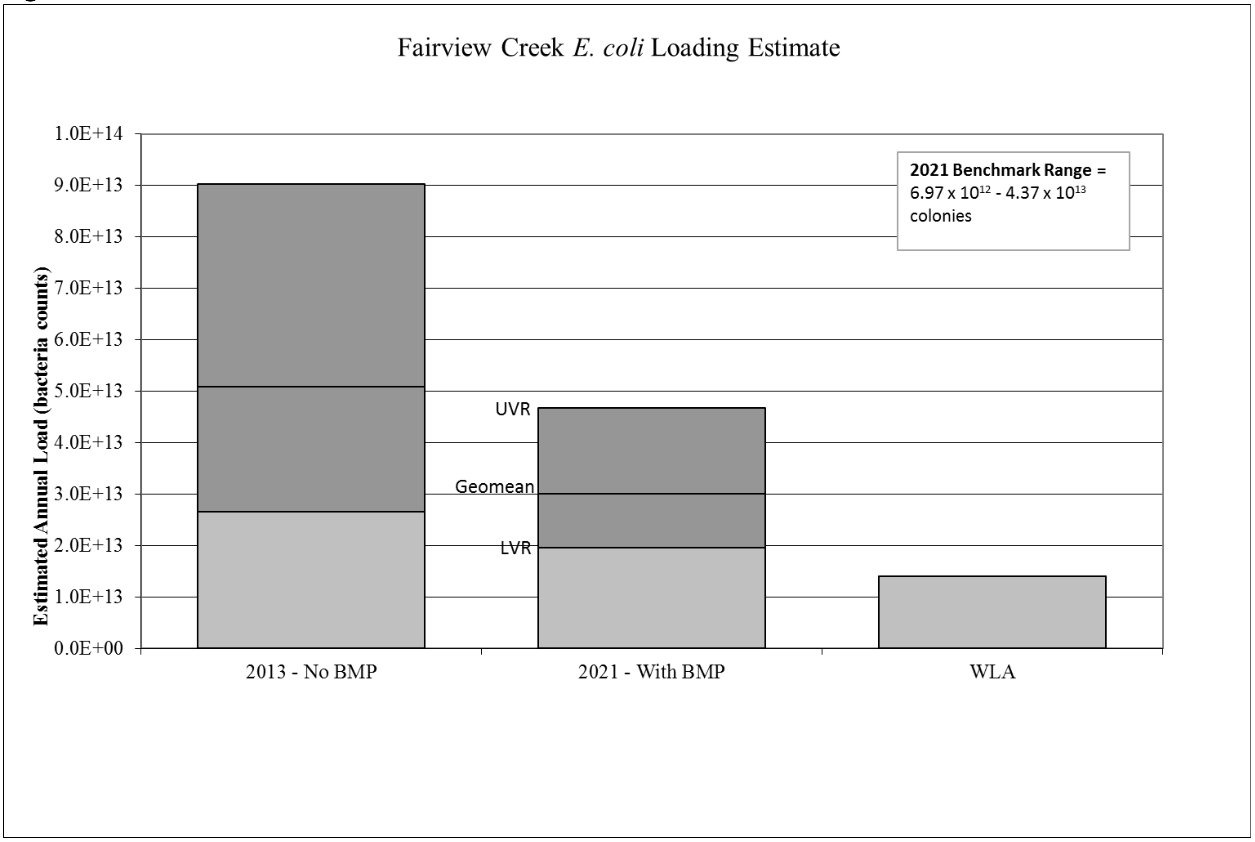


Figure 7. Johnson Creek Toxics

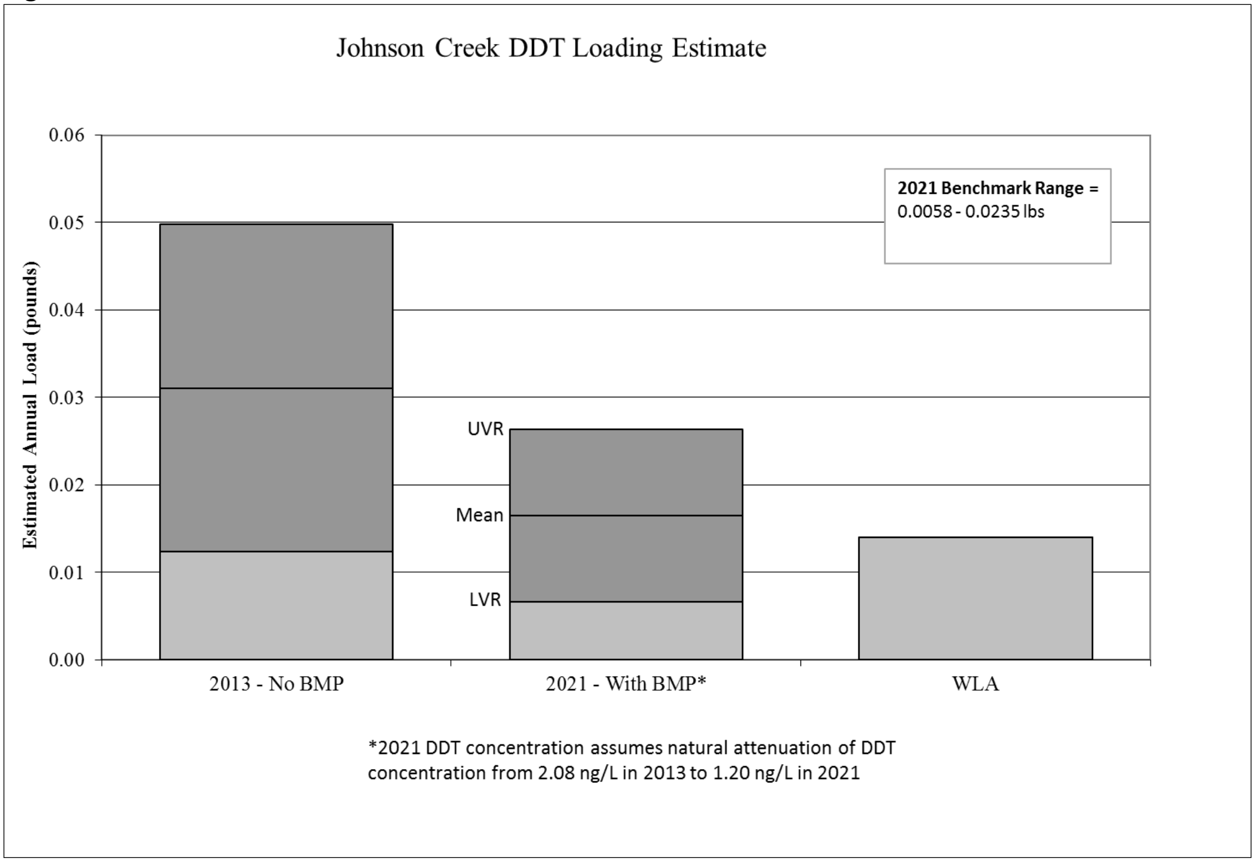


Figure 8. Johnson Creek Bacteria

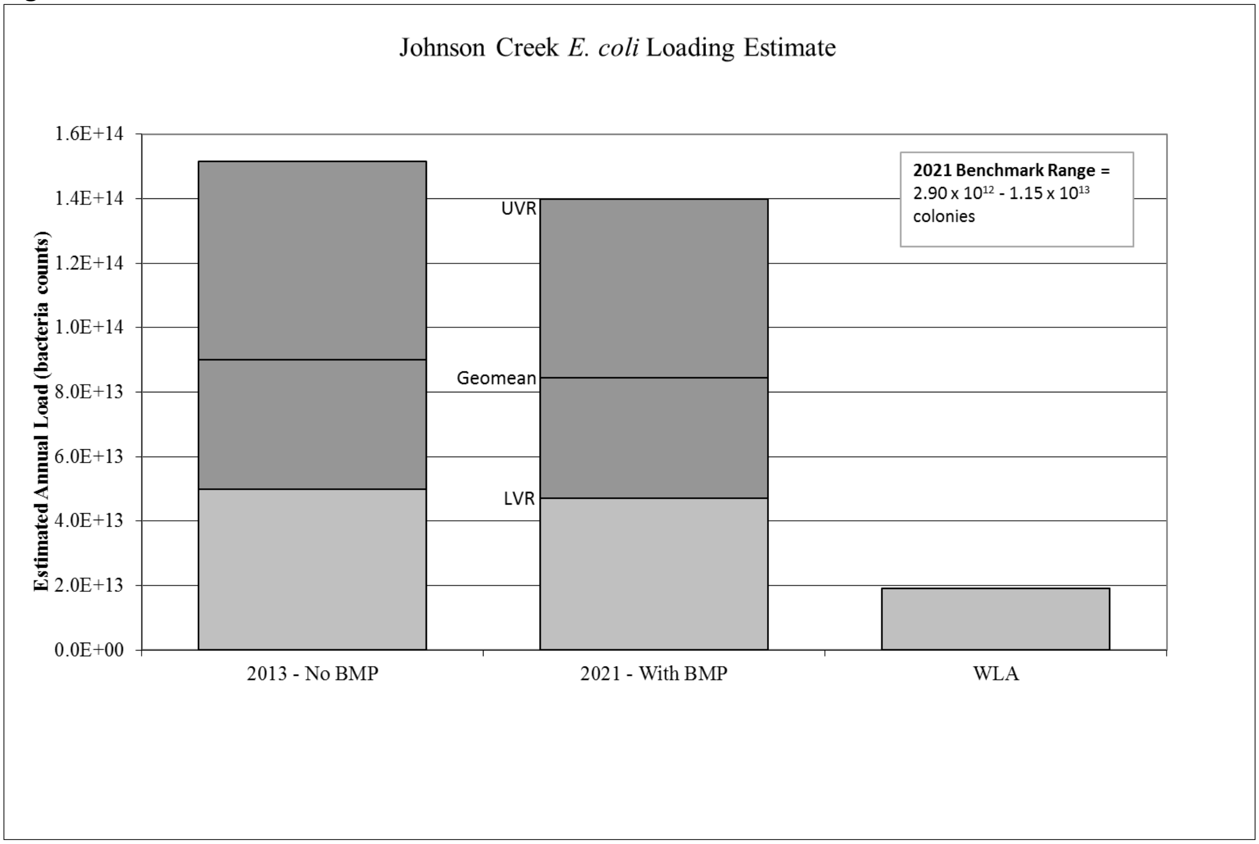


Figure 9. Kelly/Burlingame/Beaver Creek Bacteria

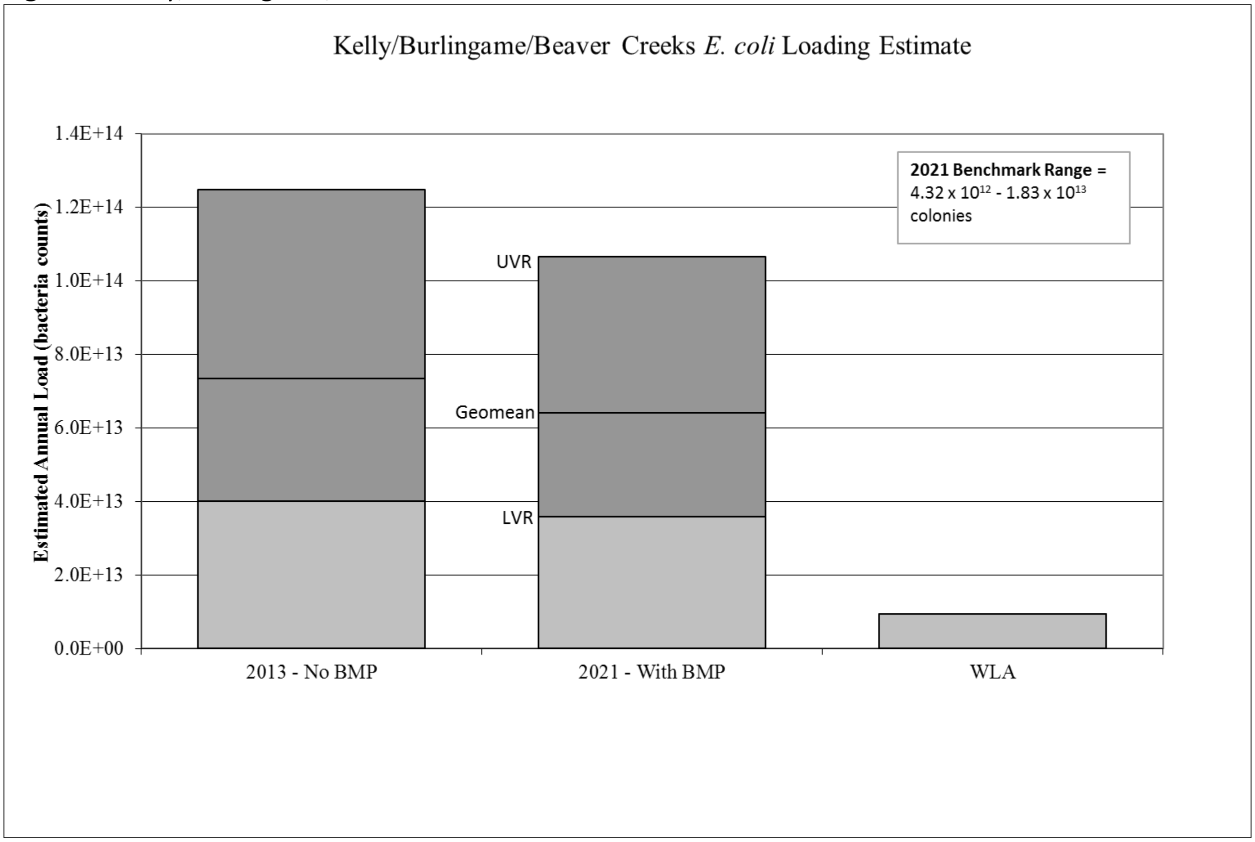


Table 2. Summary of 2021 Annual Pollutant Load Reduction Benchmarks. Note that because Columbia Slough loads and reductions were calculated based on a 0.51"/24-hour storm, annual loads were estimated by multiplying by the ratio of the annual rainfall to storm (45.48"/0.51"=89.17).

TMDL Parameter or Surrogate	Lower Value of Range	Upper Value of Range
Columbia Slough		
Total Suspended Solids	644,610 lbs.	1,609,073 lbs.
E. coli	1.03×10^{13} colonies	6.63×10^{13} colonies
Total Phosphorus	2,345 lbs.	4,895 lbs.
Dissolved Lead	18 lbs.	45 lbs.
Biochemical Oxygen Demand	103,348 lbs.	251,727 lbs.
Fairview Creek		
E. coli	6.97×10^{12} colonies	4.37×10^{13} colonies
Johnson Creek		
E. coli	2.90×10^{12} colonies	1.15×10^{13} colonies
DDT	0.0058 lbs.	0.0235 lbs.
Kelly/Burlingame/Beaver Creek		
E. coli	4.32×10^{12} colonies	1.83×10^{13} colonies

5 Annual Stormwater Pollutant Load Estimate

Schedule B.6.c. requires, *"An updated estimate of total annual stormwater pollutant loads for applicable TMDL pollutants or applicable surrogate parameters, and the following pollutant parameters: BOD_5, 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 concentration, including any modeling, data analysis and calculation methods."*

The annual stormwater pollutant load estimate is something that has been calculated with other permits in the past. While the current requirement is similar to the 12 pollutants listed in the original permit, a couple changes to the list in the 2010 permit require slight modifications to ensure the assumptions are similar to those used previously. These changes include:

- Bacteria has not previously been include, but since it is a TMDL pollutant and benchmarks have been calculated, all of the load data exists;
- There are several TMDL pollutants which do not have adequate land use event mean concentration data or BMP effluent data (e.g. DDT, Dieldrin, Dioxin, PCBs), so TSS loads are displayed as a surrogate;
- The original permit stated "total ammonia plus organic nitrogen," which is determined using the Kjeldahl method, and is commonly referred to as TKN. The model used to calculate loads only included data for total nitrogen and TKN, with total nitrogen assumed to be the sum of nitrate and TKN. The estimated nitrate load in **Table 3** was assumed to be the difference between total nitrogen and TKN.

The pollutant load calculations listed in **Table 3** are based on the same model inputs and conditions used to calculate the TMDL Pollutant Load Reduction Evaluation (**Appendix B**) and the benchmarks presented previously in this document. While some development has occurred over the past year, to keep the annual stormwater pollutant load estimates consistent with the pollutant load evaluation submitted top DEQ in 2014, land use and BMP data from 2013 were used to calculate the loads for the non-TMDL pollutants. The pollutant load reductions with BMPs for non-TMDL parameters are under-estimates, since BMP effluent data was not gathered for some pollutants (e.g. TKN, nitrate, cadmium) as part of the ACWA Rangers effort.

Table 3. Annual Stormwater Pollutant Load Estimates

	E. coli	TSS	BOD_5	COD	Total Phos	Ortho-Phos	Nitrate	Total Zinc	Total Lead	Total Copper	Tot Cad-mium
Total Load (lbs) no BMPs (2013)											
Columbia Slough/ Fairview Creek	9.21×10^{13}	2,129,251	370,051	1,382,990	7,745	2,493	10,221	6,165	733	550	35
Johnson	9.00×10^{13}	1,116,736	155,857	817,407	5,077	1,624	12,019	2,256	389	268	15
Kelly/Burlingame/ Beaver	7.35×10^{13}	812,430	108,889	624,384	3,924	1,228	8,464	1,485	336	210	10
Total Load from Gresham	2.56×10^{14}	4,058,417	634,797	2,824,781	16,746	5,345	30,704	9,906	1,458	1,028	60
Total Load (lbs) with nonstructural and structural BMPs (2013)											
Columbia Slough/ Fairview Creek	6.24×10^{13}	1,093,203	201,012	1,224,376	4,262	2,167	7,484	4,953	601	452	28
Johnson	8.44×10^{13}	1,028,348	145,808	770,509	4,720	1,531	10,953	2,028	348	244	14
Kelly/Burlingame/ Beaver	6.43×10^{13}	705,595	98,018	583,254	3,464	1,162	7,772	1,371	309	195	10
Total Load from Gresham	2.11×10^{14}	2,827,146	444,838	2,578,139	12,446	4,860	26,209	8,352	1,258	891	52

All loads are in pounds per year, except *E. coli* (which is in colonies per year)

FISCAL EVALUATION OF THE CITY OF GRESHAM STORMWATER MANAGEMENT PROGRAM

Introduction

This section of Gresham's permit renewal submittal fulfills the requirements of the 2010 NPDES Permit #101315 as described in the following places:
Schedule B 6) f.:

> *A fiscal evaluation summarizing program expenditures for the current permit cycle and projected program allocations for the next permit cycle.*

Fiscal Evaluation

A. Historic Financing

After a legal challenge in 1993 to the city's stormwater rate introduction, the rate was reinstated in August 1994. Initially, the rate was set at $3.54 per month and is currently $10.09 per month. The rate is based upon a 2,500 square foot drainage residential unit (DRU) and is the same for residential, commercial and industrial uses. The calculation includes the house/business, garage, driveway/parking lot and sidewalk. In other words, a house or business that has a total of 5,000 impervious square feet would currently pay a monthly fee of $20.18. In 1995, stormwater rates generated $1.8M and have grown to almost $7M in 2014.

B. Future Program Allocations

Predicting the stormwater rate revenues in the future is somewhat difficult because the annual budgeting process considers many other factors such as the state of the general fund programs, community safety and stated priorities, overall utility costs to the public based upon national and local economic factors, and long term asset management. The City creates 20 Year Finance Models for the Stormwater Utility for planning purposes. Any budget increases are subject to City Council approval.

As stated above, the city's DRUs are assessed per house or business. Additional annual revenue is also gained from System Development Charges (SDCs) that help fund capital improvement projects related to system growth. The five year average for SDC expenditures is $230,000 per year. SDCs are legally restricted to system capacity development and do not apply to staff salaries, programs or operations and maintenance and are therefore, not projected into the future for the purposes of this fiscal evaluation. The five year average for Stormwater Capital Implementation Program expenditures is $1.8 M.

Table 1. reflects the City's stormwater rate revenue forecast. This table includes the 2007-2014 figures reported in the 2008 Permit Renewal Submittal. Actual revenues from this time frame have been added. The predicted rate revenue has been extended out to year 2021 for purposes of the 2015 Permit Renewal Submittal.

Table 1: Stormwater Utility Rate Revenue Forecast

Year	DRUs*	Predicted Rate Revenue**	Actual Rate Revenue
2007	58,000	$5,369,785	$5,211,594
2008	58,000	$5,806,528	$5,558,860
2009	59,000	$5,922,659	$5,905,222
2010	59,500	$6,041,112	$6,079,576
2011	60,000	$6,161,934	$6,362,659
2012	60,000	$6,285,173	$6,786,551
2013	60,000	$6,410,876	$7,014,059
2014	60,000	$6,539,094	$6,920,620
2015	60,000	$6,930,000	$7,057,585
2016	60,000	$7,304,000	NA
2017	60,000	$7,511,000	NA
2018	60,000	$7,763,000	NA
2019	60,000	$8,060,000	NA
2020	60,500	$8,370,000	NA
2021	61,000	$8,693,000	NA

*Drainage Residential Units of impervious area. 1 DRU = 2,500 impervious area. Figures are rounded.
**2007-2014 figures were projected and reported for the 2008 Permit Renewal Submittal.

As noted above rates are assumed to grow slightly to keep up with inflation, but exact rate growth increases are subject to approval by City Council and are unknown beyond 2017. The proposed draft SWMP and Monitoring Plan enhancements are proposed to be implemented within the budget predicted above.

Appendix A

2008 Land Use Compatibility Statement

LUCS 08-26-0050246

Department of Environmental Quality
LAND USE COMPATIBILITY STATEMENT (LUCS)

State of Oregon
Department of Environmental Quality

WHAT IS A LUCS? The Land Use Compatibility Statement is the process used by the DEQ to determine whether DEQ permits and other approvals affecting land use are consistent with local government comprehensive plans.

WHY IS A LUCS REQUIRED? Oregon law requires state agency activities that impact land use be consistent with local comprehensive plans. DEQ Oregon Administrative Rules (OAR) Chapter 340, Division 18 identifies agency activities or programs that significantly affect land use and must have a process for determining local plan consistency.

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. These permits and activities are listed on p. 2 of this form. A single LUCS can be used if more than one DEQ permit/approval is being applied for concurrently.

A permit modification requires a LUCS when any of the following applies:

1. Physical expansion on the property or proposed use of additional land;
2. A significant increase in discharges to water;
3. A relocation of an outfall outside of the source property; or
4. 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.

A permit renewal requires a LUCS if one has not previously been submitted, or if any of the above modification factors apply.

HOW TO COMPLETE A LUCS:

Step	Who Does It	What Happens
1	Applicant	Completes Section 1 of the LUCS and submits it to the appropriate city or county planning office.
2	City or County Planning Office	Completes Section 2 of the LUCS by determining if the activity or use meets all local planning requirements, and returns to the applicant the signed and dated LUCS form **with findings of fact for any local reviews or necessary planning approvals**.
3	Applicant	Includes the completed LUCS with **findings of fact** with the DEQ permit or approval submittal application to the DEQ.

WHERE TO GET HELP: For questions about the LUCS process, contact the DEQ staff responsible for processing the permit/approval. Headquarters and regional staff may be reached using DEQ's toll-free telephone number 1-800-452-4011. 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, extension 232.*

SECTION 1 - TO BE COMPLETED BY APPLICANT

A. Applicant Name: City of Gresham

Contact Name: Steve Fancher

Mailing Address: 1333 NW Eastman Parkway

City, State, Zip: Gresham, OR 97030

Telephone: 503-618-2583

Tax Account No.: 93-6002176

B. Project Name: NPDES MS4 Permit Renewal Submittal

Physical Address: 1333 NW Eastman Parkway

City, State, Zip: Gresham, OR 97030

Tax Lot No.: 2000

Township: 1S **Range:** 3E **Section:** 04

Latitude: 45.5059

Longitude: -122.4351

*For latitude/longitude, use the **DEQ Location** Finder at http://deq12.deq.state.or.us/website/findloc.*

C. Describe the type of business or facility and services or products provided:

Municipality with permit to discharge via the publicly-owned stormwater management system

The permit area for Gresham includes the incorporated areas (the city limits) of the City of Gresham.

SECTION 1 - TO BE COMPLETED BY APPLICANT (Continued)

Applicant Name: City of Gresham

Project Name: City of Gresham Municipal NPDES MS4 Permit

D. Check the type of DEQ permit(s) or approval(s) being applied for at this time.

☐ Air Notice of Construction	☐ Pollution Control Bond Request
☐ Air Discharge Permit *(excludes portable facility permits)*	☐ Hazardous Waste Treatment, Storage, or Disposal Permit
☐ Title V Air Permit	☐ Clean Water State Revolving Fund Loan Request
☐ Parking/Traffic Circulation Plan	☐ Wastewater/Sewer Construction Plan/Specifications *(includes review of plan changes that require use of new land)*
☐ Air Indirect Source Permit	☒ Water Quality NPDES Individual Permit
☐ Solid Waste Disposal Permit	☐ Water Quality WPCF Individual Permit *(for onsite construction-installation permits use DEQ's Onsite LUCS form)*
☐ Solid Waste Treatment Permit	☐ Water Quality NPDES Stormwater General Permit *(1200-A, 1200-C, 1200-CA, 1200-COLS, and 1200-Z)*
☐ Solid Waste Compost Registration or Permit	☐ Water Quality General Permit *(all general permits, except 600, 700-PM, 1700-A, and 1700-B when they are mobile.)*
☐ Solid Waste Letter Authorization Permit	☐ Water Quality 401 Certification for federal permit
☐ Solid Waste Material Recovery Facility Permit	
☐ Solid Waste Transfer Station Permit	
☐ Solid Waste Tire Storage Permit	

E. This application is for: ☒ permit renewal ☐ new permit ☐ permit modification ☐ other: ____________

SECTION 2 - TO BE COMPLETED BY CITY OR COUNTY PLANNING OFFICIAL

Please Note: A LUCS approval cannot be accepted by DEQ until all local requirements have been met. Written findings of fact for all local decisions addressed under Item C below are required. Written findings for an activity or use addressed by the acknowledged comprehensive plan in accordance with OAR 660-031-0020 may simply reference the specific plan policies, criteria, or standards that were relied upon in rendering the decision and indicate why the decision is justified based on the plan policies, criteria, or standards.

A. The facility proposal is located: ☒ inside city limits ☒ inside UGB ☐ outside UGB

B. 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 Gresham

C. Does the activity or use comply with all applicable local land use requirements *(as required by OAR Chapter 660, Division 31)*?

☒ **YES,** you must complete below or attach findings to support the affirmative compliance decision

i) Relevant specific plan policies, criteria, or standards: See attached

ii) Provide the reasons for the decision: ____________

☐ **NO,** you must complete below or attach findings for noncompliance, and identify requirements the applicant must comply with before LUCS compatibility can be determined.

i) Relevant specific plan policies, criteria, or standards: ____________

ii) Provide the reasons for the decision: ____________

D. Planning Official Signature: [signature] **Title:** Assistant Planner

Print Name: Michelle Kimble **Telephone No.:** 503-618-2520 **Date:** 7/17/08

E. ***If necessary, depending upon city/county agreement on jurisdiction outside city limits but within UGB:***

Planning Official Signature: ____________ **Title:** ____________

Print Name: _____ **Telephone No.:** _____ **Date:** _____

COMPLIANCE WITH STATEWIDE PLANNING GOALS;
LAND USE COMPATIBILITY STATEMENT

The purpose of this section is to analyze whether Gresham's application to renew its MS4 permit falls under the provisions of OAR 660-031-0040 and OAR 340-018-0050(2)(b). Gresham's MS4 permit renewal application does not request a substantial modification or intensification of currently permitted activity. Consequently, a LUCS, which is a determination of compatibility with the Acknowledged Comprehensive Plan, is not required for the permit.

LEGAL STANDARD

ORS 197.180(1) requires that state agencies take actions with respect to programs affecting land use in compliance with" the statewide planning goals and in a manner compatible with acknowledged comprehensive plans.

The Land Conservation and Development Commission (LCDC) has concluded that a determination of compliance with the statewide planning goals and compatibility with acknowledged comprehensive plans is not needed for the renewal of an existing permit except in certain circumstances. OAR 660-031-0040 provides that:

> A determination of compliance with the Statewide Planning Goals or compatibility with Acknowledged Comprehensive Plan is not required if the proposed permit is a renewal of an existing permit except when the proposed permit would allow a substantial modification or intensification of the permitted activity. Substantial modifications or intensification shall be defined in an agencies' State Agency Coordination Agreement under ORS 197.180.

OAR 340-018-0040(1) and (2) are part of DEQ's acknowledged State Agency Coordination program and generally provide that DEQ shall achieve goal compliance for department land use actions, including issuance of NPDES permits, by assuring that such actions are compatible with applicable acknowledged comprehensive plans. OAR 660-018-0050(2) provides that compatibility with an acknowledged comprehensive plan may be determined in one of several ways, including submission of a land use compatibility statement (LUCS) to DEQ, in which the affected local government determines whether or not the activity is consistent with the acknowledged comprehensive plan.

OAR 340-018-0050(2)(b) implements OAR 660-031-0040 in providing that a LUCS is required for the *renewal* or *modification* of a permit if DEQ "determines the permit involves a substantial modification or intensification of the permitted activity." OAR 340-018-0050(2)(b)(A) provides that "renewal permits" require a LUCS if the permit renewal involves a "modification" that would require a LUCS.

OAR 340-018-0050(2)(b)(B) sets out three relevant circumstances in which modification permits require a LUCS: where the activity (1) relates to use of additional property or a physical expansion on the existing property, (2) involves a significant increase in discharge to state waters or into the ground, or (3) involves the relocation of an outfall outside of the source property.

In Tualatin Riverkeepers, et. al. v. Oregon Department of Environmental Quality, dismissed 01/15/2008 (LUBA No. 2004-050, LUBA No. 2004-051, LUBA No. 2004-054, LUBA No. 2004-057), the Land Use Board of Appeals determined that the 2005 MS4 Permit was a renewed NPDES permits and thus subject to the OAR 340-018-0050(2)(b) and OAR 660-031-0040 exception to the requirement to demonstrate compliance with the statewide planning goals.

PERMIT PROVISIONS

To determine whether the 2008 MS4 permit renewal application constitutes a substantial modification or intensification of a permitted activity it is necessary to compare the permit renewal application with the previously issued permit. The results of this comparison are summarized as follows:

1995 MS4 Permit

Gresham received its first MS4 permit in September 1995.

The "Permitted Activities" section of the 1995 MS4 permit authorizes Gresham to "implement a storm water management program to reduce the contribution of pollutants in storm water to the maximum extent practicable and to discharge storm water to public waters in conformance with all of the requirements and conditions set forth in the [permit] schedules."

The Sources Covered by the permit includes "all existing and new discharges of storm water from the Municipal Separate Storm Sewer System" within the permit area.

The "Controls and Limitations" section of the 1995 permit is Schedule A, which required Gresham to do the following:

- Implement the SWMP submitted with the NPDES application.
- Reduce the discharge of the pollutants from the MS4 to the maximum extent practicable.
- Effectively prohibit non-storm water discharges into the MS4.

The 1995 permit also contains monitoring and reporting requirements, special conditions and general conditions.

2004 MS4 Permit

The 2004 MS4 Permit is very similar to the 1995 MS4 permit. For example, the Permitted Activities section of the 2004 permit authorized the permittees to "implement a stormwater management program to reduce the contribution of pollutants in stormwater to the maximum extent practicable and to discharge stormwater to waters of the State."

The MS4 Sources Covered by this Permit are described as "all Existing and New Discharges of Storm Water from the [MS4]."

The relevant provisions of Schedule A.2 of the 2004 permit are substantively the same as the 1995 permit and require Gresham to do the following:

- Implement all applicable provisions of the Storm Water Management Plan.
- Reduce the discharge of pollutants from the MS4 to the maximum extent practicable.
- Effectively prohibit non-storm water discharges into the MS4.

Schedule D.2 of the 2004 permit contains a very detailed description of what a SWMP must contain and how SWMPs relate to the achievement of TMDLs.

2005 MS4 Permit

The 2005 MS4 Permit was issued after DEQ granted reconsideration of the 2004 MS4 Permit. The revisions that DEQ made to the 2004 permit as a result are detailed in the "City of Gresham, City of Fariview and Multnomah County National Pollutant Discharge Elimination System Permit Supplemental Permit Evaluation Report and Fact Sheet" dated March 7, 2005. Some of the changes include but are not limited to:

- Addition of a specific reference citation to the Stormwater Management Plan
- Addition of the compliance standard description for "maximum extent practicable"
- Addition of Tables B-1 and B-2 to summarize the minimum monitoring requirements
- Clarification of required SWMP elements and revision process
- Addition of elements within the public involvement requirements

2008 MS4 Permit Renewal Application

The 2008 permit renewal application is substantially similar to the previous permits and the proposed changes do not amount to a substantial modification. Gresham proposes to emphasize low impact development techniques, develop an inspection program for private water quality facilities, and to better manage and enhance the urban tree canopy.

SUBSTANTIAL MODIFICATION CRITERIA

Turning to the specific criteria of OAR 340-018-0050(2)(b)(B).

Will the permitted source or activity be expanded or use additional property?

The activities requested to be authorized by the 2008 MS4 permit renewal application are virtually identical to previous permits. All authorize Gresham to implement a Storm Water Management Plan to reduce the contribution of pollutants in storm water to the maximum extent practicable.

Further, the 1995, 2004 and 2005 permits identify all existing and new discharges of storm water from the Municipal Separate Storm Sewer System as sources covered by the permit. Since all expressly include new discharges of storm water in their scope, the existing permit does not expand the permitted source or activity. All clearly contemplate that new discharges will be added to the MS4 during the term of the permits. The addition of new discharges is an integral component of the MS4 process. The 2008 MS4 permit renewal application will authorize a continuation, rather than an expansion, of the activity authorized by the previous permits.

Does the 2008 MS4 permit renewal application involve a significant increase in discharge to state waters?

The DEQ evaluated this question in its Antidegradation Review for the 2004 permit and concluded the permit "is not expected to allow a discharge of a new or increased load beyond that presently allowed in the existing permit ***." The goal of the renewed permit is a net reduction in pollutant loadings over the five-year permit term."

Gresham made an assessment of the pollutant loads as part of the 2008 MS4 permit renewal application. Considering actual land uses and the City's extensive application of best management practices, the assessment concludes that the pollutant loads over the next permit term are expected to be lower than the loads permitted under the pervious permits.

The City has also created incentives for low impact development, and acted to remove barriers to these practices -- thereby encouraging installation of treatment facilities that reduce peak flows and volume as well as pollutants. In addition, the water quality treatment standards adopted for areas that will be annexed into the City prohibit development from increasing pollutant loads and flow intensity and volume. The renewal permit does not involve a significant increase in discharge to state waters or into the ground.

Does the 2008 MS4 permit renewal application involve the relocation of an outfall outside of the source property?

Since the Sources Covered by both the previous permits are identified as "all existing and new discharges of storm water" from the Municipal Separate Storm Sewer System, which is presumed to grow as development occurs, the permit renewal application does not involve the relocation of an outfall outside of the source property.

Gresham's MS4 permit renewal application does not request a substantial modification or intensification of currently permitted activity. Consequently, a LUCS, which is a determination of compatibility with the acknowledged comprehensive plan, is not required for the permit.

LAND USE COMPATIBILITY STATEMENT

As an alternative to the primary conclusion that the 2008 MS4 permit renewal application does not modify or intensify the permitted activities and thus no LUCS or other consideration of compliance with goals or comprehensive plans is required, and without waiving the right to invoke the exception under OAR 660-031-0040 and OAR 340-018-0050(2)(b), Gresham submits the attached LUCS.

CITY OF GRESHAM
LAND USE COMPATIBILITY STATEMENT (LUCS)

I. Introduction

The City of Gresham has applied for renewal of its National Pollutant Discharge Elimination System (NPDES) Discharge Permit or "MS4 permit". This permit would authorize the city, according to federal regulations, to: *"implement a storm water management program to reduce the contribution of pollutants in storm water to the maximum extent practicable (MEP), to address where applicable TMDL wasteload allocations, and to discharge storm water to waters of the state".*

Oregon law requires that state agency activities, such as issuance of a NPDES permit, be consistent with local comprehensive plans that have been "acknowledged" or approved by the state Land Conservation Development Commission (LCDC). This review is conducted by the local jurisdiction in the form a Land Use Compatibility Statement or "LUCS". If a local plan has not been acknowledged or approved by LCDC, then compliance with the Statewide Planning Goals must be demonstrated.

The Oregon Administrative Rules (OAR) classifies a NPDES permit as a Class B Permit. OAR 660-031-0026(2)(b)(B) states in regard to Class B permits and comprehensive plan compatibility findings that:

> *"The applicant must receive a land use approval from the affected local government. The affected local government must include a determination of compliance with the Statewide Planning Goals or compatibility with the acknowledged comprehensive plan which must be supported by written findings as required in ORS 215.416(6) or 227.173(2). Findings for an activity or use addressed by the acknowledged comprehensive plan in accordance with OAR 660-031-0020, may simply reference the specific plan policies, criteria, or standards which were relied upon in rendering the decision and state why the decision is justified based on the plan policies, criteria or standards."*

Gresham's comprehensive plan has been acknowledged by LCDC to be in compliance with the Statewide Planning Goals, including Goal 6 (Air, Water and Land Resources Quality) and Goal 11 (Public Facilities and Services). The city's plan is titled the "Gresham Community Development Plan". It consists of Volume 1 – Findings, Volume 2 – Policies, and Volume 3 – Community Development Code.

The comprehensive plan has a number of policies and standards that are relevant to stormwater management and NPDES permitting. They are found in Volumes 2 and 3 and are described in the following sections II and III of this LUCS.

II. Volume 2: Applicable Comprehensive Plan Policies

<u>10.232 Water Resources Quality</u>

The Water Resources chapter addresses the need to prevent pollution of the groundwater, streams and other water bodies and improve overall water quality. Those policies and action measures that relate to NPDES permitting and/or inter-jurisdictional coordination are the following:

> Policy #2: *"The City shall ensure through coordination with the Oregon Department of Environmental Quality, that existing and future land uses with the potential for water discharges comply with state and federal water quality standards."*
>
> Policy #3: *"The City shall establish and maintain water quality plans, regulations and standards consistent with federal, state and Metro laws and rules as necessary to protect surface and groundwater quality."*
>
> Action Measure #3: *"Periodically review and update the City's water quality related plans, policies, regulations and standards to ensure consistency with federal, state and regional requirements."*
>
> Action Measure #5: *"Work with other jurisdictions, agencies and advocacy groups to address water quality issues that have inter-jurisdictional impacts."*
>
> Action Measure #9: *"Ensure all City operations and public improvement projects are conducted in ways to protect water quality consistent with all applicable regulations."*

<u>Response</u>: In accordance with the federal Clean Water Act, the Oregon Department of Environmental Quality (DEQ) issued a Municipal National Pollutant Discharge Elimination System (NPDES) Stormwater Permit on September 7, 1995, to the City of Gresham and co-permittees, the City of Fairview, Multnomah County, and the Oregon Department of Transportation (ODOT). During the 2000 permit renewal submittal, ODOT separated from this permit and received its own individual permit. DEQ issued the second permit renewal in 2005. The NPDES permit requires implementation of a stormwater management plan, a monitoring program, and submittal of annual compliance reports for each year of the 5 year period. Gresham agreed to be the lead agency in this joint permit. However, each co-permittee is individually responsible for writing and implementing its own stormwater management plan.

The current NPDES permit submittal is a renewal of the 2005 permit. During preparation of the renewal application, the city consulted with DEQ and other jurisdictions regarding best management practices, and DEQ expectations. Both the process that the city followed to prepare the application and the focus of the application reflect those discussions.

The permit renewal application calls for revising the Best Management Practices (BMPs) or the actions needed to improve water quality. It is proposed that Gresham's stormwater management plan be amended to:

- Eliminate BMPs that have been completed and to focus actions on BMPs that are most effective at improving water quality and reducing pollutants in stormwater.
- Refine and adjust BMPs based on experience and information collected to date.
- Shift direction for some of the BMPs from program development to implementation (e.g. development standards for stormwater quality).
- Place additional emphasis on BMPs that facilitate stormwater surface infiltration (i.e., low impact development techniques).
- Develop a program to ensure the proper maintenance and function of privately-owned water quality facilities.
- Conduct additional monitoring activities in order to better characterize Gresham's stormwater and resulting benefits from structural BMP implementation.

The city's actions in this NPDES permit renewal are consistent with the above cited policies and action measures by: complying with federal NPDES regulations and permitting requirements; coordinating with Oregon DEQ; reviewing and updating its water quality BMPs and standards to ensure that its own actions and those of the private development sector continue to be consistent with NPDES regulations; and by working with other neighboring jurisdictions in the development of its stormwater management plan.

10.333 Stormwater Management System, Public Facilities and Services

The public facilities chapter of the plan requires that new development be supported by adequate public facilities. These include transportation access, water, sanitary sewage facilities and stormwater management facilities. Developers are required to provide needed public facilities to serve their sites and to extend public facilities so that there is a logical continuation of the City's street and utility systems. Section 10.333 of this chapter addresses the stormwater management element.

The following action measures from Section 10.333 relate to the NPDES permit renewal application:

> Action Measure #2: *"The City shall update its stormwater master plans periodically to proactively manage the stormwater system and to promote economic development in the City, while meeting state and federal environmental requirements. The master plans should include modeling pollutant loads to comply with applicable requirements."*
>
> Action Measure #7: *"The City will continue its NPDES Program and modify the program as necessary to continue meeting the program's permit requirements."*

Response: The City has developed basin-specific stormwater master plans as part of its management program for each of the City's four basins: West Gresham, Kelly Creek, Johnson Creek and Fairview Creek. The goal of these master plans is to outline a City strategy intended to proactively address stormwater capacity (e.g., flooding) and water quality issues. The City has updated these Master Plans to reflect changes in land use, regulatory climates, and infrastructure requirements.

The primary goal of developing each water quality model was to aid in identifying locations of elevated peak concentrations and total loads. For the water quality analysis, the sub-basins were grouped into "water quality analysis" sites. These sites were selected by using outfalls to creeks as the downstream location and then identifying the sub-basin areas that contribute to the outfall runoff. The water quality analysis sites contain one or more of the delineated sub-basins.

All models were calibrated using measured flows obtained from in-field monitoring of water quality and flood event design storms in order to increase the accuracy and thereby the confidence model results.

An XPSWMM model was used to route select pollutants through the storm system and main stem of the creeks. The modeling allowed pollutant concentrations to be specified for each land use type. The model then simulates the calibrated rainfall storm event that "washes" the pollutants of the impervious areas and conveys them through the storm system.

The model-simulated water quality concentrations were then used to identify water quality analysis sites that had potential water quality problems. All model-simulated results were then compared to water quality data sampled at various key locations of the stormwater system.

An iterative approach was used to adjust the mean concentration values for each land use and model input and then compare the model results with the monitoring data. The Event Mean Concentrations resulting from the calibration process where then summarized for use in developing Water Quality Treatment alternative analyses & Capital Improvement Projects.

The current NPDES permit renewal application proposes changes or updates to both the stormwater management plan and the stormwater monitoring plan. These changes support the above two action measures because they will improve the overall effectiveness of the stormwater management plan, as well as the ability to evaluate the plan and will keep the city in continued compliance with NPDES permit requirements.

With respect to water quality monitoring, Gresham has spent considerable time and finances monitoring the pollution level of local water bodies since the early 1990's. Monitoring enables the city to identify major pollutant loads in its streams and to modify or adjust its stormwater management plan accordingly so that it is more effective in reducing those loads and meet NPDES monitoring requirements.

The goal of the monitoring program proposed in the city's NPDES permit renewal application is to monitor the reduction of pollutants to the maximum extent practicable and to assess the effectiveness of prohibiting non-storm water discharges in the Municipal Separate Storm Sewer System. Objectives to meet these goals include redefining and focusing the monitoring to:

- Better characterize stormwater discharges to receiving waterbodies
- Identify problem drainages, pollutant sources, and illicit connections
- Evaluate the effectiveness of the BMPs, when applicable, especially source controls

The monitoring plan consists of seven elements that include: Water sampling during the "first flush" to better characterize the kinds and quantities of stormwater pollutants that occur during the first rainfall following an extended dry period; identifying illegal stream outfall connections; monitoring erosion/sedimentation at construction sites; taking additional water samples from those streams with higher than normal pollutant loads; and sampling for various pesticides in streams. The augmentation of the monitoring plan to enhance these elements will ultimately provide the city with more useful information for making its stormwater treatment decisions, including making any necessary changes to the BMPs in the future.

III. Volume 3: Community Development Code (Development Standards)

The NPDES permit would authorize the city to implement a stormwater management plan and to discharge stormwater to waters of the state. These activities are allowed uses and are compatible with the city's land use/development regulations. Water quality or detention facilities as well as outfall pipes are considered minor utilities by the development code and are allowed in all zoning (plan) districts. They are classified as Type 1 Community Services and can be approved administratively. If such facilities are proposed as part of or accessory to a development proposal, such as a subdivision development, they are reviewed at the time the other elements of the development application are reviewed and permitted.

The development code includes specific standards that are used in reviewing the design of proposed stormwater quality facilities. These are found in Section 9.0500 of the code, which is titled: "Grading and Drainage and Stormwater Quality Control Requirements". This section lists city requirements for specific data that must be shown on the design plans for these facilities, what methods are acceptable to the city for treating stormwater drainage, the performance standards that the facilities must meet, and maintenance/inspection requirements. In addition, Section 9.0500 includes standards for preventing or minimizing soil erosion and controlling sediment on construction sites.

If a stormwater treatment facility is proposed to be located in certain locations, such as near a stream or wetland, a particular environmental overlay permit may also be needed. These environmental overlays are found in Article V of Volume 3 of the comprehensive plan and consist of the following:

<u>WQRA, Water Quality Resource Area Overlay (Section 5.0600)</u> – The overlay is based on the Metro Title 3 Water Quality Resource Area Protection Standards. The WQRA requires new development to be set back a certain distance, ranging from 50 to 200 ft., from a stream or wetland. The purpose is to leave a vegetated buffer between development and those waterbodies so surface water runoff can be filtered and cooled before it reaches them. Public facilities such as stormwater treatment facilities can be permitted to be located within the WQRA if certain standards and approval criteria can be met. WQRA permits are processed as a Type II permit which entails staff review and approval.

<u>NR, Natural Resource Overlay (Section 5.0400)</u> – This is Gresham's "Goal 5" overlay. Its purpose is to protect and conserve valuable wetlands, riparian areas, upland wildlife habitats and

important ecological areas while permitting appropriate development activities when they can be carried out in a sensitive manner with minimal impacts on identified natural resource values. The precise location of the NR boundary is determined at the time a development action is proposed based on the findings of the environmental report that an applicant is required to provide by the overlay. The boundary not only encompasses the NR site, as identified in the report, but also adjacent land (called the "transition area") lying within 25 ft. of the NR site. Any development proposed to be located within the NR site or its transitional area, such as a stormwater treatment facility, would require a demonstration that the applicable standards are met and the issuance of a NR permit. If the development would be located within the transition area a Type II NR permit is needed, and if located within the NR site itself, a Type III permit is needed. The later requires review and approval of the application at a public hearing.

FP, Flood Plain Overlay (Section 5.0100) – This overlay is intended to protect the floodwaters carrying capacity of the 100 year flood plains of Gresham's major streams. These floodplains are delineated on the federal Flood Emergency Management Agency (FEMA) maps that have been issued for the city. The development standards found in this overlay are those required by FEMA for floodplains as well as by Metro Title 3 for floodplain areas. One of the key standards calls for "balanced cut and fill". This means that any fill or structure that is placed below the 100 year flood elevation must be compensated by the removal of an equal amount of soil. Stormwater facilities can be located within the floodplain if these standards are met and with the issuance of a Type II FP overlay permit.

CONCLUSION

Gresham's acknowledged comprehensive plan has provisions that are relevant to stormwater management and NPDES permitting. Based on the above findings, it is found that the city's application to renew its NPDES permit is compatible with these provisions.

Appendix B

2014 TMDL Pollutant Load Reduction Evaluation

TMDL Pollutant Load Reduction Evaluation

City of Gresham
October 2014

1 Introduction

The following report is being submitted to DEQ to meet the TMDL Pollutant load Reduction Evaluation requirement specified in NPDES MS4 permit Schedule D.3.c.

TMDL Pollutant load Reduction Evaluation: progress towards reducing TMDL pollutant loads must be evaluated by the co-permittee through the use of a pollutant load reduction empirical model, water quality status and trend analysis, and other appropriate qualitative or quantitative evaluation approaches identified by the co-permittee. The results of the TMDL pollutant load reduction evaluation must be described in a report and submitted to the Department by November 1, 2014. The report must contain 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. The difference between these two is the pollutant load reduction.*
- *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 waterbodies with the permittee's jurisdictional area with an approved TMDL. If sufficient data to conduct a water quality trend analysis in unavailable for a receiving waterbody, the permittee must describe the data limitations. The collection of sufficient data must be prioritized and reflected as part of the monitoring project/task proposal required in Schedule B.6.d.*
- *viii.* *A narrative summarizing progress towards the applicable TMDL WLAs and existing TMDL benchmarks, if applicable. If the co-permittee estimates that an existing TMDL benchmark was not achieved during the permit term, the co-permittee must apply their adaptive management process to reassess the SWMP and current BMP implementation in order to address TMDL pollutant load reduction over the next permit term. The results of this reassessment must be submitted with the permit renewal application package described in Schedule B.6; and,*
- *ix.* *If the co-permittee estimates that TMDL WLAs are achieved with existing BMP implementation, the permittee must provide a statement supporting this conclusion.*

2 Method and Rationale

2.1 Model Use and Comparability

The spreadsheet model used to calculate the pollutant load reduction benchmarks in 2008[1] was updated and used for this Pollutant Load Reduction Evaluation. The 2008 benchmark results and documentation submitted to DEQ is included with this document as **Appendix 1**. The 2008 document estimated pollutant load reduction benchmarks that the City committed to making over a five year period (by 2013). This document evaluates the pollutant load reduction estimates with and without BMPs being implemented within the City of Gresham in 2013 compared to the projected reductions the City committed to making by the end of the 5-year permit term (calculated as 2013) in the 2008 benchmark document. For consistency, the 2013 pollutant reduction estimates use the same model assumptions as 2008, with the exception of changes/updates noted below.

2.2 Land Use

Table 1 shows the land use acres by watershed within the City. There are some slight differences in land use totals between 2008 and 2013, primarily due to:
1) Creating a new land use category – natural areas – which had previously been accounted for in the parks/open space or undeveloped/vacant land use, and
2) Including some acres as MS4 area that were previously categorized as draining to Underground Injection Control devices (UICs).

Table 1. Land use acres used in 2013 pollutant load calculations. Acres which drain fully to UICs and have no connection to MS4 system are not included in land use values.

Land Use	**Columbia Slough***	**Fairview**	**Johnson Creek**	**Kelly/Beaver Creek**
Agriculture	0	209	9	2
Industrial	673	337	139	29
Commercial	336	361	395	477
Open Space	64	89	181	63
Undeveloped	364	132	714	240
Residential	458	818	2,421	1,515
Multi-family Res	181	193	206	311
Natural Areas	39	133	1,362	227
MS4 Total	**2,116**	**2,271**	**5,426**	**2,864**
UIC Total	1,664	474	74	25
Total Acres	3,780	2,745	5,500	2,889

*Values shown for Columbia Slough do not included Fairview Creek, however, these acres were included in all Columbia Slough pollutant load calculations.

[1] The original benchmark document was submitted to DEQ in 2008 with the Permit Renewal Submittal Application, but values were revised in 2010 based on more realistic projections of development and BMP implementation expected to occur over the 5-year permit term (by 2013). In this document, that 2010 update is referred to as the 2008 benchmark document.

NATURAL AREAS:
After evaluating BMP coverage area within some areas of the City following calculation of the benchmarks in 2008, Gresham realized that some watersheds, like Johnson Creek, have large parcels of protected natural area that function differently than parks and open spaces utilized for recreational purposes – the primary difference being that these areas have natural vegetation and no impervious area. In order to more accurately reflect the function of natural areas, these areas were delineated separately and given an impervious percentage of 0% (which results in reduced runoff and therefore load based on the equation used to calculate runoff coefficients).

UIC/MS4:
As part of the Systemwide Assessment required by the WPCF permit that DEQ issued to the City of Gresham for operation of 1,100 drywells (which are classified as Underground Injection Control devices, UICs). As such, the City delineated several areas that use UICs for stormwater management, but also have an overflow that drains to the MS4 system. As part of this delineation process, 2,236 acres are UIC only and 276 acres were identified as having a combination UIC/MS4 system. The difference between the combination system and the rest of the UIC area is that overflow may occur and has the potential to enter surface water via the MS4 system. So these acres were included in the model, and assumed to function like other infiltration-based BMPs (e.g. pervious pavement, rain gardens) in that they infiltrate 100% of the design storm (which is 80% of the annual rainfall) – so there is some additional pollutant load generated by these areas for the 20% of the annual rainfall assumed to not be treated by the BMP.

2.3 Best Management Practices

Since the pollutant load reduction benchmarks were calculated and submitted to DEQ, the City has continued to improve the accuracy of the BMP inventory within the City, including corrections and updates to facility types contained in GIS compared to what is known about facilities based on public and private facility inspections.

2.3.1 Structural BMPs

In the benchmarks submitted to DEQ in 2008 (revised in 2010, see **Appendix 1**), only 9 structural BMPs were considered: 1) Hydrodynamic Devices, 2) Filters, 3) Dry Pond, 4) Wet Pond, 5) Swale, 6) Wetlands, 7) Sedimentation Manholes, and the City of Gresham also included two unique BMPs – 8) Regional Facilities and 9) the Fujitsu Ponds. The City also accounted for areas where residential downspouts had been disconnected to allow roof runoff to infiltrate into areas deemed suitable for infiltration. Areas of the City draining to drywells (UICs) were omitted from the modeled area, with the exception of the UIC/MS4 area mentioned under 2.2 (Land Use).

In addition to the structural BMPs modeled previously, the City also included green infrastructure. While some of this had been constructed prior to the 2008 benchmark calculations, the treatment areas were not fully delineated in GIS at the time. Green infrastructure BMPs modeled for 2013 include ecoroofs, rain gardens (both lined and infiltration) and pervious pavement. All infiltration-based BMPs (UICs, pervious pavement, rain gardens and downspout disconnection) were lumped together into a single category that was assumed to infiltrate all of the 80% annual rainfall design storm. Planter-style rain gardens installed in less porous soils, or those lined due to steep slopes or contamination, were assumed to only have a 30% volume reduction, and ecoroofs were assumed to have a 50% volume reduction.

2.3.2 BMPs in Series

In preparation for the next permit renewal submittal, the City has embarked upon an extensive QA/QC review of its GIS stormwater asset data. As part of the improvements in accuracy to the GIS data related to BMP treatment areas, as-built plans were reviewed and treatment areas were relabeled as "combination" whenever the same drainage area is treated by two or more BMPs. For example, many businesses or residential subdivisions install proprietary filters to meet the City's water quality standard, and then install a dry detention pond to meet the detention standard. In the 2008 benchmark calculations, a decision was made to select a single BMP to model for areas treated by multiple BMPs. This decision usually resulted in taking credit for BMPs that are effective at either reducing pollutant concentrations or reducing volume. In order to better account for both the concentration and volume reduction from some of these BMPs in series, the City decided to create a few hybrid BMPs categories.

Table 2. Categories used in the 2014 TMDL Benchmark Modeling.

Category	BMP Effluent	Volume Reduction
Filter + Dry Pond	Filter	Dry Pond (23%)
Filter + Wet Pond	Filter	Wet Pond (5%)
Filter + Swale	Filter	Swale (29%)
Regional + Filter	Filter for Bacteria only	Both (0%)
Regional + Dry Pond	Regional Facility	Dry Pond (23%)
Regional + Wet Pond	Regional Facility	Wet Pond (5%)
Regional + Swale	Regional Facility	Swale (29%)

The main benefit of adding in these hybrid categories is that it provides more accurate pollutant load reduction estimates by accounting for volume reduction coming from structural BMPs that do not provide the same pollutant concentration reduction associated with filters and regional facilities.

2.3.3 Non-Structural BMPs

When the 2008 benchmarks were calculated, two non-structural BMPs were accounted for: 1) areas of the City receiving weekly street sweeping were assumed to have a 10% reduction in the pollutant concentrations, and 2) estimates were made for TSS reductions due to improvements in the City's erosion inspection program using assumptions based on the universal soil loss equation. The City continues to operate a robust erosion prevention and sediment control (EPSC) program, but chose to not try to account for those reductions in the current pollutant load calculations. While the City continues to operate a robust EPSC program, the estimated load reductions are negligible and easier to consider with other nonstructural BMPs that are likely reducing loads to somewhere between the mean and lower value of the ranges displayed in **Figures 1** through **9**.

The City still continues to sweep all streets in the City ten times per year, but discontinued the weekly street sweeping program that used to take place in a few areas of the City – so no credit was taken for reductions due to street sweeping. The City also continues to remove sediment from 10 miles of pipe and cleans all catch basins in the City 1-2 times per year, but does not take credit for these BMPs, since some level of street sweeping, catch basin and pipe cleaning was all taking place prior to 1998 when the original ACWA land use event mean concentrations used in the benchmark calculations was collected.

3 Pollutant Load Reduction Results

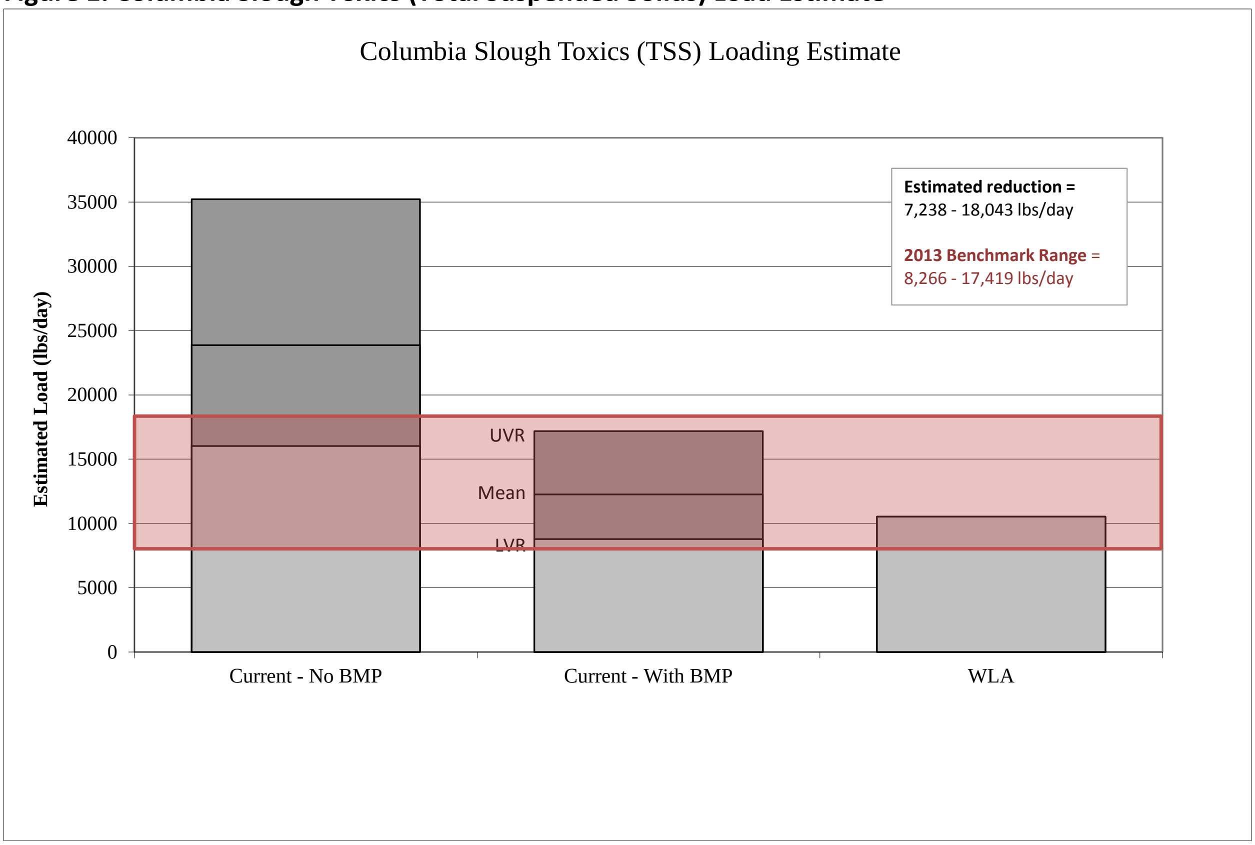
The following figures show the pollutant loading estimates with and without BMP implementation to the applicable TMDL WLA. Included on each figure is the 2013 pollutant load reduction benchmark the

City of Gresham committed to meeting. The benchmark was submitted as a range, which was based on the difference between the upper and lower 95% confidence intervals calculated for the load estimates with and without BMPs. Each of the following graphs shows the current estimated pollutant reduction along with the benchmark range, and also displays the benchmark range on each graph as a reddish box. The red "target" box shows the benchmark range subtracted from the upper and lower range of the current load with no BMPs; this is provided as a visual way to represent the current load estimate compared to the pollutant load reduction commitment made at the beginning of the permit term.

3.1 Columbia Slough Toxics (TSS)

Figure 1 shows the current pollutant loading estimate for TSS in Columbia Slough. Pollutant loads and benchmark values are shown with the mean, as well as an upper value range (UVR) and lower value range (LVR), which are based on running the model using 95% confidence intervals on the land use event mean concentration data. The load reduction and the benchmark ranges are the difference between the UVR and LVR estimates for loads with and without BMPs.

Figure 1. Columbia Slough Toxics (Total Suspended Solids) Load Estimate

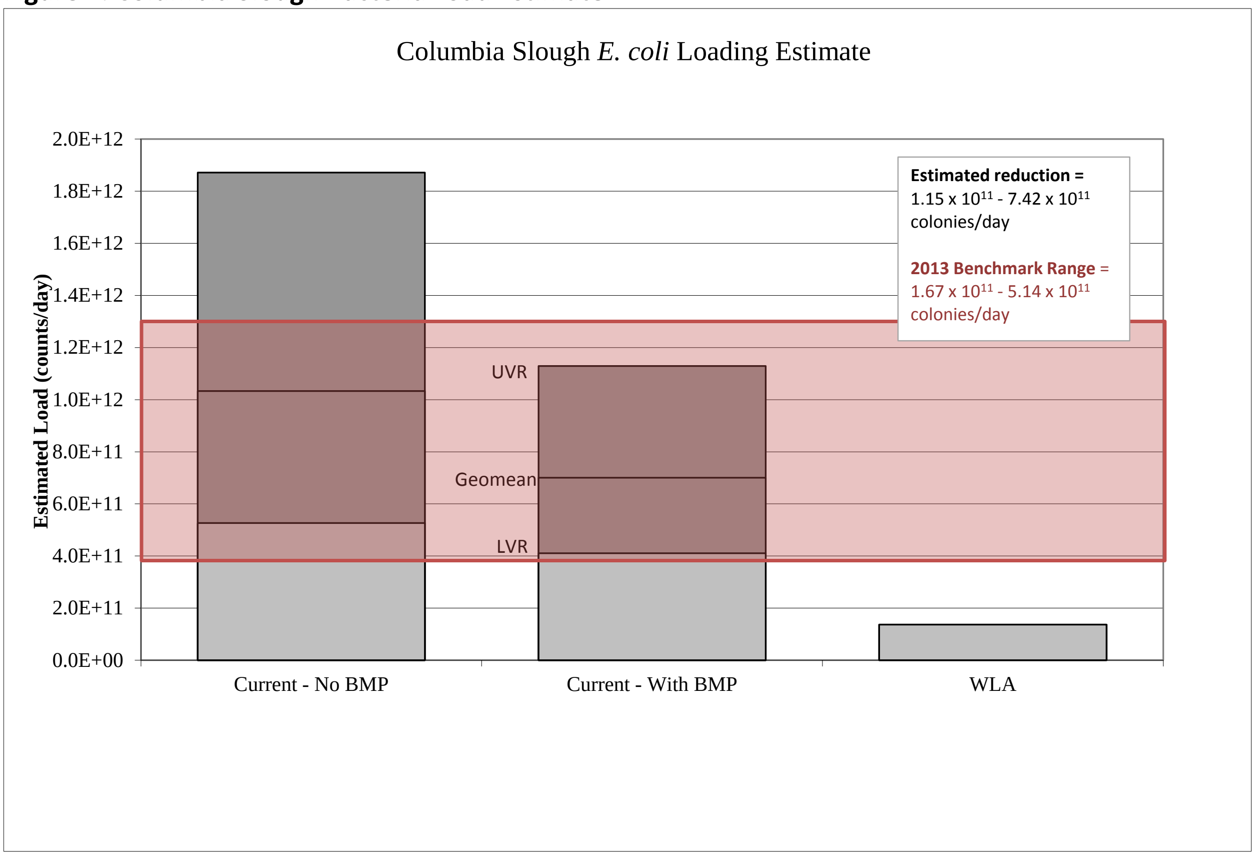


The estimated pollutant load reduction under current conditions with and without structural BMPs is 7,238 – 18,043 lbs/day. The pollutant load reduction benchmark established for the permit term is 8,266 – 17,419 lbs/day. The current pollutant load estimate is within the benchmark reduction target for the permit term, and the lower range of the estimated load with BMPs suggests that it could be meeting the wasteload allocation (WLA).

3.2 Columbia Slough Bacteria

Figure 2 shows the current pollutant loading estimate for *E. coli* in Columbia Slough. Pollutant loads and benchmark values are shown with the geomean, as well as an upper value range (UVR) and lower value range (LVR), which are based on running the model using 95% confidence intervals on the land use event mean concentration data. The load reduction and the benchmark ranges are the difference between the UVR and LVR estimates for loads with and without BMPs.

Figure 2. Columbia Slough Bacteria Load Estimate

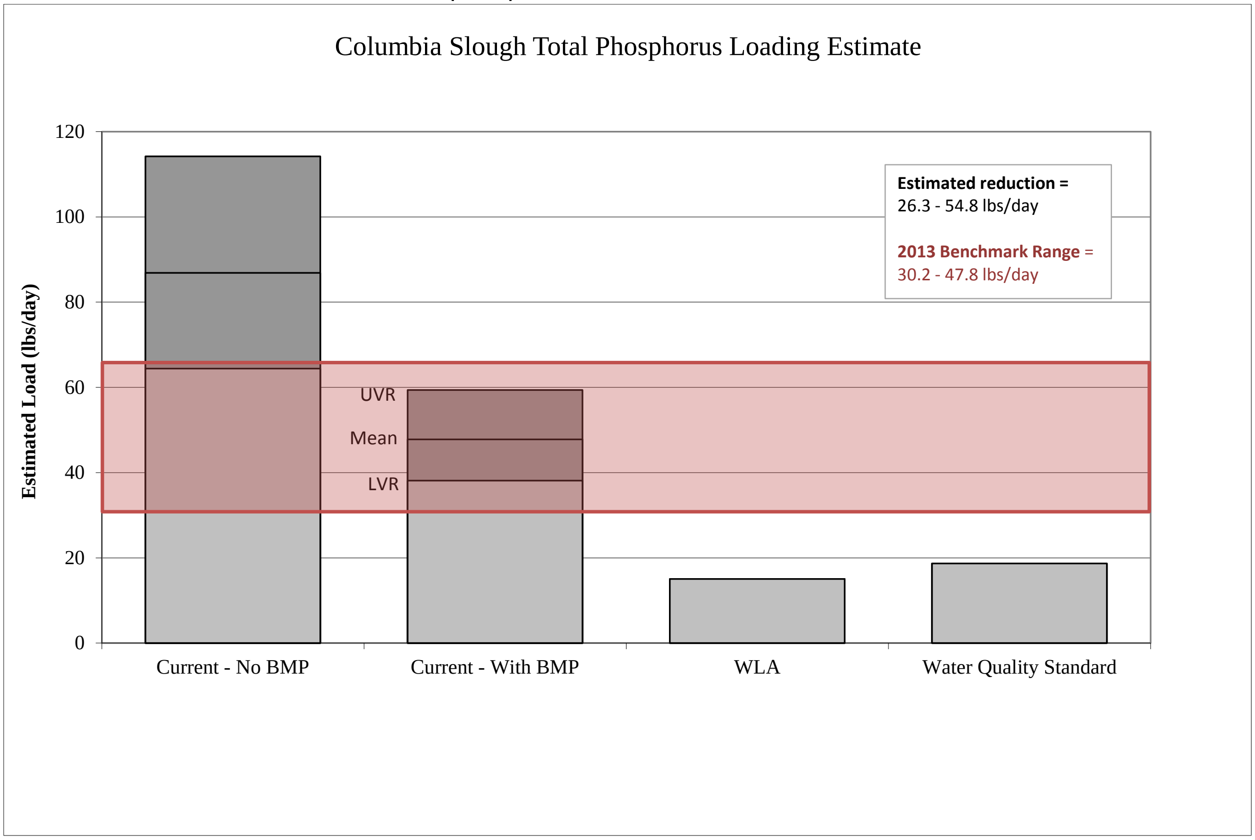


The estimated pollutant load reduction under current conditions with and without structural BMPs is $1.15 \times 10^{11} – 7.42 \times 10^{11}$ colonies/day. The pollutant load reduction benchmark established for the permit term is $1.67 \times 10^{11} – 5.14 \times 10^{11}$ colonies/day. The current pollutant load estimate is within the benchmark reduction target for the permit term, although the estimated load does not indicate that the wasteload allocation (WLA) is yet being achieved.

3.3 Columbia Slough Total Phosphorus

Figure 3 shows the current pollutant loading estimate for total phosphorus in Columbia Slough. Pollutant loads and benchmark values are shown with the mean, as well as an upper value range (UVR) and lower value range (LVR), which are based on running the model using 95% confidence intervals on the land use event mean concentration data. The load reduction and the benchmark ranges are the difference between the UVR and LVR estimates for loads with and without BMPs.

Figure 3. Columbia Slough Total Phosphorus Load Estimate. Because the WLA for total phosphorus in the Slough is more stringent than the water quality standard, an additional bar is shown for what the load would be if stormwater met the phosphorus WQ standard.

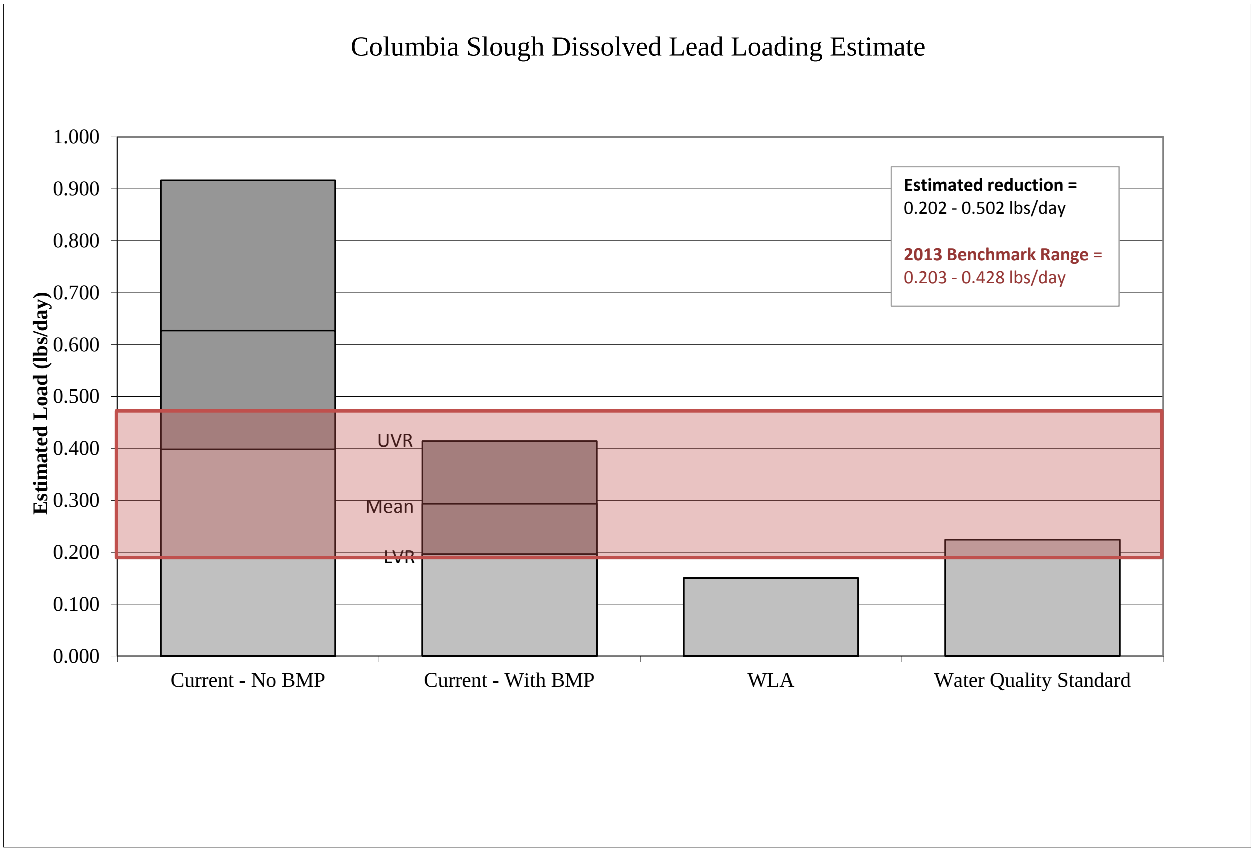


The estimated pollutant load reduction under current conditions with and without structural BMPs is 26.3 – 54.8 lbs/day. The pollutant load reduction benchmark established for the permit term is 30.2 – 47.8 lbs/day. The current pollutant load estimate is within the benchmark reduction target for the permit term, although the estimated load does not indicate that the wasteload allocation (WLA) is yet being achieved.

3.4 Columbia Slough Dissolved Lead

Figure 4 shows the current pollutant loading estimate for dissolved lead in Columbia Slough. Pollutant loads and benchmark values are shown with the mean, as well as an upper value range (UVR) and lower value range (LVR), which are based on running the model using 95% confidence intervals on the land use event mean concentration data. The load reduction and the benchmark ranges are the difference between the UVR and LVR estimates for loads with and without BMPs.

Figure 4. Columbia Slough Dissolved Lead Load Estimate. Because the WLA for dissolved lead in the Slough is more stringent than the water quality standard, an additional bar is shown for what the load would be if stormwater met the WQ standard.

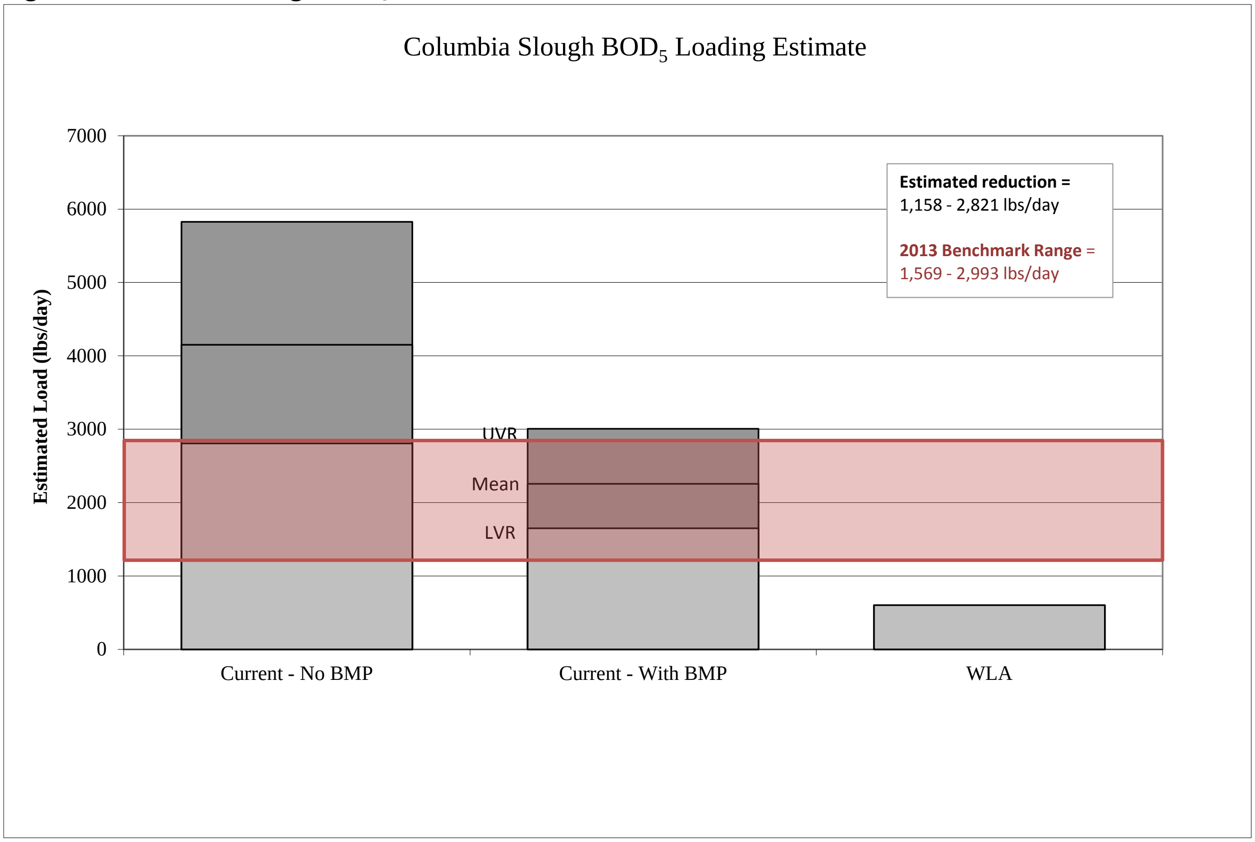


The estimated pollutant load reduction under current conditions with and without structural BMPs is 0.202 – 0.502 lbs/day. The pollutant load reduction benchmark established for the permit term is 0.203 – 0.428 lbs/day. The current pollutant load estimate is within the benchmark reduction target for the permit term, although the estimated load does not indicate that the wasteload allocation (WLA) is yet being achieved. The lower end of estimated load with BMPs indicates that the load could be meeting the water quality standard.

3.5 Columbia Slough BOD_5

Figure 5 shows the current pollutant loading estimate for BOD_5 in Columbia Slough. Pollutant loads and benchmark values are shown with the mean, as well as an upper value range (UVR) and lower value range (LVR), which are based on running the model using 95% confidence intervals on the land use event mean concentration data. The load reduction and the benchmark ranges are the difference between the UVR and LVR estimates for loads with and without BMPs.

Figure 5. Columbia Slough BOD_5 Load Estimate

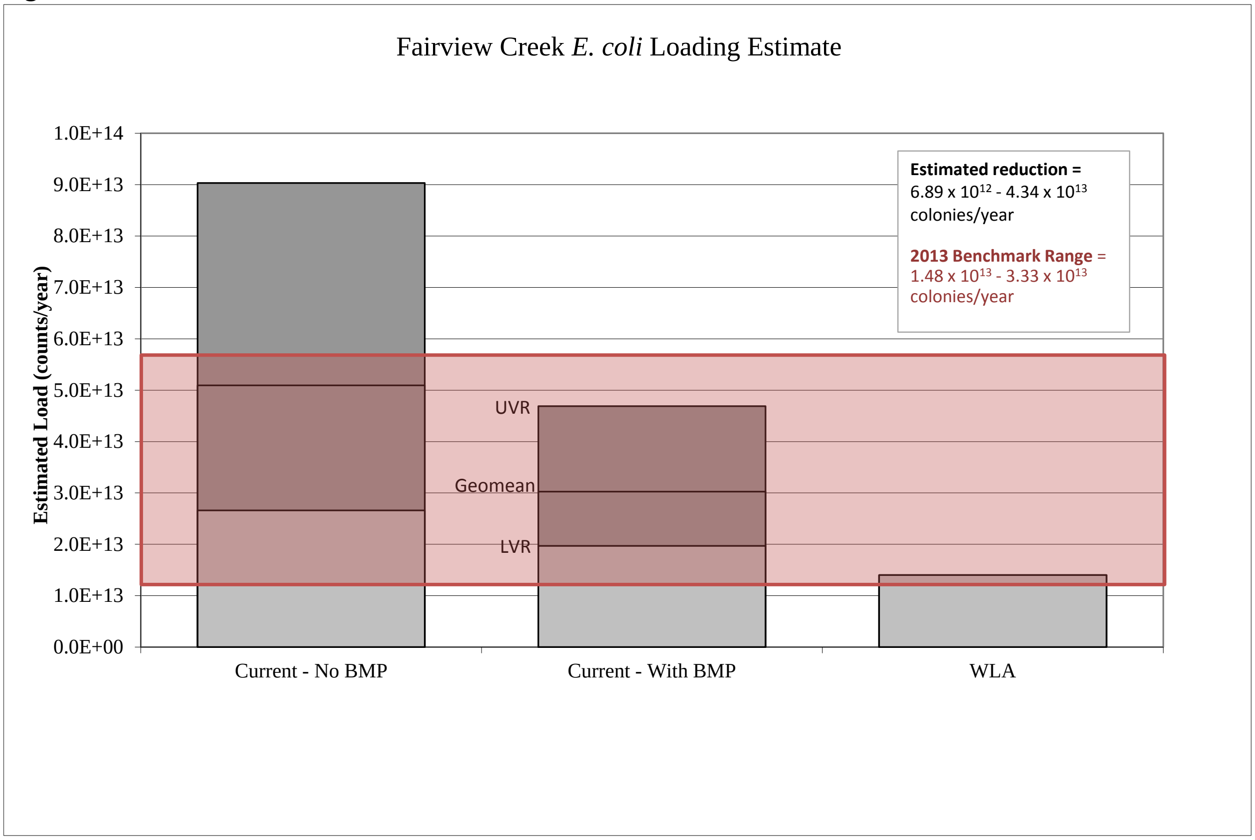


The estimated pollutant load reduction under current conditions with and without structural BMPs is 1,158 – 2,821 lbs/day. The pollutant load reduction benchmark established for the permit term is 1,569 – 2,993 lbs/day. The current pollutant load estimate is within the benchmark reduction target for the permit term, although the estimated load does not indicate that the wasteload allocation (WLA) is yet being achieved.

3.6 Fairview Creek Bacteria

Figure 6 shows the current pollutant loading estimate for *E. coli* in Fairview Creek. Pollutant loads and benchmark values are shown with the geomean, as well as an upper value range (UVR) and lower value range (LVR), which are based on running the model using 95% confidence intervals on the land use event mean concentration data. The load reduction and the benchmark ranges are the difference between the UVR and LVR estimates for loads with and without BMPs.

Figure 6. Fairview Creek Bacteria Load Estimate

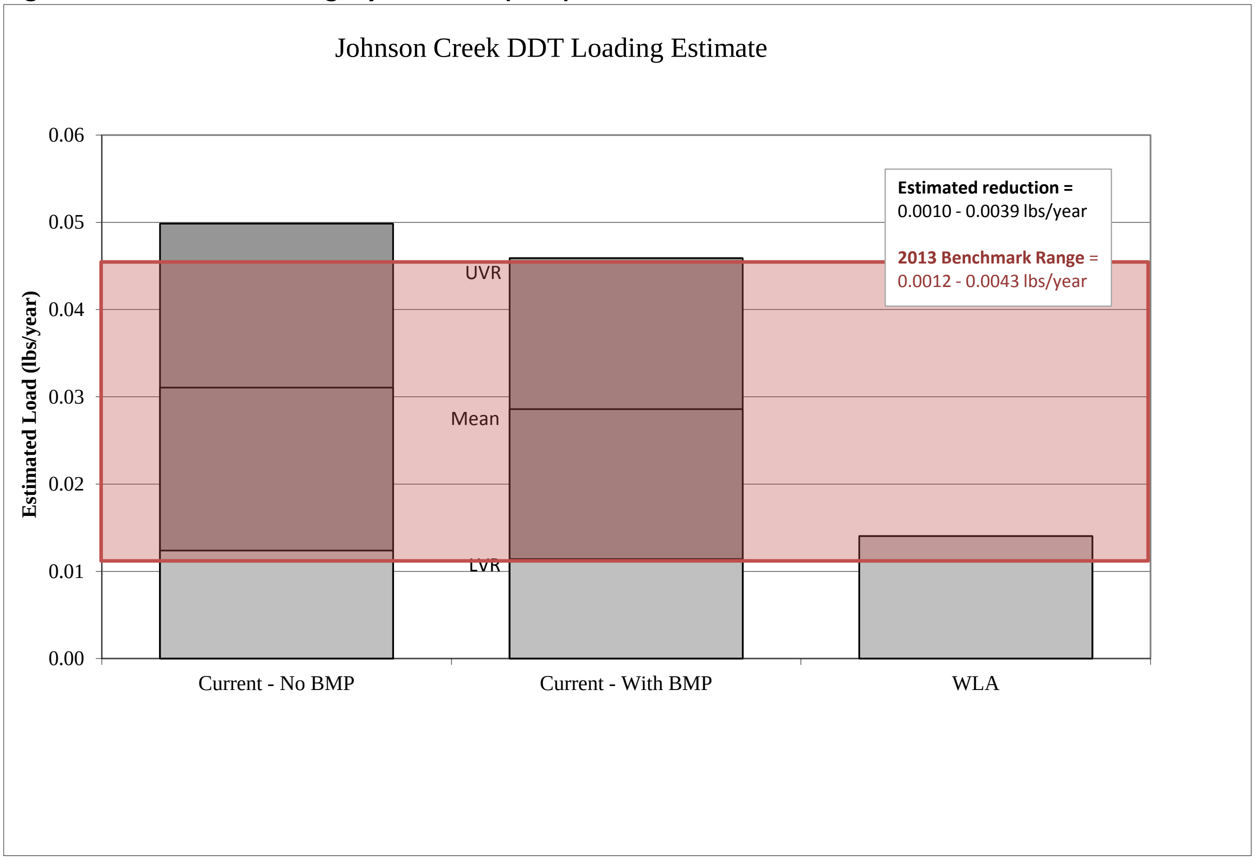


The estimated pollutant load reduction under current conditions with and without structural BMPs is $6.89 \times 10^{12} – 4.34 \times 10^{13}$ colonies/year. The pollutant load reduction benchmark established for the permit term is $1.48 \times 10^{13} – 3.33 \times 10^{13}$ colonies/year. The current pollutant load estimate is within the benchmark reduction target for the permit term, although the estimated load does not indicate that the wasteload allocation (WLA) is yet being achieved.

3.7 Johnson Creek DDT/Dieldrin

Figure 7 shows the current pollutant loading estimate for DDT in Johnson Creek. Pollutant loads and benchmark values are shown with the mean, as well as an upper value range (UVR) and lower value range (LVR), which are based on running the model using 95% confidence intervals on the land use event mean concentration data. The load reduction and the benchmark ranges are the difference between the UVR and LVR estimates for loads with and without BMPs.

Figure 7. **Johnson Creek Legacy Pesticide (DDT) Load Estimate**

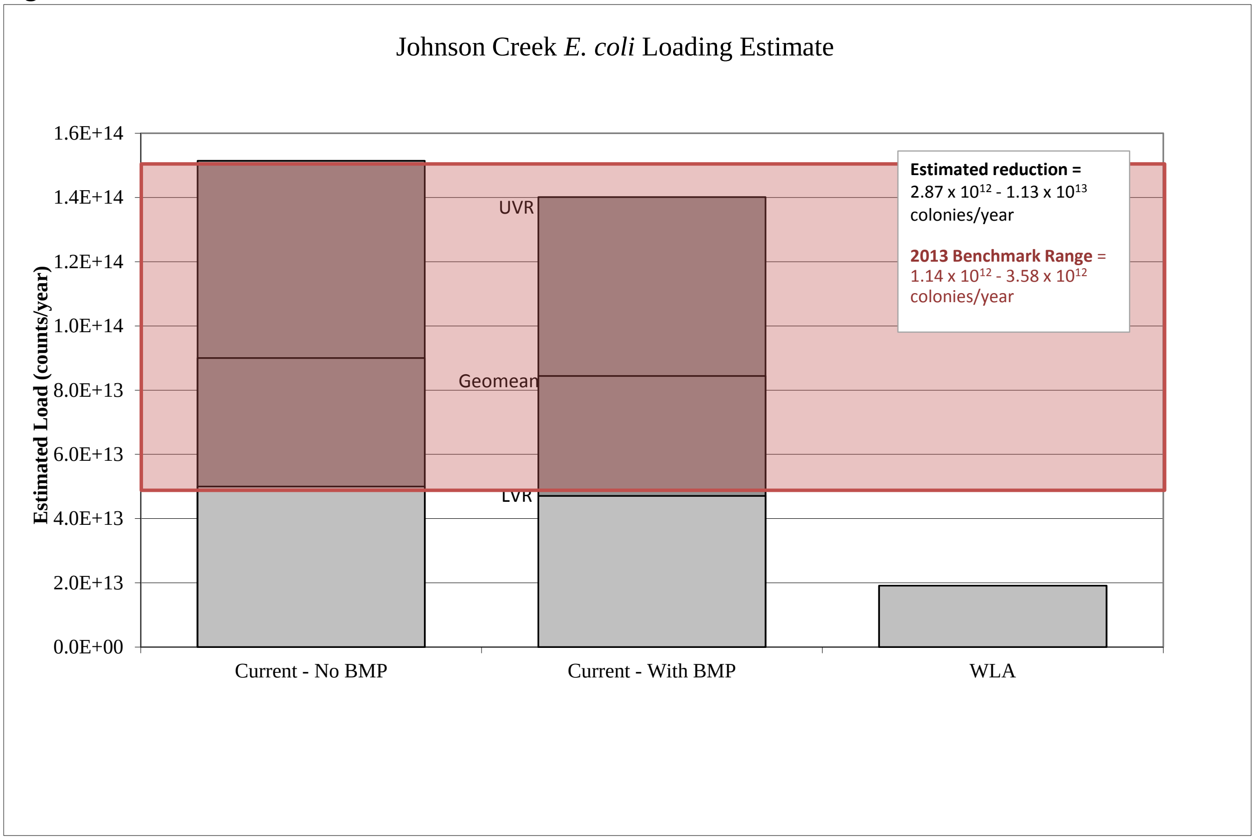


The estimated pollutant load reduction under current conditions with and without structural BMPs is 0.0010 – 0.0039 lbs/year. The pollutant load reduction benchmark established for the permit term is 0.0012 – 0.0043 lbs/year. The current pollutant load estimate is within the benchmark reduction target for the permit term, and the lower range of the estimated load with BMPs suggests that it could be meeting the wasteload allocation (WLA).

3.8 Johnson Creek Bacteria

Figure 8 shows the current pollutant loading estimate for *E. coli* in Johnson Creek. Pollutant loads and benchmark values are shown with the geomean, as well as an upper value range (UVR) and lower value range (LVR), which are based on running the model using 95% confidence intervals on the land use event mean concentration data. The load reduction and the benchmark ranges are the difference between the UVR and LVR estimates for loads with and without BMPs.

Figure 8. Johnson Creek Bacteria Load Estimate

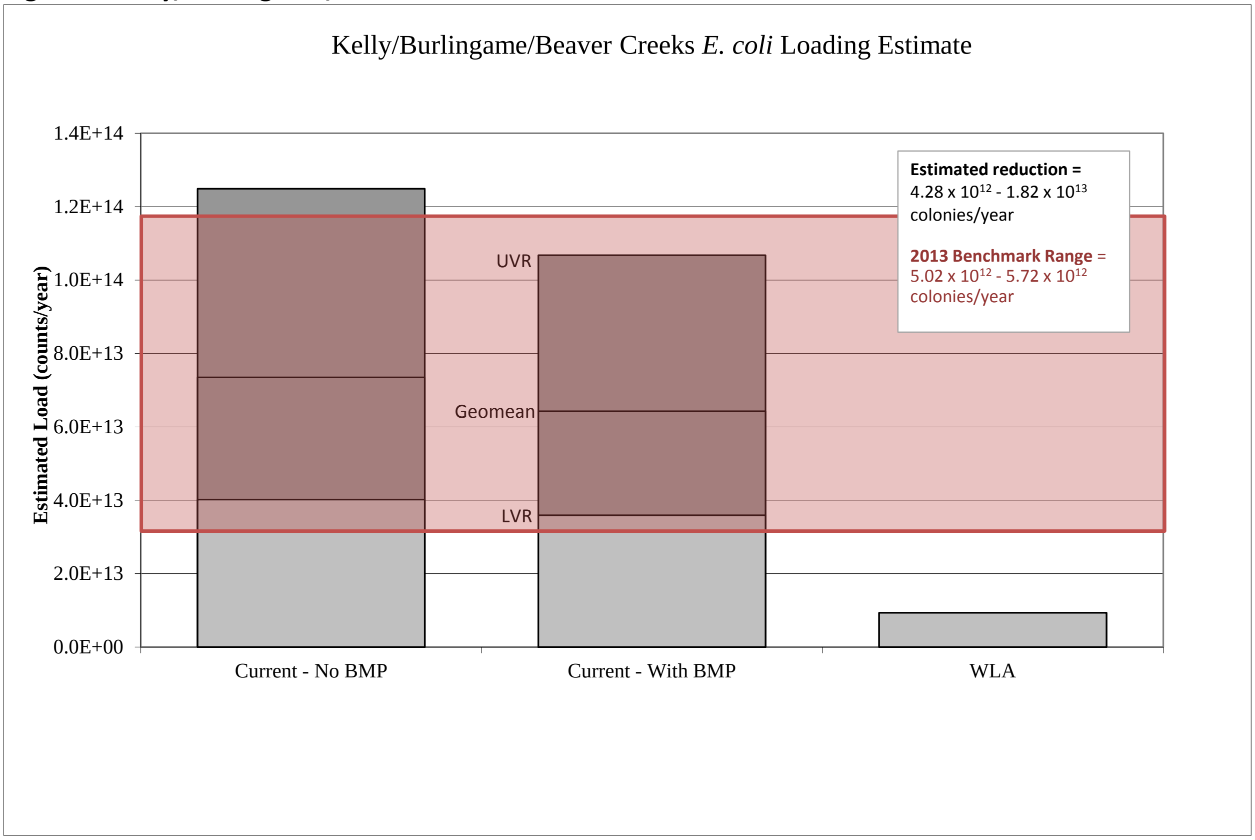


The estimated pollutant load reduction under current conditions with and without structural BMPs is $2.87 \times 10^{12} - 1.13 \times 10^{13}$ colonies/year. The pollutant load reduction benchmark established for the permit term is $1.14 \times 10^{12} - 3.58 \times 10^{12}$ colonies/year. The current pollutant load estimate is within the benchmark reduction target for the permit term, although the estimated load does not indicate that the wasteload allocation (WLA) is yet being achieved.

3.9 Kelly/Burlingame/Beaver Bacteria

Figure 9 shows the current pollutant loading estimate for *E. coli* in Kelly/Burlingame/Beaver Creeks. Pollutant loads and benchmark values are shown with the geomean, as well as an upper value range (UVR) and lower value range (LVR), which are based on running the model using 95% confidence intervals on the land use event mean concentration data. The load reduction and the benchmark ranges are the difference between the UVR and LVR estimates for loads with and without BMPs.

Figure 9. **Kelly/Burlingame/Beaver Creek Bacteria Load Estimate**



The estimated pollutant load reduction under current conditions with and without structural BMPs is $4.28 \times 10^{12} - 1.82 \times 10^{13}$ colonies/year. The pollutant load reduction benchmark established for the permit term is $5.02 \times 10^{12} - 5.72 \times 10^{12}$ colonies/year. The current pollutant load estimate is within the benchmark reduction target for the permit term, although the estimated load does not indicate that the wasteload allocation (WLA) is yet being achieved.

4 Water Quality Trend Analysis

This trend analysis fulfills NPDES permit requirement Schedule D.3.c.vii: *A water quality trend analysis, as sufficient data are available, and the relationship to stormwater discharges for receiving waterbodies with the permittee's jurisdictional area with an approved TMDL.*

The City of Gresham used the same trend analysis method submitted to DEQ in 2008 as part of the Permit Renewal Submittal package (see **Appendix 2**). The analysis used the non-parametric Seasonal Kendall-Theil regression method to determine whether data at long-term in-stream monitoring locations were showing an increasing or decreasing trend, and whether that trend was statistically significant. For the current analysis, data collected from 1999 through 2014 were evaluated for the upstream and downstream monitoring locations in Fairview Creek (**Table 2**), Johnson Creek (**Table 4**) and Kelly Creek (**Table 5**), as well as the single location within Fairview Lake (**Table 3**).

Table 2. **Trend summary for Fairview Creek.** Gresham has an IGA with Portland for collection of data on Slough, so only presenting data for the Fairview Creek portion of that watershed.

	FCI0 (downstream)					FCI1 (upstream)				
Constituent	Over-all	Sum-mer	Winter	Rain	No Rain	Over-all	Sum-mer	Winter	Rain	No Rain
Dissolved Oxygen	+++	+++	+	+++	+++	+++	+++	+++	+++	+++
BOD_5	oo	o	oo	o	o	O	o	o	o	o
Turbidity	-	+	-	-	-	++	+++	-	+	++
TSS	-	+	--	-	o	O	+++	-	o	o
Total Phosphorus	---	-	---	---	-	---	-	--	---	-
Ortho-phosphorus	-	-	-	-	-	--	---	+	-	-
Nitrate Nitrogen	-	-	o	o	-	---	---	-	-	---
Chlorophyll-a	o	o	NA	o	o	O	o	NA	o	o
Total Mercury	---	---	---	---	---	---	o	---	---	o
Total Copper	-	+	---	-	-	+	++	-	-	+
Dissolved Copper	o	o	ooo	ooo	o	O	+	-	+	o
Total Lead	---	-	---	---	--	-	+	---	-	-
Dissolved Lead	ooo	o	ooo	ooo	o	O	o	oo	o	o
Total Zinc	---	-	---	-	---	---	--	---	--	--
Dissolved Zinc	---	---	---	-	---	---	---	---	---	--
E. coli	---	-	---	---	-	-	++	-	-	+

o = no slope
+ = increasing trend with time
- = decreasing trend with time

Green highlights = TMDL parameter during stormwater
oo/--/++ = sig at p <0.10
ooo/---/+++ = sig at p <0.05

Fairview Creek is generally seeing downward trends. Dissolved oxygen has a significantly increasing trend in Fairview Creek, as well as in all other stream locations presented in **Table 4** (Johnson Creek) and **Table 5** (Kelly Creek). An increasing trend in dissolve oxygen is good, since fish and aquatic life utilize this for respiration.

Fairview Creek has a few water quality parameters showing an increasing trend at the upstream site (FCI1) during the summer. While summer is not considered to be a period when stormwater is influencing trends, several sediment-related constituents (turbidity, TSS, total metals, and *E. coli*) are all increasing during this period. In general, elevated solids in upper Fairview Creek are likely due to dewatering from the quarry pit at Knife River, which provides a significant source of water to the creek in the summer months. The City has been working with Knife River on not only meeting the discharge limits established in their 1200-A permit (e.g. TSS benchmark of 100 mg/L), but they have now installed a system utilizing Baker tanks with a sediment flocculant (chitosan) followed by sand filters. The system has the ability to treat water being discharged to Fairview Creek below 10 NTU of turbidity, which should result in decreasing future trends.

Figure 10. **Total Suspended Solids (TSS) at upstream Fairview Creek location.** The red dashed line is an Ordinary Least Squares (OLS) regression line. The blue line is the non-parametric Kendall-Theil line.

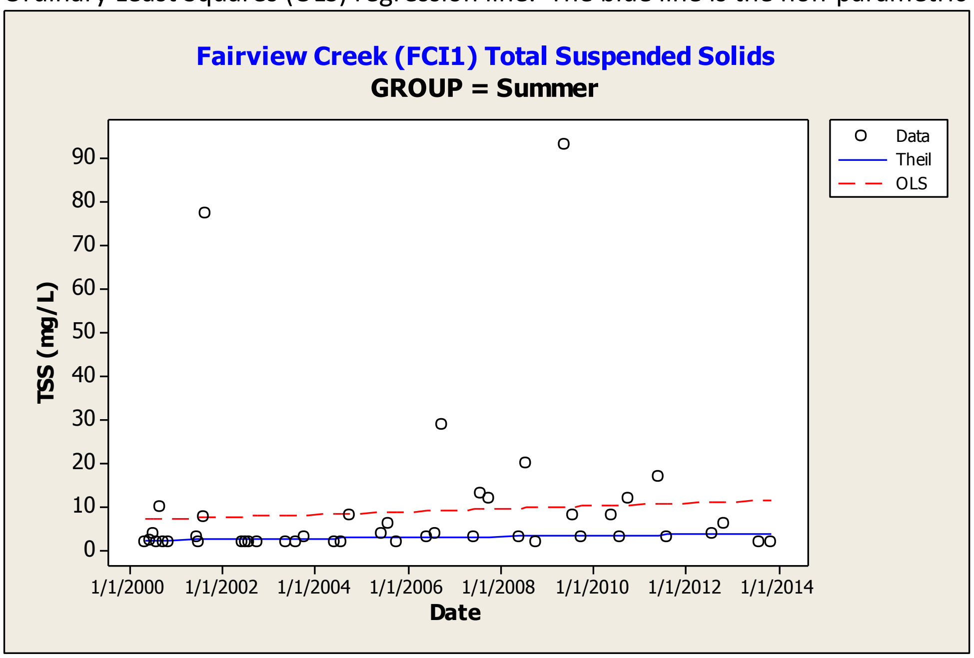


Table 3. Trend summary for Fairview Lake. The lake is the upstream end of Columbia Slough, so TMDL parameters during periods where stormwater might be present are highlighted in green.

	FVL1 (dock)				
Constituent	Over-all	Sum-mer	Winter	Rain	No Rain
Dissolved Oxygen	+++	+++	++	++	+++
BOD_5	o	o	o	o	o
Turbidity	---	---	---	---	---
TSS	---	---	---	---	---
Total Phosphorus	---	---	---	---	---
Ortho-phosphorus	o	o	o	o	o
Nitrate Nitrogen	o	ooo	-	-	o
Chlorophyll-a	---	---	NA	--	---
Total Mercury	---	o	---	---	o
Total Copper	---	---	---	---	-
Dissolved Copper	-	-	-	-	-
Total Lead	---	---	---	---	---
Dissolved Lead	o	o	o	o	o
Total Zinc	-	-	-	--	+
Dissolved Zinc	ooo	ooo	+	o	ooo
E. coli	---	o	---	o	---

o = no slope
+ = increasing trend with time
- = decreasing trend with time

Green highlights = TMDL parameter during stormwater
oo/--/++ = sig at $p < 0.10$
ooo/---/+++ = sig at $p < 0.05$

Trends in Fairview Lake are nearly all decreasing, and for most constituents, this decrease is statistically significant at the 0.05 level.

Table 4. Trend summary for Johnson Creek

	JCI1 (downstream)					JCI2 (upstream)				
Constituent	Over-all	Sum-mer	Winter	Rain	No Rain	Over-all	Sum-mer	Winter	Rain	No Rain
Dissolved Oxygen	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++
BOD_5	ooo	oo	ooo	ooo	o	ooo	oo	ooo	ooo	oo
Turbidity	-	-	-	-	-	+	+	-	-	+
TSS*	---	-	--	-	-	o	o	-	o	o
Total Phosphorus	---	-	---	-	-	-	+	-	-	+
Ortho-phosphorus	o	o	o	o	o	o	++	ooo	o	o
Nitrate Nitrogen	-	-	-	+	-	-	-	-	o	-
Chlorophyll-a	o	o	NA	+	o	+++	+++	NA	+	+++
Total Mercury	---	--	-	-	o	---	---	--	o	ooo
Total Copper	---	--	---	---	---	-	+	--	-	-
Dissolved Copper	-	-	-	-	-	+	+++	-	+	+
Total Lead	---	---	---	---	---	--	o	---	-	-
Dissolved Lead	ooo	ooo	o	o	ooo	o	oo	o	o	o
Total Zinc	---	-	---	---	-	---	-	---	-	-
Dissolved Zinc	+	+	+	+	+	+	+	-	-	+
E. coli	-	o	-	-	-	-	+	-	-	+

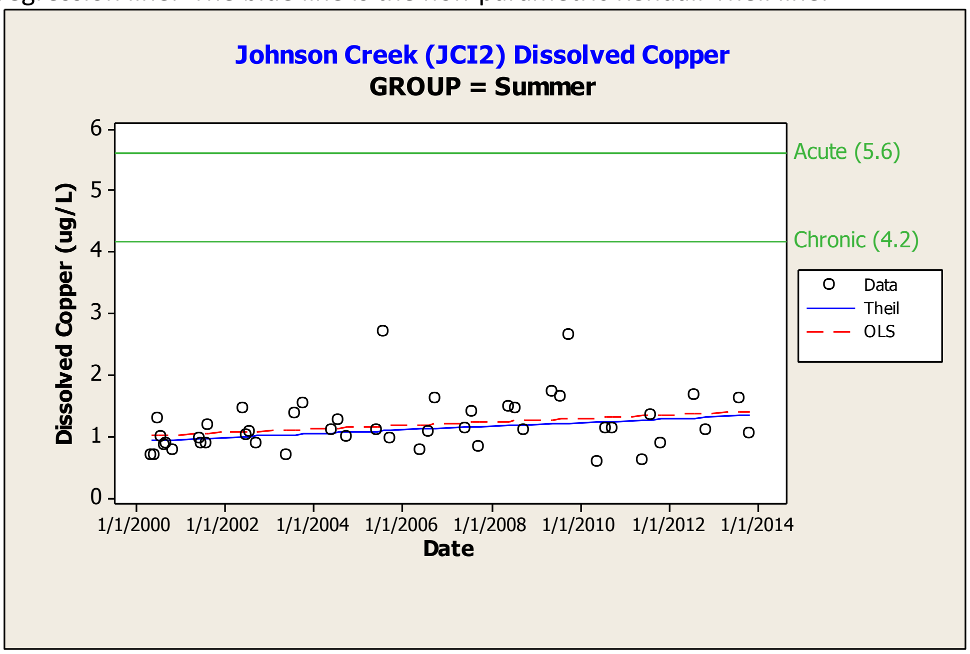
o = no slope
+ = increasing trend with time
- = decreasing trend with time

Green highlights = TMDL parameter during stormwater
oo/--/++ = sig at $p < 0.10$
ooo/---/+++ = sig at $p < 0.05$

**DDT data in Johnson Creek highly variable due to matrix issues. While sufficiently low analytical methods are used to detect DDT below the 1 ng/L water quality standard, samples collected in winter or during rainfall have high levels of suspended solids that cause the reporting limits during those events to be much higher than the water quality standard (e.g results reported as <10 ng/L). Due to these matrix issues and the fact DDT is correlated with sediment, TSS trends are considered a surrogate for DDT.*

Johnson Creek is generally showing decreasing trends, with the exception of some summer parameters at the upstream sampling location (JCI2). This location is upstream from the City of Gresham, and is therefore not related to stormwater entering the creek from the MS4. Some of these are likely due to urbanization (e.g. dissolved copper and zinc), while others could be increasing due to upstream agriculture (e.g. turbidity, phosphorus, chlorophyll-a). The increasing trend in dissolved copper and zinc is very gradual, and all detections for these metals have been far below the chronic toxicity standard.

Figure 11. Dissolved copper at upstream Johnson Creek location. The chronic toxicity value of 4.2 ug/L is an estimate based on the equation from DEQ Table 30[2] using the average hardness value for this site of 29.5 mg/L. Acute toxicity estimate is 5.6 ug/L. The red dashed line is an Ordinary Least Squares (OLS) regression line. The blue line is the non-parametric Kendall-Theil line.



[2] Water Quality Standards: Beneficial Uses, Policies, and Criteria for Oregon. 340-041-0033. Table 30: Aquatic Life Water Quality Criteria for Toxic Pollutants. (Effective April 18, 2014).

Figure 12. **Dissolved zinc at upstream Johnson Creek location.** The estimated toxicity values for zinc are based on the equation from DEQ Table 30. Using the average hardness value for this site of 29.5 mg/L, the chronic and acute toxicity values are 41.7 and 42.0 ug/L, respectively. The red dashed line is an Ordinary Least Squares (OLS) regression line. The blue line is the non-parametric Kendall-Theil line.

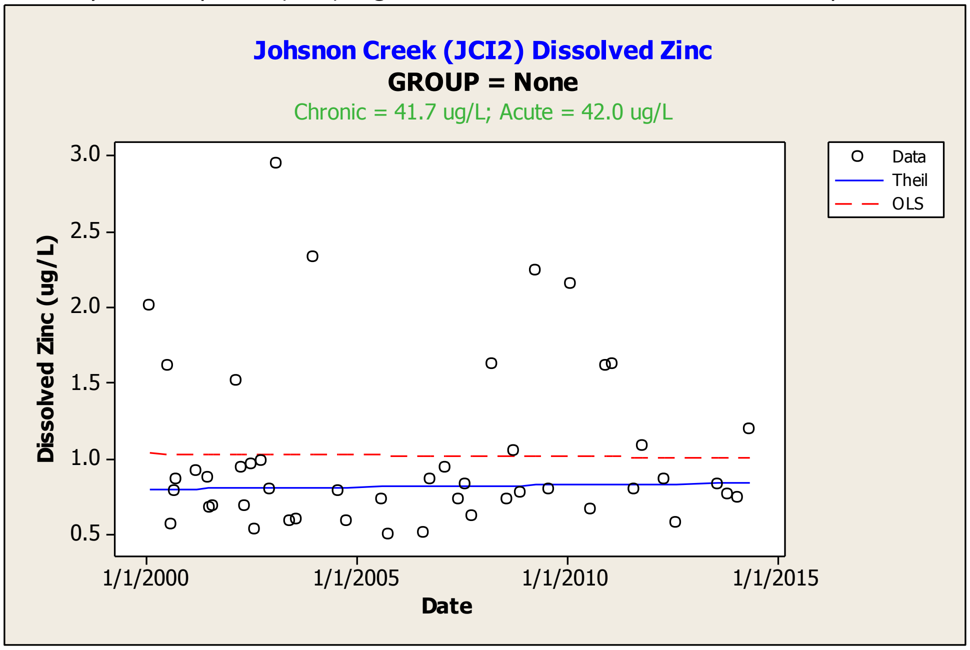


Table 5. Trend summary for Kelly Creek

	KCI1 (downstream)					KCI4 (upstream)				
Constituent	Over-all	Sum-mer	Winter	Rain	No Rain	Over-all	Sum-mer	Winter	Rain	No Rain
Dissolved Oxygen	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++
BOD_5	ooo	ooo	o	o	oo	ooo	o	oo	o	ooo
Turbidity	-	-	-	-	-	---	-	---	-	-
TSS	---	-	---	---	---	---	o	---	---	o
Total Phosphorus	---	-	---	-	--	---	-	---	-	---
Ortho-phosphorus	o	o	o	o	o	o	o	ooo	ooo	o
Nitrate Nitrogen	+	+	o	+	+	+	+++	-	+	+
Chlorophyll-a	---	---	NA	-	--	ooo	ooo	NA	o	ooo
Total Mercury	---	--	-	-	ooo	---	---	--	-	ooo
Total Copper	---	-	--	-	--	---	-	---	---	-
Dissolved Copper	-	-	+	+	-	o	+	-	+	-
Total Lead	---	---	---	---	---	---	---	---	---	---
Dissolved Lead	o	oo	o	o	o	o	o	o	o	o
Total Zinc	-	-	-	-	-	-	+	--	-	+
Dissolved Zinc	+	+	++	++	-	+++	++	+++	+++	++
E. coli	-	-	-	-	o	--	+	---	-	-

o = no slope
+ = increasing trend with time
- = decreasing trend with time

Green highlights = TMDL parameter during stormwater
oo/--/++ = sig at $p < 0.10$
ooo/---/+++ = sig at $p < 0.05$

Trends for most constituents in Kelly Creek have a downward trend, although nitrate and some of the dissolved metals appear to be increasing. The upstream site (KCI4) is within the City limits, but receives drainage from agricultural areas upstream from Gresham.

Figure 13. Nitrate during summer at upstream Kelly Creek location. Summer trends appear to be increasing, although levels are far below the water quality standard of 10,000 ug/L (10 mg/L). The red dashed line is an Ordinary Least Squares (OLS) regression line. The blue line is the non-parametric Kendall-Theil line.

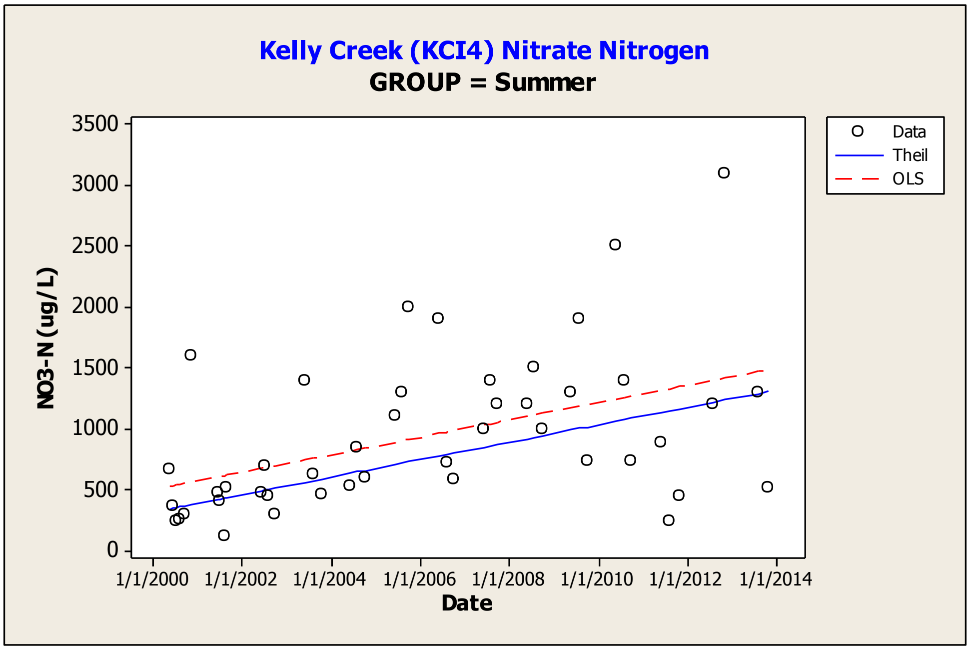
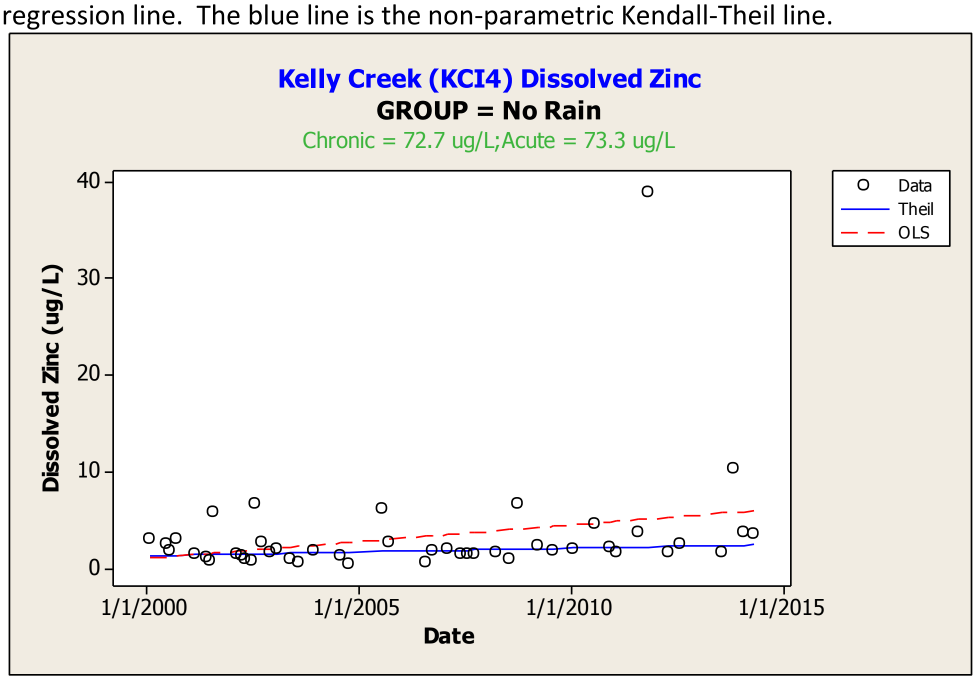


Figure 14. Dissolved zinc at upstream Kelly Creek location. The estimated toxicity values for zinc from DEQ Table 30 using the average hardness value for this site of 56.9 mg/L the chronic and acute toxicity standards are 72.7 and 73.3 ug/L, respectively. The red dashed line is an Ordinary Least Squares (OLS) regression line. The blue line is the non-parametric Kendall-Theil line.



5 Discussion

The data within in this report provides an assessment of the progress towards meeting the TMDL pollutant load reductions (benchmarks) established at the beginning of the permit term and an in-stream trend analysis for water quality parameters.

Figures 1 through **9** show that the City reduced pollutant loads to a level that met or exceeded the benchmark established at the beginning of the permit term. While the structural best management practices (BMPs) employed by the City are reducing pollutant loads, few of the TMDL pollutants appear to be meeting the established wasteload allocation (WLA) based on the current model's assumptions. However, as noted the City's numerous nonstructural BMPs are not modeled, so the actual load may be closer to the lower value range than the mean load.

In addition to this report, the City is also submitting a Wasteload Allocation Attainment Assessment. That report provides an assessment into whether some of the WLAs can be met using the BMPs currently available. For example, the City has made significant investments in adding stormwater quality treatment in the Fairview Creek and Columbia Slough watersheds. Currently, 78% of the Fairview Creek watershed is treated by some structural BMP, yet the bacteria reduction achieved from the estimated load without BMPs is only a 41% reduction. While the lower value range (LVR) of the bacteria load estimate shown in Figure 6 is getting close to the WLA, the Wasteload Allocation Attainment Assessment document suggests that 100% treatment using rain gardens would be required for the mean load based to be at or below the WLA. The stormwater management efforts in Fairview Creek do seem to be confirmed by the decreasing overall trend for bacteria (and other pollutants) in Fairview Creek (see Table 2).

The trend analysis summary tables (**Tables 2** through **5**) show that most water quality parameters are improving over time. All TMDL parameters that were assessed during periods when stormwater is most likely to be present (Winter and Rain) are highlighted in green. All of these periods show trends that are decreasing or not changing over time. Often times the trends showing no change that are significant (e.g. "oo" or "ooo") are caused by the data being at or below the detection limit of the analytical method, so a trend that is not changing in those parameters often means the levels have been low and remain that way.

E. coli is the most frequently occurring TMDL pollutant, occurring in all watersheds within the City. Due to the highly variable nature of biological measurements, showing significant trends for bacteria can be difficult at the $p<0.10$ or $p<0.05$ level. Some sites do have a significantly decreasing trend (Fairview Creek, Fairview Lake and Kelly Creek), and the trend line for all sites is decreasing during periods of rain or during winter months, when rain and stormwater are most likely to occur.

TMDL pollutants appear to have decreasing trends during periods of time when stormwater is expected to be present (rain and winter). These decreasing trends are what would be expected from stormwater management efforts, including structural BMPs, as well as nonstructural BMPs (e.g. education) that are difficult to take credit for. This suite of BMPs is likely contributing to the in-stream trends that indicate water quality is improving in our local streams.

Appendix C

Maps of the service boundary and required elements
(Schedule B. 6. g.)

UPDATED MS4 MAPS

Introduction

This section of Gresham's Permit Renewal Application Package fulfills the requirement specified in 2010 NPDES Permit #101315 Schedule B.6.g.

Updated MS4 maps including the service boundary of the MS4, projected changes in land use and population densities, projected future growth, location of permittee-owned operations, facilities, or properties with storm sewer systems, and the location of facilities issued an industrial NPDES permit that discharge to the MS4.

Rather than create large static maps of data, the City of Gresham, Fairview and Multnomah County have created on-line digital maps containing all of the required map elements. These on-line maps allow the viewer to zoom in and out and turn a variety of elements off and on, as needed, to review the various systems. Example images of the maps available in digital format is provided in **Figures 1** and **2**.

To view the complete library of digital data, visit: http://tiny.cc/emcstormwater

Data layers available in on-line maps:

- Base data, including streets, building, parks, etc
- Boundaries (cities, county, Urban Growth Boundary)
- Watersheds
- Streams
- Land Use
- Parks and natural areas
- Designated drywell (UIC) area[1]
- Stormwater pipes and structures (catch basins, outfalls, manholes, structural controls[2])
- Population change (from 2010 to 2040) from Traffic Analysis Zone (TAZ) data
- Population density (households per square mile) from TAZ
- NPDES permitted industries with 1200-Z or 1200-COLS permits
- Publically-owned properties (Cities and County)

Land Use and Runoff Coefficients

The CFRs ask for land use activities and runoff coefficients. Runoff coefficients are not listed in the attributes table of the on-line maps since 1) values vary based on imperviousness and 2) the impervious areas vary by watershed. For benchmark calculations, the runoff coefficients are calculated using the EPA method, where Runoff Coefficient = 0.05 + 0.009*(% impervious).

[1] The City of Gresham has a large area (mostly in Fairview Creek/Columbia Slough) that has no MS4 system and drains 100% to UICs

[2] Structural controls includes any grey or green infrastructure, including ponds, swales, rain gardens, detention pipes, etc

The runoff coefficients shown in **Table 1** are based on Gresham city-wide average impervious percentage by land use category. The impervious values for each watershed come from basin-specific master plans. The runoff coefficient used in the benchmarks were calculated using watershed-specific impervious values – so are not the same for the entire city (and may vary from those used by other jurisdictions).

Table 1: Impervious areas by watershed and city-wide runoff coefficient

Land Use Category	Columbia Slough	Fairview Creek	Johnson Creek	Kelly/Burlingame/Beaver Creek	City-wide Average	Runoff Coefficient*
Agriculture	2%	NA	5%	10%	5.7%	0.1013
Residential	35%	35%	35%	35%	35.0%	0.365
Multi-Family Residential	60%	60%	55%	60%	58.8%	0.5792
Commercial	85%	90%	90%	90%	88.8%	0.8492
Industrial	75%	70%	90%	70%	76.3%	0.7367
Vacant	2%	10%	5%	10%	6.8%	0.1112
Parks/Open Space	2%	10%	5%	10%	6.8%	0.1112
Natural Areas	0%	0%	0%	0%	0%	0.05

*Runoff coefficients shown in table based on city-wide average impervious values

Figure 1: Example from on-line maps showing Gresham stormwater infrastructure, streams and watersheds

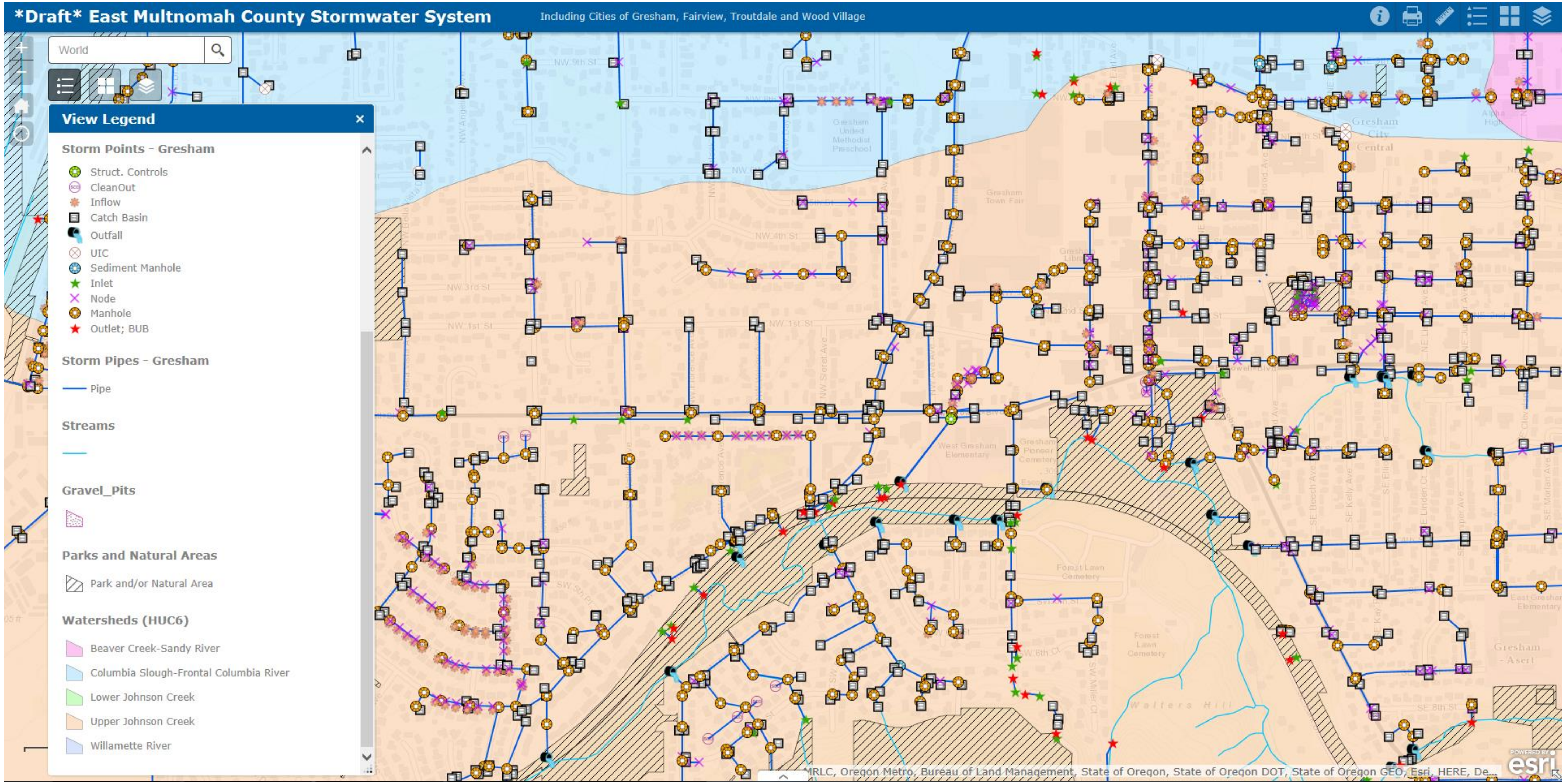


Figure 2: Example from on-line maps showing Gresham and Fairview boundaries, land use and population change from 2010-2040