# City of Eugene, Oregon
Stormwater Management Program

## Municipal Stormwater Permit Renewal

Submitted in accordance with the requirements of National Pollutant Discharge Elimination System (NPDES)

**Permit # 101244**

**File # 107989**

**December 2015**

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# CITY OF EUGENE

## NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) PERMIT RENEWAL APPLICATION PACKAGE

December 2015

The undersigned hereby submits this permit renewal application package in accordance with NPDES Permit Number 101244. I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person, or persons, who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

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# Section 1
# Introduction

## 1.1 Permit Background

In the early 1990s, the Federal Clean Water Act required municipalities with populations greater than 100,000 to apply for and obtain a National Pollutant Discharge Elimination System (NPDES) permit for their stormwater discharges. In Oregon, this program was delegated to the Oregon Department of Environmental Quality (DEQ). As a result, DEQ directed six Oregon jurisdictions and associated co-permittees to apply for and obtain an NPDES municipal separate storm sewer (MS4) permit. The City of Eugene (City) was one of the six jurisdictions required to obtain an NPDES MS4 permit.

The City submitted Part 1 of its original NPDES MS4 permit application in May 1992, with the Oregon Department of Transportation as a co-permittee. Part 1 of the original permit application required review of the stormwater system including mapping, outfall inventories, stormwater monitoring, etc. The City submitted Part 2 of its application in May 1993. Part 2 of the application required the development of a Stormwater Management Plan (SWMP), which included a number of best management practices (BMPs) to address specific sources of pollutants. The permit did not specify the number of type of BMPs to be implemented; rather the permit stated that BMPs should be implemented to reduce pollutant discharge to the "maximum extent practicable" (MEP). The City was issued its first NPDES MS4 permit in November 1994.

The City submitted a renewal application prior to the end of the original (1994) 5-year permit period and was issued its second NPDES MS4 permit in March 2004. The City submitted a renewal application prior to the end of its second (2004) 5-year permit period and was issued its third NPDES MS4 permit in December 2010. The 2010 permit is the City's current permit and it is scheduled to expire on December 29, 2015.

This document represents the City of Eugene's NPDES MS4 permit renewal application and is being submitted to DEQ in accordance with Schedule F, Section A.4 (per DEQ letter dated April 13, 2015). The renewal addresses all the elements required by permit Schedule B.6, including an updated proposed SWMP, updated proposed Monitoring Plan, and other required elements.

## 1.2 Description of Permit Area

The City of Eugene is located in the western third of the Upper Willamette River watershed in Lane County, Oregon. Eugene is the second largest city in the state with a population of approximately 155,000. The area covered by the City's MS4 permit is the Eugene city limits shown in Figure 1-1 and is approximately 44 square miles in area.

All of Eugene's stormwater runoff discharges to the Willamette River, either relatively directly via direct outfalls and tributaries including Spring Creek, Flat Creek and the McKenzie River, or indirectly via the Amazon Creek/Long Tom River system. The Willamette River runs through the City for about six miles, from river mile 184 to river mile 178.

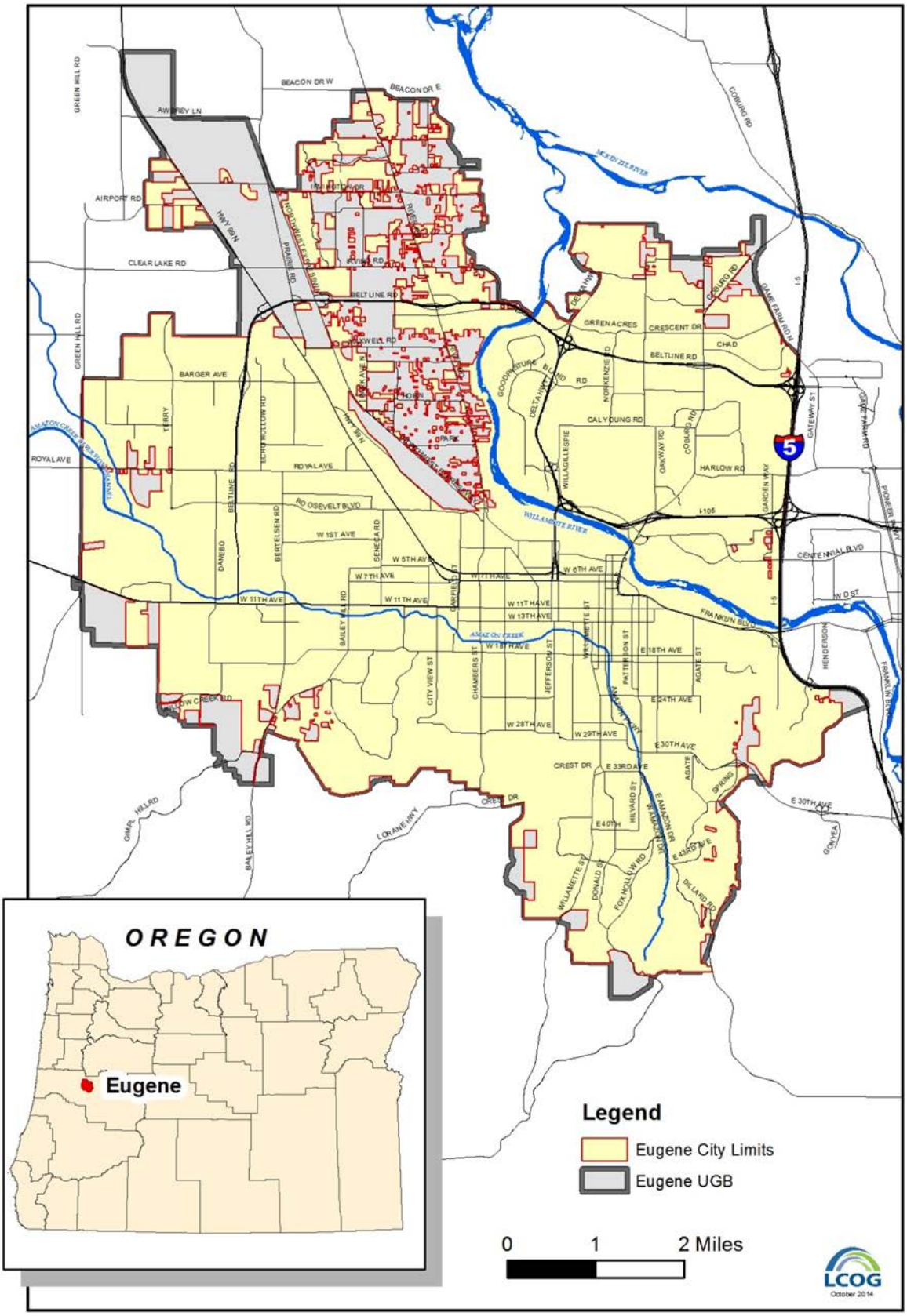


Figure 1-1. Eugene Permit Area Map

## 1.3 Eugene's Stormwater Program

The City's Public Works Department has primary responsibility for implementing the SWMP. Other departments are involved in implementation of the SWMP, including the Planning & Development Department, which is the lead department on two of the SWMP BMPs.

Stormwater program-area responsibilities are summarized in Table 1-1. Public Works staff coordinates with other City departments (e.g., Fire, Central Services, and Library, Recreation, and Cultural Services), and other local agencies (e.g., Lane County) to implement the city-wide program.

**Table 1-1. General Areas of Responsibility for Stormwater Program**

| | |
|---|---|
| Public Works Administration Division | • Stormwater outreach and education, graphics<br>• Financial management |
| Public Works Engineering Division | • NPDES permit management<br>• Stormwater development standards<br>• Erosion control<br>• Capital improvement projects<br>• Storm system mapping & data management |
| Public Works Maintenance Division | • Illicit discharge and spill response program<br>• Street sweeping and leaf pick-up<br>• City vehicle maintenance<br>• Constructed system maintenance practices<br>• Road sanding and de-icing<br>• Regulation of private underground facilities |
| Public Works Parks & Open Space Division | • Open channel maintenance practices<br>• Vegetation management<br>• Litter pick up<br>• Volunteer programs<br>• Tree planting program<br>• Regulation of private vegetated facilities<br>• Bacteria pilot study coordination |
| Public Works Wastewater Division | • Water quality sampling and data analysis<br>• Industrial stormwater program |
| Planning and Development Department | • Recycling and waste prevention education<br>• Yard debris recovery program |

Coordination of the various activities occurs through routine staff communication and via several staff teams as shown in Table 1-2.

| Table 1-2. Stormwater Program Policy, Management and Coordination Teams | |
|---|---|
| Stormwater Policy Team | Provides policy direction for the Stormwater Program. |
| Stormwater Management Team | Provides overall management for the Stormwater Program. Oversees development of new policy for approval by the Policy Team. Implements Policy Team direction. |
| Stormwater Operations Team | Shares information for on-going program coordination. Resource pool of key staff for specific tasks. |
| Stormwater Enforcement Coordination Team | Coordinates on code compliance incidents. Shares information on enforcement actions. |
| Stormwater Penalty Review Team | Reviews administrative civil penalties and makes determinations. Provides inter-divisional coordination. |

### 1.3.1 City of Eugene's Stormwater Policy

In 1993, the Eugene City Council adopted the Comprehensive Stormwater Management Plan (CSWMP), which provides the policy framework for the City's stormwater program. The impetus for adopting the CSWMP was in part due to the impending federal requirements of the NPDES MS4 permit, as well as concerns over open waterway management and the discovery of an extensive concentration of wetlands in west Eugene in the early 1990's.

Establishing program policy enabled the City to address a variety of stormwater issues within a comprehensive management framework– to manage each of the program areas so that they are coordinated and consistent, meet the requirements of federal law, meet the needs of the community, and meet multiple objectives. CSWMP laid the foundation for implementing a stormwater program that meets multiple objectives including flood control, water quality enhancement, natural resource protection, and recreation and educational opportunities and provides the policy background for implementation of the City's SWMP. CSWMP is reviewed periodically to ensure that it is still relevant and represents the appropriate policy basis for Eugene's stormwater program.

### 1.3.2 Legal Authority

Section D.1 of the City's NPDES MS4 permit requires that the City "maintain adequate legal authority, through ordinance(s), interagency agreement(s) or other means, to effectively implement and enforce the provisions of this permit." A summary of the legal authority for the stormwater program is provided in each stormwater annual report, most recently the Year 2015 Stormwater Annual Report (December 2015), including Eugene Code section references and related Administrative Orders that the City relies upon to apply and enforce stormwater-related regulations.

### 1.3.3 Relationship to Other Local Jurisdictions

The United States Environmental Protection Agency (EPA) adopted rules to implement "Phase II" of the MS4 permitting program in December 1999. Phase II expanded the MS4 permitting program to include smaller communities located in United States census-defined urban areas. Locally, the city of Springfield and Lane County were issued their first NPDES MS4 Phase II individual permits in 2007. These permits have been administratively extended pending action by DEQ on a new, second-term permit. DEQ is in the process of drafting a General Phase II permit and expects to issue new Phase II permits by mid-2016.

In April 2004, Lane County and the City of Eugene entered into an intergovernmental agreement (IGA) to collaborate on stormwater program activities in the jurisdictional area outside of the Eugene city limits and within the Eugene urban growth boundary (UGB). Coordinated stormwater program

activities include stormwater planning, stormwater education, erosion prevention, and illicit discharge detection and elimination. The agreement remains in effect and was recently amended to extend the timeframe to December 2017.

In addition to work completed under the IGA, the cities of Eugene and Springfield and Lane County actively participate in the Pollution Prevention Coalition and often collaborate on stormwater education activities such as defining topics for the City of Eugene's Stormwater Connections newsletter and topic-specific informational brochures such as best management practices for pressure washing.

## 1.4 Organization of Document

Table 1-3 summarizes the requirements of the permit renewal application and provides the corresponding submittal component's location within this permit renewal application.

**Table 1-3. Organization of Document and Permit Renewal Submittal Components**

| Submittal component | Permit requirement | Related 2015 application section |
|---|---|---|
| **Introduction** | - | Section 1.0 |
| **Proposed SWMP Modifications**<br>• Narrative summary of proposed SWMP revisions and measurable goals, including rationale.<br>• Proposed SWMP | B.6.a | Section 3.0<br>Appendix A |
| **MEP Evaluation**<br>Information and analysis related to:<br>• How the City's existing program addressed requirements of the 2010 permit<br>• How the City's proposed program will meet maximum extent practicable (MEP) criteria | B.6.b | Section 2.0 |
| **Service Area Expansions**<br>Description of any service area expansions anticipated to occur during the next permit term and a finding as to whether or not the expansion is expected to result in a substantial increase in area, intensity, or pollutant loads. | B.6.e | Section 4.1 |
| **Total Annual Pollutant Loading**<br>Updated estimate of total stormwater pollutant loads for applicable TMDL pollutants and other identified pollutants. | B.6.c | Section 4.2 |
| **TMDL Wasteload Allocations (WLAs) and Benchmarks**<br>• List of WLAs met<br>• New benchmarks | B.6.h<br>D.3.c, d | Section 5.0<br>Appendix C |
| **Fiscal Evaluation**<br>Current permit term expenditures summary and projected program allocations for next permit cycle. | B.6.f | Section 6.0 |
| **Monitoring**<br>• Updated monitoring program objectives matrix<br>• Draft monitoring plan | B.6.d<br>B.6.d | Section 7.0<br>Appendix B |
| **MS4 Map** | B.6.g | Appendix D |

# Section 2
# Maximum Extent Practicable Evaluation

Permit Requirements

Schedule B.6: MS4 Permit Renewal Application Package

…The application package must include an evaluation of the adequacy of the proposed SWMP modifications in reducing pollutants in discharges from the MS4 to the MEP. The application package must contain:

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

   i. Effectiveness – program elements effectively address stormwater pollutants

   ii. Local Applicability – technically feasible considering local soils, geography, etc.

   iii. Program Resources – program elements are being implemented considering availability to resources and the permittees stormwater management program priorities.

This section of the permit renewal application provides information to support the Oregon DEQ's assessment that the City's Stormwater Management Plan (SWMP) reduces pollutants in discharges from the municipal separate storm sewer system (MS4) to the maximum extent practicable (MEP).

To address this requirement, this MEP evaluation includes two parts:

- Section 2.1: How the Existing Stormwater Management Program Addressed Existing (2010) Permit Requirements
- Section 2.2: How the Proposed Stormwater Management Program (for the Upcoming Permit Term) Meets the MEP Requirement

## 2.1 How the Existing Stormwater Management Program Addressed 2010 Permit Requirements

The City's overall stormwater management program is comprised of activities outlined in its SWMP, environmental monitoring, and additional permit-defined assessments and submittals. The following sections summarize how the SWMP (as a subset of the City's overall program) was adaptively managed during the current permit term, and how the overall stormwater management program addressed existing permit requirements.

### 2.1.1 Annual Adaptive Management

The SWMP is assessed by the City's program managers on an annual basis through an adaptive management process. SWMP modifications are made as necessary to achieve a reduction of

pollutants in stormwater discharges to the MEP. This requirement is outlined in Schedule D.4 of the permit:

> *The permittee must follow an adaptive management approach to assess annually and modify, as necessary, any or all existing SWMP components and adopt new or revised SWMP components to achieve reductions in stormwater pollutants to the MEP....*

A description of the City's adaptive management approach was submitted to DEQ as required in permit Schedule D.4 on December 1, 2011 as part of the Year 2011 Stormwater Annual Report. The adaptive management process outlined the approach for assessing and modifying the SWMP to achieve reductions in stormwater pollution to the maximum extent practicable. The approach was divided into two distinct processes: an annual adaptive management process and a permit cycle adaptive management process.

During each annual assessment, SWMP modifications in the form of adjustments to best management practices (BMPs) may be made to achieve continued reduction of pollutants in stormwater discharges. Adjustments may be based on a number of factors outlined in the adaptive management process description including: improved efficiencies, resources availability changes, greater effectiveness in pollution reduction, public input, achievability of measurable goals, appropriateness of tracking measures, and procedural or organizational changes. Each annual report submitted to DEQ, beginning with the Year 2011 Stormwater Annual Report, includes a section to summarize implementation of the adaptive management process and any resulting proposed SWMP changes.

Over the current permit term, the City has modified its SWMP two times. The first modification submitted in March 2011 and subsequently approved by DEQ, reflected incorporation of specific measurable goals into select BMPs per Schedule D.6 of the permit. The second modification, submitted in December 2012 with the Year 2012 Stormwater Annual Report and subsequently approved by DEQ, reflected the consolidation of three volunteer programs into one with no substantive change to the SWMP activities, and other minor administrative changes. The December 2012 SWMP is the City's current, effective SWMP.

Since the December 2012 formal SWMP update, no additional SWMP modifications have been made as a result of the annual adaptive management process.

### 2.1.2 Overall Permit Requirements

Per Schedule A.2 of the permit:

> *Compliance with this permit and implementation of a stormwater management program, including the Department-approved Stormwater Management Plan, establishes this MEP requirement... (to reduce pollutants to the MEP).*

The City implemented its SWMP and addressed all of the existing (2010) permit requirements, as shown in Table 2-1.

### 2.1.3 Results of Existing Program MEP Evaluation

The City's approved SWMP (December 2012) has been adaptively managed over the current permit term, using its annual adaptive management process. In addition to implementing and adaptively managing the SWMP, the City has addressed all of the other existing permit requirements. Therefore, the City's existing, overall program has met the MEP requirement.

**Table 2-1. 2010 NPDES MS4 Permit Requirements**

| Permit requirement | Permit section | Due date | Status (shaded areas = permit requirement has been met) |
|---|---|---|---|
| Illicit Discharge Detection and Elimination | | | |
| • Document an enforcement response plan for responding to illicit discharges. | A.4.a.ii | December 1, 2011 | • City of Eugene Stormwater Investigation and Enforcement Manual submitted to DEQ December 1, 2011. |
| • Document pollutant parameter action levels and report them to the Department in an enforcement response plan or similar document. | A.4.a.iii | July 1, 2012 | • Pollutant parameter action levels documented and submitted to DEQ June 29, 2012. |
| • Annual dry-weather field screening activities must include identified priority locations, which are identified on a map. | A.4.a.iv and xi | July 1, 2012 | • Map of dry weather field screening locations submitted to DEQ June 29, 2012. |
| Industrial and Commercial Facilities | | | |
| Implement an updated strategy to reduce pollutants to the MS4 from industrial and commercial facilities identified as sources that contribute significant pollutant loads to the MS4. | A.4.b.iii | January 1, 2013 | Strategy documented in letter to DEQ January 1, 2013. The City is an agent for the 1200-Z permit program. Critical elements of the City's industrial and commercial program include screening new and existing businesses, 1200-Z and 1700-A permit management, facility inspections, education and outreach, and compliance enforcement of Eugene City Code. |
| Education and Outreach | | | |
| Conduct or participate in an effectiveness evaluation to measure the success of public education activities. | A.4.d.vi | December 1, 2014 | Participated in a regional public education effectiveness evaluation submitted to DEQ on December 1, 2014 as part of the City's Year 2014 Stormwater Annual Report. |
| Public Involvement and Participation | | | |
| Provide opportunities for public comments including on the updated monitoring plan due May 1, 2011, annual reports, SWMP revisions, and the TMDL pollutant load reduction benchmark development. | A.4.e | various | Public notices placed in the Eugene Register Guard for all referenced documents, for a two-week public review/comment period prior to finalizing documents for submittal to DEQ. Draft documents were posted during public review on the City's web site and printed copies were made available. |
| Post Construction Site Runoff | | | |
| • Implement a post-construction site runoff program that meets designated permit conditions. | A.4.f | January 1, 2014 | • To ensure a substantive public involvement process, the City requested (letter December 31, 2013) and received a 3-month extension to complete post-construction site runoff program updates. Updates to the City's program to meet related 2010 permit conditions were completed and reported to DEQ on February 28, 2014. Eugene Code and Stormwater Management Manual were updated to incorporate a BMP hierarchy emphasizing low impact development (LID) facilities and include off-site LID mitigation alternative. |
| • Identify, minimize, or eliminate barriers in ordinances, code, and development standards that inhibit low impact development/green infrastructure. | A.4.f | January 1, 2014 | • See above bullet. A review of potential barriers and opportunities to increase the use of LID practices was completed in September 2008 and updated in 2012 and 2013. Adoption of the BMP hierarchy emphasizing LID addressed the single most substantive barrier to implementing LID. |
| • Develop or reference an enforceable post-construction stormwater management manual or equivalent document. | A.4.f | January 1, 2014 | • See above bullets. |
| Pollution Prevention for Municipal Operations | | | |
| Inventory, assess, and implement a strategy to reduce the impact of stormwater runoff from municipal facilities that treat, store or transport municipal waste. | A.4.g.iii | January 1, 2013 | The City does not regulate solid waste transfer activities and does not have any transfer stations within its jurisdictional boundaries. Solid waste management, including solid waste transfer activities, is provided by Lane County Public Works. Communication in this regard submitted to DEQ January 1, 2013. |
| Stormwater Management Facilities O&M Activities | | | |
| Inventory and map stormwater management facilities and controls and implement a program to verify that stormwater management facilities and controls are inspected, operated and maintained. | A.4.h | January 1, 2013 | All public and private facilities have been mapped. Programs to inspect and maintain public and private facilities including necessary legal authority have been established and are on-going. Communication in this regard submitted to DEQ January 1, 2013. |

**Table 2-1. 2010 NPDES MS4 Permit Requirements**

| Permit requirement | Permit section | Due date | Status (shaded areas = permit requirement has been met) |
|---|---|---|---|
| Hydromodification Assessment | | | |
| Conduct assessment and submit report. | A.5 | December 1, 2014 | Hydromodification Assessment submitted to DEQ on November 26, 2014. |
| Retrofit Strategy | | | |
| • Identify one stormwater quality improvement project. | A.6.c | December 1, 2013 | • The I-105/Willamette River Water Quality improvement project planned for summer 2011. Additional public water quality retrofit projects have been constructed during the permit term and are planned for the future including for the current permit term. Communication in this regard submitted to DEQ November 29, 2013. |
| • Initiate, construct, or implement the project. | A.6.c | Permit expiration | • I-105/Willamette River Water Quality improvement project constructed summer 2011. |
| • Develop a retrofit strategy and submit plan to DEQ. | A.6.b | December 1, 2014 | • Retrofit Plan submitted to DEQ on November 26, 2014. |
| Monitoring and Reporting Requirements | | | |
| • Submit draft plan to DEQ for review. | B.2 | May 1, 2011 | • Monitoring Plan submitted on April 28, 2011 and subsequently approved by DEQ. |
| • Implement approved plan. | B.2 | July 1, 2011 | • Updated Monitoring Plan implemented beginning July 1, 2011. |
| Annual Reporting | | | |
| Submit annual reports each year from the time period July 1 of the previous year through June 30 of the same year. | B.5 | December 1 - yearly | All annual reports for the permit term were submitted to DEQ by December 1 each year and contained information as outlined in Schedule B.5.a-i. |
| Permit Renewal | | | |
| Submit permit renewal application package. | B.6 | December 29, 2015* | • Permit renewal application date will be submitted by December 29, 2015.<br>* Original permit renewal package due date June 30, 2015 (180 days before permit expiration). An extension of time was requested by City of Eugene on March 2, 2015 and subsequently approved by DEQ, to December 29, 2015 which coincides with the permit expiration date. |
| 303(d) Listed Pollutants | | | |
| Submit evaluation report in fourth annual report. | B.5.k<br>D.2 | December 1, 2014 (4th annual report) | Submitted with Year 2014 Stormwater Annual Report on November 26, 2014. |
| TMDLs | | | |
| • Submit Wasteload Allocation Attainment Assessment. | B.5.k<br>D.3.b | December 1, 2014 (4th annual report) | • Submitted with Year 2014 Stormwater Annual Report on November 26, 2014. |
| • Submit TMDL Pollutant Load Reduction Evaluation. | B.5.k<br>D.3.c | December 1, 2014 (4th annual report) | • Submitted with Year 2014 Stormwater Annual Report on November 26, 2014. |
| • Submit TMDL benchmarks. | D.3.d | July 30, 2015 (180 days before permit expiration) | • Provided in Section 5 of this permit renewal application. |
| Adaptive Management | | | |
| Submit adaptive management approach. | D.4 | December 1, 2011 | Submitted with Year 2011 Stormwater Annual Report on December 1, 2011. |
| SWMP Measurable Goals | | | |
| Revise to include new permit requirements. | D.6 | April 1, 2011 | Revised SWMP submitted to DEQ March 31, 2011. |

## 2.2 How the Proposed Stormwater Management Program Meets the MEP Requirement

The City's adaptive management process also requires the City to conduct a comprehensive assessment of the stormwater management program at the end of the current permit term, with the results used to identify proposed program modifications to be submitted as part of this permit renewal package for the upcoming permit term.

This section provides background on MEP, identification of standardized criteria for evaluating the City's stormwater program relative to MEP, and a summary of the process the City employed to identify proposed SWMP modifications. A narrative summary of the proposed SWMP modifications is provided in Section 3 of this permit renewal application. The updated proposed SWMP is included as Appendix A.

### 2.2.1 MEP Background

MS4 permittees initially developed and implemented SWMPs that met the MEP requirement as part of their original 1993 permit applications. Those SWMPs have become the foundation for each permittee's program—a foundation that has been continuously evaluated and improved through adaptive management since 1994/1995 when Oregon's first MS4 Phase I permits were issued. As a result, the BMPs described in the City's current SWMP are the result of the cumulative effect of implementing, continuously evaluating, and making corresponding changes (i.e., adaptive management) to a variety of technically and economically feasible BMPs that ensure that the most appropriate controls are implemented in the most effective manner based on local Eugene conditions.

From the initial SWMP development up until the submittal of this permit renewal application, the City followed the process listed below to assure its SWMP meets the MEP standard. A more detailed summary of the initial SWMP development process and adaptive management up to 2008 can be found in the City's 2008 National Pollutant Discharge Elimination System (NPDES) MS4 permit renewal application (September 2008).

- **Original development of the SWMP submitted with the 1993 permit application:** All Phase I NPDES MS4 permit applicants were encouraged by the EPA to design programs tailored for local problems, priorities, resources, and objectives. Part 1[1] of the application required the compilation of information related to the stormwater system within the permit area, including outfall investigation results, maps, and monitoring data. Part 2[2] of the application required development of a SWMP. Appendix C of the City's original Part 2 NPDES permit application includes a description of these efforts.

  The City employed a coordinated and comprehensive structured approach to developing its original NPDES SWMP. An interagency group of personnel, stakeholders representing other neighboring agencies and governments, and the Nature Conservancy participated in a series of technical workshops, small group meetings, and development of reports. The overall process included water quality problem identification, objective definition, candidate BMP development, BMP prioritization based on BMP screening factors, BMP evaluation and selection, and documentation. The BMPs were evaluated with respect to meeting permit requirements, addressing pollutants of concern, costs (implementation and maintenance), public acceptance,

[1] Part 1 of the City of Eugene NPDES Permit Application, May 1992

[2] Part 2 of the City of Eugene NPDES Permit Application, May 1993

flexibility, sustainability, and consistency with local policies. A SWMP was developed for the City to include the selected BMPs.

Issuance of the first NPDES MS4 permit by DEQ in November 1994, which included implementation of the SWMP, was regarded as acceptance of a program that met the MEP standard.

- **Overall SWMP review conducted for the "Second Year Annual Report" due in 2005:** DEQ issued the City its second term MS4 permit in March 2004. The 2004 permit required a SWMP evaluation to be conducted and submitted to DEQ in conjunction with the City's (2005) Second Year Annual Report. For this evaluation, the effective (2000) SWMP was reviewed for concurrence with the federal regulations (documented in 40 Code of Federal Regulations [CFR] 122.26), the ability to address parameters on the current 303(d) list, and specific non-stormwater discharges listed in Schedule A.3 of the permit. BMPs were revisited and reviewed, and a determination was made as to whether implementation of the components in the SWMP was sufficient to reduce the discharge of pollutants to the MEP. A revised SWMP and stormwater monitoring plan were prepared and a public involvement process was conducted to solicit feedback. This revised SWMP was submitted with the Year 2005 Stormwater Annual Report (also called the Second Annual Report under the second term permit) and was approved by DEQ on November 2, 2006.
- **Overall SWMP review conducted for the 2008 permit renewal application:** The City prepared a revised SWMP for the permit renewal application in 2008 for the third term MS4 permit. The revised SWMP was intended to synthesize the implementation and findings from the current permit cycle, and reflect an evaluation of the adequacy in reducing pollutants to the MEP, based on three evaluation criteria as required by DEQ: program effectiveness, local applicability, and program resources. Given the limited time between development of the 2005 SWMP and revised (2008) SWMP, no significant gaps in the program were identified, but some adaptive management changes were incorporated.
- **Continual adaptive management (1993 to present):** The effectiveness of the City's SWMP programs, activities, and BMPs has been reviewed regularly to assure that the City's SWMP continues to meet the MEP standard. The City's adaptive management process was formalized and documented in the Year 2011 Stormwater Annual Report. Beginning with the Year 2011 Report, a recap of the process and a summary of the adaptive management evaluation results have since been included in the City's annual stormwater reports.

As described above, the SWMP was initially developed in the early 1990's and has continuously evolved through an adaptive management process.

### 2.2.2 MEP Evaluation Factors and Criteria

As part of this MEP evaluation and demonstration, Phase I jurisdictions coordinated on an approach to defining and standardizing objective criteria related to the three MEP evaluation factors listed previously. The collaborative process included identification of example criteria for consideration. Each jurisdiction scored and ranked the example criteria depending on deemed importance and applicability. Highest ranking criteria were deemed universally acceptable by all participating jurisdictions and identified for use with the proposed SWMP revision processes, as follows.

**Program Effectiveness**

- The program includes a range of BMPs that encompass pollution prevention, source control, and treatment approaches.
- The program includes BMPs that are technically feasible, effective, and implementable.
- The program reflects the results of an adaptive management process, which provides for ongoing review and evaluation of program effectiveness.

**Local Applicability**

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

**Program Resources**

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

The City evaluated its SWMP against these standardized criteria and concluded that its program met all the criteria listed for program effectiveness, local applicability, and program resources. The City referred back to these criteria following the more detailed program assessment and SWMP revisions described in the following section.

### 2.2.3 Program Assessment and Results for the Permit Renewal

The City's documented approach to permit cycle adaptive management includes a review of all annual adaptive management evaluations over the permit term, a review of the SWMP BMP fact sheets, a review of long-term water quality trends, a review of evaluations/reports produced during the current permit term, and consideration of public input and comments.

#### 2.2.3.1 Review of Annual Adaptive Management Evaluations during Current Permit Term

A summary of the annual adaptive management process and results for this permit term is described in Section 2.1.1. As described, following the December 2012 formal SWMP update, no additional SWMP modifications were made in 2013 or 2014 as a result of the annual adaptive management process.

#### 2.2.3.2 Review of SWMP BMP Fact Sheets

The current December 2012 SWMP includes 24 BMP fact sheets that describe the individual program areas, highlight the primary tasks and include associated measurable goals and tracking measures. As part of the permit-cycle adaptive management process, program managers reviewed each BMP fact sheet to identify any out of date information – for example, changes in program names, tasks that have been completed, redundancies in activities across BMPs, and appropriateness of associated measurable goals and tracking measures.

#### 2.2.3.3 Review of Long-Term Water Quality Trends

With each Stormwater Annual Report, the City conducts an updated analysis of long-term in-stream water quality trends, incorporating the reporting year's data into the expanding pool of water quality data available.

The City has conducted in-stream water quality monitoring since 1997, every other month (6 times per year) at 12 monitoring locations currently. Many of the monitoring locations have remained consistent over the years; some have been added; all are reflected in the City's approved Monitoring

Plans. The most recent trends analysis results were included in the Year 2015 Stormwater Annual Report (December 2015) and in the TMDL Pollutant Load Reduction Evaluation (December 2014). Program managers were presented with the results of the most recent water quality trends analysis and considered the results in identifying any potential changes to the SWMP as part of the permit-cycle adaptive management evaluation.

#### 2.2.3.4 Review of Evaluations and Reports

As part of the City's permit-cycle adaptive management process, specific assessments required under the current permit were reviewed and considered with respect to stormwater program updates. The permit assessments that were reviewed and considered include the following:

1. *Public Education Effectiveness Evaluation – An evaluation of the effectiveness of public education activities, conducted in coordination with other Oregon Phase I MS4s.*
2. *Hydromodification Assessment – An examination of the potential causes of hydromodification in Eugene's open waterways, and current and potential future strategies and actions to address it.*
3. *Retrofit Plan – Documentation of the City's retrofit strategy for reducing water quality impacts from existing developed areas within the Eugene MS4 area.*
4. *Evaluation of 303(d) Listed Pollutants – An updated evaluation of the state's current 303(d) list, including an assessment of the contribution of pollutants from the City's MS4 and an evaluation of the City's program in reducing 303(d) pollutants in stormwater discharges.*
5. *TMDL Pollutant Load Reduction Evaluation - An estimate of pollutant loads and pollutant load reduction for specific applicable TMDL parameters for the current permit term.*
6. *TMDL Wasteload Allocation Attainment Assessment – An evaluation of the ability to attain TMDL wasteload allocations applicable to the City of Eugene's MS4.*

Each of the assessments described above was submitted to DEQ in December 2014 either as part of the City's 2014 Stormwater Annual Report (#1), Supplement to the Stormwater Annual Report (#4, 5 and 6), or as a stand-alone document (#2 and 3).

#### 2.2.3.5 Public Comment

A public notice of permit renewal related documents was published in the local Eugene newspaper, the Register Guard, on November 26, 2015. The draft narrative summary of SWMP changes (Section 3 of this permit renewal application), updated SWMP (Appendix A of this permit renewal application) and TMDL Benchmarks (Section 5 and Appendix C of this permit renewal application) were posted on the City's web site and printed copies were available for review. No public comments were received.

### 2.2.4 Results of Proposed Program MEP Evaluation

As a result of the permit renewal program assessment, changes to the City's SWMP were identified. The proposed SWMP is provided in Appendix A and a summary of changes from the existing SWMP is provided in Section 3. The City evaluated its proposed SWMP against the standardized MEP criteria identified in Section 2.2.2 and concluded that its updated program met all the criteria listed for program effectiveness, local applicability, and program resources. Therefore, the proposed program meets the MEP requirement.

# Section 3
# Proposed Stormwater Management Plan Changes

<u>Permit Requirements</u>

Schedule B.6: MS4 Permit Renewal Application Package

...The application package must include an evaluation of the adequacy of the proposed SWMP modifications in reducing pollutants in discharges from the MS4 to the MEP. The application package must contain:

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

This section of the permit renewal application provides the proposed changes to the City of Eugene's (City's) 2012 Stormwater Management Plan (SWMP), in conjunction with results of the maximum extent practicable (MEP) evaluation documented in Section 2.

The City's proposed SWMP includes 22 best management practices (BMPs) designed to reduce the discharge of stormwater pollutants. Each BMP is identified by an ID and number, associated with the City work section with lead responsibility as follows:

A = Administration Division of Public Works Department

B = Building Division of Planning and Development Department

E = Engineering Division of Public Works Department

M = Maintenance Division of Public Works Department

P = Parks and Open Space Division of Public Works Department

W = Wastewater Division of Public Works Department

Tables 3-1 to 3-8 summarize the proposed changes to the City's 2012 SWMP by general stormwater program category and associated BMP. Changes reflect administrative changes (BMP renumbering, renaming, deletion/removal) and implementation and adaptive management changes (adjustments to description, measurable goals, and tracking measures). Only BMPs with proposed changes are included in Tables 3-1 to 3-8.

An updated SWMP reflecting these proposed changes is provided in Appendix A of this permit renewal application.

**Table 3-1. Summary of Proposed SWMP Changes (Public Education)**

| Original BMP naming | | Proposed BMP naming | | Description of proposed changes (Dec '15) |
|---|---|---|---|---|
| BMP # (Dec '12) | BMP title (Dec '12) | BMP # (Dec '15) | BMP title (Dec '15) | |
| A1 | Stormwater Education | A1 | Stormwater Education | • Added "social media" to the means of communication.<br>• Added a measurable goal to increase awareness and behaviors of residents and business owners about best practices to reduce targeted pollutants..<br>• Moved measurable goal and associated tracking measure related to installation of catch basin markers from A1 to P1 (Educational Volunteer Program) since this work is done in association with volunteer projects.<br>• Updated measurable goal related to staff training video to reflect its completion and current use; removed reference to "green team" as it no longer exists. |
| P1 | Educational Volunteer Program | P1 | Educational Volunteer Program | • Modified description and tasks to clarify the volunteer program's focus of hands-on stewardship activities in City-owned parks and natural areas including waterways.<br>• Modified measureable goals to reflect an increase in the number of annual volunteer work parties related to water quality and the number of work parties for maintenance of publicly owned vegetated stormwater facilities.<br>• Incorporated measurable goal and tracking measure related to installation of catch basin markers associated with volunteer projects (formerly in A1).<br>• Modified description and task to incorporate tree-related information and education from P3 (Tree Planting and Information Programs). |

**Table 3-2. Summary of Proposed SWMP Changes (Operations and Maintenance)**

| Original BMP naming | | Proposed BMP naming | | Description of proposed changes (Dec '15) |
|---|---|---|---|---|
| BMP # (Dec '12) | BMP title (Dec '12) | BMP # (Dec '15) | BMP title (Dec '15) | |
| M3 | Street Sweeping Program and Leaf Pick-up | M3 | Street Sweeping Program and Leaf Pick-up | • Updated measurable goals to reflect changes in sweeping frequencies for certain areas, consistent with the current Operations and Maintenance Manual. Changes are based on sweeping needs; no overall change anticipated in lane miles swept or amount of debris collected. |
| M4 | Prevent Leaks and Spills from Municipal Vehicles and Equipment | M4 | Prevent Leaks and Spills from Municipal Vehicles and Equipment | • Modified measurable goal related to vehicle/equipment maintenance to reference preventative maintenance schedules.<br>• Modified measurable goal to reflect that all vehicles and large equipment now have a spill procedure card, which will continue as a part of routine business. |
| M5 | Public Stormwater System Cleaning Program – Piped System | M5 | Public Stormwater System Cleaning Program – Closed Conduit System | • Clarified tracking measures and added a new tracking measure for the number and percentage of public underground stormwater quality structures maintained.<br>• Incorporated information related to the piped system condition assessment, identification of repair needs, and GIS and mapping updates (formerly in M2 and M7). Elements incorporated include updated BMP description, task, two measurable goals, and two tracking measures. |
| M8 | Winter Road Sanding and De-Icing Program | M2 | Winter Road Sanding and De-Icing Program | • Added tracking measure related to the timing of initiation of sand clean up following storms, to better correspond with related measurable goal.<br>• Minor changes to clarify use of terms. |
| P3 | Tree Planting and Information Programs | P3 | Tree Planting and Information Programs | • Modified BMP description, tasks, measurable goals, and tracking measures to better align tree planting program areas with the organizational units responsible for the work.<br>• Commitments (in the form of measurable goals for number of trees planted) are no longer included for the regulatory tree planting program associated with new private development since the City has no control over the pace of private development.<br>• Added measurable goal for the number of community members involved in tree planting.<br>• Moved the "information and education" aspects of tree planting to P1 (Educational Volunteer Program). |
| P4 | Public Stormwater System Maintenance – Developed Parks and Rights-of-Way | P4 | Public Stormwater System Maintenance – Developed Parks and Landscapes within the Rights-of-Way | • Modified measureable goal to reference the Resource Management Plans and Priority Matrix, which were developed to guide the inspection and maintenance of publicly owned vegetated facilities.<br>• Modified tasks, measurable goals and tracking measures related to Pesticide Free Parks to emphasize caring for the existing inventory of Pesticide Free Parks and Pesticide Free Zones over further expansion of the program. |
| P5 | Public Stormwater System Maintenance – Open Waterways | P5 | Public Stormwater System Maintenance – Open Waterways | • Clarified BMP description and tracking measures to include maintenance of public vegetated facilities in undeveloped parks and natural areas.<br>• Added a reference under tasks to the Resource Management Plans and Priority Matrix, which were developed to guide the inspection and maintenance of publicly owned vegetated facilities.<br>• Increased measurable goal of "green piping" public waterways from 5 miles/year to approximately 8 miles/year and reduced the length of waterways to be planted with adjacent trees and shrubs from 5,000 lineal feet/year to 1,000 lineal feet/year. This adjustment reflects the program's accomplishments in that significantly more waterways have been planted (thus pruning needs have increased) and significantly fewer lineal feet of waterways in public ownership are unplanted (thus the smaller available length to be planted).<br>• Revised measurable goal and tracking measure related to Open Waterway Maintenance Plans to review the plans and update, if necessary, once during the next permit term. |

**Table 3-3. Summary of Proposed SWMP Changes (Illicit Discharge Controls)**

| Original BMP naming | | Proposed BMP naming | | Description of proposed changes (Dec '15) |
|---|---|---|---|---|
| BMP # (Dec '12) | BMP title (Dec '12) | BMP # (Dec '15) | BMP title (Dec '15) | |
| M1 | Management of Illicit Discharges to the Municipal Stormwater System | M1 | Management of Illicit Discharges to the Municipal Stormwater System | • Incorporated the illicit discharge-related elements of the original BMPs M2 (Spill Response) and M7 (Systematic Stormwater Field Screening and Investigation). Merging these three BMPs brings together into one BMP the key aspects of the illicit discharge detection and elimination (IDDE) program, clarifies the scope and breadth, and eliminates redundancies in tasks and tracking measures.<br>• Added reference to Dry Weather Field Screening Procedure, guidance for the annual dry weather screening element of the IDDE program.<br>• Added a tracking measure to comprehensively track all illicit discharges and related enforcement actions. The comprehensive tracking will include illicit discharges related to two other BMPs: Erosion Prevention and Construction Site Management Program (E2) and the Industrial Stormwater Management program (W1).<br>• Clarified tracking measures. |
| M2 | Spill Response | -- | N/A | • Incorporated elements from the original M2 into two other BMPs:<br>  • M1 –Incorporated illicit discharge related spill response tasks, measurable goals, and tracking measures.<br>  • M5 – Incorporated system inspection, condition assessment and mapping tasks, goals and tracking measures. |
| M7 | Systematic Stormwater Field Screening and Investigation | -- | N/A | • Incorporated elements from the original M7 into two other BMPs:<br>  • M1 – Incorporated illicit discharge program related systematic field screening and investigation.<br>  • M5 – Incorporated system condition assessment related tasks. |
| P7 | Litter and Illegal Dumping Control | P2 | Litter and Illegal Dumping Control | • Refined measurable goals to reflect that litter pick up is ensured following all events on City-operated outdoor facilities (from ≥75%).<br>• Adjusted measurable goal related to waterway inspections for dumped debris and illegal campsites to focus on areas adjacent to the Willamette River, where the largest need is.<br>• Adjusted inspections of historic dump sites to reflect that historic dumping sites no longer exist as such and that periodic inspections will help ensure they stay that way.<br>• Clarified tracking measures. |

**Table 3-4. Summary of Proposed SWMP Changes (Waste Management)**

| Original BMP naming | | Proposed BMP naming | | Description of proposed changes (Dec '15) |
|---|---|---|---|---|
| BMP # (Dec '12) | BMP title (Dec '12) | BMP # (Dec '15) | BMP title (Dec '15) | |
| B1 | Household Hazardous Waste Program | B1 | Household Hazardous Waste Program | • Refined task to reflect the collaboration that occurs between household hazardous waste and stormwater program staff on educational outreach activities.<br>• Revised measurable goal and tracking measure to reflect shift from printed information in local phone book to maintaining up to date information on City's web site. |
| B2 | Solid Waste Management Program | B2 | Solid Waste Management Program | • Revised measurable goals to reflect annual review of Administrative Rule and include a once per permit term commitment to assess the need for contracting on an updated waste composition study. |

**Table 3-5. Summary of Proposed SWMP Changes (Construction and New Development)**

| Original BMP naming | | Proposed BMP naming | | Description of proposed changes (Dec '15) |
|---|---|---|---|---|
| BMP # (Dec '12) | BMP title (Dec '12) | BMP # (Dec '15) | BMP title (Dec '15) | |
| E2 | Erosion Prevention and Construction Site Management Program | E2 | Erosion Prevention and Construction Site Management Program | • Added new tracking measure to track illicit discharges related to the erosion prevention program. These measures will be comprehensively reported on in M1 (Management of Illicit Discharges to the Municipal Stormwater System). |
| E4 | Stormwater Development Standards | E4 | Stormwater Development Standards | • Updated description, measurable goals and tracking measures to reflect significant developments in this program area including the implementation (beginning in 2014) of a BMP hierarchy that emphasizes on-site low impact development (LID) techniques over mechanical approaches and the inclusion of provisions for off-site LID mitigation in certain circumstances.<br>• Added measurable goal and tracking measure to document the types of water quality and flow control facilities selected from Eugene's Stormwater Management Manual, to enable a look-back and comparison of outcomes vs. expectations.<br>• Added tracking measure to track the number of off-site LID mitigation approvals.<br>• Clarified other tracking measures. |
| P6 | Compliance Program for Maintenance of Privately Owned Vegetated Stormwater Facilities | P6 | Compliance Program for Maintenance of Privately Owned Vegetated Stormwater Facilities | • Added task for entering new private vegetated facilities into the City's database for inspection.<br>• Updated BMP overall to reflect that the inspection/enforcement program for privately maintained vegetated stormwater facilities is now developed, the related Administrative Rule has been adopted, and inspection/enforcement procedures are established and in use.<br>• Added reference to the Stormwater Facilities Procedures Manual and private facilities priority matrix which were developed to help guide work planning and inform future inspection program refinement.<br>• Added a measurable goal and related tracking measure to revise frequencies for private vegetated facility owner maintenance log submittals and City inspections by the end of Year 2 of the permit in order to prioritize work and improve efficiencies as the inventory of private vegetated facilities continues to increase. |
| M6 | Regulation of Inspection, Maintenance and Reporting of Private Underground Stormwater Structures | M6 | Regulation of Inspection, Maintenance and Reporting of Private Underground Stormwater Facilities | • Added task for entering new private mechanical facilities into the City's database for inspection.<br>• Updated BMP overall to reflect that the inspection/enforcement program for privately maintained mechanical stormwater facilities is now developed, the related Administrative Rule has been adopted, and inspection/enforcement procedures are established and in use.<br>• Added a new tracking measure for tracking the number of new private underground stormwater structures. |

**Table 3-6. Summary of Proposed SWMP Changes (Planning, Capital Improvements, and Data Management)**

| Original BMP naming | | Proposed BMP naming | | Description of proposed changes (Dec '15) |
|---|---|---|---|---|
| BMP # (Dec '12) | BMP title (Dec '12) | BMP # (Dec '15) | BMP title (Dec '15) | |
| E1 | Stormwater Capital Improvement Projects | E1 | Stormwater Capital Improvement Projects | • Added a task, measurable goal, and tracking measure for initiating updates to the city's Stormwater Basin Master Plan during the upcoming permit term.<br>• Modified measurable goals to reflect implementation of at least four water quality retrofit projects and additional retrofits as opportunities arise.<br>• Expanded tracking of capital improvement projects to include stormwater retrofit projects and off-site LID mitigation projects.<br>• Deleted completed task, measurable goal, and tracking measure related to River Road - Santa Clara Basin Plan projects as this work has been completed. |
| E3 | Stormwater System Mapping and Data Management | E3 | Stormwater System Mapping and Data Management | • Updated measurable goals and tracking measures to review and update as necessary the public and private stormwater facility that was developed over the current permit term, reflecting the significant GIS data and mapping process improvements made, and the need to review and update to maintain the caliber of information available.<br>• Clarified tasks, measurable goals and tracking measures. |
| P2 | Bacteria Pilot Study | -- | N/A | • BMP will be discontinued. The bacteria pilot study, incorporated into the City's SWMP in 2005, has served its purpose and achieved its goals to the extent that it identified potential sources of bacteria, validated the importance of current program elements that address bacteria, and led to some program refinements including incorporating four public water quality retrofit projects into the City's CIP (E1), continuation of bacteria sampling of stormwater and receiving water (consistent with MS4 Monitoring Plan), and refinements to programs beyond the MS4 SWMP that will be reflected in the City's annual TMDL Implementation reports. |

**Table 3-7. Summary of Proposed SWMP Changes (Industrial Facilities)**

| Original BMP naming | | Proposed BMP naming | | Description of proposed changes (Dec '15) |
|---|---|---|---|---|
| BMP # (Dec '12) | BMP title (Dec '12) | BMP # (Dec '15) | BMP title (Dec '15) | |
| W1 | Industrial Stormwater Management Program | W1 | Industrial Stormwater Management Program | • Incorporated task to reflect that City continues to act an agent for DEQ in administering 1200-Z (industrial stormwater) and 1700-A (wash water) NPDES permits.<br>• Added new tracking measure to track illicit discharges related to the industrial stormwater program. These measures will be comprehensively reported on in M1 (Management of Illicit Discharges to the Municipal Stormwater System). |

**Table 3-8. Summary of Proposed SWMP Changes (Permit Management)**

| Original BMP naming | | Proposed BMP naming | | Description of proposed changes (Dec '15) |
|---|---|---|---|---|
| BMP # (Dec '12) | BMP title (Dec '12) | BMP # (Dec '15) | BMP title (Dec '15) | |
| E5 | Permit Management and Reporting | E5 | Permit Management and Reporting | • Updated and clarified tasks, measurable goals and tracking measures for permit-related assessments, documentation, and public involvement. |

# Section 4
# Total Annual Stormwater Pollutant Load Estimate and Service Area Expansion

Permit Requirements

Schedule B.6: MS4 Permit Renewal Application Package

....The application package must contain:

c. An updated estimate of total annual 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 concentrations, including any modeling, data analysis and calculation methods.

e. A description of any service area expansions that are anticipated to occur during the following permit term and a finding as to whether or not the expansion is expected to result in a substantial increase in area, intensity or pollutant loads.

This section of the permit renewal application provides both the updated estimate of total annual stormwater pollutant loads and the description of service area expansions. In accordance with the methodology and assumptions detailed in the City's 2008 permit renewal application, the updated estimate of total annual stormwater pollutant loads needs to account for projected annexations through the end of the permit term. Therefore, these two evaluations have been provided together in one section.

To address these requirements, this section is organized as follows:

- Section 4.1: Updated Estimate of Total Annual Pollutant Loads
- Section 4.2: Description of Service Area Expansions
- Section 4.3: Findings and LUCS

## 4.1 Updated Estimate of Total Annual Stormwater Pollutant Loads

The City submitted its original estimate of total annual stormwater pollutant loads in Part 2 of its 1994 NPDES MS4 permit application. Pollutant loads reflected the City's calculated MS4 permit area and land use categorization at that time. The original pollutant load calculations and estimate of total annual stormwater pollutant loads were based on City stormwater sampling data and supplemented by National Urban Runoff Program data.

The City provided an updated estimate of total annual stormwater pollutant loads with its NPDES MS4 permit renewal application in 2008. The updated estimate was based on the MS4 permit area and land use categorization in 2008 and the estimated MS4 permit area and development projections at the end of the 5-year permit term (2013). The MS4 permit area as of 2013 was estimated to be 28,220 acres. This area and the associated land use categorization were used as

the basis for the total annual stormwater pollutant load calculations included with the 2008 permit renewal application. A spreadsheet loads model, using the United States Environmental Protection Agency (EPA) simple method equation, was developed for the analysis and used a regional compilation of land use event mean concentration (EMC) data.

Modeling methods and assumptions used for this (2015) updated estimate of total annual stormwater pollutant loads are detailed below, and are generally consistent with the approach used in 2008.

### 4.1.1 Modeled Parameters

Total annual stormwater pollutant loads are required to be calculated for TMDL pollutants or applicable pollutant surrogates and additional parameters as listed in Schedule B.6.c of the NPDES MS4 permit.

The Willamette Basin TMDL (Upper Willamette Subbasin and McKenzie River Subbasin) is the applicable TMDL for the City. Applicable TMDL parameters include bacteria (*E. coli*), dissolved oxygen (with biochemical oxygen demand [BOD]), total phosphorus, and volatile suspended solids ([VSS] used as surrogates), and turbidity (with total suspended solids [TSS] used as a surrogate). Given limited data for VSS, TSS is the common analyzed parameter. A more detailed summary of applicable TMDLs and TMDL parameters is included in Section 5 of this permit renewal application.

The comprehensive list of pollutant parameters included in this pollutant loads analysis is as follows:

- TSS
- *E. coli*
- 5-day biochemical oxygen demand ($BOD_5$)
- Chemical oxygen demand (COD)
- Nitrate
- Total and dissolved phosphorus
- Total Cadmium
- Total Copper
- Total Lead
- Total Zinc

### 4.1.2 Model Area and Land Use

Total annual stormwater pollutant load estimates are based on the City's projected service area and development conditions at the end of the next permit cycle (2021). The City's projected service area in 2021 is estimated to be 28,707 acres as described in Section 4.2. Development conditions for projected service area expansions (*i.e.*, annexations) are consistent with the land use forecasting described Section 4.2, Table 4-4.

It is assumed that all developed area within the current (2015) city limits will remain developed in 2021 consistent with current land use. Vacant lands within the current city limits will be developed at a rate consistent with the calculated reduction in vacant lands from 2009 to 2015. Forecasting suggests that approximately 82 acres of vacant land currently inside city limits will develop by 2021. These 82 acres are also expected to develop consistent with the land use forecasting summarized in Section 4.2, Table 4-4.

A summary of model area and associated land use is provided below in Table 4-1. Impervious percentages by modeled land use category are also summarized and are consistent with values used in the City's adopted Stormwater Basin Master Plan, and with the percentages used for the 2014 TMDL PLRE and calculation of the 2015 TMDL benchmarks (see Section 5 and Appendix C of the permit renewal application).

**Table 4-1. Total Annual Pollutant Load Model Area by Land Use**

| Generalized land use category | Modeled impervious percentage | Current service area (2015) (acres) | Vacant land development (2015-2021) (acres)[a] | Annexations (2015–2021) (acres)[a] | Estimated total service area (2021) (acres) |
|---|---|---|---|---|---|
| SFR | 44% | 12,524.2 | 35.2 | 150.5 | 12,674.7 |
| MFR | 59% | 1,514.3 | 7.2 | 30.8 | 1,545.1 |
| COM | 71% | 4,847.8 | 16.7 | 71.4 | 4,919.2 |
| IND | 61% | 1,230.2 | 5.9 | 25.1 | 1,255.3 |
| OS | 18% | 5,087.6 | 17.0 | 72.5 | 5,160.1 |
| VAC | 2% | 3,109.9 | (82.0) | 42.6 | 3,152.5 |
| Total | | 28,314 | Net Zero | 393 | **28,707** |

a. *A description of annexation areas and forecasted land use for the annexation areas and vacant areas are provided in Section 4.2.*

### 4.1.3 Modeling Methods and Assumptions

A spreadsheet pollutant loads model using the EPA simple method was used for the pollutant load calculations. The spreadsheet loads model contains baseline land use EMCs, which were developed in 2008 as part of a coordinated effort between the Oregon Association of Clean Water Agencies (ACWA) and Oregon Phase I jurisdictions. The land use EMCs reflect monitoring data collected from all Oregon Phase I jurisdictions, and thus differ somewhat from the Eugene-specific values used in the original permit application. The City's projected NPDES MS4 service area by land use is input into the model, and pollutant loads reflective of the respective areas and land use EMCs are calculated.

Land use EMCs are included as a range reflecting the upper and lower 95 percent confidence level, and reflecting generalized (*e.g.*, commercial, residential, industrial, open space) land use categories. Transportation or ROW area is not a modeled land use category, as the data collected to develop the land use EMCs reflect the monitored land use category and adjacent ROW. Therefore the ROW area is reflected in the generalized land use EMCs.

Table 4-2 summarizes the land use EMCs used in the model. For vacant land use, because land use EMCs for vacant lands were not specifically calculated, the open space land use EMC was used to simulate loading from vacant lands. Similarly, single family and multi-family residential land use area are both modeled using the residential land use EMC.

**Table 4-2. Land Use EMC Values used in the Total Annual Pollutant Load Estimate**

| Parameter | Land use | Count | Bootstrapped mean | | |
|---|---|---|---|---|---|
| | | | 95% lower confidence level (LCL) | Mean | 95% upper confidence level (UCL) |
| TSS, milligrams per liter (mg/L) | Commercial | 72 | 64 | 82 | 103 |
| | Industrial | 48 | 117 | 184 | 284 |
| | Open space[a] | 10 | 16 | 31 | 50 |
| | Residential[b] | 65 | 44 | 66 | 99 |
| *E. coli*, colony-forming units (CFUs)/ 100 milliliters (mL) (geomean) | Commercial | 52 | 573 | 1,247 | 2,409 |
| | Industrial | 58 | 154 | 438 | 1,004 |
| | Open space[a] | 9 | 57 | 87 | 124 |
| | Residential[b] | 65 | 970 | 1,656 | 2,651 |
| $BOD_5$, mg/L | Commercial | 22 | 8.5 | 11.9 | 16.6 |
| | Industrial | 23 | 26.1 | 39.6 | 56.1 |
| | Open space[a] | 3 | 2.4 | 3.3 | 4.2 |
| | Residential[b] | 28 | 5.9 | 8.1 | 10.8 |
| COD, mg/L | Commercial | 26 | 51.8 | 65.1 | 81.5 |
| | Industrial | 25 | 76.8 | 102.6 | 134.1 |
| | Open space[a] | 9 | 11.1 | 19.6 | 27.6 |
| | Residential[b] | 36 | 37.4 | 50.9 | 66.0 |
| Nitrate, mg/L | Commercial | 46 | 0.27 | 0.38 | 0.53 |
| | Industrial | 22 | 0.18 | 0.24 | 0.31 |
| | Open space[a] | 263 | 1.36 | 1.51 | 1.66 |
| | Residential[b] | 32 | 0.60 | 0.91 | 1.33 |
| Total phosphorus, mg/L | Commercial | 26 | 0.28 | 0.38 | 0.50 |
| | Industrial | 25 | 0.40 | 0.51 | 0.64 |
| | Open space[a] | 8 | 0.095 | 0.12 | 0.15 |
| | Residential[b] | 36 | 0.23 | 0.34 | 0.48 |
| Dissolved phosphorus, mg/L | Commercial | 46 | 0.09 | 0.11 | 0.14 |
| | Industrial | 21 | 0.10 | 0.17 | 0.27 |
| | Open space[a] | 261 | 0.04 | 0.04 | 0.04 |
| | Residential[b] | 30 | 0.08 | 0.11 | 0.15 |
| Cadmium, total, micrograms per liter (µg/L) | Commercial | 53 | 0.75 | 1.11 | 1.56 |
| | Industrial | 23 | 2.27 | 3.47 | 5.00 |
| | Open space[a] | 131 | 0.10 | 0.11 | 0.13 |
| | Residential[b] | 45 | 0.41 | 0.53 | 0.66 |
| Copper, total, µg/L | Commercial | 26 | 20.8 | 28.6 | 38.2 |
| | Industrial | 26 | 33.8 | 45.5 | 58 |
| | Open space[a] | 10 | 2.0 | 2.5 | 3.0 |
| | Residential[b] | 33 | 10.5 | 13.4 | 17.1 |

| Table 4-2. Land Use EMC Values used in the Total Annual Pollutant Load Estimate | | | | | |
|---|---|---|---|---|---|
| Parameter | Land use | Count | Bootstrapped mean | | |
| | | | 95% lower confidence level (LCL) | Mean | 95% upper confidence level (UCL) |
| Lead, total, µg/L | Commercial | 25 | 37.8 | 54.0 | 72.7 |
| | Industrial | 22 | 32.7 | 48.3 | 67.0 |
| | Open space[a] | 9 | 0.6 | 0.8 | 1.1 |
| | Residential[b] | 28 | 11.0 | 17.7 | 27.6 |
| Zinc, total, µg/L | Commercial | 28 | 130 | 170 | 217 |
| | Industrial | 24 | 283 | 674 | 1,353 |
| | Open space[a] | 9 | 6.3 | 7.8 | 9.5 |
| | Residential[b] | 39 | 77 | 104 | 134 |

*Note: Data range (+/- 95 percent) provided by the City of Portland. Based on modified ACWA data set (2008).*

*a. Land use EMCs for open space are used to simulate vacant land use.*

*b. Land use EMCs for residential are used to simulate single-family residential and multi-family residential.*

The annual stormwater pollutant load estimates are based on an average annual rainfall volume of 46 inches, consistent with the rainfall volume assumed in the 2008 NPDES MS4 permit renewal.

### 4.1.4 Updated Estimate of Total Annual Stormwater Pollutant Loads

Total annual stormwater pollutant loads, reflective of the City's MS4 service area and development conditions at the end of the upcoming permit term (i.e., 2021), are summarized in Table 4-3 for the applicable parameters. This updated estimate is presented in terms of a pollutant load range because of the inherent variability in stormwater runoff quality. Pollutant loads are shown in pounds (lb) per year, with the exception of *E. coli*, which is shown as total counts per year. It is noteworthy that the estimated pollutant loads (the total loads and all of the individual loads) are projected to be lower than the City's 1994 pollutant loads.

| Table 4-3. Updated Annual Estimate of Stormwater Pollutant Loads for the City of Eugene | | | |
|---|---|---|---|
| Stormwater pollutant load parameter | LCL (lb or counts) | Mean (lb or counts) | UCL (lb or counts) |
| TSS | 5,762,268 | 8,344,043 | 11,979,374 |
| *E. coli* (counts) | $3.61 \times 10^{14}$ | $6.61 \times 10^{14}$ | $1.13 \times 10^{15}$ |
| $BOD_5$ | 846,654 | 1,196,335 | 1,639,267 |
| COD | 4,624,721 | 6,163,995 | 7,934,300 |
| Nitrate | 63,437 | 88,257 | 121,181 |
| Total phosphorus | 27,033 | 38,058 | 51,766 |
| Dissolved phosphorus | 8,977 | 11,951 | 16,070 |
| Cadmium, total | 66 | 94 | 127 |
| Copper, total | 1,570 | 2,085 | 2,712 |
| Lead, total | 2,117 | 3,156 | 4,495 |
| Zinc, total | 10,942 | 16,651 | 24,802 |

## 4.2 Projected Service Area Expansions

This section outlines the process for estimating the City's NPDES MS4 service area expansion over the upcoming permit term, and the results.

### 4.2.1 Current Service Area

The City's NPDES MS4 permit area or "service area," for purposes of this evaluation, is considered to be the area within the City of Eugene city limits, excluding the Willamette River main stem itself. As of August 2015, the City's NPDES MS4 service area is 28,314 acres.

### 4.2.2 Projected Service Area Expansions

Since 1994 (the year the City's original NPDES MS4 permit was issued), city limits have expanded through the annexation of property within the City's UGB. In order to estimate the expansion of service area through the end of the next anticipated NPDES MS4 permit term (*i.e*. through 2021), the City first calculated the average rate in which the Eugene city limits increased from 2008 to 2015, and then used that average rate to project a future expansion area. As of January 2008, the City's NPDES MS4 service area was 27,839 acres. Over the 92-month period (2008 - 2015) 475 acres were annexed into the City, resulting in 28,315 acres and a growth rate of approximately 5.17 acres per month.

The UGB itself has not changed in the post-1994 timeframe. The City is in the midst of a long-range planning process called Envision Eugene that will determine the best way to accommodate future population and job growth. UGB expansion is expected to be an element of the long-range strategy; however the outcome of the process has yet to be determined and final decisions rest with the Eugene City Council. Given the complexity of the Envision Eugene process, the extended timeline, uncertainty of the outcome, and potential lag time for providing urban services to any future UGB expansion areas, no service area expansions are projected beyond the existing UGB through the end of the next anticipated NPDES MS4 permit term (2021). For purposes of this section and the associated pollutant loads update in Section 1, projected service area expansions are solely associated with annexation and development of area to city limits from within the current UGB.

For purposes of this evaluation, the estimated permit issuance and implementation timeframe for the next permit term is assumed to be approximately 6.3 years (or 76 months), from August 2015 (the baseline date for this evaluation, four months prior to permit expiration) to December 2021. Even though the MS4 permits are 5-year permits, it is realistic to assume some additional time beyond the 5-year permit period to accommodate the permit renewal process. Applying the average monthly growth rate of 5.17 acres per month to the estimated future permit timeframe (76 months), the city limits would be expected to grow by approximately 393 acres. This would result in a total projected NPDES MS4 service area of 28,707 acres as of December 2021. This projected service area expansion represents an increase of approximately 1.4 percent of the City's NPDES MS4 permit area anticipated in the year 2021.

The City, in coordination with regional geographic information system (GIS) services provided by the Lane Council of Governments, has developed and maintains generalized land use coverage information in for the City in GIS. This generalized land use information was used to categorize the land use breakdown (i.e., land use category by percentage of overall area within city limits) from 2009 to 2015, and then to project the future land use breakdown for the expanded city limits in 2021. Table 4-4 summarizes the forecasted land use breakdown for 2021. This forecasted land use breakdown was also used to estimate development of vacant land from 2016 to 2021 (see Section 4.1.2).

Using the available GIS data, street right-of-way (ROW) can be categorized and quantified separately as a land use category; however data assumptions and methods related to the pollutant loads modeling (Section 4.1) do not include modeling the ROW area separately. To adjust for this, the ROW portions of the forecasted land use breakdown were incorporated into the other six generalized land use categories by means of a GIS spatial infill method. Using this method, ROW land use is replaced, or "filled in," spatially by adjacent non-ROW land uses. This method is consistent with what was used to adjust the land use coverage associated with ROW for the TMDL pollutant load reduction evaluation (PLRE) in 2014 and TMDL benchmark development in 2015. Table 4-4 includes the forecasted land use breakdown for 2021, with ROW distributed among the other six land use categories.

The forecasted land use breakdown, which incorporates the ROW into each of the other six land use categories, was then applied to the projected 393 acres of service expansion area. Table 4-4 summarizes the projected service area expansion by land use category. This information for the projected service area expansion is also referenced in Table 4-1 as related to the annexation areas.

**Table 4-4. Estimated Land Use for Projected Service Area Expansions**

| Generalized land use category | Forecasted land use breakdown (2021) | Forecasted land use breakdown (2021) with ROW distributed among other land use categories | Projected service area expansion (acres) |
|---|---|---|---|
| Single-family residential (SFR) | 33.5% | 38.3% | 150.5 |
| Multi-family residential (MFR) | 4.9% | 7.8% | 30.8 |
| Commercial (COM) | 14.2% | 18.2% | 71.4 |
| Industrial (IND) | 3.5% | 6.4% | 25.1 |
| Open Space (OS) | 16.7% | 18.5% | 72.5 |
| ROW | 16.9% | -- | -- |
| Vacant (VAC) | 10.4% | 10.8% | 42.6 |
| Total | 100% | 100% | 393 |

A detailed description of the GIS calculations in support of this projection of service area expansions is provided in the internal memorandum *2015 Permit Area Determination*, prepared by Bill Clingman at Lane Council of Governments[3].

### 4.2.3 Stormwater Management in Expansion Areas

Properties that are annexed to the City will be included in the City's NPDES MS4 service area boundary and covered by the range of stormwater program BMPs that have been implemented and adaptively managed since the City's first MS4 permit was issued. This means that programmatic controls like system maintenance, street sweeping, spill prevention, volunteer programs, water quality capital projects, and stormwater education that collectively reduce stormwater pollutants to the maximum extent practicable would now be implemented. Such programmatic controls would not otherwise be implemented on properties outside of the MS4 service area.

Newly annexed area will also be subject to post-construction stormwater development standards for new and redevelopment including a hierarchy of BMPs that emphasizes infiltration/filtration over mechanical treatment for pollution reduction, and construction-related standards for erosion

[3] Lane Council of Governments. 2015. *2015 Permit Area Determination.* Prepared by Bill Clingman.

prevention and construction site management. Such structural controls help offset pollutant discharges associated with new and redeveloped impervious surfaces

In addition to programmatic controls and structural controls, the City is actively implementing its stormwater retrofit strategy which is expected to improve the overall water quality condition over time. The City's stormwater retrofit strategy objectives, documented in its Stormwater Retrofit Plan (November 20, 2014) are to reduce the water quality impacts associated with existing development and support comprehensive watershed restoration. The City is accomplishing these objectives through a combination of stormwater capital projects, regulatory measures that apply to re-development sites, financial incentives and voluntary measures, and education and demonstration.

## 4.3 Findings and LUCS

Based on the discussion in Sections 4.1 and 4.2 above, the service area expansions that the City anticipates will occur during the following permit term are not expected to result in a substantial increase in area, intensity or pollutant load.

Pursuant to OAR 340-018-0050(2)(b), the City must submit a land use compatibility statement (LUCS) with its NPDES permit renewal application if the Department determines that the City's renewal permit involves a substantial modification or intensification of the permitted activity. The administrative rule further describes a permit modification to encompass when the "permitted source or activity relates to the use of additional property or a physical expansion on the existing property." See OAR 340-018-0050(2)(b)(B)(i).

For the reasons discussed above, the City's renewal permit will not substantially modify or intensify the permitted activity. Notably, the permitted activities that will be covered by this renewal permit are virtually identical to the permitted activities covered by the 2010 permit. Additionally, like the City's 2010 permit, the renewal permit includes adaptive management measures designed to improve the City's management practices, thereby further reducing pollutant discharges. Nevertheless, because the OAR provision states that a permit modification occurs if the permitted activity "relates to the use of additional property" (which *could* be strictly read as the addition of one acre of property added to the City's service area) and the City projects that approximately 393 acres will be annexed to the City during the renewal permit period, the City is submitting a LUCS with its permit renewal application. The City is submitting the LUCS out of an abundance of caution, not because it has found that the renewal permit involves a substantial modification or intensification of the permitted activity.

# Section 5
# Benchmarks

<u>Permit Requirements</u>

Schedule B.6: MS4 Permit Renewal Application Package

…The application package must include an evaluation of the adequacy of the proposed SWMP modifications in reducing pollutants in discharges from the MS4 to the MEP. The application package must contain:

h. If applicable, the established TMDL pollutant load reduction benchmarks, as required in Schedule D.3.d.

This section of the permit renewal application summarizes the City of Eugene's (City's) TMDL pollutant load reduction benchmarks in accordance with Schedule D.3.d of the City's NPDES MS4 permit.

Per Schedule D.3.d.ii (1-4), the TMDL benchmarks must reflect the City's commitment to achieving additional pollutant load reduction and progress towards achieving the TMDL wasteload allocation (WLA) during the next permit term. The TMDL benchmark submittal must include the following:

1. *An explanation of the relationship between the TMDL WLAs and the TMDL benchmark for each applicable TMDL parameter;*
2. *A description of how SWMP implementation contributes to the overall reduction of the TMDL pollutants during the next permit term;*
3. *Identification of additional or modified BMPs that will result in further reductions in the discharge of the applicable TMDL pollutants, including the rationale for proposing the BMPs; and*
4. *An estimate of current pollutant loadings that reflect the implementation of the current BMPs and the BMPs proposed to be implemented during the next permit term.*

Detailed explanation of the four items above, including additional information related to pollutant modeling methods, assumptions, and results is provided in the City's TMDL Benchmark Report (December 2015), which is included in Appendix C of this permit renewal application.

This section summarizes the relationship between the TMDL WLAs and benchmarks, lists the additional best management practices (BMPs) that will result in further reduction of TMDL pollutants, and summarizes the City's TMDL benchmarks and how implementation of the City's SWMP contributes. This section is organized as follows:

- Section 5.1: Relationship between TMDL WLAs and Benchmarks
- Section 5.2: BMP Identification
- Section 5.3: TMDL Benchmarks Results and Discussion

## 5.1 Relationship between TMDL WLAs and Benchmarks

A TMDL is a calculation of the maximum amount of a pollutant that a water body can receive and still meet water quality standards for that particular pollutant. A TMDL is used to allocate the allowable pollutant load discharge to point sources (i.e., wastewater treatment plants (WWTP), areas covered by an NPDES permit) through wasteload allocations (WLAs), and to nonpoint sources (i.e., agriculture, forests) through load allocations (LAs). Permitted dischargers, including MS4s, are considered point sources and pollutant discharge is regulated via assigned WLAs.

Under the coverage of the City's NPDES MS4 permit, the discharge of TMDL pollutants must be reduced to the maximum extent practicable (MEP) through the implementation of best management practices (BMPs). BMPs may be both structural and non-structural in nature.

To evaluate progress in reducing the discharge of TMDL pollutants to the MEP, the City's NPDES MS4 permit includes a requirement to develop TMDL pollutant load reduction benchmarks for each TMDL parameter where existing BMP implementation is not estimated to be achieving the WLA. By definition, a TMDL benchmark is a future TMDL pollutant load reduction estimate. It reflects current BMP implementation and projected BMP implementation over the next 5-year permit term and is used as a tool to guide progress and adaptive management of MS4 NPDES permitted stormwater programs.

The Willamette Basin TMDL (2006) references the City as a designated management agency (DMA) due to urban stormwater runoff, and thus the City is subject to waterbody-specific WLAs for stormwater. Applicable waterbodies referenced in the Willamette Basin TMDL include the Upper Willamette River, Upper Amazon Creek, A3 Channel, Amazon Diversion Channel, Fern Ridge Reservoir, and McKenzie River. Applicable TMDL parameters include bacteria, dissolved oxygen (DO) (with biochemical oxygen demand [BOD], total phosphorus, and volatile suspended solids (VSS)[4] used as a surrogate), and turbidity (with total suspended solids (TSS) used as a surrogate). Given limited data for VSS, TSS is the common analyzed parameter. A summary of waterbodies and associated WLAs applicable to the City is provided in Table 5-1.

**Table 5-1. Willamette River WLAs (applicable to the City's MS4)**

| Water body | Parameter | WLA |
|---|---|---|
| Upper Amazon Creek | Bacteria *(E. coli)* | 84% (annual reduction) |
| A3 Channel | Bacteria *(E. coli)* | 33% (annual reduction) |
| Fern Ridge Reservoir | Bacteria *(E. coli)* | 64% (annual reduction) |
| | Turbidity (TSS surrogate) | 54.6% (annual reduction) |
| Amazon Diversion Channel | Biological oxygen demand | 40% (annual reduction) |
| | Volatile suspended solids (TSS surrogate) | 40% (annual reduction) |
| | Nutrients (total phosphorus surrogate) | 40% (annual reduction) |
| Upper Willamette River (main and unreferenced tributaries) | Bacteria *(E. coli)* | 65% (annual reduction) |
| McKenzie River | Bacteria *(E. coli)* | 65% (annual reduction) |

[4] In the Willamette Basin TMDL, page 10-147, sediment oxygen demand is caused partly by discharges of VSS. Load reduction is referred to as the reduction of VSS in the TMDL.

The City conducted a pollutant load reduction evaluation for TMDL parameters in 2014. Based on results of the pollutant load reduction evaluation, the City is not estimated to be meeting TMDL WLAs for any parameter in any of the six, modeled TMDL watersheds. Thus, the City is required to establish TMDL pollutant load reduction benchmarks for these parameters for the next permit term.

## 5.2 BMP Identification

As TMDL benchmarks are pollutant load reduction estimates projected for the end of the next permit term, planned structural BMP installations or retrofits provide the basis for achieving future pollutant load reductions.

To identify these BMPs that will result in additional TMDL pollutant load reduction and establish the TMDL benchmarks, the City's Public Works staff reviewed the Retrofit Plan (December 2014), the adopted FY16-21 Capital Improvement Plan (CIP) and the current Stormwater Basin Master Plans (2002 & 2012), to identify potential future public stormwater facility installations. Staff estimated the location (by TMDL watershed), BMP facility type(s), and drainage area(s) for these projects. The potential, future stormwater facility installations, or equivalent projects, will be completed by 2021, or end of the City's next NPDES MS4 permit term, in accordance with Schedule D.3.d.i.2 of the NPDES MS4 permit. A total of four future stormwater capital projects were identified and are reflected in the TMDL benchmarks. Table 5-2 lists the TMDL watersheds, and estimated future stormwater BMP installations.

**Table 5-2. 2015 TMDL Benchmark Status and Future BMP Installations**

| TMDL watershed | Parameter (units) | 2014 pollutant load reduction estimate results | 2015 TMDL benchmark development | | |
|---|---|---|---|---|---|
| | | Met TMDL WLA? | Estimated future BMP installation | Est. future BMP location description | Est. total drainage area (ac) |
| A3 Channel | Bacteria (counts) | No | Manufactured treatment facility (type TBD, modeled as hydromodynamic separator) | West Eugene, north of 5th and Seneca | 20 |
| Upper Amazon Creek | Bacteria (counts) | No | Filtration raingarden/lined planter | Street ROW along 7th Street, east of Bailey Hill | 1 |
| Upper Willamette River | Bacteria (counts) | No | Bioswale | River Play parking lot, Alton Baker Park | 0.7 |
| | | | Filtration rain garden/lined planter | Street ROW along 2nd Avenue, west of Blair Blvd. | 1 |
| McKenzie River[a] | Bacteria (counts) | No | None, see Section 4 | N/A | N/A |
| Fern Ridge Reservoir[b] | Bacteria (counts) | No | See future BMP installations for the A3 Channel and Upper Amazon | See future BMP installations for the A3 Channel and Upper Amazon | 21 |
| | TSS (pounds) | No | | | |
| Amazon Diversion Channel[b] | Total phosphorus (pounds) | No | See future BMP installations for the A3 Channel and Upper Amazon | See future BMP installations for the A3 Channel and Upper Amazon | 21 |
| | BOD (pounds) | No | | | |
| | TSS (pounds) | No | | | |

a. *This watershed was not modeled in 2008, thus no TMDL benchmarks were previously established. No future BMPs are projected for this watershed.*

b. *The Amazon Diversion Channel and Fern Ridge Reservoir watershed areas are the same, and reflect the combined area of the Upper Amazon Creek and A3 Channel TMDL watersheds.*

## 5.3 TMDL Benchmark Results and Discussion

This section describes the TMDL benchmark results and provides discussion related to the conservative nature of the TMDL benchmarks in light of SWMP implementation.

### 5.3.1 Calculation Methods and Results

The same spreadsheet loads model used for the pollutant load reduction evaluation was used to simulate predicted future BMP implementation and calculate future pollutant load reduction estimates (i.e., TMDL benchmarks). Consistent model input data including rainfall, land use coverage, pollutant concentrations and BMP effectiveness was used.

TMDL benchmarks are calculated as the difference between the modeled loads associated with the no-BMP scenario, and the (future/2021) with-BMP scenario. Because of the variability in stormwater data, pollutant loads themselves are typically calculated and presented as a range; therefore, the TMDL benchmarks are also presented as a range. Table 5-3 provides TMDL benchmarks both as a load reduction and as a percentage load reduction. Calculation of the TMDL benchmarks as a percentage load reduction allows for direct comparison between the WLA and the TMDL benchmarks per Schedule D.3.d.ii.1 of the City's NPDES MS4 permit. The WLA is shown in Table 5-3 for reference.

The actual pollutant load estimates reflecting the no-BMP, current/2014 with-BMP, and future/2021 with-BMP scenarios used to calculate the TMDL benchmarks are provided in Appendix C of this permit renewal application.

**Table 5-3. TMDL Benchmarks (2016-2021)**

| TMDL watershed | Parameter (units) | Annual WLA[a] (% reduction) | 2015 TMDL benchmark development | |
|---|---|---|---|---|
| | | | TMDL benchmarks (% load reduction)[b], range | TMDL benchmarks (counts or pounds)[b], range |
| A3 Channel[c] | Bacteria (counts) | 33 | 0.63–0.90 | $1.42 \times 10^{11}$–$7.38 \times 10^{11}$ |
| Upper Amazon Creek | Bacteria (counts) | 84 | 0.23–0.35 | $3.00 \times 10^{11}$–$1.36 \times 10^{12}$ |
| Upper Willamette River | Bacteria (counts) | 65 | 0.55–0.82 | $1.05 \times 10^{12}$–$4.87 \times 10^{12}$ |
| McKenzie River | Bacteria (counts) | 65 | None, See Section 5.3.2 | None, See Section 5.3.2 |
| Fern Ridge Reservoir | Bacteria (counts) | 64 | 0.29–0.45 | $4.40 \times 10^{11}$–$2.09 \times 10^{12}$ |
| | TSS (pounds) | 54.6 | 0.55–0.90 | 13,948–48,389 |
| Amazon Diversion Channel | Total phosphorus (pounds) | 40 | 0.58–1.23 | 68–274 |
| | BOD (pounds) | 40 | 0.82–1.36 | 3,136–10,226 |
| | TSS (pounds) | 40 | 0.55–0.90 | 13,948–48,389 |

a. *Bacteria, total phosphorus, TSS, and BOD WLAs are all expressed as a percent load reduction.*

b. *The TMDL benchmarks are calculated as the difference between the current no-BMP scenario load and the future with-BMP scenario load (which includes existing BMPs). The benchmarks have been calculated as a load reduction and as a percent reduction for direct comparison with the WLA.*

c. *Future-conditions BMP implementation is assumed in the A3 Channel TMDL watershed. However, the proposed BMP is not effective at bacteria removal. Therefore, no quantitative TMDL benchmark has been developed.*

As noted in Table 5-3, a TMDL benchmark was not established for the McKenzie River watershed in 2008. No anticipated CIPs are set to be installed in this area from 2016 to 2021; however, the City's stormwater program, including the full suite of non-structural control measures, apply in this watershed and are expected to contribute to TMDL pollutant load reduction as described in Section 5.3.2.

### 5.3.2 Discussion and Application to the City's SWMP

The TMDL benchmarks are conservative estimates of the pollutant load reduction anticipated during the upcoming MS4 permit term with the use of public structural BMPs alone. They do not directly account for the many non-structural BMPs implemented by the City. They also do not account for all future private and public structural BMP installations. This conservative approach was taken, in part, because of the relative lack of quantitative pollutant reduction data for non-structural controls, the unpredictable pace and location of private development activities (and associated private structural BMP installation), and variability with respect to the installation of public stormwater retrofits.

Specifically, additional load reduction is expected through the following:

- Non-structural and source control BMPs (e.g., erosion control, illicit discharge detection and elimination, street sweeping, catch basin cleaning, facility maintenance, system operations and maintenance, pet waste program, and public education) per the City's Stormwater Management Plan (SWMP). These essential non-structural program areas obviously reduce stormwater pollution but data is not available to quantify the pollutant load reduction achieved from these measures.
- Additional public and private structural BMPs, installed as retrofits and designed in conjunction with the 2014 City's Stormwater Design Standards.

Therefore, the TMDL benchmarks do not reflect the full range of pollutant load reduction anticipated through implementation of their stormwater program. Appendix C of this permit renewal includes a more in-depth reflection of the TMDL benchmarks results in conjunction with the City's SWMP.

The City prepared a WLA attainment assessment for DEQ in November 2014, which indicated that achievement of the WLA would require construction and maintenance costs that far exceed the City's definition of MEP. The purpose of this assessment was to evaluate and estimate what it would take, hypothetically, in terms of additional BMP implementation and costs, to achieve the WLAs. As such, progress toward the WLA, and not achievement of the WLA, is Eugene's goal for the TMDL benchmarks.

Additional detail related to the conservative nature of the TMDL benchmarks is provided in Appendix C.

# Section 6
# Fiscal Evaluation of Stormwater Expenditures

Permit Requirements

Schedule B.6: MS4 Permit Renewal Application Package

...The application package must include an evaluation of the adequacy of the proposed SWMP modifications in reducing pollutants in discharges from the MS4 to the MEP. The application package must contain:

f. A fiscal evaluation summarizing program expenditures for the current permit cycle and projected program allocations for the next permit cycle.

This section of the permit renewal application provides the fiscal evaluation including a summary of stormwater-related expenses incurred from fiscal year (FY) 2011 through FY 2016 and projections of utility rate revenue through FY 2021. This section is organized as follows:

- Section 6.1: Stormwater Program Revenue Background
- Section 6.2: Current and Projected Stormwater Expenditures

### 6.1.1 Stormwater Program Revenue Background

The primary revenue source for the stormwater program is the City's stormwater user fee, which is paid by all existing and new residents and businesses and is billed monthly along with other utility fees. The fee is based upon impervious surface area or building footprint. The user fee funds operations, maintenance, and capital program activities. Stormwater user fees represent over 90 percent of the stormwater utility revenue. Stormwater user fees are established by an administrative process that includes opportunity for public input and City Council review.

The other major revenue source for the stormwater program is system development charges (SDCs). SDCs are paid by new and expanding development, and are based upon impervious surface area, number or dwelling units, or development footprint. SDCs are used to fund the portion of the cost of construction of stormwater infrastructure needed to support development demands in the community, to maintain health and safety standards, and to recoup a portion of the community's investment in the infrastructure that is already in place. SDCs are established by an administrative process that includes opportunity for public input and City Council review. Modifications to the methodology for calculating stormwater SDCs were made in 2014 to support implementation of changes to the stormwater development standards (BMP E4). The revised methodology includes a new rate component to be paid only by private development that does not construct on-site stormwater infiltration or filtration facilities. The new SDC rate component funds equivalent off-site public stormwater infiltration and filtration treatment facilities.

### 6.1.2 Current and Projected Stormwater Expenditures

A summary of actual stormwater expenditures for the current permit cycle is provided in Table 6-1. A summary of projected program allocations for the next permit cycle are provided in Table 6-2.

**Table 6-1. Stormwater Expenditures for the Current Permit Term**

| Fund | Division | FY11 | FY12 | FY13 | FY14 | FY15 | 2016 |
|---|---|---|---|---|---|---|---|
| | | Actual | Actual | Actual | Actual | Actual | Budget |
| 335-SDCs | 93 - Engineering | $275,534 | ($2,537) | $0 | $161,792 | $217,945 | $534,518 |
| | 99 - Non Departmental | $1,800 | $0 | $2,000 | $2,000 | $2,000 | $0 |
| Total Stormwater SDCs | | $277,334 | ($2,537) | $2,000 | $163,792 | $219,945 | $534,518 |
| 531-Stormwater Utility-Capital | 93 - Engineering | $2,099,976 | $4,924,303 | $3,346,002 | $2,643,197 | $3,667,824 | $7,104,872 |
| Total Stormwater Utility-Capital | | $2,099,976 | $4,924,303 | $3,346,002 | $2,643,197 | $3,667,824 | $7,104,872 |
| 535-Stormwater Utility-Operating | 87 - WWTP | $378,415 | $391,032 | $412,992 | $451,743 | $445,832 | $539,039 |
| | 89 - Administration | $1,433,403 | $1,484,509 | $1,549,354 | $1,550,659 | $1,659,412 | $1,873,894 |
| | 93 - Engineering | $1,535,424 | $1,600,887 | $1,556,213 | $1,490,328 | $1,653,791 | $2,064,093 |
| | 94 - Maintenance | $3,955,087 | $4,083,557 | $4,152,092 | $4,141,534 | $4,448,408 | $4,747,122 |
| | 96 - Parks & Open Space | $3,459,491 | $3,747,633 | $3,824,188 | $4,265,283 | $4,736,960 | $5,393,923 |
| | 99 - Non Departmental | $857,000 | $855,000 | $975,000 | $927,000 | $994,000 | $1,080,000 |
| Total Stormwater Utility-Operating | | $11,618,820 | $12,162,617 | $12,469,839 | $12,826,547 | $13,938,403 | $15,698,071 |

*Notes:*

*Figures shown for FY11– FY15 are actual expenditures, figures shown for FY16 (July 1, 2015, through June 30, 2016) reflect budgeted amounts.*

*For FY16 Budget, SDCs, $134,000 is capital carryover, balance is new appropriation).*

*Effective FY16 budget, the non departmental line it is no longer being charged to Fund 335, it is being charged to the SDC Admin Fund.*

*Non Departmental line item accounts for central services (human resources, finance, information technology, administration) and pass through payments.*

*For FY16 stormwater utility capital, capital carryover is $4.3 million and the balance is new appropriation).*

**Table 6-2. Projected Stormwater Expenditures for the Next Permit Term**

| Fund | Division | Forecast | | | | |
|---|---|---|---|---|---|---|
| | | FY17 | FY18 | FY19 | FY20 | FY21 |
| 335-Stormwater SDCs | 93 - Engineering | | | | | |
| | 99 - Non Departmental | | | | | |
| Total Stormwater SDCs | | $500,000 | $500,000 | $500,000 | $500,000 | $450,000 |
| 531-Stormwater Utility-Capital | 93 - Engineering | | | | | |
| Total Stormwater Utility-Capital | | $1,865,000 | $2,265,000 | $2,265,000 | $2,328,624 | $2,615,000 |
| 535-Stormwater Utility-Operating | 87 - WWTP | | | | | |
| | 89 - Administration | | | | | |
| | 93 - Engineering | | | | | |
| | 94 - Maintenance | | | | | |
| | 96 - Parks & Open Space | | | | | |
| | 99 - Non Departmental | | | | | |
| Total Stormwater Utility-Operating | | $14,468,300 | $14,912,900 | $15,383,650 | $15,982,573 | $16,497,045 |

# Section 7
# Monitoring Program Revisions

<u>Permit Requirements</u>

Schedule B.6: MS4 Permit Renewal Application Package

…The application package must include an evaluation of the adequacy of the proposed SWMP modifications in reducing pollutants in discharges from the MS4 to the MEP. The application package must contain:

d. A proposed monitoring program objective matrix and proposed monitoring plan including the information required in Schedule B.2.d for each proposed monitoring project/ task.

This section of the permit renewal application provides a summary of proposed changes to the City's stormwater monitoring program and an updated monitoring program objectives matrix (Table 7-1). A Draft Monitoring Plan (Plan) is provided as Appendix B in this permit renewal application.

In conjunction with the Maximum Extent Practicable (MEP) Evaluation process described in Section 2, the City's current (2011) stormwater monitoring plan was reviewed in accordance with results of monitoring conducted over the last permit term and other evaluations and reports completed over the permit term. The City is proposing minor changes to the Plan, as listed below:

- Environmental monitoring parameters are expanded to incorporate 2010 303(d) listed pollutants: iron and manganese.
- Storm event criteria are modified with respect to antecedent dry period to better assess water quality associated with a wider range of storm event runoff characteristics.
- Specific pesticides proposed for monitoring in the City's Monitoring Plan, Table 2, reflect those that were detected in samples conducted during the current permit term; future analyses will continue to use the multi-residue screening method.
- Dioxin (2,3,7,8-TCDD) is eliminated from ambient (instream) and MS4 (stormwater) monitoring; this elimination is due to no detections observed at quantitation levels of between 2 to 6 pg/L during the current permit term, in accordance with Schedule B, Table B-1, footnote #2..
- City will propose elimination of methyl mercury from MS4 (stormwater) monitoring in a separate request to DEQ, in accordance with Schedule B, Table B-1, footnote #10.
- The fixed location MS4 (stormwater) monitoring is changed to a rotating monitoring location approach among the seven drainage basins defined in the City's Stormwater Basin Master Plan.
- Bacteria field assessments associated with the current term's Bacteria Pilot Study (BMP P2) will be discontinued. As described in Table 3-6, the Bacteria Pilot Study will be discontinued given that it has served its purpose and met its goals. The associated ambient (instream) and MS4 (stormwater) monitoring will continue to include bacteria analysis.

**Table 7-1. Monitoring Objectives Matrix (December 2015)**

| Monitoring objective | Environmental monitoring elements | | | | | | Program monitoring elements | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Instream dry and wet season monitoring | Macroinvertebrate monitoring | Stormwater monitoring | Rainfall/flow monitoring | Physical assessment monitoring | Dry weather field screening | SWMP program monitoring (measurable goals and BMP tracking) | Pollutant load modeling | Literature review | Data evaluation |
| 1. Evaluate the source(s) of the 2010 303(d) listed pollutants applicable to the permittee's permit area | Instream monitoring program includes 303(d) listed pollutants and will be used to assess MS4 stormwater pollutant contributions to receiving water body. | Macroinvertebrate studies will be used to support characterization of stream health and overall effects of pollutant contributions. | Stormwater monitoring will be used to characterize stormwater quality, and may contribute to the source evaluation of 303(d) pollutants. | N/A, since flow and rainfall are not 303(d) listed parameters. | Physical assessment monitoring of waterways can be used to support evaluation of pollutant contributions and overall stream health. | Dry weather field screening may assist with source identification of 303(d) pollutants. | SWMP program BMPs may help to identify potential sources of 303(d) pollutants. | Insight from pollutant load modeling will assist evaluations of 303(d) listed pollutant source(s). | Literature, regulations, committee and conference proceedings, databases, etc., will be reviewed for current developments pertaining to 303(d) listed pollutants. | 303(d) source evaluations and literature reviews will be reported annually or at the end of permit term as appropriate. |
| 2. Evaluate the effectiveness of Best Management Practices (BMPs) in order to help determine BMP implementation priorities | Instream water quality characteristics can be used as an indicator of overall effectiveness of applied BMPs, in combination with stormwater monitoring. | Macroinvertebrate studies will be used to support characterization of stream health and overall effectiveness of applied BMPs. | Stormwater monitoring will be used to support the evaluation of the overall effectiveness of applied BMPs. | Measurement of discharges from BMPs can provide information on effectiveness. | Physical assessment of waterways can be used as an indicator of overall effectiveness of applied BMPs. | Information gathered will help assess the overall effectiveness of the Illicit Discharge Detection and Elimination program BMP. | Program monitoring activities help evaluate the effectiveness of SWMP BMPs. | Pollutant load modeling will be used to estimate the overall effectiveness of applied BMPs. | Literature, committee, and conference proceedings, databases (e.g. International Stormwater BMP database), etc., will be reviewed for current developments in BMP effectiveness. | Literature review and BMP effectiveness findings will be reported annually or at the end of the permit term as appropriate. |
| 3. Characterize stormwater runoff discharges based on land use type, seasonality, geography or other catchment characteristics | Instream water quality characteristics will be used to support assessment of stormwater pollutant contributions. | Macroinvertebrate studies will be used to support characterization of stream health and overall effects of stormwater runoff. | Stormwater monitoring, in conjunction with other monitoring efforts where applicable and available, will be used to characterize stormwater quality. | Seasonal and geographic variations of rainfall and/or instream flow may assist in evaluating MS4 discharges. | Physical assessment of waterways can be used as indicators of stormwater runoff discharges and overall effects of stormwater runoff. | Dry weather field screening may identify legal and illicit non-stormwater discharges. | Some SWMP program elements provide information that helps to characterize MS4 discharges. | Pollutant load modeling will consider appropriate catchment characteristics. | Stormwater runoff characteristics will be compared to other data sources for any distinguishing characteristics. | Stormwater runoff characterization and any comparisons to external data sources will be reported annually or at the end of the permit term as appropriate. |
| 4. Evaluate status and long term trends in receiving waters associated with MS4 stormwater discharges | Instream monitoring program will be used to build upon existing data and establish new data to assess water quality characteristics and trends. | Macroinvertebrate studies will be used both to support instream trend evaluation and as parameters for trend analysis as applicable. | Stormwater monitoring will be used to support assessment of instream water quality characteristics and trends. | Instream flow may be used to support trend evaluation of MS4 discharge volumes. | Physical assessment of waterways can be used to support long term trends of overall stream health that may be directly or indirectly associated with MS4 stormwater discharges. | N/A | N/A | N/A | Review data collected by DEQ, USGS, and in peer- reviewed articles, to compare, contrast, and enhance data collected by permittee. | Instream water quality trends and any comparisons to external data sources will be reported annually or at the end of the permit term as appropriate. |
| 5. Assess the chemical, biological, and physical effects of MS4 discharges on receiving waters | Instream water quality characteristics will be used to assess the chemical and physical effects of MS4 runoff on receiving waters. | Macroinvertebrate studies will be used to assess the biological effects of MS4 runoff on receiving waters. | Stormwater monitoring will be used to support evaluation of MS4 discharge effects on receiving waters. | Rainfall/flow monitoring may be used to assess physical effects of MS4 runoff. | Physical assessment of waterways will be used to assess the physical effects of MS4 discharges on receiving waters. | N/A | N/A | Pollutant load modeling results will be used to characterize the effects of MS4 runoff on receiving waters. | Review studies done by others for application of assessment methodologies. | Assessment of the effects of MS4 discharges on receiving waters will be done annually or at the end of the permit term as appropriate. |
| 6. Assess progress towards meeting TMDL pollutant load reduction benchmarks | Instream monitoring program includes TMDL listed pollutants and will be used to assess progress towards meeting pollutant load reduction benchmarks. | N/A | Stormwater monitoring data will be used to enhance pollutant load model to assess progress towards meeting TMDL pollutant load reduction benchmarks. | Rainfall/flow monitoring may be used to calculate pollutant loads in the pollutant loads model. | Physical assessment of waterways may be used to support assessment of progress toward meeting TMDL pollutant load reduction benchmarks. | N/A | Program monitoring may help evaluate progress towards meeting TMDL pollutant load reduction benchmarks. | Pollutant load modeling will be used to estimate progress towards achieving TMDL pollutant load reduction benchmarks. | N/A | See benchmark reporting requirements under the permit renewal application requirements. |

# Appendices

Appendix A Updated SWMP (December 2015)

Appendix B Draft Monitoring Plan (December 2015)

Appendix C TMDL Benchmarks (December 2015)

Appendix D MS4 Map

# Appendix A: Updated SWMP (December 2015)

# CITY OF EUGENE, OREGON

# STORMWATER MANAGEMENT PLAN

**DECEMBER 2015**

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# STORMWATER MANAGEMENT PLAN

This Stormwater Management Plan (SWMP) describes the set of best management practices (BMPs) that the City of Eugene has committed to conducting to reduce pollutant discharges from the municipal stormwater system to the maximum extent practicable. This plan is incorporated by reference into the City's National Pollutant Discharge Elimination System Municipal Separate Storm Sewer Discharge Permit #101244 re-issued _____.

Section 1 of the plan includes an explanation of the SWMP BMP identification numbers and general categories and the relationship between the BMPs and specific federal requirements that govern stormwater management plans nation-wide. Section 2 includes a set of fact sheets that provide a description of each BMP, specific tasks and timelines, measurable goals and tracking measures.

## 1 STORMWATER MANAGEMENT PLAN BMP IDENTIFICATION AND CATEGORIES

Eugene's SWMP includes 22 BMPs designed to reduce the discharge of stormwater pollutants to the maximum extent practicable. Each BMP is given an ID (for example, A1) for tracking and reporting purposes; the ID's are based on the City work section with lead responsibility, as follows:

A = Administration Division of Public Works Department

B = Building Division of Planning and Development Department

E = Engineering Division of Public Works Department

M = Maintenance Division of Public Works Department

P = Parks and Open Space Division of Public Works Department

W = Wastewater Division of Public Works Department

The 22 BMPs, listed in Table 1, fall into eight general categories:

- Public Education
- Operations and Maintenance
- Illicit Discharge Controls
- Waste Management
- Construction and New Development
- Planning, Capital Improvements and Data Management
- Industrial Facilities
- Permit Management

Fact sheets describing each BMP, specific tasks conducted, prospective and numeric measurable goals where practicable, and tracking measures are provided in Section 2.

**TABLE 1. STORMWATER MANAGEMENT PLAN BEST MANAGEMENT PRACTICES**

| BMP ID | BMP Title | BMP Category |
|---|---|---|
| **A1** | Stormwater Education | Public Education |
| **E1** | Stormwater Capital Improvement Projects | Planning, Capital Improvements, Data Mgt. |
| **E2** | Erosion Prevention and Construction Site Management Program | Construction and New Development |
| **E3** | Stormwater System Mapping and Data Management | Planning, Capital Improvements, Data Mgt. |
| **E4** | Stormwater Development Standards | Construction and New Development |
| **E5** | Permit Management and Reporting | Permit Management |
| **M1** | Management of Illicit Discharges to the Municipal Stormwater System | Illicit Discharge Controls |
| **M2** | Winter Road Sanding and De-Icing Program | Operations & Maintenance |
| **M3** | Street Sweeping Program and Leaf Pick-up | Operations & Maintenance |
| **M4** | Prevent Leaks and Spills from Municipal Vehicles and Equipment | Operations & Maintenance |
| **M5** | Public Stormwater System Cleaning Program – Closed Conduit System | Operations & Maintenance |
| **M6** | Regulation of Inspection, Maintenance and Reporting of Private Underground Stormwater Facilities | Construction and New Development |
| **P1** | Educational Volunteer Program | Public Education |
| **P2** | Litter and Illegal Dumping Control | Illicit Discharge Controls |
| **P3** | Tree Planting Programs | Operations & Maintenance |
| **P4** | Public Stormwater System Maintenance – Developed Parks and Landscaped Areas within Rights-of-Way | Operations & Maintenance |
| **P5** | Public Stormwater System Maintenance – Open Waterways | Operations & Maintenance |
| **P6** | Compliance Program for Maintenance of Privately Owned Vegetated Stormwater Facilities | Construction and New Development |
| **B1** | Household Hazardous Waste Disposal | Waste Management |
| **B2** | Solid Waste Management | Waste Management |
| **W1** | Industrial Stormwater Management Program | Industrial Facilities |

# 2 BEST MANAGEMENT PRACTICES FACT SHEETS

This section includes the set of 22 fact sheets that provide descriptions of each BMP, associated tasks and timelines, measurable goals and tracking measures. A brief description of the purpose of each general BMP category is included, followed by the list of BMPs representing the category and the BMP fact sheets themselves.

## 2.1 Public Education

The purpose of public education BMPs is to inform the public, the commercial/industrial sector, and in-house personnel about the sources and causes of stormwater pollution, its effect on the local receiving waters, and to encourage active involvement (e.g., behavioral changes, volunteerism, etc.) in the effort to reduce pollution. The following BMPs represent the public education elements of the SWMP:

A1 Stormwater Education

P1 Educational Volunteer Program

| A1 | Stormwater Education |
|---|---|
| **Responsible Department/Division** | Public Works/Administration Division |
| **Description** | Plan, develop, implement and revise as necessary a program to provide stormwater information and education based on key values to homeowners, school children, City and other agency staff and the general public about the impacts to stormwater quality and natural resource values from both point and non-point sources of pollution.<br><br>In addition, educate professional, commercial, and industrial business owners about best management practices that can help prevent and reduce stormwater quality impacts to the public stormwater system and local receiving waters. |
| **Tasks** | 1. Update and improve upon educational materials through assorted print material, videos, web, social media, and audio/visual media.<br>2. Prepare and staff booths at special events to reach community members.<br>3. Develop communication initiatives to support projects, programs, special opportunities, and targeted pollutants. |
| **Measurable Goals** | • Increase, awareness of residents and business owners about best practices to reduce targeted pollutants.<br>• Conduct surveys every 2 years with Eugene residents and business owners to determine attitudes, opinions, awareness, and behaviors related to stormwater.<br>• Provide Stormwater Pollution Learn and Share (SPLASH) educational curriculum to teachers and administrators in local school districts.<br>• Continue to implement internal stormwater education to City staff through new employee orientation and work group presentations.<br>• Work collaboratively on education campaigns with other local and regional groups. |
| **Tracking Measures** | • Document stormwater survey responses including any significant changes in attitudes, opinions, awareness, and behaviors.<br>• Track number of students and teachers who use SPLASH curriculum annually.<br>• Track number of employees attending stormwater education sessions.<br>• Track number and types of information materials provided to the public.<br>• Track number of attendees at public outreach events.<br>• Track number of businesses reached and information provided.<br>• Identify collaborative campaigns, target audience, and summary of campaign. |

| P1 | Educational Volunteer Program |
|---|---|
| **Responsible Department/Division** | Public Works/Parks & Open Space Division |
| **Description** | Manage and support the City's Eugene Park Stewards volunteer program promoting stormwater quality and stewardship activities on Parks and Open Space managed lands. Provide information and hands-on stewardship opportunities through adoption groups, in which volunteers commit to caring for parks and natural areas including waterways, and through project-specific work parties. These activities provide benefits to the environment while increasing public awareness related to improving water quality. |
| **Tasks** | 1. Manage and support volunteer adoption groups.<br>2. Manage and support volunteer work parties for publicly owned vegetated stormwater facilities.<br>3. Involve community members in volunteer work parties for regular and drop-in events including projects aimed at invasive species removal, riparian vegetation planting, tree planting, and waterway clean-up.<br>4. Partner with community members to coordinate and implement large scale waterway clean-up work parties.<br>5. Inform community members about the purpose of the volunteer program and the City's Stormwater Program clean water messaging. |
| **Measurable Goals** | • Continue to recruit adoption groups and partners.<br>• Conduct three volunteer work parties annually addressing maintenance needs at publicly owned vegetated stormwater facilities.<br>• On average, conduct 36 volunteer work parties related to water quality.<br>• Conduct at least one community wide, partnership based large-scale waterway clean-up or enhancement work party per year.<br>• Provide information to work party volunteers about the purpose of Eugene Park Stewards program and the City's overarching stormwater messaging.<br>• Install catch basin markers with "dump no waste" messages in association with volunteer projects, where appropriate. |
| **Tracking Measures** | • Track the number of adoptions groups.<br>• Track the number of work parties involved in the maintenance of publicly owned vegetated stormwater facilities.<br>• Track the number of water quality work parties.<br>• Track the number and location of large-scale waterway clean-up and enhancement project(s) and the number of community members participating.<br>• Document efforts to educate the public about the City's volunteer programs and the protection of water quality as it relates to stormwater.<br>• Track quantity of catch basin markers installed in association with volunteer projects. |

## 2.2 Operations and Maintenance

The purpose of operations and maintenance BMPs is to maintain the publicly managed stormwater system (e.g. pipes, culverts, open waterways, water quality facilities), balancing flood control, drainage services, water quality, and natural resource protection needs, and to adaptively manage for continuous improvement of current operations and maintenance practices. Operations and maintenance BMPs are also focused on planning and performing other City services, such as landscape maintenance or road repair projects, in a manner that minimizes the potential for stormwater pollution from these activities. The following BMPs represent the operations and maintenance element of the SWMP:

M2 Winter Road Sanding and De-Icing Program

M3 Street Sweeping Program and Leaf Pick-up

M4 Prevent Leaks and Spills from Municipal Vehicles and Equipment

M5 Public Stormwater System Cleaning Program – Closed Conduit System

P3 Tree Planting Programs

P4 Public Stormwater System Maintenance – Developed Parks and Landscaped Areas within Rights-of-Way

P5 Public Stormwater System Maintenance – Open Waterways

| M2 | Winter Road Sanding and De-icing Program |
|---|---|
| **Responsible Department/Division** | Public Works/Maintenance Division |
| **Description** | Apply and clean up winter traction sand on publicly maintained roads and parking areas in conjunction with the application of a pre-wetting agent designed to reduce the need for repeat sanding. Conduct research efforts to identify and evaluate new technology and strategies for application of environmentally friendly chemical anti-icing and de-icing agents. Conduct research into new methods, practices, and efficiencies which may further limit the runoff of sanding related pollutants to the storm system. Conduct preseason staff training on the proper application methods of sand and chemical agents. |
| **Tasks** | 1. Apply sand to roadways in accordance with the *Public Works Snow and Ice Plan*.<br>2. Apply chemical agents in accordance to Guidelines for Anti-icing/Deicing included in the *Public Works Snow and Ice Plan*.<br>3. Respond to priority routes as outlined in *Public Works Snow and Ice Plan*.<br>4. Collect data such as streets plowed and sanded, material used, and other data related to snow/ice events. |
| **Measurable Goals** | • Minimize the use of abrasive materials (sand) for snow and ice control through adaptive management practices.<br>• Begin cleanup of abrasive materials (sand) when streets become free of ice and snow, and the forecast does not call for more ice and snow within the next 24 hours. |
| **Tracking Measures** | • Document the quantities of sand applied and collected during each storm event.<br>• Document the volume of deicing/anti-icing agents used for winter operations.<br>• Document initiation of sand cleanup following winter storm events where sand has been applied. |

| M3 | Street Sweeping Program and Leaf Pick-up |
|---|---|
| **Responsible Department/Division** | Public Works /Maintenance Division |
| **Description** | Undertake both mechanical brush and vacuum sweeping of publicly maintained roads, bike paths, and parking lots in accordance with the Stormwater Operations and Maintenance (O&M) Manual. Monitor and evaluate new technology and methods related to street sweeping, and make appropriate adjustments to the current sweeping program when feasible to maximize water quality benefits. |
| **Tasks** | 1. Follow sweeping frequencies as outlined in the Stormwater O&M Manual.<br>2. Collect sweeping data such as amount of debris swept, curb miles swept, streets and/or areas swept.<br>3. Conduct annual curbside pickup of leaves on City streets. |
| **Measurable Goals** | Follow sweeping frequencies as outlined in the Stormwater O&M Manual, for example:<br>**Street sweeping:**<br>• Sweep downtown core once per week.<br>• Sweep university and industrial areas once per week.<br>• Sweep arterial streets every 1 to 2 weeks.<br>• Sweep residential streets every 6 weeks.<br>• Sweep bike paths and improved alleys twice per year.<br>**Leaf pick-up:**<br>• Coordinate and manage two seasonal opportunities for the citizens' leaves to be picked up and managed by the stormwater operations crew. |
| **Tracking Measures** | • Track lane miles swept.<br>• Track amount of debris collected.<br>• Track amount of leaves picked up. |

| M4 | Prevent Leaks and Spills from Municipal Vehicles and Equipment |
|---|---|
| **Responsible Department/Division** | Public Works/Maintenance Division |
| **Description** | Undertake preventive maintenance program for all municipal vehicles and equipment in order to prevent or correct sources of vehicle fluid leaks. Implement employee education practices and field operations procedures to detect and report leaks and to prevent incidences of fluid and material spills from municipal vehicles and equipment. Equip municipal trucks and large equipment with renewable spill response kits. |
| **Tasks** | 1. Maintain training competencies for Fleet Services employees.<br>2. Maintain a preventative maintenance schedule for all vehicles and equipment.<br>3. Maintain a supply of spill kit materials for designated vehicles and equipment.<br>4. Fleet staff ensures that spill procedure cards are in all City vehicles and equipment. |
| **Measurable Goals** | • Perform preventative maintenance service on all City vehicles and equipment in accordance with the preventative maintenance schedule.<br>• During the repair/clean-up process, analyze the type and cause of the spills associated with the repairs conducted by Fleet staff, and evaluate whether operator training maybe helpful with spill minimization.<br>• Keep spill procedure cards in all City vehicles and large equipment. |
| **Tracking Measures** | • Track the number of vehicles and equipment that receive preventative maintenance service.<br>• Track the number of Fleet service employees that receive annual Hazardous Waste Operations and Emergency Response (HAZWOPER) Awareness level training.<br>• Percentage of City vehicles and large equipment with spill procedure cards. |

| M5 | Public Stormwater System Cleaning Program – Closed Conduit System |
|---|---|
| **Responsible Department/Division** | Public Works/Maintenance Division |
| **Description** | Undertake frequent, systematic cleaning of the components of the public stormwater system such as catch basins, pipes, culverts, inlets, and underground stormwater quality devices in accordance with the adopted Stormwater Operations and Maintenance (O&M) Manual. Document quantities of material removed from each structure. Using the maintenance management system, refine the regular cleaning schedule for pipes, catch basins, and underground stormwater quality devices. Inspect the piped stormwater system to identify needed repairs and to maintain accurate GIS and mapping information. Research and monitor developments in maintenance technology and operations and maintenance methods for the closed systems which will further increase the effectiveness of our cleaning practices and water quality improvement practices. |
| **Tasks** | 1. Follow cleaning procedures as outlined in the Stormwater O&M Manual.<br>2. Collect loading information for individual structures and facilities.<br>3. Work with the Sub Surface Maintenance Crew to assess, inspect and map the details of the public and private stormwater system. |
| **Measurable Goals** | • Clean 50% of the all of the public catch basins and inlet structures annually unless increased efficiencies are shown through adaptive management.<br>• Maintain all public underground stormwater quality structures at least once per year or as outlined in the Stormwater O&M Manual.<br>• Identify and repair defects to the piped stormwater system.<br>• Improve accuracy of the Stormwater System layer in our Geographic Information Systems (GIS) through map update requests. |
| **Tracking Measures** | • Track the number and percentage of catch basins and inlet structures cleaned.<br>• Track the number and percentage of public underground stormwater quality structures maintained.<br>• Track the lineal footage of stormwater lines cleaned.<br>• Track the amount of debris recovered from public catch basins, inlet structures, underground stormwater quality structures, and stormwater lines.<br>• Track work orders created for system repairs discovered through the inspection process.<br>• Track the number of map update requests forwarded to the GIS team. |

| P3 | Tree Planting Programs |
|---|---|
| **Responsible Department/Division** | Public Works/Parks and Open Space Division |
| **Description** | Manage and support both governmental and community tree planting programs to further the multiple benefits that trees provide for protecting and enhancing stormwater quality. |
| **Tasks** | 1. Plant street trees in existing public rights-of-way.<br>2. Plant trees in City-owned parks and natural areas.<br>3. Facilitate planting of street trees in new private developments in accordance with Eugene Code 7.280.<br>4. Plant street trees with new public street construction and replace existing trees that are removed during street renovation projects.<br>5. Involve community members in tree planting efforts. |
| **Measurable Goals** | • On average, plant 200 street trees/year in existing public rights-of-way.<br>• On average, plant 100 trees/year in City-owned parks and natural areas.<br>• Facilitate planting of street trees with all new private developments in accordance with Eugene Code 7.280.<br>• Plant street trees with all new public street construction projects and replace existing trees that are removed during street renovation projects.<br>• On average, involve 250 community members/year in tree planting efforts. |
| **Tracking Measures** | • Track the number of street trees planted each year in existing public rights-of-way.<br>• Track the number of trees planted each year in City-owned parks and natural areas.<br>• Track the number of street trees planted through the new development tree planting requirements (Eugene Code 7.280).<br>• Track the number of street trees planted through City-engineered street construction and renovation projects.<br>• Track the number of community members involved in tree planting efforts. |

| P4 | Public Stormwater System Maintenance – Developed Parks and Landscapes within the Rights-of-Way |
|---|---|
| **Responsible Department/Division** | Public Works/Parks and Open Space Division |
| **Description** | Evaluate and, as necessary, adapt or revise turf, landscape, and natural area vegetation management programs to protect and improve water quality for public lands under the City's jurisdiction. Such areas include developed parkland and vegetated areas in the public rights-of-way. The focus of this BMP is to minimize pollutants in stormwater runoff from these areas. |
| **Tasks** | 1. Annually review the Integrated Pest Management (IPM) policy document and Operations Manual and update as necessary in light of new information and techniques and as the result of implementation of these techniques is uncovered.<br>2. Research, evaluate, and implement park and landscaped area design practices and new vegetation management techniques to minimize impervious surfaces; reduce pesticide and fertilizer use; and maximize the use of native vegetation where appropriate.<br>3. Utilize Resource Management Plans and Priority Matrix to inform maintenance practices for all publicly-maintained vegetated stormwater facilities within developed parks and rights-of-way. Complete and document stormwater inspections and maintenance utilizing inspection checklist.<br>4. Evaluate the Pesticide Free Parks program. Revise, adapt, and expand program as appropriate. Utilize the IPM policy and Operations Manual to identify and maintain Pesticide Free Zones within Eugene's developed parks. |
| **Measurable Goals** | • Complete an annual review of the IPM policy and Operations Manual; update and refine in accordance with integrated pest management principles as necessary.<br>• Schedule, conduct, and document inspections of publicly maintained vegetated stormwater facilities within rights-of-way and developed parks in accordance with current Resource Management Plans and Priority Matrix.<br>• Provide scheduled maintenance of publicly maintained vegetated stormwater facilities within rights-of-way and developed parks.<br>• Provide service to existing pesticide free parks and pesticide free zones within parks. Review and update map of City Parks' Pesticide Free Zones annually or as necessary. |
| **Tracking Measures** | • Document frequency of review and any updates to the IPM policy document and Operations Manual.<br>• Document the number and percentage of publicly maintained vegetated stormwater facilities in developed parks and rights of-way inspected.<br>• Document maintenance activities performed on publicly maintained vegetated stormwater facilities in developed parks and rights-of-way.<br>• Document condition and updates to map of Pesticide Free Parks and pesticide free zones within developed parks.<br>• Track total use of pesticides in developed parks per year (lbs. per acre). |

| P5 | Public Stormwater System Maintenance – Open Waterways |
|---|---|
| **Responsible Department/ Division** | Public Works/Parks and Open Space Division |
| **Description** | Manage public open waterways consistent with adopted Open Waterway Maintenance Plans. These plans are intended to protect and enhance stormwater quality and natural resources values while continuing to maintain sufficient conveyance capacity in the waterways. Manage and maintain public stormwater facilities located in undeveloped parks and natural areas. |
| **Tasks** | 1. Follow written procedures for on-going maintenance of open waterways, including pruning woody vegetation, utilizing the Open Waterway Maintenance Plans (for all open waterways) and U.S. Army Corps of Engineers Levee Owner's Manual (for portions of Amazon Creek).<br>2. Establish native trees and shrubs along portions of waterways lacking shade.<br>3. Repair channel banks as erosion or slumping issues occur.<br>4. Review, and if necessary revise, Open Waterway Maintenance Plans to incorporate new information and techniques to further advance the goal of maximizing water quality and habitat benefits while also maintaining sufficient conveyance.<br>5. Implement storm event monitoring at potential choke points in the open waterway system.<br>6. Utilize resource management plans and priority matrix to inform maintenance practices for all publicly-maintained vegetated stormwater facilities in undeveloped parks and natural areas. Complete and document stormwater inspections utilizing inspection checklist. |
| **Measurable Goals** | • Annually prune woody vegetation within active channel zone, or "green pipe", on approximately 8 miles of open waterway to maintain conveyance while maintaining water quality and other natural resource functionality.<br>• Annually establish native trees and shrubs on approximately 1,000 linear feet of waterway to help shade streams, lower water temperatures, and increase slope stability.<br>• Once within the permit term, review Open Waterway Maintenance Plans and, if deemed necessary, revise.<br>• Conduct and document annual inspections for publicly-maintained vegetated stormwater facilities (e.g., detention ponds and bioswales) in undeveloped City parks and natural areas. |
| **Tracking Measures** | • Document miles of open waterway maintained by green piping each year.<br>• Document linear feet of waterways planted with trees and shrubs, and the number and general type of native species planted (i.e. trees, shrubs, grasses)<br>• Document number of channel bank repair projects (e.g., to reduce erosion or slumping) completed each year, and total linear feet of such repairs.<br>• Document timing of review and any updates to the Open Waterways Maintenance Plans.<br>• Document number of times each year that the storm event monitoring program for open waterways was activated.<br>• Document number and percentage of publicly maintained vegetated stormwater in undeveloped parks and natural areas that are annually inspected. |

## 2.3 Illicit Discharge Controls

The purpose of illicit discharge control BMPs is to become aware of, investigate, detect, mitigate, and enforce the elimination of illicit (non-stormwater) discharges and illegal dumping to the stormwater system. The following BMPs represent the illicit discharge control element of the SWMP:

M1 Management of Illicit Discharges to the Municipal Stormwater System

P7 Litter and Illegal Dumping Control

| M1 | Management of Illicit Discharges to the Municipal Stormwater System |
|---|---|
| **Responsible Department/Division** | Public Works/Maintenance Division |
| **Description** | Discourage and reduce improper discharges into the stormwater system through field screening and investigation, spill response, and operation of a stormwater discharge compliance enforcement program. The primary goals of this program are to protect the quality of the receiving waters of the City's stormwater system and to ensure that discharges to the City's stormwater system are in compliance with local, state, and federal regulations to the maximum extent practicable.<br><br>As part of this program, the City will maintain an on-call team trained and equipped to investigate illicit discharges, respond to spills involving environmentally hazardous materials, and mitigate these discharges as necessary. Coordinate efforts with other local response teams such as the City of Eugene Fire and Police Departments, Lane County, and state agencies. The City will conduct periodic review of illicit discharge enforcement program practices and procedures and make revisions as deemed necessary.<br><br>The stormwater field screening and investigation part of this program includes inspection of the public stormwater outfalls for condition assessment and the private stormwater system to assess water quality impacts to the municipal stormwater system. Where illicit discharges are found, actions are taken to identify the source and eliminate the discharge. |
| **Tasks** | 1. Use CCTV inspection, dye testing, smoke testing, and field investigation to identify illegal connections, cross connections with the wastewater system and failures in the pipe system.<br>2. Inspect stormwater outfalls to identify illicit discharges, perform condition assessment, and track outfalls added or removed from the stormwater system.<br>3. Conduct annual dry-weather field screening inspections at priority locations per the City of Eugene Dry Weather Field Screening Procedure.<br>4. Maintain on-call list of personnel trained to respond to illicit discharges and an inventory of equipment necessary to mitigate illicit discharges.<br>5. Coordinate with the Fire Department/Hazmat Team on mitigation efforts including hazardous material clean-up and disposal.<br>6. Implement the City's Stormwater System Administrative Rule, 58-11-09-F, with the intent to prohibit improper connections and illegal discharges to the City's stormwater system by utilizing the existing enforcement and education programs.<br>7. Update the City of Eugene's Public Works Maintenance Spill Response and Illicit Discharge Operations Plan as necessary. |

| M1 (continued) | Management of Illicit Discharges to the Municipal Stormwater System |
|---|---|
| **Measurable Goals** | • Reduce the number of improper discharges into the municipal stormwater system through public education and reasonable enforcement of regulations.<br>• Identify and remove illicit discharges to the municipal stormwater system through routine outfall inspections and the dry-weather field screening process.<br>• Review and update as necessary a list of Hazardous Waste Operations and Emergency Response (HAZWOPER) trained personnel that are available for 24-hour emergency response.<br>• Review and update annually or as necessary, the City's On-Call Emergency Roster for Environmental Spills. |
| **Tracking Measures** | • Comprehensively track the number of work orders pertaining to illicit discharge and the number of verified illicit discharges and related enforcement actions. This includes illicit discharges related to BMPs E2 and W1.<br>• Track the number of outfalls inspected annually.<br>• Document dry-weather field screening inspections including number of inspections conducted and follow-up details.<br>• Document all updates to HAZWOPER trained personnel list and On-Call Emergency Roster for Environmental Spills. |

| P7 | Litter and Illegal Dumping Control |
|---|---|
| **Responsible Department/ Division** | Public Works/Parks and Open Space Division and Maintenance Division |
| **Description** | Manage and support efforts to reduce impacts to stormwater runoff and local receiving waters by controlling litter and debris in public spaces and by removing illegally dumped refuse and debris as well as garbage and trash from illegal camp sites.<br><br>There are two primary focal points of this BMP. The first is to provide opportunities for proper disposal of litter and trash at strategic publicly owned sites to prevent it from being washed into the public stormwater system. The second is to clean-up illegal dump sites and illegal camp sites prior to pollutants from the trash and debris being washed into the public storm system or the local receiving waters. |
| **Tasks** | 1. Place trash receptacles in parks, public areas and at venues for public events which are likely to generate garbage, litter and other throw-away items. Provide frequent collection service to prevent over filling.<br>2. Require up-front security deposits for large events in City parks, rental of City park shelters, and rental of other City owned and operated recreation or outdoor cultural facilities.<br>3. Conduct routine debris inspections of significant waterways under the City's jurisdiction and remove illegally dumped or discarded debris and other items as appropriate.<br>4. Conduct routine inspections along riverbanks and in other undeveloped lands under the City's jurisdiction to locate, dismantle, and clean-up illegal camp sites and their associated trash, garbage, debris and bio-hazardous materials.<br>5. Identify and monitor known historic dump sites in remote areas of the public right-of-way (such as undeveloped cul-de-sacs, dead-end streets, etc.), attempt to identify a responsible party for significant piles of dumped debris, and remove the dumped material as soon as possible to discourage additional dumping by others. |
| **Measurable Goals** | • Ensure all parks, all public space areas managed by the City and all venues for outdoor public events on City lands have adequate trash receptacles. Empty trash receptacles frequently enough to prevent spillage due to being over filled.<br>• Ensure all rentals of parks, park shelters, and other City operated outdoor facilities will result in no loose litter and debris left behind.<br>• Inspect the Willamette River corridor weekly and all other waterways and riverbanks periodically for dumped or discarded debris and illegal campsites. Remove dumped materials, dismantle illegal campsites and clean-up as soon as is physically and legally possible.<br>• Periodically monitor identified historic dumping sites in the public right-of-way and promptly respond to requests for cleanup in these areas. |
| **Tracking Measures** | • Document adjustments to trash collection schedules as necessary to maintain capacity of receptacles.<br>• Track the number of illegal campsites cleaned-up along riverbanks, waterways, or open space areas managed by the City.<br>• Track the frequency of trash collection from waterways and from the public right-of-way.<br>• Track the response to requests for service at dump sites within the public right-of-way. |

## 2.4 Waste Management

The purpose of the waste management BMPs is to educate the public, regulate waste management services, and to ensure that proper facilities are available in order to minimize the potential of negative stormwater impacts from solid waste collection, improper disposal of toxic materials, and illegal dumping of garbage and debris. The following BMPs represent the waste management element of the SWMP:

B1 Household Hazardous Waste Disposal

B2 Solid Waste Management

| B1 | Household Hazardous Waste Disposal |
|---|---|
| **Responsible Department/Division** | Planning and Development/Building and Permit Services Division |
| **Description** | Support existing efforts and programs within the Eugene metro area to inform citizens of local opportunities for the proper discard and disposal of their household hazardous waste materials. Support and promote facilities and programs that provide such opportunities.<br><br>The improper disposal of household hazardous waste poses a serious threat to local stormwater quality. Old paint, solvents and thinners, pesticides, bleach, drain cleaners, antifreeze, gasoline, used motor oil and other motor vehicle fluids can easily be flushed into the stormwater system if disposed of in yards, left uncovered in the rain, or poured down driveways or into the street. Supporting efforts to inform homeowners and tenants about where they can properly dispose of these products as well as supporting local household hazardous waste management facilities and efforts is an effective way to reduce the amount of these products that inadvertently make their way into the stormwater system and local receiving waters. |
| **Tasks** | 1. Collaborate with Lane County Waste Management Division and City of Eugene stormwater program staff on educational outreach via the development and distribution of brochures, fact sheets, and community outreach events.<br>2. Require solid waste haulers to notify their customers of the special wastes programs offered through the Lane County Waste Management Division.<br>3. Maintain information on a City website page that provides education on household hazardous waste and explains how to set up an appointment with Lane County Solid Waste to dispose of materials properly.<br>4. Collaborate with local metro area partners to publish information regarding waste prevention, recycling, composting, and disposal of household hazardous waste. |
| **Measurable Goals** | • Update the City's web site periodically to direct residents to the latest information about hazardous waste disposal.<br>• Update the City's web site periodically to direct residents to the latest information about recycling and waste prevention news, resources, and local events. |
| **Tracking Measures** | • Document updates to City's web site related to hazardous waste disposal.<br>• Document materials disbursed about household hazardous materials |

| B2 | Solid Waste Management |
|---|---|
| **Responsible Department/Division** | Planning and Development/Building and Permit Services Division |
| **Description** | Evaluate and revise, as necessary, existing solid waste and recycling collection rules to address stormwater quality.<br><br>Improper and/or unregulated collection and recycling of solid waste has a serious potential for creating negative impacts to stormwater quality. High collection fees, infrequent or spotty collection service may lead to illegal dumping activity. Unregulated waste containers may be prone to leaking or spilling allowing pollutants to wash into the storm system. By continuing to monitor and evaluate local solid waste management collection efforts, the City will be better able to improve local regulations so that stormwater quality is taken into account. |
| **Tasks** | 1. Regulate solid waste and recycling collection activities within the City limits to curb possible impacts to the stormwater systems from leachate of garbage, yard debris, and recycling materials.<br>2. Support a minimum of biweekly collection service for organic materials and provide backyard composting classes for residents with or without collection service.<br>3. Implement the nuisance abatement enforcement program that provides rapid response to illegal dumping of garbage, yard debris, or other solid waste materials. |
| **Measurable Goals** | • Review Administrative Rule annually to ensure that regulations are up to date and requirements to support appropriate waste management and prevention are included; update Admin Rule as necessary.<br>• Review the need to conduct a waste composition study once per permit term; if needed, contract with Oregon DEQ to conduct the study. |
| **Tracking Measures** | • Document total tons of yard debris collected through the curbside program.<br>• Document the number of compost demonstration workshops and participants.<br>• Document number of enforcement cases related to inappropriate garbage handling.<br>• Document and compare waste composition study with the prior one. |

## 2.5 Construction and New Development

The purpose of the construction and new development BMPs is to ensure that appropriate control measures are considered, implemented, and maintained during and after the planning, design, and construction phases for new public and private development and significant re-development projects. The following BMPs represent the new construction and new development related elements of the SWMP:

E2 Erosion Prevention and Construction Site Management Program

E4 Stormwater Development Standards

P6 Compliance Program for Maintenance of Privately Owned Vegetated Stormwater Facilities

M6 Regulation of Inspection, Maintenance and Reporting of Private Underground Stormwater Facilities

| E2 | Erosion Prevention and Construction Site Management Program |
|---|---|
| **Responsible Department/Division** | Public Works/Engineering Division |
| **Description** | Administer and monitor an Erosion Prevention and Construction Site Management Program in compliance with Eugene Code 6.625-6.645, preventing and mitigating pollutant and sediment discharges into the City's stormwater system due to construction activities and land disturbance. |
| **Tasks** | 1. Screen all development permits for sensitive area status, conduct plan reviews, issue erosion permits, conduct erosion inspections, and provide compliance enforcement as appropriate.<br>2. Issue Erosion Permits for activities which disturb an area one acre or greater in size or disturb an area 500 square feet or greater within a sensitive area (i.e., adjacent to a water feature or its buffer, ground slopes greater than 10%, having highly erodible soils).<br>3. Conduct education and outreach related to erosion prevention and construction site management techniques and practices.<br>4. Continue to act as 1200-C Agent for DEQ. |
| **Measurable Goals** | • Conduct one inspection prior to the commencement of work for all erosion permitted sites.<br>• Inspect non-erosion-permitted sites at least twice during the life of the building/construction permit or as necessary to assure compliance with the program.<br>• Inspect permitted sites monthly or as necessary to assure compliance with the program.<br>• Conduct one annual erosion prevention training event. |
| **Tracking Measures** | • Track the number of permits issued.<br>• Track the number of inspections.<br>• Track the number of compliance orders issued.<br>• Track the number of training/outreach events.<br>• Track the number of work orders pertaining to erosion-related illicit discharges, the number of verified illicit discharges, and related enforcement actions.<br>(Note: this data to be comprehensively reported in BMP M1) |

| E4 | Stormwater Development Standards |
|---|---|
| **Responsible Department/Division** | Public Works/Engineering Division |
| **Description** | Administer and monitor a program that implements the City's Stormwater Development Standards, Eugene Code 9.6790-9.6797, Eugene Code 7.143 (3), and associated *Stormwater Management Manual*. The Stormwater Development Standards regulate the location, design, construction and maintenance of private and public stormwater facilities for flood control, flow control for development sites in the headwaters area, water quality, natural resource protection, oil control, and source control. The standards utilize a hierarchy of best management practices which emphasizes on-site low impact development (LID) techniques over mechanical approaches and includes provisions for off-site LID mitigation in certain circumstances. |
| **Tasks** | 1. Review land use applications for applicability and compliance with stormwater development standards.<br>2. Screen development permits for post-construction stormwater management, conduct plan reviews to ensure compliance with Eugene Code and *Stormwater Management Manual*, approve stormwater facilities, and conduct inspections.<br>3. Maintain an up-to-date Stormwater Management Manual for new development.<br>4. Track, evaluate, and develop new technologies and practices for post-construction stormwater management.<br>5. Provide training and technical assistance on stormwater management facilities to City staff and the public.<br>6. Continue to identify any policies, practices, and regulations that act as potential barriers to implementing LID techniques. |
| **Measurable Goals** | • Review land use and/or development permit applications (i.e., earliest stage of review) for applicability of the Stormwater Development Standards.<br>• Review and approve construction plans for public and private stormwater management facilities to which the City's stormwater development standards apply.<br>• Annually quantify and review the water quality and flow control facility types selected.<br>• Review Eugene's *Stormwater Management Manual* every 2 years and update as needed to provide new information or practices for post-construction stormwater management. |
| **Tracking Measures** | • Track number of land use applications reviewed.<br>• Track number of private water quality and flow control facilities permitted with building permits.<br>• Track number off-site LID mitigation approvals.<br>• Track number and type of public water quality and flow control facilities constructed.<br>• Document completion date for *Stormwater Management Manual* review and updates.<br>• Track number and type of training/outreach events held. |

| P6 | Compliance Program for Maintenance of Privately Owned Vegetated Stormwater Facilities |
|---|---|
| **Responsible Department/Division** | Public Works/Parks and Open Space Division |
| **Description** | Implement and manage a program to ensure that privately owned and operated vegetated stormwater treatment facilities are maintained as designed and constructed. The program employs guidance provided by the required individual facility Maintenance Plan. The program will employ a combination of rules, protocols, and procedures to require: each facility is routinely inspected; corrective maintenance actions are performed; and completion of activities are regularly documented. Based on Eugene City Code requirements, penalties and/or other legal remedies will be employed to enforce compliance with these requirements as necessary. |
| **Tasks** | 1. When accepted by the City, include new private vegetated facilities in City's database for tracking.<br>2. Follow the *Private Stormwater Facilities Procedure Manual* for tracking, inspection, and assessment of stormwater facilities.<br>3. Provide written correspondence to private stormwater facility owners, as needed, such as inspection notification, reporting reminder, notice of non-compliance, notice of violation, and enforcement documents.<br>4. Review facility Maintenance Plan and inspection and maintenance logs with private stormwater facility owners.<br>5. Utilize the inspection priority matrix to inform adaptive management changes to the *Private Stormwater Facilities Procedures Manual*. |
| **Measurable Goals** | • Inspect all new vegetated private stormwater facilities at the time of construction and document pertinent information.<br>• Follow inspection frequencies as outlined in the current *Private Stormwater Facilities Procedures Manual*.<br>• Review inspection and maintenance logs for privately-owned vegetated stormwater facilities.<br>• Utilize inspection priority matrix to inform updates to the *Private Stormwater Facilities Procedures Manual* with respect to inspection frequencies by the end of year two of the new MS4 permit. |
| **Tracking Measures** | • Document the number of new private vegetated stormwater facilities added to the City's database and the percentage inspected at time of construction.<br>• Document the number of inspections of existing facilities.<br>• Document the number of maintenance logs reviewed.<br>• Document updates to the *Private Stormwater Facilities Procedure Manual*.<br>• Document the number of notices of non-compliance and subsequent enforcement. |

| M6 | Regulation of Inspection, Maintenance and Reporting of Private Underground Stormwater Facilities |
|---|---|
| **Responsible Department/Division** | Public Works/Maintenance Division |
| **Description** | Implement and manage a program to ensure that privately owned and operated underground stormwater treatment structures are properly maintained.<br>The program employs guidance provided by the required individual Maintenance Plan for each structure. |
| **Tasks** | 1. When accepted by the City, include new private vegetated facilities in City's database for tracking.<br>2. Provide written correspondence to the private operator, as needed, such as inspection notifications, reporting reminders, notices of non-compliance, notices of violation, and enforcement documents.<br>3. Maintain mechanisms, processes and procedures to track structure type, stormwater facility ownership, maintenance inspections, required reports, corrective maintenance activity and enforcement actions.<br>4. Use preventive maintenance schedule to assist in determining inspection frequency based on priority of stormwater facility.<br>5. Review required inspection and maintenance logs submitted by stormwater facility owners. |
| **Measurable Goals** | • Inspect all new private underground stormwater structures at the time of construction and document pertinent information. Establish a correspondence file for each structure/operator.<br>• Ensure that each private underground stormwater structure is inspected, maintained and documented as required by the Maintenance Plan for the specific device.<br>• Review inspection and maintenance reports for privately-owned underground stormwater facilities. |
| **Tracking Measures** | • Document the number of new private underground stormwater structures added to the City's database and the percentage inspected at the time of construction.<br>• Track the number of Maintenance Plans obtained and reviewed.<br>• Track the number of private inspection, maintenance and reporting activities conducted.<br>• Track any enforcement activities related to the individual structures. |

## 2.6 Planning, Capital Improvements and Data Management

The purpose of planning, capital improvements, and data management is to develop and implement comprehensive stormwater basin plans, evaluate potential sources of specific pollutants and related BMPs to address them, and maintain up to date data on the stormwater system. The following BMPs represent the planning, capital improvements and data management elements of the SWMP:

E1 Stormwater Capital Improvement Projects

E3 Stormwater System Mapping and Data Management

| E1 | Stormwater Capital Improvement Projects |
|---|---|
| **Responsible Department/Division** | Public Works/Engineering Division |
| **Description** | Implement the Stormwater capital improvement program (CIP), including projects identified in the City's Stormwater Basin Master Plans (Basin Plans) for Amazon, Willow Creek, Bethel-Danebo, Willakenzie, Laurel Hill, and Willamette River and the River Road – Santa Clara basins.<br><br>The Basin Plans describe a multiple-objective strategy for managing stormwater that addresses water quality protection and improvement, conveyance and flood control, and waterway protection and restoration. The basin strategies reflect the unique characteristics, problems and opportunities in each basin and contain a prioritized capital projects list including: water quality enhancement projects, stream bank stabilization, stream restoration, and capacity enhancement projects.<br><br>The Basin Plan capital projects are one of the main sources of capital projects that comprise the City's CIP. In addition to the Basin Plans, CIP projects also originate from a list of maintenance and rehabilitation needs, other focused planning studies, and partnership opportunities. The prioritized Basin Plan capital projects are combined with projects from these other sources, ranked, and incorporated into the CIP bi-annually. |
| **Tasks** | 1. Implement Stormwater Basin Plan projects and other water quality projects into the City's bi-annual CIP and annual budget processes.<br>2. Maintain GIS coverage of constructed capital improvement projects including location, project, or facility type and drainage area.<br>3. Maintain current Basin Plan documents in accessible locations including in electronic form on the City's web site and in printed form at the Downtown Eugene Public Library.<br>4. Update Stormwater Basin Plans with current stormwater-related characterization data and updated list of capital improvement projects including water quality retrofit projects. |
| **Measurable Goals** | • Implement Stormwater CIP projects including at least four water quality retrofit projects over the 5-year permit term, and additional retrofits as opportunities arise.<br>• Initiate updates to the Stormwater Basin Plans by end of the permit term. |
| **Tracking Measures** | • Track the number, type, watershed location, and total drainage area of capital improvement projects, including retrofit projects and off-site LID mitigation projects (see BMP E4), constructed for water quality.<br>• Track initiation and progress related to the Stormwater Basin Plan update. |

| E3 | Stormwater System Mapping and Data Management |
|---|---|
| **Responsible Department/Division** | Public Works/Engineering Division |
| **Description** | Support on-going implementation of the stormwater program by providing mapping, GIS data, and application development and support services. Maintain up-to-date inventories and maps of the natural and constructed features of the City's stormwater system. Include in the inventories and maps public and private water quality, flow control, and flood control facilities. Develop and integrate asset inventory data and geographic information system (GIS) systems which describe and map the conveyance system, water quality attributes and related natural resource information. Integrate information generated through other BMPs such as E1 (Capital Improvement Projects) and E4 (Stormwater Development Standards) which create or modify system components and/or change the attributes of the stormwater system. |
| **Tasks** | 1. Update stormwater system inventory and GIS map layers on a bi-monthly basis.<br>2. Develop, upgrade, and maintain new software applications as needed which make system information available and more useful to staff.<br>3. Update printed stormwater infrastructure map sets bi-annually.<br>4. Support implementation of Stormwater Development Standards (E4), help to ensure that data management needs are identified and protocols established for documenting appropriate information to ensure that operations and maintenance, inspection and enforcement, and BMP effectiveness objectives are met.<br>5. Track implementation of Capital Improvement Projects by helping to ensure documentation of location, type and other attributes of stormwater capital projects for purposes of evaluating their effectiveness, and tracking and reporting progress. |
| **Measurable Goals** | • Enter 95% of all newly constructed public and private stormwater system features into inventory databases and GIS within two months of final construction approval.<br>• Survey GIS and data application users every two to three years.<br>• Review every one to two years, and update as necessary, data development and maintenance procedures for public and private stormwater facilities. |
| **Tracking Measures** | • Track mapping and database update activities.<br>• Track GIS and data application survey results including the % of respondents who rate the GIS/data systems as satisfactory or better.<br>• Track frequency of review and updates to data development and maintenance procedures for public and private stormwater facilities. |

## 2.7 Industrial Facilities

The purpose of industrial controls is to provide oversight of stormwater discharges from industrial facilities, including screening, inspections, technical assistance, and response to spills at permitted facilities. The following BMP represents the industrial element of the SWMP:

W1 Industrial Stormwater Management Program

| W1 | Industrial Stormwater Management Program |
|---|---|
| **Responsible Department/Division** | Public Works/Wastewater Division |
| **Description** | Provide oversight of stormwater discharges and washing activities from industrial facilities, screen new businesses for those that may require NPDES permits, conduct inspections and provide technical assistance to industries with NPDES Permits, and respond to spills at facilities with permits. |
| **Tasks** | 1. Continue to act as 1200Z and 1700A agent for DEQ.<br>2. Manage 1200Z and 1700A NPDES permit files.<br>3. Evaluate new and existing facilities for requiring NPDES permits.<br>4. Determine permit compliance with existing NPDES permitted facilities.<br>5. Issue Request for Corrective Action letters for permit noncompliance.<br>6. Conduct periodic monitoring for compliance determination.<br>7. Provide technical assistance to permitted facilities.<br>8. Retain copies of Stormwater Pollution Control Plans for each permitted industry.<br>9. Retain copies of facility inspections. |
| **Measurable Goals** | • Conduct site inspections on 20% of permitted facilities annually. |
| **Tracking Measures** | • Track percentage of permitted facilities inspected.<br>• Track number of corrective action letters sent and follow-up responses.<br>• Track number of Action Plans prepared by permit registrants.<br>• Track number of work orders pertaining to industrial site-related illicit discharges, the number of verified illicit discharges, and related enforcement actions. (Note: illicit discharge data to be comprehensively reported in BMP M1). |

## 2.8 Permit Management

The purpose of permit management is to ensure effective permit management, coordination, and reporting. The following BMP represents the administrative element of the SWMP:

E5 Permit Management and Reporting

| E5 | Permit Management & Reporting |
|---|---|
| **Responsible Department/Division** | Public Works/Engineering |
| **Description** | Administration of the City of Eugene's overall NPDES MS4 permit compliance effort including permit program coordination, program evaluation and adaptive management processes, annual reports, and permit renewal submittals. |
| **Tasks** | 1. 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.<br>2. Ensure that special assessments or studies as required by the MS4 permit are completed and deliverable timelines are met.<br>3. Evaluate programs and BMPs as described in the SWMP to ensure that the overall MS4 permit objectives are being met including reduction of pollutants on the DEQ's 303(d) list and progress towards meeting TMDL pollutant load reduction benchmarks.<br>4. Conduct appropriate public involvement efforts related to various MS4 permit elements such as SWMP, Monitoring Plan, and TMDL benchmarks updates. May include presentations to advisory groups, elected officials, and public notices. |
| **Measurable Goals** | • Submit annual reports to DEQ by the permit due date that summarize implementation of the MS4 permit and SWMP, program evaluation and adaptive management results, and any proposed program changes.<br>• Update MS4 permit web site at least once a year, including posting annual report and reporting-year water quality monitoring data.<br>• Evaluate progress toward meeting TMDL pollutant load reduction benchmarks leading up to permit renewal submittal.<br>• Conduct public involvement within an appropriate time to meet legal requirements for the MS4 permit, and for on-going adaptive management, as appropriate. |
| **Tracking Measures** | • Document submittal dates for all MS4 permit-related deliverables including assessments, reports, and permit renewal application package.<br>• Document dates annual reports are posted on City's MS4 web site.<br>• Document TMDL benchmarks methodology, assumptions, and results.<br>• Document date, nature, and target audience(s) for public involvement efforts related to MS4 permit management and reporting. |

# Appendix B: Draft Monitoring Plan (December 2015)

# Draft
# City of Eugene Stormwater Monitoring Plan

# for

# National Pollutant Discharge Elimination System
# Municipal Separate Storm Sewer System (MS4) Discharge
# Permit 101244

## December 2015

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**APPENDIXES**

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**A-2** **City of Eugene Monitoring Objectives Matrix** (December, 2015)

**B** **Eugene/Springfield Environmental Services Laboratory Quality Assurance Plan**

Table 5.1: Sample Preservation and Holding Times
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**C** **Multiresidue Screen Pesticide List and Reporting Limits**

**D** **Standard Operating Procedures (SOPs)**

SAMP-834: Field Measurement of Conductivity
SAMP-851: Decontamination of Field Equipment
SAMP-853: Field Measurement of pH (Electrometric)
SAMP-854: Sample Quality Assurance / Quality Control
SAMP-856: Field Measurement of Water Temperature
SAMP-1206: Ambient Monitoring Sample Schedule
SAMP-1207: Ambient Monitoring Site Sampling Procedure
SAMP-1208: Field Measurement of Dissolved Oxygen
SAMP-1209: Bottle/Sample Jug Cleaning
SAMP-1210: Sample Bag Preparation for Ambient Monitoring Program – Clean Techniques Sampling
SAMP-1212: Composite Sampling Procedure
SAMP-1214: Grab Sampling Procedure
SAMP-1216: Sampler Cleaning
SAMP-1805: Storm Event MS4 Site Sampling Procedure

WW-833: Chain-of-Custody Form Instructions
RES-650: Chain-of-Custody Form – Ambient River Route
RES-651: Chain-of-Custody Form – Ambient Land Route
ISC-1441: Chain-of-Custody Form – Bacteria Study
ISC-1624: Chain-of-Custody Form – Composite
ISC-1625: Chain-of-Custody Form – Grab

# 1. Overview

The City of Eugene has developed this Updated Stormwater Monitoring Plan to meet requirements specified in its new, fourth-term National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) Discharge Permit Number 101244 issued by the Oregon Department of Environmental Quality (DEQ) to the City on_____. This Monitoring Plan describes environmental monitoring elements used to assist the City with ongoing efforts to characterize stormwater pollutant discharges, determine potential pollutant sources, assess the effects of stormwater runoff on streams, evaluate the effectiveness of stormwater management program elements in reducing those effects, and assist with the adaptive management of the stormwater program.

Since receiving its first stormwater NPDES permit in 1994, water quality data have been systematically collected at multiple locations on rivers and streams within the City's jurisdictional boundaries. Water quality trends indicate significant improvements have occurred over that time at many monitored locations, an indication of the City's stormwater management program's effectiveness in reducing pollutants in stormwater runoff and improving receiving stream water quality. However, water quality data also indicate activities within the City continue to have measurable impacts on levels of pollutants observed in our rivers and streams. Many of Eugene's local waterbodies contain pollutant concentrations that are above Oregon's water quality criteria for the protection of human health and aquatic life. In response, the City continues to refine public policy and practices addressing stormwater conveyance and urban stormwater quality issues through the development, implementation, and adaptive management of water quality controls such that pollutant loads are reduced to the maximum extent practicable (MEP).

The environmental monitoring requirements in the City's new stormwater NPDES permit include elements that continue to build upon our knowledge of pollutant characterization and source evaluation, the effectiveness of best management practices, and overall stormwater management efforts to improve stormwater quality. Continuation of historical monitoring programs combined with new environmental monitoring requirements add to this knowledge base and will prove essential in assessing the effectiveness of many stormwater quality control programs.

Monitoring elements in this plan include sampling for the analysis of pollutants in stormwater from the MS4, instream water quality monitoring, macroinvertebrate and bacteria monitoring, physical and hydrologic monitoring, and structural BMP monitoring. These elements are complimented by program monitoring elements associated with the 2015 Stormwater Management Plan (e.g. dry weather field screening, BMP tracking and measurable goals, etc.). Collectively, the environmental and program monitoring elements are intended to meet six monitoring objectives defined in the City's stormwater NPDES permit. Specifically, the objectives require the City to:

1. Evaluate the source(s) of the 2010 303(d) listed pollutants applicable to Eugene's MS4 permit area;

2. Evaluate the effectiveness of Best Management Practices (BMPs) in order to help determine BMP implementation priorities;

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

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

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

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

The monitoring elements in this plan meet or exceed those required in Schedule B, Table B-1 of the City's new stormwater NPDES permit.

A monitoring objectives matrix is included in Appendix A-2, providing a synopsis of how each monitoring program element will be used to address each of the six monitoring objectives. For each monitoring element included in Schedule B, Table B-1 of the City's permit, there is a corresponding section in this monitoring plan with a more detailed "Purpose" section relating the monitoring element to one or more of the six monitoring objectives. These purpose statements collectively serve as a template for the analysis that will be done as data are acquired and progress assessed toward meeting stated objectives.

In general, data collected under this monitoring plan will be reviewed and utilized, as applicable, during the annual adaptive management process (for example, through identification of data anomalies, and water quality standards exceedances) and the permit cycle (5-year) adaptive management process (for example, to assist with BMP assessment and/or evaluation, assess data collection strategies, and assist with evaluation of overall effectiveness of the stormwater management program). The structured, iterative adaptive management process is intended to elicit informed decisions when refining stormwater program elements and monitoring strategies to assure that the City continues to improve its stormwater management programs and reduce the discharge of pollutants to the maximum extent practicable.

It is important to note that some of the planned or ongoing monitoring elements are long-term activities that generally do not yield immediate interpretable results over the course of a monitoring year or even a single permit cycle. For example:

- Water quality trends for some streams cannot be established immediately; generally, samples collected over multiple years covering all seasons are necessary to establish trends and make meaningful statistical comparisons.

- The use of storm-event sampling data in modeling to estimate MS4 pollutant loads is a complex undertaking in that numerous variables in the watershed can influence stormwater runoff quality including land use activities, topography, soils and vegetation, magnitude and duration of the storm events, seasonal influences, etc. Therefore, multiple storm sampling events are usually necessary, and even at that, the results may be at best a broad characterization of pollutant quantity.

- The measurable effects of shade on stream temperature, dissolved oxygen, and overall stream health following vegetation planting within a riparian area will likely not be known for many years after planting because maturity of riparian habitat generally takes many years after restoration.

## 2. Monitoring Program Organization

Monitoring elements described in this plan will be managed by City of Eugene staff in the Public Works Department. Program managers in the Engineering, Maintenance, Parks & Open Space, and Wastewater Divisions will be responsible for ensuring all plan elements are developed, implemented and managed as described.

The sections that follow describe each environmental monitoring element, a brief statement describing the intended purpose for the acquired information, and details of the monitoring effort, such as sampling location, frequency, analysis type and methods, and other criteria.

## 3. Instream Monitoring

Select streams that receive MS4 stormwater runoff generated by the permittee will be sampled and analyzed for water quality. Instream sampling will be conducted under direction of the Environmental Services Supervisor in the Wastewater Division.

## 3.1 Purpose and Study Design

Instream sampling and analysis is designed to enable water quality assessments coincident with geographic areas within the permitted boundary and as delineated by MS4 systems within these areas. In addition, monitoring will be used to:

3.1.1 Assess 303(d) listed pollutants in streams and MS4 stormwater contributions from the permittee.

3.1.2 Serve as an indicator of the overall effectiveness of applied BMPs.

3.1.3 Support assessment of stormwater pollutant contributions based on catchment characteristics.

3.1.4 Build upon existing data or establish new data to assess water quality characteristics and trends; when applicable and available other monitoring data and/or sampling efforts will be used to support this task, including sources such as other Oregon communities, the Oregon DEQ and U.S. Geological Survey.

3.1.5 Assess chemical and physical effects of MS4 runoff on receiving waters.

3.1.6 Assess progress toward meeting applicable TMDL pollutant load reduction benchmarks.

3.1.7 Assess the effectiveness of the Water Quality Waterways ordinance establishing water quality setbacks for specific headwaters and other waterways.

## 3.2 Locations

Stream monitoring locations will consist of those previously sampled with established historical trends in the Amazon and Willamette River basins, and new locations to meet monitoring program interests or concerns. The following basins or streams that receive MS4 stormwater runoff from the City of Eugene will be sampled:

3.2.1 Amazon Basin

3.2.1.1 Six (6) sites on streams within the Amazon Basin including:

- Amazon Creek at 29th Avenue
- Amazon Creek at Railroad Crossing
- Amazon Creek at Royal Avenue
- Amazon Diversion Channel at Royal Avenue
- A3 Channel at Terry Street
- Willow Creek north of 18th Avenue

3.2.1.2 Two (2) sites will be selected on a rotational basis between the A3 Channel and Amazon Creek for chlorinated hydrocarbons as listed in Table 1. Rotation will be done annually such that sampling at both sites reflects seasonal influences.

3.2.2 Willamette River

3.2.2.1 Five (5) sites on the Willamette River including:

- Upstream of Urban Growth Boundary (River Mile 186.9)
- At Knickerbocker Bridge (River Mile 183.9)
- At Owosso Bridge (River Mile 178.6)
- Downstream of Randy Papè Beltline Bridge (River Mile 176.8)

- Delta Ponds Near Randy Papè Beltline Bridge & Upstream of Willamette River Confluence

3.2.3 Willamette River Basin Streams

3.2.3.1 Urban Streams within the Willamette River Basin

- Spring Creek at Beacon Drive East

3.2.4 Coordinated monitoring with other agencies or jurisdictions may be done to meet any of the stormwater quality monitoring requirements in Table 1 subject to an established agreement with the agency or jurisdiction prior to conducting such activities.

3.2.5 Other urban streams within the Amazon and Willamette basins may be added at any time during the permit term to fulfill monitoring objectives.

## 3.3 Frequency

Sampling events will be scheduled every other month for a total of six (6) events per year. The following sampling schedule criteria also apply:

3.3.1 Wet Season Sampling: Three (3) sampling events will be done during wet season months from November through April; and

3.3.2 Dry Season Sampling: Three (3) sampling events will be done during dry season months from May through October.

3.3.3 In the event sampling must be rescheduled due to safety or logistical reasons, a minimum of fourteen (14) days must separate sampling events while also meeting criteria 3.3.1 and 3.3.2 above.

## 3.4 Sample Type and Sequence

Grab sampling methods will be used to collect instream samples. This type of sample refers to an individual sample collected at a particular time and place, and represents conditions at the time it was collected. In general, sampling on a single waterway is done such that the sequence is from downstream to upstream sites to maintain location independence of the water samples.

## 3.5 Analytes

Stream samples will be analyzed for water quality parameters listed in Table 1. The table is a modified version of Table B-1 in Schedule B of the permit in that it lists only those parameters associated with instream monitoring (the remainder of the monitoring requirements for other elements is specified in subsequent sections).

Select monitoring sites will be sampled for those chlorinated hydrocarbons for which the water body is listed as being water quality limited as shown in Table 1 and as site-qualified in Sections 3.2.1.2 above.

Laboratory analysis will be done by the Eugene/Springfield Environmental Services Laboratory under direction of the Laboratory Supervisor in the Wastewater Division. The services of an accredited laboratory will be used for the analysis of chlorinated hydrocarbons listed in Table 1.

3.5.1 Analytes listed in Table 1 meet the monitoring requirements specified in the City's permit, and will be used to achieve the six objectives described in Section 1. A list of analytes, current methodologies, and reporting limits are included in Tables 7.1;

preservation and hold times are in Table 5.1; both tables are in Appendix B.

3.5.2 Recently the U.S. EPA proposed modified filtration requirements for the analysis of Ortho Phosphorous in water samples, specifying that samples be filtered immediately upon collection in the field to prevent hydrolysis of particulate phosphorous to ortho phosphorous in slightly acidic samples; however, these requirements pose several logistical issues and may confound interpretation of observed historical trends.

No significant benefits are realized from the new filtration requirements to achieve a precise ortho phosphorus concentration since there is no potential to underestimate the quantity of this nutrient in the receiving waterbody, nor will the results likely change the City's adaptive management strategies or development and application of BMPs to address this pollutant. Continuation of the previous sampling and analysis protocol will not measurably detract from the integrity of data used to meet the objectives of instream water quality monitoring for ortho phosphorus.

The City will continue to utilize EPA's previous sampling and analysis protocol for instream samples to provide continuity of observed statistically significant concentration trends; specifically, instream samples will be filtered in the laboratory immediately upon receipt and within six hours of sample collection.

3.5.3 Reported Non-Detects: Any analyte whose value is reported as Not Detected (i.e., less than the method reporting limit) greater than 90% of the time after 18 in-stream monitoring events at a specific location may be eliminated from routine sampling.

**Table 1.**
**Instream Water Quality Monitoring Parameters**

| **Field Parameters** | **Metals, Total and Dissolved** | **Nutrients** |
|---|---|---|
| pH | Arsenic[2] | Ammonia – as Nitrogen |
| Temperature[1] | Cadmium | Nitrate+Nitrite – as Nitrogen |
| Dissolved Oxygen[1,2] | Chromium | Total Kjeldahl Nitrogen |
| | Copper[2] | Ortho Phosphorus |
| **Conventional Parameters** | Iron[2] | Total Phosphorus |
| Biochemical Oxygen Demand | Lead[2] | |
| Chemical Oxygen Demand | Manganese[2] | **Chlorindated Hydrocarbons** |
| Calcium (Total) | Mercury[1,2] | ***A3 Channel*** |
| Magnesium (Total) | Molybdenum | Dichloroethylenes[2] |
| Hardness (Calculated) | Nickel | Tetrachloroethylene[2] |
| Specific Conductance | Selenium | |
| Total Dissolved Solids | Silver | ***Amazon Creek*** |
| Total Suspended Solids | Zinc | Dichloroethylenes[2] |
| Turbidity[1] | | Trichloroethylene[2] |
| *Escherichia coli*[1] | | Tetrachloroethylene[2] |
| Fecal Coliform[1] | | |

**Table 1 Notes:**

[1] Annotated analytes indicates TMDL applies to one or more water bodies included in the list of monitoring locations.

[2] Annotated analytes indicates 2010 303(d) listing for one or more water bodies included in the list of monitoring locations.

# 4. Stormwater Storm-Event Monitoring using Focused Basin Approach

Stormwater runoff at select sites will be sampled during select storm events and analyzed for water quality. Storm-event sampling will be done under direction of the Environmental Services Supervisor in the Wastewater Division.

## 4.1 Purpose and Study Design

Stormwater event sample collection and analysis is designed to enable stormwater quality assessments coincident with geographic areas within the permitted boundary and as delineated by MS4 systems within these areas. In addition, monitoring will be used to:

4.1.1 Assess 303(d) listed pollutants in stormwater runoff.

4.1.2 Assist with pollutant source evaluations.

4.1.3 Characterize overall effectiveness of applied BMPs.

4.1.4 Characterize stormwater quality; when applicable and available other monitoring data and/or sampling efforts will be used to support this task, including data sources such as other communities nationwide.

4.1.5 Support assessment of in-stream water quality characteristics and trends.

4.1.6 Support evaluation of MS4 discharge chemical and biological effects on receiving waters.

4.1.7 Enhance pollutant load models to assess progress towards meeting TMDL pollutant load reduction benchmarks as applicable.

## 4.2 Locations

Specific locations within the MS4 will be monitored to characterize water quality from defined catchment areas within basins delineated in the City's Stormwater Basin Master Plan.

4.2.1 A minimum of two (2) MS4 locations will be sampled per storm event; sampling locations will be rotated among MS4 catchment areas.

4.2.2 Sampling locations will be selected from among the following stormwater basin areas:

- River Road – Santa Clara
- Willakenzie
- Willamette River
- Laurel Hill
- Amazon
- Willow Creek
- Bethel – Danebo

4.2.3 Under some circumstances, stormwater event sampling at a specific location may be conducted to satisfy multiple monitoring requirements described in the MS4 permit, Schedule B, Table B-1. For example, storm event sampling conducted to meet the pollutant monitoring requirements for a specific catchment area may also include collection of additional samples to satisfy the pesticide or chlorinated hydrocarbon monitoring requirements.

4.2.4 Factors that will be considered when selecting monitoring locations will generally include the following as applicable:

- sampling objectives
- MS4 outfall location and system characteristics;
- receiving water body characteristics and whether 303(d) listing(s) or TMDL(s) apply;
- representative current and/or historical land use type(s);
- pollutant(s) of concern based on knowledge of MS4 basin characteristics;
- potential for illicit discharges;
- permeability of surface areas; and
- surface/soil type, infiltration capacity, slope, and stability within the catchment area.
- staff safety

4.2.5 Coordinated monitoring with other agencies or jurisdictions may be done to meet any of the stormwater quality monitoring requirements in Table 2 subject to an established agreement with the agency or jurisdiction prior to conducting such activities.

### 4.3 Frequency

The frequency of storm-event sampling will be as follows:

4.3.1 At least three (3) storm events will be sampled per year for locations described in Sections 4.2.1 and 4.2.2.

4.3.2 At least three (3) storm events will be sampled per permit term for pesticides listed in Table 2 below.

4.3.3 The storm event sampling frequency by stormwater basin area (Section 4.2.3), will be determined based on the factors described in Section 4.2.4.

### 4.4 Storm Event Criteria

Storm event sampling requires meticulous planning and cooperative weather that often does not materialize as predicted. The following storm event criteria apply to MS4 storm event monitoring:

4.4.1 Qualified Storm Event: Precipitation for a qualified storm event must be greater than or equal to one-tenth (≥0.1) inch.

4.4.2 Antecedent Dry Period: The antecedent dry period must be at least six (6) hours before a storm event sample can be collected. Antecedent dry period is defined as receiving less than one-tenth (<0.1) inch of precipitation for the 6-hour period before a sample can be collected.

4.4.3 Intra-Event Dry Period: The intra-event dry period must not exceed six (6) hours, unless a 24-hour flow-weighted composite sample collection method is employed. Intra-event dry period is defined as the period of time during which stormwater flow ceases during a sampling event. Stormwater flow may not cease for a period greater than 6 hours for the sampling event to be valid.

### 4.5 Sample Type

Storm event samples will consist of sample types listed in the sections below. The sample type selected will be dependent on the types of analytes required and the sampling objectives. Grab samples will be utilized to identify the presence and concentration of pollutants of potential concern. Peak flow estimates may be calculated for the sampled basin using methods such as the Rational Method or other approaches. Pollutant concentrations and estimated peak flow rates will help assess whether pollutants in stormwater runoff have the potential to degrade the water quality of the receiving waterbody. This information, along with other basin characteristics, will be evaluated to determine whether additional sampling

data are necessary to estimate pollutant loads from a defined catchment area as would be obtained, for example, from flow-weighted sampling.

4.5.1 Grab samples: Grab sample can be collected at any time stormwater runoff occurs for a storm event. To minimize potential bias in the results the time at which sampling is done during a storm event will be varied among sampling events.

4.5.2 Flow-weighted composite samples: These sample types are collected for the entire duration of the storm event or for a time period based on the estimated peak flow for the MS4 drainage basin.

4.5.3 24-Hour flow-weighted composite samples: These samples will be collected utilizing automated samplers programmed to initiate and complete a sampling event over a 24-hour period.

### 4.6 Analytes

MS4 stormwater runoff samples will be analyzed for water quality parameters listed in Table 2 following the schedules described under Sections 4.2 and 4.3 for location and frequency. The table is a modified version of Table B-1 in Schedule B of the permit in that it lists only those parameters associated with storm event monitoring (the remainder of the monitoring requirements for other elements is specified in previous or subsequent sections).

Laboratory analysis will be done by the Eugene/Springfield Environmental Services Laboratory under direction of the Environmental Services Supervisor in the Wastewater Division. The services of an accredited laboratory will be used for those parameters not done by the in-house laboratory such as chlorinated hydrocarbons and pesticides listed in Table 2.

4.6.1 Analytes listed in Table 2 meet the monitoring requirements specified in the City's permit, and will be used to achieve the six objectives described in Section 1. A list of analytes, current methodologies, and reporting limits are included in Tables 7.1; preservation and hold times are in Table 5.1; both tables are in Appendix B.

4.6.2 Table 2 lists pesticides the City has identified as potential contaminants of concern because they were detected in samples collected in previous monitoring events. However, to better target pesticide use within the permit area the City will utilize a screening technique for multiple pesticide residues. A list of pesticides included in the multiple residues analysis, current methodologies, and reporting limits are specified in Appendix C.

4.6.3 Recently the U.S. EPA proposed modified filtration requirements for the analysis of Ortho Phosphorous in water samples, specifying that samples be filtered immediately upon collection in the field to prevent hydrolysis of particulate phosphorous to ortho phosphorous in slightly acidic samples; however, these requirements pose several logistical issues and may confound interpretation of observed historical trends.

No significant benefits are realized from the new filtration requirements to achieve a precise ortho phosphorus concentration since there is no potential to underestimate the quantity of this nutrient in stormwater samples, nor will the results likely change the City's adaptive management strategies or development and application of BMPs to address this pollutant. Continuation of the previous sampling and analysis protocol will not measurably detract from the integrity of data used to meet the objectives of stormwater quality monitoring for ortho phosphorus.

The City will continue to utilize EPA's previous sampling and analysis protocol for instream samples to provide continuity of observed statistically significant

concentration trends; specifically, stormwater samples will be filtered in the laboratory immediately upon receipt and within six hours of sample collection.

4.6.4 Reported Non-Detects: Any analyte whose value is reported as Not Detected (i.e., less than the method reporting limit) greater than 90% of the time after nine (9) stormwater monitoring events may be eliminated from routine sampling.

**Table 2.**
**Stormwater Runoff Water Quality Monitoring Parameters**

| | | |
|---|---|---|
| **Field Parameters** | **Metals, Total and Dissolved** | **Chlorinated Hydrocarbons** |
| pH | Arsenic[2] | ***MS4 to A3 Channel*** |
| Temperature | Cadmium | Dichloroethylenes[2] |
| Dissolved Oxygen[1,2] | Chromium | Tetrachloroethylene[2] |
| Flow Rate[3] | Copper[2] | |
| | Iron[2] | ***MS4 to Amazon Creek*** |
| **Conventional Parameters** | Lead[2] | Dichloroethylenes[2] |
| Biochemical Oxygen Demand | Manganese[2] | Trichloroethylene[2] |
| Chemical Oxygen Demand | Mercury[1,2] | Tetrachloroethylene[2] |
| Calcium (Total) | Molybdenum | |
| Magnesium (Total) | Nickel | **Pesticides** |
| Hardness (Calculated) | Selenium | 2,4-D |
| Specific Conductance | Silver | Dicamba |
| Total Dissolved Solids | Zinc | Diruon |
| Total Suspended Solids | | Fipronil |
| Turbidity[1] | **Nutrients** | MCPP |
| *Escherichia coli* [1] | Ammonia – as Nitrogen | Propiconazole |
| Fecal Coliform[1] | Nitrate+Nitrite – as Nitrogen | Pyrimethanil |
| | Total Kjeldahl Nitrogen | Quinclorac |
| | Ortho Phosphorus | Simazine |
| | Total Phosphorus | Triclopyr |

**Table 2 Notes:**

[1] Annotated analytes indicates TMDL applies to one or more water bodies receiving MS4 stormwater runoff included in the monitoring program.

[2] Annotated analytes indicates 2010 303(d) listing for one or more water bodies receiving MS4 stormwater runoff included in the monitoring program.

[3] Cumulative precipitation from the beginning of the storm event and for the duration of the sampling event may substitute for flow rate.

## 5. Stormwater Monitoring for Bacteria

Stormwater samples will be collected during storm events and analyzed for bacteria. Bacteria sampling will be done under direction of the Sampling Team Supervisor in the Wastewater Division.

### 5.1 Purpose

The collection of stormwater runoff for the analysis of bacteria will be used to:

5.1.1 Continue efforts underway to characterize stormwater bacteria contributions from the MS4 to receiving streams; when applicable and available other monitoring data and/or sampling efforts will be used to support this task, including communities nationwide.

5.1.2 Evaluate the effectiveness of select BMPs applied to MS4 catch basins that discharge to streams within the Eugene UGB.

5.1.3 Assess bacteria contributions based on stormwater catchment characteristics.

5.1.4 Assess site-specific stormwater bacteria data from the MS4 for effects on bacteria trends observed in streams.

5.1.5 Evaluate the effects of stormwater bacteria from the MS4 on receiving streams.

5.1.6 Evaluate stormwater bacteria data for potential to enhance pollutant load models and progress toward meeting TMDL pollutant load reduction benchmarks.

## 5.2 Locations

Specific locations within the MS4 will be monitored to characterize bacteria water quality from defined catchment areas within basins delineated in the City's Stormwater Basin Master Plan.

5.2.1 A minimum of two (2) MS4 locations will be sampled per storm event; sampling locations may be rotated among multiple locations within the MS4.

5.2.2 Sampling locations will be selected from among the following stormwater basin areas:

- River Road – Santa Clara
- Willakenzie
- Willamette River
- Laurel Hill
- Amazon
- Willow Creek
- Bethel – Danebo

5.2.3 Factors that will be considered when selecting monitoring locations will generally include the following:

- Sampling objectives
- MS4 outfall location and system characteristics;
- receiving waterbody characteristics and whether a 303(d) listing or TMDL(s) applies;
- representative current and/or historical land use type(s);
- knowledge of MS4 basin characteristics;
- potential for illicit discharges;
- permeability of surface areas; and
- surface/soil type, infiltration capacity, slope, and stability.
- staff safety

## 5.3 Frequency

The frequency of storm-event sampling will be as follows:

5.3.1 At least three (3) storm events will be sampled per year for locations described in Sections 5.2.1 and 5.2.2.

## 5.4 Storm Event Criteria

The storm event criteria described in Section 4.4 as applied to general storm event monitoring are applicable to stormwater monitoring for MS4 stormwater bacteria grab samples described below.

### 5.5 Sample Type

Grab sampling methods will be used to collect samples for bacteria analysis.

5.5.1 MS4 stormwater grab samples can be collected at any time stormwater runoff occurs during the storm event. To minimize potential bias in the results the time at which sampling is done during a storm event will be varied among sampling events.

5.5.2 Streams receiving MS4 runoff may be sampled in conjunction with stormwater monitoring for bacteria and will consist of grab samples.

### 5.6 Analytes

5.6.1 MS4 stormwater runoff samples will be analyzed for water quality parameters listed Table 3. A list of analytes, current methodologies, and reporting limits are included in Tables 7.1; preservation and hold times are in Table 5.1; both tables are in Appendix B.

Table 3 is a modified version of Table B-1 in Schedule B of the permit in that it lists only those parameters associated with bacteria monitoring (the remainder of the monitoring requirements for other elements is specified in previous or subsequent sections).

Laboratory analysis will be done by the Eugene/Springfield Environmental Services Laboratory under direction of the Laboratory Supervisor in the Wastewater Division.

5.6.2 When collected, samples collected from streams receiving MS4 runoff will be analyzed for water quality parameters listed in Table 3.

**Table 3.**
**Stormwater Monitoring for Bacteria**

| **Field Parameters** | **Bacteria Parameters** |
|---|---|
| pH | Fecal Coliform |
| Temperature | *Escherichia coli* |
| Dissolved Oxygen | |

## 6. Macroinvertebrate Monitoring

Macroinvertebrate monitoring will be done in the Amazon Creek and Willamette River basins to characterize current macroinvertebrate community conditions, assess the effects of stormwater runoff on receiving waters, and to assess opportunities for and effects of future riparian restoration projects.

### 6.1 Purpose

Site-specific macroinvertebrate monitoring will be used to:

6.1.1 Support characterization of stream health and overall effects of stormwater pollutants.

6.1.2 Support efforts to identify opportunities for and characterize overall effectiveness of applied BMPs and stream enhancement/restoration projects.

6.1.3 Characterize overall stormwater quality; when applicable and available other monitoring data and/or sampling efforts will be used to support this task.

6.1.4 Support instream trend evaluation; evaluate metrics for trend analysis as applicable.

6.1.5 Assess the biological effects of MS4 runoff on receiving water.

6.1.6 Assess the effectiveness of the Water Quality Waterways ordinance establishing water quality setbacks for specific headwaters and other waterways.

## 6.2 Locations

Macroinvertebrate monitoring locations will consist of Amazon Creek and Willamette River basin sites. The following basins or streams that receive MS4 stormwater runoff will be sampled:

6.2.1 Amazon Basin: Five (5) sites on streams within the Amazon Basin including:

- Amazon Creek at Kinney Park
- Amazon Creek near 31st Avenue
- Amazon Creek near Garfield Street
- A3 Channel near Terry Street
- Amazon Diversion Channel near Royal Avenue

6.2.2 Willamette River: Five (5) sites on the Willamette River will be selected. Locations will generally be in proximity to the monitoring site locations specified in Section 3.2.2.1.

6.2.3 Willamette River Basin Streams:

- Spring Creek at Awbrey Park

6.2.4 Other urban streams within the Eugene UGB may be added at any time during the monitoring period to fulfill monitoring objectives.

6.2.5 Reference Site: One (1) reference site will be selected to represent “undeveloped” conditions, either on Middle Fork Spencer Creek or Willow Creek south of 18$^{th}$ Avenue. Spencer Creek is currently used as the reference site for the Amazon drainage basin although it is not located within the Eugene UGB. If a more suitable reference location within the Amazon drainage basin is identified, this will be used for reference purposes. Willow Creek is within the basin, however, it is an ephemeral stream and often does not have flow during the months when the macroinvertebrate survey would normally be done.

## 6.3 Frequency

Macroinvertebrate surveys will be scheduled once every three (3) years and will be done in the fall before seasonal rains begin.

## 6.4 Methodology

Macroinvertebrate surveys will be done using the following methodology:

6.4.1 Habitat Surveys: Modified Rapid Stream Assessment Protocols (RSAT).

6.4.2 Macroinvertebrate Collection: Oregon Department of Environmental Quality (DEQ) Benthic Macroinvertebrate Protocol for Wadeable Rivers and Streams.

6.4.3 Macroinvertebrate Taxonomic Analysis: PREDATOR (PREDictive Assessment Tool for Oregon) model. A set of community metrics are also calculated to support the PREDATOR analysis.

## 7. Physical Monitoring

Physical monitoring will be conducted at select locations to characterize the current physical condition of receiving waterbodies, assess the effects of stormwater runoff on receiving waters, and the effects of future restoration efforts.

Field condition assessments will be done by Parks & Open Space staff under direction of the Natural Areas Restoration Supervisor.

Historical photo documentation will be done under direction of the Sampling Team Supervisor in the Wastewater Division.

### 7.1 Purpose

Physical monitoring waterway assessment ranking protocol will be used to/as:

7.1.1 Support assessment of pollutant contributions and evaluate overall stream health;

7.1.2 Support efforts to identify opportunities for and characterize overall effectiveness of applied BMPs and stream enhancement/restoration projects;

7.1.3 Indicators of stormwater runoff discharges and overall effects of stormwater runoff;

7.1.4 Support long-term trends of overall stream health that are directly or indirectly associated with MS4 stormwater discharges;

7.1.5 Assess the physical effects of MS4 discharges on receiving waters; and

7.1.6 Support assessment of progress toward meeting TMDL pollutant load reduction benchmarks.

### 7.2 Locations

7.2.1 Select locations for physical monitoring will be from among those publicly managed streams and waterways identified in the City of Eugene's Open Waterway Maintenance Plans. These will generally coincide with macroinvertebrate monitoring locations within the Amazon basin.

7.2.2 Key aquatic and riparian characteristics of select waterways will be photo-documented to accompany the physical assessment.

7.2.3 Amazon Creek Historical Photomonitoring will be done at the following locations:

- West Amazon Drive 200' north of Martin Street;
- West Amazon Drive at intersection with Martin Street;
- West Amazon Drive north of Hillside Drive;
- South of East Amazon Drive and Nectar Way intersection;
- North of East Amazon Drive and Nectar Way intersection;

- East and West Amazon Drive at Larch Street;
- East and West Amazon Drive at 39th Avenue;
- West of Hilyard between 33rd and 32nd Avenues; and
- At 29th Avenue.

### 7.3 Frequency

The frequency of physical assessments will be as follows:

7.3.1 Physical assessments will be done every three (3) years in the form of updates to the City's Open Waterway Maintenance Plans for selected streams and waterways; photo-documentation will be done for key aquatic and riparian characteristics at selected sites.

7.3.2 Photomonitoring will be done annually at Amazon Creek Historical Photomonitoring sites listed in section 7.2.3.

### 7.4 Methodology

Physical monitoring will follow the methodology used in the Eugene-Springfield Metro Waterways Study, which was done to assess existing problems and opportunities related to area waterways, and to identify solutions to improve their function. The U.S. Army Corps of Engineers, in partnership with the cities of Eugene and Springfield, Eugene Water & Electric Board, and Lane County, with the Bureau of Land Management as a Cooperating Agency (2009), conducted a multi-year study in the Eugene-Springfield metropolitan area and surrounding rural lands. The first phase of the study focused on the Amazon Creek watershed.

The methodology consists of condition assessment ranking protocol for classifying stream and channel segments in terms of their water quality, natural resource, conveyance functions, and maintenance considerations. This information will also be used to update, as needed, the City's Open Waterway Maintenance Plans (a task in SWMP BMP P5: Public Stormwater System – Open Waterways).

Key aquatic and riparian characteristics of select waterways (see Section 7.2.2) will be digitally photographed and annotated with appropriate contextual information to assist development of a visual record to accompany the physical assessment.

Digital photographs will be taken at locations listed in Section 7.2.3. These images will build upon historical photo documentation of locations along Amazon Creek to develop a visual record of any changes occurring to the waterbody or riparian zone.

## 8. Structural BMP Monitoring

Select structural BMPs will be monitored to assess their effectiveness in mitigating identified stormwater quality issues. Functionality and effectiveness are a function of the type(s) of BMP structure(s) installed; metrics for assessing functionality and effectiveness will be developed during design and specification of the structural BMP.

Structural BMP monitoring will be coordinated through multiple work sections, including Engineering, Maintenance, and Wastewater; storm-event sampling will be done under direction of the Sampling Team Supervisor in the Wastewater Division.

### 8.1 Purpose and Study Design

Structural BMP monitoring is designed to enable water quality assessments associated with a specific structural BMP applied to a defined geographic area within the permitted boundary

and as delineated by MS4 systems within this discrete area. Each structural BMP study will be designed to assess its unique functional properties. In addition, monitoring will be used to:

8.1.1 Evaluate BMP effectiveness in reducing stormwater pollutants.

8.1.2 Support assessment of stormwater pollutant contributions to 303(d)-listed waterbodies under site-specific circumstances.

8.1.3 Support efforts to identify opportunities for and characterize overall effectiveness of applied BMPs.

8.1.4 Characterize stormwater runoff quality based on site-specific catchment characteristics.

8.1.5 Evaluate potential effects on instream water quality trends.

8.1.6 Evaluate their chemical, biological, and physical effects on receiving waters.

8.1.7 Support assessment of progress toward meeting TMDL pollutant load reduction benchmarks.

## 8.2 Locations

Structural BMPs in the MS4 system will be monitored to characterize stormwater quality entering and exiting the structure. At least one (1) structural BMP will be sampled per storm event and sampling will occur upstream and downstream of the structural BMP. Factors that will be considered when selecting structural BMP monitoring locations will generally include the following:

- Purpose, location, and characteristics of the structural BMP;
- Availability of reliable data on the effectiveness of the particular type of BMP;
- Pollutant(s) of concern based on knowledge of MS4 basin characteristics;
- Receiving water body characteristics and whether a 303(d) listing or TMDL applies;
- Representative current and/or historical land use type(s);
- Potential for illicit discharges;
- Types of comparisons to be made, i.e., inflow/outflow characteristics, qualitative and/or quantitative; and
- Precipitation event characteristics.

## 8.3 Frequency

At least three (3) storm events will be sampled <u>per permit term</u> to characterize functionality and effectiveness of the structural BMP.

## 8.4 Storm Event Criteria

The storm event criteria described in Section 4.4 as applied to general storm event monitoring are applicable to this stormwater BMP monitoring.

## 8.5 Sample Type

The type and application of structural BMP will dictate the type(s) of stormwater sample to be collected. In general, the sample types described in Section 4.5 would be applicable to this monitoring element.

## 8.6 Analytes

The type and application of structural BMP will dictate the types of water quality analyses to be performed. These will be defined at the time each project is identified

Laboratory analysis will be done by the Eugene/Springfield Environmental Services Laboratory under direction of the Laboratory Supervisor in the Wastewater Division.

Examples of factors that may be considered when selecting stormwater quality parameters include:

- The purpose of the structural BMP and the stormwater pollutant analytes it is designed to reduce;
- Types of comparisons to be made; e.g., BMP data compared to instream water quality data to determine if the permittee's MS4 discharge pollutant loads have potential to contribute to or cause instream water quality degradation;
- Whether there is reasonable potential for a specific MS4 pollutant to exceed the applicable pollutant load reduction benchmarks;
- Whether a specific pollutant in the MS4 causes or contributes to water quality degradation in 2010 303(d)-listed streams;
- Whether there is a statistically significant concentration trend for a specific stormwater pollutant in the respective receiving stream;
- Knowledge gained from field screenings for illicit discharges; and
- Knowledge of catch basin characteristics.

## 9. Quality Assurance Plan, Standard Operating Procedures, and Methodology

The Eugene/Springfield Environmental Services Laboratory performs analytical services under a DEQ-approved Quality Assurance Plan (QAP). The QAP describes quality control procedures, including application of method blanks, laboratory control samples, matrix spikes, laboratory duplicates and duplicate matrix spikes, initial and continuing calibration verification standards, calibration and continuing calibration blanks and standards, and calibration standards. Sample handling procedures, quality control objectives, lists of analytical methods and reporting limits, data reduction, validation, and reporting, are also specified in the plan.

All stormwater samples will be analyzed following the protocol specified in the QAP to ensure the quality of laboratory results. Any pollutants that cannot be analyzed in house will be contracted to laboratories that likewise perform analytical services under a QAP that meets or exceeds the Division's laboratory standards.

All field sampling will be done following documented Standard Operating Procedures (SOPs) to ensure consistency, representativeness, and quality of results. Application of quality assurance/quality control (QA/QC) protocol for the collection of field samples will include chain-of-custody protocol, field instrument calibration techniques, the collection of field replicates or duplicates, field blanks, and trip blanks as appropriate. The Division Document Control System is used to control and maintain all of its documentation, including the documents referenced here, and are available upon request.

Analytical methodologies specified and referenced in 40CFR136 will apply, as well as other EPA methodologies where appropriate, to the analysis of all instream and stormwater samples (noted exceptions are described in Sections 3.5.2 and 4.6.3 for Ortho Phosphorous).

Appendix B presents a copy of the QAP and associated reference tables; Appendix C contains SOPs applicable to this monitoring plan.

## 10. Due Diligence and Notification

Staff will ensure all measures within their control are taken to implement and conform to the requirements described in this Plan. However, some circumstances may arise whereby specific elements of this plan

cannot be fulfilled due factors beyond the control of staff; for example, drought conditions or other natural disaster may preclude the collection of surface water or stormwater samples. The Stormwater Program Coordinator will be contacted as soon as the Plan nonconformance is identified.

## 11. Data Management, Documentation and Record-Keeping

The Eugene/Springfield Water Pollution Control Facility maintains an Environmental Management System (EMS) for which it has earned certification under the International Organization for Standardization (ISO). Organizations that earn ISO certification under the 14001:2004(E) standard commit to develop an environmental policy, establish objectives and processes to achieve policy commitments, take action as needed to improve its performance and demonstrate the conformity of the system to the requirements of the ISO standard. ISO 14001 elements include establishing, implementing and maintaining procedures applicable to legal requirements, documentation and records determined to be necessary to ensure effective planning, operation and control of processes, control of records and documents, evaluation of legal compliance, defining roles, responsibilities and authority of staff, competence and training requirements, and management review. In addition, the E/S WPCF's EMS is audited by internal and external auditors on an annual basis to ensure conformance and compliance to the policies and objectives established by and applicable to the E/S WPCF.

As such, all sampling and analysis of stormwater and stream samples for this plan performed by staff at the E/S WPCF falls under the umbrella of the EMS program. Documents and records associated with stormwater monitoring elements are readily available through the E/S WPCF electronic document control system, including the QAP, associated tables and SOPs, and are available upon request. All laboratory and field measurements collected under this plan including QA/QC will be controlled through the E/S WPCF's Laboratory Information Management System (LIMS), which has strict data entry requirements and access restrictions.

## 12. Data Analysis

Multiple techniques are applicable to the analysis of stormwater data, including parametric and non-parametric statistical procedures, trend analysis, cluster techniques, etc. The techniques applied will largely depend on the characteristics of the data set and the types of comparisons desired. Commercial and non-commercial (e.g., IBM SPSS, USGS) software applications will be applied as needed. Application summaries and complete output information will accompany annual reports.

Data analysis will be performed by individuals within the City organization who have appropriate training and experience to assess laboratory and field data, or by consultants who are qualified to perform this task.

# Appendix A-1

## City of Eugene
## Schedule B, Table B-1

## Excerpted from:
## National Pollutant Discharge Elimination System (NPDES)
## Municipal Separate Storm Sewer System (MS4)
## Discharge Permit Number 107989
## (December 30, 2010)

| Table B-1<br>Proposed Environmental Monitoring | | | |
|---|---|---|---|
| **Monitoring Type** | **Monitoring Location(s)** | **Monitoring Frequency** | **Pollutant Analyte(s)** |
| Instream Monitoring | Six (6) sites in the Amazon Basin | Six (6) events/year | Field; Conventional; Nutrients; Metals |
| | Six (6) sites in the Willamette Basin | | |
| Instream Monitoring – Chlorinated Hydrocarbons | One (1) site rotated among sites in the Amazon Subbasin | Six (6) events/year | Chlorinated Hydrocarbons |
| Stormwater Monitoring – Focused Basin | Two (2) sites during each storm event on a rotating basis | Three (3) storm events/year | Field; Conventional; Nutrients; Metals |
| Stormwater Monitoring – Pesticides | Two (2) sites during each storm event on a rotating basis | Three (3) storm events | Pesticides |
| Stormwater Monitoring – Chlorinated Hydrocarbons | Two (2) sites during each storm event rotated among sites in the Amazon Subbasin | Three (3) storm events/year | Chlorinated hydrocarbons |
| Stormwater Monitoring – Bacteria | Two (2) sites during each storm event | Three (3) storm events/year | Field; Fecal Coliform, E. coli |
| Macroinvertebrate Monitoring | Five (5) sites in the Amazon Basin | One (1) event/permit term | N/A |
| | Six (6) sites in the Willamette Basin | | |
| | One (1) reference site | | |
| Geomorphic Condition Monitoring | Photomonitoring – Varies City-wide | Annually | N/A |
| | Waterway Assessment – Varies City-wide | One (1) event/permit term | N/A |
| Structural BMP Monitoring | One (1) stormwater structural control measure | Three (3) storm events/permit term | Field; Conventional; Nutrients; Metals |

**Special Conditions**:

1. The monitoring frequency reflects the number of required sample events per monitoring location.

2. If after 18 Instream Monitoring events a pollutant analyte value is reported as a non-detect for greater than 90% of the samples, the pollutant analyte may be eliminated from routine monitoring.

3. If after 9 Stormwater Monitoring events a pollutant analyte value is reported as a non-detect for greater than 90% of the samples, the pollutant analyte may be eliminated from routine monitoring.

4. Field pollutant parameters for Stormwater Monitoring activities include Flow Rate when performing flow-weighted sampling.

5. The Macroinvertebrate Monitoring must follow generally accepted macroinvertebrate monitoring methodology (e.g., DEQ Benthic Macroinvertebrate Protocol for Wadeable Rivers and Streams). The methodology must be documented in the Monitoring Plan.

6. Photomonitoring must photodocument and record observations of the condition of the identified monitoring location.

Pollutant parameter(s) identified in each analyte category in Table B-1 are as follows:

**Field Parameters**
- pH
- Temperature
- Dissolved Oxygen
- Flow Rate

**Conventional Parameters**
- Biochemical Oxygen Demand
- Chemical Oxygen Demand
- Calcium (Total)
- Magnesium (Total)
- Hardness (Calculated)
- Specific Conductance
- Total Dissolved Solids
- Total Suspended Solids
- Turbidity
- *Escherichia coli*
- Fecal Coliform

**Metals, Total Recoverable & Dissolved**
- Arsenic
- Cadmium
- Chromium
- Copper
- Iron
- Lead
- Manganese
- Mercury
- Molybdenum
- Nickel
- Selenium
- Silver
- Zinc

**Nutrients**
- Ammonia – as Nitrogen
- Nitrate+Nitrite – as Nitrogen
- Total Kjeldahl Nitrogen
- Ortho Phosphorus
- Total Phosphorus

**Chlorinated Hydrocarbons**

**Amazon Subbasin Sites:**

***A3 Channel***
- Dichloroethylenes
- Tetrachloroethylene

***Amazon Creek***
- Dichloroethylenes
- Trichloroethylene
- Tetrachloroethylene

**Pesticides**
- 2,4-D
- Dicamba
- Diruon
- Fipronil
- MCPP
- Propiconazole
- Pyrimethanil
- Quinclorac
- Simazine
- Triclopyr

# Appendix A-2

# City of Eugene

# Monitoring Objective Matrix (December 2015)

| CITY OF EUGENE MONITORING OBJECTIVES MATRIX (DECEMBER 2015) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Environmental monitoring elements | | | | | | Program monitoring elements | | | |
| Monitoring objective | Instream dry and wet season monitoring | Macroinvertebrate monitoring | Stormwater monitoring | Rainfall/flow monitoring | Physical assessment monitoring | Dry weather field screening | SWMP program monitoring (measurable goals and BMP tracking) | Pollutant load modeling | Literature review | Data evaluation |
| 1. Evaluate the source(s) of the 2010 303(d) listed pollutants applicable to the permittee's permit area | Instream monitoring program includes 303(d) listed pollutants and will be used to assess MS4 stormwater pollutant contributions to receiving water body. | Macroinvertebrate studies will be used to support characterization of stream health and overall effects of pollutant contributions. | Stormwater monitoring will be used to characterize stormwater quality, and may contribute to the source evaluation of 303(d) pollutants. | N/A, since flow and rainfall are not 303(d) listed parameters. | Physical assessment monitoring of waterways can be used to support evaluation of pollutant contributions and overall stream health. | Dry weather field screening may assist with source identification of 303(d) pollutants. | SWMP program BMPs may help to identify potential sources of 303(d) pollutants. | Insight from pollutant load modeling will assist evaluations of 303(d) listed pollutant source(s). | Literature, regulations, committee and conference proceedings, databases, etc., will be reviewed for current developments pertaining to 303(d) listed pollutants. | 303(d) source evaluations and literature reviews will be reported annually or at the end of permit term as appropriate. |
| 2. Evaluate the effectiveness of Best Management Practices (BMPs) in order to help determine BMP implementation priorities | Instream water quality characteristics can be used as an indicator of overall effectiveness of applied BMPs, in combination with stormwater monitoring. | Macroinvertebrate studies will be used to support characterization of stream health and overall effectiveness of applied BMPs. | Stormwater monitoring will be used to support the evaluation of the overall effectiveness of applied BMPs. | Measurement of discharges from BMPs can provide information on effectiveness. | Physical assessment of waterways can be used as an indicator of overall effectiveness of applied BMPs. | Information gathered will help assess the overall effectiveness of the Illicit Discharge Detection and Elimination program BMP. | Program monitoring activities help evaluate the effectiveness of SWMP BMPs. | Pollutant load modeling will be used to estimate the overall effectiveness of applied BMPs. | Literature, committee, and conference proceedings, databases (e.g. International Stormwater BMP database), etc., will be reviewed for current developments in BMP effectiveness. | Literature review and BMP effectiveness findings will be reported annually or at the end of the permit term as appropriate. |
| 3. Characterize stormwater runoff discharges based on land use type, seasonality, geography or other catchment characteristics | Instream water quality characteristics will be used to support assessment of stormwater pollutant contributions. | Macroinvertebrate studies will be used to support characterization of stream health and overall effects of stormwater runoff. | Stormwater monitoring, in conjunction with other monitoring efforts where applicable and available, will be used to characterize stormwater quality. | Seasonal and geographic variations of rainfall and/or instream flow may assist in evaluating MS4 discharges. | Physical assessment of waterways can be used as indicators of stormwater runoff discharges and overall effects of stormwater runoff. | Dry weather field screening may identify legal and illicit non-stormwater discharges. | Some SWMP program elements provide information that helps to characterize MS4 discharges. | Pollutant load modeling will consider appropriate catchment characteristics. | Stormwater runoff characteristics will be compared to other data sources for any distinguishing characteristics. | Stormwater runoff characterization and any comparisons to external data sources will be reported annually or at the end of the permit term as appropriate. |
| 4. Evaluate status and long term trends in receiving waters associated with MS4 stormwater discharges | Instream monitoring program will be used to build upon existing data and establish new data to assess water quality characteristics and trends. | Macroinvertebrate studies will be used both to support instream trend evaluation and as parameters for trend analysis as applicable. | Stormwater monitoring will be used to support assessment of instream water quality characteristics and trends. | Instream flow may be used to support trend evaluation of MS4 discharge volumes. | Physical assessment of waterways can be used to support long term trends of overall stream health that may be directly or indirectly associated with MS4 stormwater discharges. | N/A | N/A | N/A | Review data collected by DEQ, USGS, and in peer- reviewed articles, to compare, contrast, and enhance data collected by permittee. | Instream water quality trends and any comparisons to external data sources will be reported annually or at the end of the permit term as appropriate. |
| 5. Assess the chemical, biological, and physical effects of MS4 discharges on receiving waters | Instream water quality characteristics will be used to assess the chemical and physical effects of MS4 runoff on receiving waters. | Macroinvertebrate studies will be used to assess the biological effects of MS4 runoff on receiving waters. | Stormwater monitoring will be used to support evaluation of MS4 discharge effects on receiving waters. | Rainfall/flow monitoring may be used to assess physical effects of MS4 runoff. | Physical assessment of waterways will be used to assess the physical effects of MS4 discharges on receiving waters. | N/A | N/A | Pollutant load modeling results will be used to characterize the effects of MS4 runoff on receiving waters. | Review studies done by others for application of assessment methodologies. | Assessment of the effects of MS4 discharges on receiving waters will be done annually or at the end of the permit term as appropriate. |
| 6. Assess progress towards meeting TMDL pollutant load reduction benchmarks | Instream monitoring program includes TMDL listed pollutants and will be used to assess progress towards meeting pollutant load reduction benchmarks. | N/A | Stormwater monitoring data will be used to enhance pollutant load model to assess progress towards meeting TMDL pollutant load reduction benchmarks. | Rainfall/flow monitoring may be used to calculate pollutant loads in the pollutant loads model. | Physical assessment of waterways may be used to support assessment of progress toward meeting TMDL pollutant load reduction benchmarks. | N/A | Program monitoring may help evaluate progress towards meeting TMDL pollutant load reduction benchmarks. | Pollutant load modeling will be used to estimate progress towards achieving TMDL pollutant load reduction benchmarks. | N/A | See benchmark reporting requirements under the permit renewal application requirements. |

# Appendix B

# Eugene/Springfield Environmental Services Laboratory Quality Assurance Plan

# CITY OF EUGENE – WASTEWATER DIVISION

## Plan

| | | | |
|---|---|---|---|
| **Subject:** | Quality Assurance Plan | **Document No:** | WW – 416 |
| **Reviewed By:** | Brown / Mendes / Ryan | **Original Date:** | 4/1/98 |
| **Approved By:** | EMS Management Team | **Date Approved:** | 8/21/14 |

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## Appendixes

None at this time

## Abbreviations & Acronyms

| | |
|---|---|
| AA | Atomic Absorption spectrometer |
| BMF | Biosolids Management Facility |
| CCV | Continuing Calibration Verification standard |
| CFR | Code of Federal Regulations |
| COC | Chain-of-Custody |
| DEQ | Oregon Department of Environmental Quality |
| DL | (Method) Detection Limit |
| DMR | Discharge Monitoring Report |
| E/S WPCF | Eugene/Springfield Water Pollution Control Facility |
| EAS | Environmental Analytical Services |
| ICP | Inductively Coupled Plasma spectrometer |
| ICV | Initial Calibration Verification standard |
| ID | Identification |
| IDL | Instrument Detection Limit |
| IPR | Initial Precision Recovery |
| ISC | Industrial Source Control |
| LCR | Linear Calibration Range |
| LCS | Laboratory Control Sample |
| LDR | Linear Dynamic Range |
| LIMS | Laboratory Information Management System |
| MDL | Method Detection Limit |
| mgd | million gallons per day |
| MWMC | Metropolitan Wastewater Management Commission |
| QL | (Method) Quantitation Limit |
| QA | Quality Assurance |
| QAP | Quality Assurance Plan |
| QC | Quality Control |
| RPD | Relative Percent Difference |
| SIWS | Seasonal Industrial Waste Site |

| | |
|---|---|
| SAP | Sampling and Analysis Plan |
| USEPA or EPA | United States Environmental Protection Agency |

## 1.0 INTRODUCTION and WASTEWATER DIVISION QUALITY ASSURANCE STATEMENT

The Wastewater Division is actively engaged in many processes and environmental sampling programs. Among the media sampled and analyzed are groundwater, surface water, wastewater, soil, sludge, biosolids, industrial waste, and stormwater. To ensure samples are representative of the media from which they are sampled, and analytical results are of sound, defensible, and documented quality, the Eugene/Springfield Water Pollution Control Facility (WPCF) has implemented this Environmental Services Quality Assurance Plan (QAP).

Quality assurance and quality control procedures are presented here with emphasis on activities in facility laboratories. The procedures cover the full scope of sampling and analysis protocol including sample collection, receipt, handling and storage; preparation and maintenance of standards, reagents, gases, and water; calibration and maintenance of analytical equipment; performance and evaluation of analytical methodologies (in conformance with standards defined by the appropriate regulatory agency), and the compilation and generation of reportable data. Particular emphasis is given to documentation practices from sample receipt through laboratory analysis and reporting with the objective of employing uniform standards for instrument maintenance, document control, analytical methodologies, data generation, quality assurance, and quality control.

WPCF staff is dedicated to providing data of the highest quality and recognizes that success in achieving this goal requires a commitment to and ownership of the Plan by everyone in the organization.

## 2.0 PROGRAM DESCRIPTIONS

The following sections present program descriptions for the work sections within the WPCF, as well as Mission Statements reflecting commitment to quality assurance:

### Regional Environmental Analytical Services Laboratory

Program Description: The Environmental Analytical Services (EAS) Laboratory provides analytical services in support of Wastewater Division program operations including wastewater treatment, residuals management, industrial source control, stormwater monitoring, ambient monitoring, and special projects. Laboratory services include sample collection, preparation and analysis of wastewater, sludge, biosolids, soil, industrial wastes, ambient water, stormwater, and groundwater. Analytical results generated by the laboratory are used to make process control decisions, document compliance with regulatory requirements, and demonstrate environmental protection.

### Industrial Source Control

Program Description: The Pretreatment Program is a regional activity implemented jointly by the cities of Eugene and Springfield. The Industrial Source Control (ISC) section of the Wastewater Division is charged with administering the Pretreatment Program for the regulation and oversight of wastewaters discharged to the sanitary collection system by

fixed-site industries in Eugene and by mobile waste haulers in the Eugene-Springfield areas. ISC is responsible for ensuring these wastes do not damage the collection system, interfere with wastewater treatment processes, or result in the pass-through of harmful pollutants to treated effluent, water reuse, or biosolids.

This responsibility is fulfilled through the use of a permit system for industrial dischargers. This permit system, common to both Eugene and Springfield, implements necessary limitations on waste characteristics and establishes inspection, monitoring, and reporting requirements for documenting waste quality and quality controls. ISC staff is also responsible for locating new industrial dischargers in Eugene and evaluating the impact of new non-residential discharges on the regional wastewater treatment facility.

The ISC section also has responsibilities related to spill tracing in the collection system as well as being backup for sample collection activities as they pertain to the industrial wastewater, stormwater and ambient water quality monitoring programs.

**Biosolids Management (Residuals staff operate the Biosolids Management Facility (BMF) and the Beneficial Reuse Site (BRS).**

Biosolids Management Facility Program Description: Biological solids (biosolids) produced from the activated sludge treatment of wastewater are managed by the Residuals Management section of the Wastewater Division. This section operates the Biosolids Management Facility (BMF), located on Awbrey Lane in Eugene. Approximately 195,500 tons of wet biosolids are produced annually by the WPCF. These biosolids are treated using anaerobic digestion, stored in facultative lagoons, which provide additional treatment, dewatered and then air-dried to reduce the water content and facilitate transport. The dried material is ultimately recycled to agricultural land as a beneficial fertilizer and soil conditioner.

In addition to sample collection and testing activities to meet operational controls, BMF staff performs limited sampling and analysis activities that meet permit requirements and are subject to the protocol specified in the QAP.

Biocycle Farm Program Description: The Biocycle Farm is a 595-acre farm designed and operated to grow hybrid poplar trees utilizing nutrients provided by liquid biosolids and moisture from recycled water to encourage rapid tree growth. The trees are harvested and marketed on a 10-12 year cycle.

Beneficial Reuse Site Program Description: The Beneficial Reuse Site (BRS) was originally designed and operated to dispose of seasonal industrial wastewater from a vegetable cannery processor. The vegetable cannery permanently closed operations in 2001, and the BRS is no longer receiving seasonal influent flow. Lagoon stored wastewater will continue to be irrigated on the site until lagoon wastewater and solids are completely removed or use and purpose of the site is redefined. Biosolids are land applied to an irrigated area providing needed nutrients and soil building properties. A grass hay crop is harvested to remove the nutrients.

### Regional Wastewater Treatment Facility Operations

Program Description: The Wastewater Division operates the WPCF to treat domestic and industrial wastewater and achieve a quality that protects and sustains the beneficial uses of the Willamette River. The WPCF is designed to treat 49 million gallons per day (mgd) of dry weather flow, with a peak hydraulic capacity of 105 mgd for full secondary treatment.

The Operations section optimizes integrated wastewater treatment processes to ensure effluent quality requirements are met in an effective manner. In addition, Operations provides 24-hour alarm monitoring of all plant processes; regional and local pump stations; and biosolids and seasonal waste facilities.

In addition to sample collection and testing activities to meet operational controls, Operations performs limited sampling and analysis activities to meet permit requirements and is also subject to the protocol specified in the QAP.

## 3.0 STATEMENT of PROFESSIONAL CONDUCT and ETHICAL PRACTICE

The integrity and quality of the data generated by the Environmental Services Laboratory is of foremost importance. Any manipulation or falsification of analytical data is unacceptable; therefore, employees at Wastewater Division will be held to the following statements of conduct:

> *Under no circumstance does the Wastewater Division condone the willful act of fraudulent manipulation of analytical data. Such acts are to be reported immediately to staff's Supervisor or the Division Director.*

Wastewater Division will not tolerate falsification of data in any form. While it is understood that at times data is subject to professional judgment and interpretation, any willful falsification, if observed or discovered, will be documented and appropriate actions taken toward those responsible.

Lab staff engaged in data collection, generation, analysis, or reporting is required to complete in-house ethics training to reinforce the Division's expectations in this area.

## 4.0 ORGANIZATIONAL STRUCTURE and RESPONSIBILITIES

The organizational structure of the Wastewater Division follows a traditional hierarchy system of management with overall authority and responsibility for management of the organization held by the Division Director. Individuals within the organization that direct and supervise staff, who are either directly or indirectly responsible for collection and/or analysis of samples required by permits issued to the facility, include the Plant Operations Supervisor, the Residuals Supervisor, and the Laboratory Supervisor. The Laboratory Supervisor reports directly to the Division Director and the Plant Operations and Residuals Supervisors report to the Plant Manager. Staff within each work section report to their respective supervisor. The

QA/QC Officer reports directly to the Division Director. Figure 4.1 Wastewater Division Organizational Chart presents the Organizational Chart for the Wastewater Division.

Implementation of the QAP is achieved through delegation of defined responsibilities to individuals in the organization. The individual responsibilities related to the Quality Assurance Plan are described below. Sample collection duties are performed by trained analysts and technicians within the organization; these activities are conducted under site-specific Sampling and Analysis Plans (SAPs) detailing the sampling program requirements. Sample collection and handling protocol are outlined in Standard Operating Procedures (SOPs) appended to the SAP. The SAPs are incorporated through reference to the Quality Assurance Plan.

In general, analysts and technicians, as designated by their supervisor, are responsible for ensuring that sample collection, handling, analysis, and reporting protocol are followed in accordance with documented methods. Technicians in these work sections are responsible for following all quality assurance guidelines and requirements specified in applicable SAP/SOPs and the QAP, participation in all internal and external audits, and completing all associated quality assurance administrative duties related to the data they generate (sample QA/QC, chain-of-custody, etc.).

### Laboratory Supervisor

The responsibilities of the Laboratory Supervisor are to manage, coordinate, and lead the analytical laboratory activities of the Wastewater Division, coordinate programmatic activities with other City Divisions and Departments, and provide technical assistance to Wastewater Division Director. The Laboratory Supervisor provides technical, operational, and administrative leadership through planning, allocation, and management of resources (personnel and equipment). In addition, the Laboratory Supervisor is responsible for achieving the quality assurance and quality control objectives defined in this document, ensuring overall laboratory operation efficiency, as well as cost effectiveness of laboratory activities.

Additional Laboratory Supervisor responsibilities include:

- Ensuring the quality of analytical data generated: laboratory results must meet the reliability and accuracy standards established by the U.S. Environmental Protection Agency (EPA), the State of Oregon Department of Environmental Quality (DEQ), and the State of Oregon Water Resources Board.

- Ensuring analysts adhere to and follow the QAP: Management of laboratory activities to satisfy the standards for precision and accuracy specified by the EPA and DEQ.

- Ensuring analysts are appropriately trained in all aspects of laboratory and quality assurance protocol as applicable to their job duties.

- Ensuring analysts have received appropriate training on professional conduct and ethical standards expectations as related to their job duties.

- Ensuring quality assurance problems or issues are reported in a timely manner to the QA/QC Officer.

- Reviewing the QAP on a scheduled basis, including contributing revisions and making suggestions for improvement, as necessary, to the Division Director for consideration by the Management Team.

### Lead Laboratory Technical Analysts

The responsibilities of Lead Laboratory Technical Analysts (Lead Analysts) are to provide technical guidance, training and oversight for other laboratory analysts. Lead Analysts also administer the Laboratory Information Management System (LIMS), and have administrative responsibilities in relation to the QAP.

Lead Analysts have other responsibilities related to the QAP including implementation of new procedures and technology, data evaluation, oversight of quality control charts, review and analysis of quality assurance data and analytical procedures to determine whether all data complies with QA/QC requirements . Lead Analysts perform their duties under the direction of the Laboratory Supervisor.

### Laboratory Technical Analysts

Laboratory Technical Analysts (Laboratory Analysts) are responsible for performing laboratory analyses on samples submitted for purposes of process control and regulatory compliance.

Laboratory Analysts are responsible for following all quality assurance guidelines and requirements specified in SOPs and the QAP. In addition, analysts are responsible for participation in all internal and external audits, reporting any quality assurance problems to the Lead Analyst or the Laboratory Supervisor, and completing all associated quality assurance administrative duties related to the data they generate (data entry, reports, control charts, etc.).

Laboratory Analysts perform their duties under the direction of the Laboratory Supervisor and under technical guidance of the Lead Analysts.

## Plant Operations and Residuals Supervisors

Within the scope of the QAP the Plant Operations and Residuals Supervisors are responsible for management and coordination of staff involved in the collection and analysis of samples to meet program requirements. Wastewater Division supervisors provide technical, operational, and administrative leadership through planning, allocation, and management of resources (personnel and equipment) in a cost effective and efficient manner and provide direction and guidance to staff in achieving the quality assurance and quality control objectives defined in this document.

Additional Plant Operations and Residuals Supervisors responsibilities include:

- Ensuring the quality of analytical data generated: laboratory results must meet the reliability and accuracy standards established by the U.S. Environmental Protection Agency (EPA), the State of Oregon Department of Environmental Quality (DEQ), and the State of Oregon Water Resources Board.

- Ensuring analysts adhere to and follow the QAP: development and management of all laboratory activities to satisfy the standards for precision and accuracy specified by the EPA and DEQ.

- Ensuring analysts are appropriately trained in all aspects of laboratory and quality assurance protocol as applicable to their job duties.

- Ensuring technicians have received appropriate training on professional conduct and ethical standards expectations as related to their job duties.

- Ensuring quality assurance problems or issues are reported in a timely manner to the QA/QC Officer,

- Reviewing the QAP on a scheduled basis, including contributing revisions and making suggestions for improvement, as necessary, to the Division Director for consideration by the QA/QC Officer and Management Team.

- Coordinating assistance and support staff to the Laboratory Supervisor during sample collection activities.

### Wastewater Technicians

Wastewater Technicians performing sampling and analysis activities are responsible for following all quality assurance guidelines and requirements specified in applicable SAP/SOPs and the QAP, participation in all internal and external audits, reporting any quality assurance problems to their Supervisor, and completing all associated quality assurance administrative duties related to the data they generate (chain-of-custody, etc.).

Wastewater Technicians perform their duties under the direction of their respective Supervisor.

## QA/QC Officer

Conformance to the QAP procedures is monitored by the QA/QC Officer, who also oversees and coordinates all QA/QC programs for the Wastewater Division. Reviews the QAP on a scheduled basis, including contributing revisions and making suggestions, as necessary to the Division Director for consideration by the Management Team.

The function of the QA/QC Officer is to provide an independent assessment of the QAP to ensure that plan elements are adequate, consistent, and implemented as intended. In addition, the QA/QC Officer ensures that all data collection activities within the Division

follow uniform standards of quality assurance/quality control with respect to sampling and analysis, documentation, and record keeping.

## 5.0 SAMPLING, SAMPLE PRESERVATION & HANDLING PROCEDURES

The degree to which analytical data represent the media sampled is largely a function of the procedures used to collect, preserve and store samples as well as the analytical procedures used in the laboratory. Wastewater Division staff follows the sampling protocol included in the SAPs referencing this QAP. If changes need to be made to sampling protocols, the Laboratory Supervisor and Sampling Technicians in consultation with the respective Program Manager shall ensure that the changes comply with all applicable permits and shall modify the written sampling procedure to reflect the changes before any such changes are implemented. Sampling procedures follow guidelines described in 40CFR136, 40CFR503, Standard Methods, and other methodologies as applicable.

### Sample Tracking

Samples received by the laboratory are logged into the Laboratory Information Management System (LIMS). Sample information entered into the LIMS includes:

- Client Project Site Codes
- Sample Location
- Project Name
- Matrix code
- Sample Collection date/time
- Sample Duration
- Sample Received date/time
- Received from
- Received by
- Tests required

The LIMS system assigns each sample a unique sample number (e.g. BB0001).
Labels (see Figure 5.1) are generated for each sample and aliquot entered into the system and include:

- Sample Number or ID
- Client project site Location Code
- Bottle type
- Test Codes ordered
- Preservative and holding time requirements (see Table 5-1).

LIMS includes extra management features that enhance the QAP, including an audit trail to document changes to results data in the system to preserve data integrity, results validation to ensure data integrity before report generation, and a QA/QC batching module for generation of QC reports related to analytical results.

## 6.0 CHAIN-OF-CUSTODY (SAMPLE CUSTODY)

Samples delivered to the EAS Laboratory are received by laboratory staff who verify that samples are clearly marked, proper containers are used, sample quantity is adequate to perform requested tests, and chain-of-custody forms are complete and correctly filled out. All samples must be accompanied by a chain-of-custody (COC) form. If the laboratory staff receiving the sample(s) detects obvious or potential inconsistencies with sampling or handling requirements, the receiver will notify the Lead Analyst or the Laboratory Supervisor who will determine whether to contact the client for additional sample or a new sample.

### Water Pollution Control Facility Samples

Plant (WPCF) samples are collected by designated staff, either from the Sampling Team, Laboratory, Operations, or Residuals work groups, and delivered directly to the laboratory. Samplers are located within the secured plant site. Plant samples are accompanied by COC forms and are centrally retained and controlled by the EAS laboratory.

### Industrial Waste Samples

Industrial waste samples are collected by Sampling Team or designated Industrial Source Control staff, and must be accompanied by a chain-of-custody form. Chain-of-custody forms are centrally retained and controlled by the EAS laboratory.

### Ground Water Samples, Soil, Sludge, Stormwater, and Ambient samples

These samples are collected by Sampling Team staff and, on occasion, in coordination with designated staff from other Division work sections. All samples must be accompanied by a chain-of-custody form. The COC is centrally retained and controlled by the EAS laboratory.

## 7.0 QUALITY CONTROL OBJECTIVES (PRECISION, ACCURACY, Method DLs and QLs)

This section presents elements developed by the Environmental Services Laboratory to ensure the accuracy and precision of analytical results. Quality Control (QC) objectives for accuracy and precision are derived from the applicable published method or statistical techniques. The QC objectives define tolerance limits for “acceptable” data generated in the laboratory. Quality Control objectives are defined below and the tolerance limits are shown in Table 7-1.

### Definition of Accuracy

Accuracy means the nearness of a result, or the mean of a set of results, to the true value. Accuracy is assessed through use of laboratory control samples and percent recoveries of spikes.

## Definition of Precision

Precision means the measurement of agreement of a set of replicate results among themselves without assumption of any prior information as to the true result. Precision is assessed by means of duplicate or replicate sample analysis.

## Procedure for Determining Precision and Accuracy

The precision of an analytical process is monitored by use of duplicate samples, matrix spike duplicates, or duplicate determinations of a laboratory control sample.

Relative percent differences (RPDs) of the duplicates must be within the ranges specified in Table 7-1. These tolerance limits apply only to sample values greater than five times the DL. Sample values less than five times the DL will result in a high RPD because the value is near the DL.

The LIMS system allows for construction of QC charts. Analysts re-run an analysis when data quality objectives are not met, thus only data that meets objectives are entered in the system.

## Control Charts Developed from Duplicates

Control charts are generally constructed of duplicate determinations of a laboratory control sample over a specified period. The average range of duplicate determinations is first established by accumulating data on 60 pairs of data and establishing control limits as follows:

$$\text{Upper Control Limit} = 3.27 \times RangeAverage$$

$$\text{Upper Warning Limit} = 2.51 \times RangeAverage$$

Control charts can also be constructed from sample duplicates or sample spike duplicates, if the data are approximately grouped by concentration range.

The accuracy of an analytical process is determined by the analysis of laboratory control samples, showing the degree of difference between the known and found values, and the use of spikes, showing the spike recovery.

Determination of precision criterion for microbiological tests is based on the standard deviation of a range of values. The equation to determine the standard deviation of a range is taken from Taylor (Statistical Techniques for Data Analysis, 1990; p. 48), and is as follows:

$$\overline{R} = \left(R_1 + R_2 + \ldots + R_k\right) \big/ k$$

$$\sigma = \overline{R} \big/ d_2^* \ .$$

The constant $d_2^*$ must be obtained from statistical tables for Replicate QC data, (Taylor, 1990; p. 163). Since the number of sets of replicates is generally greater than 20, the

constant is 1.13. Hence, the upper control and warning limits is simply 3σ and 2σ respectively.

When using data from laboratory control samples or spikes without a control chart, the result must meet the tolerance limits specified in Table 7-1.

### 7.1 Control Charts Developed from Laboratory Control Samples

Control charts constructed from laboratory control samples require the results from 60 analyses of the same sample. When using spike data, recoveries must be at least 20%. In both cases, the upper and lower warning limits are set at ± 2 σ (standard deviation) from the mean, while the upper and lower control limits are set at ± 3 σ.

### 7.2 Method Detection Limits and Quantitation Limits

The Method Detection Limits (DLs) and Quantitation Limits (QLs) used by the laboratory are either method specified or determined as outlined in 40CFR136, Appendix B.

- The Method DL is the minimum concentration that can be measured and reported with a 99% confidence that the analyte concentration is greater than zero.

- The Method QL is the lowest concentration at which the analytical system gives a recognizable signal and acceptable calibration for the analyte. It is greater than or equal to the lowest calibration standard assuming that all method-specified sample weights, volumes, and cleanup procedures have been employed.

For all analytical methods, the DL is always a lower concentration than QL.

## 8.0 QUALITY CONTROL PROCEDURES

Results of analytical quality control samples are used to estimate the precision and accuracy of data from sample preparation through analysis. The specific types, frequencies, and processes for quality control sample analyses are described in the sections that follow and are performed according to individual method requirements. For some test procedures, the quality control sample analyses are not appropriate and are not required. Also note that laboratory control samples and/or matrix blanks are not available for some test procedures and sample matrices. Acronyms and synonymous terms are provided in parentheses.

Under 40CFR136, 40CFR503, Standard Methods, and other applied methodologies, QA/QC requirements are commonly specified. In cases where QA/QC requirements are not specified in the methodology the twelve quality control elements listed below must be clearly documented in written standard operating procedures for each analytical method where applicable. Any QA/QC element not applicable to a given method may be omitted provided a rationale is documented indicating why the element(s) is/are inappropriate for a specific method.

1. Demonstration of Capability (DOC);
2. Method Detection Limit (DL or MDL);

3. Laboratory reagent blank (LRB), also referred to as method blank (MB);
4. Laboratory fortified blank (LFB), also referred to as a spiked blank, Laboratory control sample (LCS);
5. Matrix spike (MS) and matrix spike duplicate (MSD), or laboratory fortified matrix (LFM) and LFM duplicate, may be used for suspected matrix interference problems to assess precision;
6. Internal standards (for ICP/MS or GC/MS analyses), surrogate standards (for organic analysis) or tracers (for radiochemistry);
7. Calibration (initial and continuing), also referred to as initial calibration verification (ICV),continuing calibration verification (CCV), or Check Standard;
8. Control charts (or other trend analyses of quality control results);
9. Corrective action (root cause analysis);
10. QC acceptance criteria;
11. Definitions of preparation and analytical batches that may drive QC frequencies; and
12. Minimum frequency for conducting all QC elements.

## Quality Control Frequency

Quality control samples are analyzed for each analytical batch, as specified in individual analytical methods, or once every twenty samples where unspecified.. The laboratory control standard is used as the verification standard. Quality control samples for each batch generally include:

- Method Blank (Laboratory Reagent Blank)
- Laboratory Control Sample (Quality Control Sample)
- Matrix Spike (if Duplicate Matrix Spike is not done)
- Laboratory Duplicate and/or Duplicate Matrix Spike
- Initial Calibration Verification Standard
- Continuing Calibration Verification Standard

Other initial or periodic QC such as IPR, IDL, LDR, LCR, spectral interference checks, or equivalency studies may be required. Analysts will verify that all initial and periodic QC is performed according to individual method requirements. Descriptions of each type of quality control sample used in the laboratory are provided below.

## Method Blank (Laboratory Reagent Blank)

The method blank is analyte-free water (a blank matrix for solid samples is not available), subjected to the entire analytical process. Analysis of a method blank verifies that interferences from contaminants in solvents, reagents, glassware, and other sample-processing devices are quantified. If contamination is found in the method blank, the analyst attempts to identify the source and samples are reanalyzed. Method blank results should be below the QL for the analyte(s) tested.

## Laboratory Control Sample (Quality Control Sample)

A laboratory control sample (LCS) is a sample of known value that serves as an independent check on equipment performance, technique, and standards. Results provide

an estimate of method bias. The LCS consists of an aliquot of analyte-free water or analyte-free solid to which a known amount of the method analyte(s) is added. A standard reference material of known matrix type, containing certified amounts of target analyte(s), is used for the LCS. The LCS is analyzed according to method requirements and consists of a commercially prepared standard solution / solid, or an aliquot of a commercially prepared standard solution.

Standard reference materials for the LCS are purchased from sources independent of calibration standards. The percent recovery of the target analytes in the LCS assists in determining whether the methodology is in control and whether the laboratory is capable of making accurate and precise measurements at the QL. Acceptable percent recovery limits for each analyte are shown in Table 7-1 as specified in the method or by the reference material manufacturer.

### Matrix Spikes

A matrix spike consists of a sample aliquot to which a known amount of the target analyte has been added. The spiked sample is then prepared and analyzed in exactly the same manner as routine samples. Stock solutions are purchased for spiking the samples. The spike recovery measures the effects of interferences caused by the sample matrix and reflects the accuracy of the method for a given matrix.

Recovery results verify the presence or absence of matrix effects and are particularly important when analyzing complex matrices, such as soil and sludge. Samples to be spiked are selected by the analyst.

### Laboratory Fortified Blank (LFB)

The laboratory Fortified Blank is prepared by fortifying an aliquot of the Laboratory Reagent Blank with a known amount of the target analyte. The LFB should be spiked at the same concentration as the matrix spike. The LFB is then prepared and analyzed in exactly the same manner as routine samples.

Spike recoveries are calculated as follows:

$$\%\,\text{Recovery} = \frac{(S - A)}{T} \times 100$$

where:

$S$ = observed concentration of analyte in the spiked sample;
$A$ = analyte concentration in the original sample; and
$T$ = theoretical concentration of analyte added to the spiked sample.

### Laboratory Duplicates (Analytical Duplicates) and Duplicate Matrix Spikes

Laboratory duplicates are sample aliquot replicates subjected to the same preparation and analytical procedures as the original sample. If prior knowledge about the sample suggests

the analyte concentration is within the measurable range of the method, a duplicate analysis and a matrix-spiked sample are run. If it is known that the original sample will be low, a matrix-spiked sample and duplicate matrix-spiked sample are analyzed.

The relative percent difference (RPD) between duplicate analyses, or between the matrix-spiked sample and duplicate matrix-spiked sample, is a measure of batch precision for the given method. The RPD for the analyses is calculated as follows:

$$\text{Relative Percent Difference (RPD)} = \frac{|[C_1]-[C_2]|}{([C_1]+[C_2])/2} \times 100$$

where:

$C_1$ and $C_2$ = observed concentrations of analyte in the sample and its duplicate, or in the matrix spike and its duplicate matrix spike.

Determination of precision criterion for microbiological tests is based on the standard deviation of a range of values. The equation to determine the standard deviation of a range is taken from Taylor (Statistical Techniques for Data Analysis, 1990; p. 48), and is as follows:

$$\overline{R} = (R_1 + R_2 + \ldots + R_k)/k$$

$$\sigma = \overline{R}/d_2^* \ .$$

The constant $d_2^*$ must be obtained from statistical tables for Replicate QC data, (Taylor, 1990; p. 163). Since the number of sets of replicates is generally greater than 20, the constant is 1.13. Hence, the upper control and warning limits is simply 3σ and 2σ respectively.

### Initial Calibration Verification Standard

Initial calibration standards (ICVs) are analyzed after the calibration standards, but before sample analysis, in order to verify calibration of the analytical procedure. Preparation of the ICV must be from a source other than the calibration standards. The laboratory uses Laboratory Control Samples (LCSs) as ICVs.

### Continuing Calibration Verification Standard

Continuing calibration standards (CCVs) are midrange analytical standards that are reanalyzed with test samples to verify calibration of the analytical system.

### Analytical Batch

The analytical batch is defined as samples that are analyzed together with the same method sequence and the same lots of reagents and with manipulations common to each sample

within the same time or in continuous sequential times. Samples in each batch should be of similar composition.

### Calibration Blank

Calibration blanks are prepared along with calibration standards in order to create a calibration curve. Calibration blanks are free of the analyte of interest, and provide the zero point of the calibration curve.

### Continuing Calibration Blank

Continuing calibration blanks are free of the analyte of interest and used to verify the zero point of the analytical procedure.

### Calibration Standard

Calibration standards are solutions of known concentration prepared from primary standard solutions, which are in turn prepared from stock standard materials. Calibration standards are used to calibrate the instrument response with respect to analyte concentration.

Calibration Procedures and Frequency are specified in Table 8-1.

## 9.0 DATA REDUCTION, VALIDATION, REPORTING, and STORAGE

All analytical data generated by the laboratories is recorded, reported, reviewed, and stored according to Division policy. The general procedures involved in the process of data reduction, validation, reporting, and storage, are explained in this section.

### Data Reduction – Projects

Data reduction is the process of transforming raw data into results that are reported in standard units. The goal is to minimize the steps needed to transform raw data into reportable results and hence minimize the potential for data transcription and calculation error. Every instrument and/or method has a slightly different data reduction process depending on the way in which data are generated and the required data transformations. Laboratory SOPs include equations used to calculate results, the method of calculation, and bench sheets used to record pertinent data for each analytical method.

A project file is created for each set of project samples received. All raw data, including paper data sheets, charts, printouts, graphs, etc., are stored in the project file. Calculations are done by the analyst performing the laboratory testing. After the analysis is complete the results are entered into LIMS, and a two-tiered validation process is applied – analysis validation and sample validation.

The analyst validates the analytical results by comparing these to raw data. Once all analyses for a project are complete, the Lead Analyst will review the data, validate the sample results in the LIMS, and generate a printed report. This report, together with the project file, is circulated among the analysts who performed the testing and who again review their data in the report.

After validation, the report and file are forwarded to the Lead Analyst for review of calculations, significant figures, etc., and forwarded to the Laboratory Supervisor for final review and signature. Upon final approval, the report is submitted to the client. All original documentation is archived, including all laboratory generated raw data, notebooks, and instrument output, following document control protocol.

### Data Validation

The analyst who generates the analytical data has the primary responsibility for its correctness and completeness. It is also the responsibility of the analyst to verify that the instrument was calibrated and performing correctly, and to analyze the appropriate type and quantity of quality control samples with their daily work.

The integrity of the data generated by the analyst is assessed using a variety of control samples described in Section 8.0, including reagent blanks, matrix spikes, duplicates, laboratory control standards, etc. The process of data validation consists of systematic review of analytical results for control samples, verification of accurate transcription of results from the laboratory notebooks to LIMS, and crosschecks through multiple reviews.

In general, comparison is made between the expected value and the analysis value and assessing whether the comparison is within the tolerance limits specified for the procedure. The tolerance limits may be defined by the analytical method through construction of control charts or application of standardized statistical methods.

In the event discrepancies are found during the data validation process, LIMS provides strict control over the means by which data are changed. An interactive module prompts the user for specific input to modify or delete current information. Previous and subsequent inputs are stored as the permanent audit trail for the record.

### Data Reporting

A data report is generated following the systematic review and validation processes described in the previous sections. All data are calculated and reported in units consistent with project specifications.

Final reports prepared to satisfy regulatory requirements are first distributed to appropriate program supervisors and staff for review and approval before submittal to the regulatory agency. An additional report copy is maintained in the project file with raw laboratory data. All original reports, with the exception of industrial reports, are archived following document control protocol. All reports generated are kept for five years as specified in the laboratory data retention schedule (See: Records Retention Schedule). Generally, no reports are generated for process control samples.

### Data Storage

Laboratory data is maintained such that records are retrievable by the Lead Analyst and Laboratory Supervisor. Laboratory notebooks used to document pertinent information are stored in the laboratory and subsequently archived to a secure on-site location. Information

contained in the notebooks includes: sample-processing steps such as extractions and digestion records, instrument maintenance and routine checks, and standard and reagent preparations. Data is retained following the protocol specified in the Records Procedure.

Data in the LIMS system reside in the local E/S WPCF server and is backed-up using the schedule specified in Application Support Notes, which are maintained by MIS staff. Contact MIS staff for specifics regarding these notes.

## 10.0 AUDITS

The success of the QA program is driven by its ability to monitor the effectiveness of the quality systems that are in practice. The means for monitoring effectiveness of quality systems is the auditing process. Both internal and external quality control programs are established to evaluate the effectiveness of the QA program. These consist of performance evaluations and system audits.

### Internal and External Performance Evaluations

The QA Officer conducts internal performance evaluations on a quarterly to annual basis. This consists of a group of samples that are tested for the typical parameters run by the laboratory. Internal performance evaluations are run blind; the technician knows the sample is for performance evaluation purposes but the known values are only known to the QA Officer. Performance results are reported to the respective work section supervisor and the Division Manager.

The EAS Laboratory participates in two external performance evaluation programs consisting of:

- Annual U.S. Environmental Protection Agency DMR-QA Laboratory Performance Evaluation Studies; and
- Periodic State of Oregon Department of Environmental Quality Inspection, including Inter-Laboratory Split Comparison.

Results of the performance evaluation studies and external inspections are reviewed by the Laboratory Supervisor, the QA/QC Officer, and laboratory staff. Any problems identified are investigated and corrective action is taken regarding all deficiencies. The Laboratory Supervisor is responsible for informing the Division Director of these performance activities.

### System Audits

System audits are conducted internally by the QA/QC Officer on an annual basis. These audits provide a thorough overview of implementation of the QAP by the laboratories. Audits will be performed using the following protocol:

An audit plan will be prepared, reviewed, and updated for every annual audit, taking into consideration the information gained during the previous audits. The audit plan will be the basis for the audit and will define the audit schedule, applicable documentation, and scope

of laboratory activities to be audited. Based on the audit plan, a detailed audit checklist will be prepared for use in future audits. The scope of the audit may include, but is not necessarily limited to, the following:

- Review of written QA/QC policies and procedures.
- Random evaluation of laboratory practices for adherence to Federal and State requirements.
- Random evaluations of the QA/QC program with attention to the following:
  - Written and Electronic Records
    - Chain of Custody
    - Data Entry
    - Raw Data
    - Calculations
    - Calibration
    - Charts and Control Charts
  - Sampling
    - Sampling Protocol Adherence
    - Documentation (field data sheets, chain-of-custody)
    - Quality Assurance Field Samples (duplicates, blanks)
    - Field Meters (calibration, operation, maintenance)
    - Safety
  - Laboratory Analyses
    - SOP Adherence
    - Method adherence
    - Quality Assurance Plan Adherence
    - Laboratory Instrumentation (calibration, operation, maintenance)
    - Corrective Action Protocol Adherence
    - Storage (holding times, preservative)
    - Appropriate Dilutions and Calibration Ranges
  - Safety

At the close of the audit, a post-audit meeting will be held with the Laboratory Supervisor and staff to discuss the audit findings. Upon completion, the auditor will submit an audit summary report to the Laboratory Supervisor (with a copy routed to the Division Director) containing the following:

- Date and location of audit
- Laboratory operations audited
- Findings requiring corrective action
- For each finding, a due date for corrective action will be specified, as well as the means for verifying correction. A finding closure statement will be filed with the audit record upon completion of all requirements. All findings must be closed.
- Observations or recommendations for improvement

The audit summary report will be issued as soon as possible after completing the audit.

A periodic audit/inspection of the EAS Laboratory is also conducted by the DEQ.

## 11.0 PREVENTIVE MAINTENANCE

Preventive maintenance procedures include work performed through instrument service contracts and in-house preventive maintenance procedures. In-house preventive maintenance procedures and schedules are used by staff to schedule maintenance tasks in their respective work areas.

Routine minor equipment maintenance tasks outlined in manufacturer instruction manuals are performed regularly by laboratory staff or under contract services. All maintenance tasks are documented in appropriate forms and retained for verification purposes.

Laboratory staff uses preventive maintenance forms to document on-going instrument maintenance activities. Analysts responsible for instruments in their work area document maintenance activities on these forms or in electronic format located on the instrument PC.. At the end of the year, maintenance forms are filed by the Lead Analyst.. These records are retained for five years in accordance with the laboratory record retention requirements (See: Records Retention Schedule).

## 12.0 CORRECTIVE ACTION

Data qualifiers from Table 12.1 are used to explain out of control data. These qualifiers are entered into the LIMS system under the detail section for the out of control sample. .

Corrective actions may be initiated because of a problem identified through a system audit, performance audit, or data end user's request. The process is generally initiated by the QA Officer and documented on a Quality Assurance Irregularity Report form (see Shared Documents) by the analyst responsible for the data, the Lead Analyst, or the Laboratory Supervisor. The Laboratory Supervisor authorizes the implementation of corrective actions recommended in the Irregularity Report. The lead analyst is responsible for evaluating the effectiveness of the corrective actions. If a corrective action is ineffective, it is the analyst's responsibility to notify the laboratory supervisor. The steps taken in the corrective action process are:

- Identify and define the problem;
- Assign responsibility for investigating the problem;
- Determine the cause of the problem;
- Determine the actions needed to eliminate the problem;
- Implement corrective action; and
- Establish effectiveness of the corrective action.

When Data Quality Objectives defined in Section 8.0 are not met, corrective action is initiated by the appropriate person(s) in the Division. These corrective actions may include, but are not limited to:

- Review of the raw data and calculations;
- Re-calibration of instrumentation;

- Re-analysis of calibration standards;
- Re-analysis of samples;
- Instrumentation troubleshooting tasks;
- Method of standard additions, dilutions, post spikes;
- Re-sampling;
- Review of analytical procedures; or
- Qualifying statements on reports as pertain to the problem.

When using a control chart, the result must be within the control limits. A result outside the limits is termed "out of control" and the analysis repeated. If the analysis cannot be repeated, the laboratory report for all samples in the analytical batch will indicate that an analysis was "out of control".

In the absence of control charts, spike recoveries must be within the range defined by the data quality objective for the analysis to be accepted. If recovery is outside this range, the analysis must be repeated. If the recovery is again outside this range, this will be noted on the laboratory report for any samples in the analytical batch, or another analytical technique will be used (e.g. standard additions).

In the absence of control charts, check sample analytical results must be within the range defined by the data quality objective of the true value, or the analysis repeated, or noted on the effected laboratory reports.

Flow charts outlining procedures to follow in relation to quality data are presented in Figures 12.1 through 12.7. These flow charts are distributed throughout the laboratory as guidelines of appropriate corrective action steps to be used at different steps of the analysis. All corrective action steps must be documented.

Figure 12.2 – Evaluation of Method Calibration
Figure 12.3 – Evaluation of Method Blank and Instrument Blank
Figure 12.4 – Evaluation of Continuing Calibration
Figure 12.5 – Evaluation of Duplicate Sample and/or Duplicate Matrix Spike Results
Figure 12.6 – Evaluation of Laboratory Control Sample (LCS) Results
Figure 12.7 – Evaluation of Matrix Spike Recoveries
Figure 12.8 – Evaluation of Sample Results for Inorganic Analyses

References in the flow charts to Qualifier Codes that are used in LIMS are detailed in Table 12-1.

## 13.0 QUALITY ASSURANCE REPORTS

The Laboratory Information Management System (LIMS) allows for the generation of quality assurance reports that include blank, relative percent difference, recoveries, and qualifier information. These reports are printed for all projects where reports are generated.

All laboratory Analysts and Technicians review the Quality Assurance Plan on an annual basis and understand their responsibilities and the data quality objectives they must meet in order to

report their data. Either the Lead Analyst or the Laboratory Supervisor reviews analytical data to ensure conformance to method and QA/QC requirements.

The QA/QC Officer conducts audits and provides overview and support for the Quality Assurance Plan components.

## 14.0 ANALYTICAL METHODS

Analytical methods performed by the Environmental Analytical Services, Operations, and Residuals Laboratories are summarized in Table 7-1.

## 15.0 CHEMICALS and REAGENTS

After receipt in the laboratory, chemicals will be entered into the laboratory inventory system including the date received and labeled with the assigned container number. When a chemical container is opened, the date opened will be hand written on the container label.

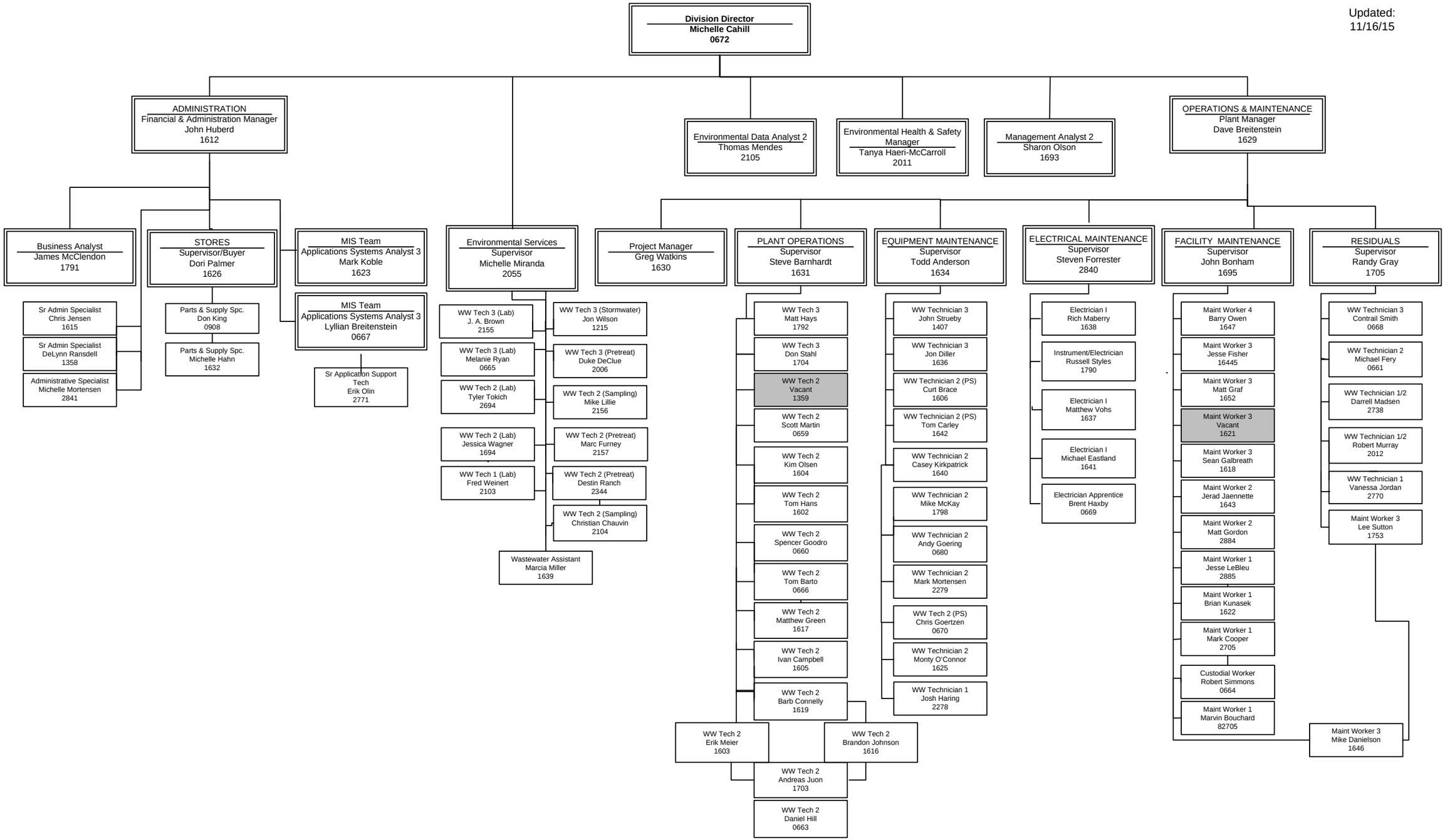
Prepared standards and solutions are documented electronically and labeled with preparation date, lot number and expiration date.

## 16.0 CHEMICAL HYGIENE PLAN

Work practices and procedures pertaining to health and safety implemented in the laboratories are documented in the Chemical Hygiene Plan. Laboratory facilities operated by the E/S WPCF conforms to the Occupational Safety and Health Administration (OSHA) standards specified in 29 CFR 1910 Subpart Z: Occupational Exposure to Hazardous Chemicals, and the General Occupational Safety and Health Rules specified in OAR 437, Division 2.

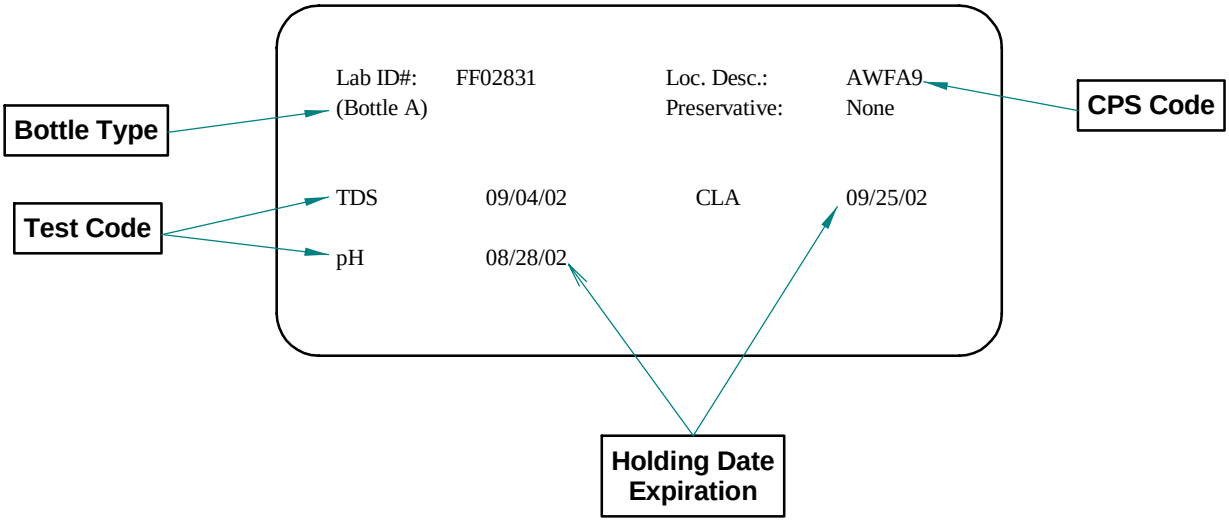
# WASTEWATER DIVISION ORGANIZATIONAL CHART

Updated:
11/16/15



# Figure 5.1

## Example of Sample Label



| Table 5.1<br>Sample Preservation and Holding Times[1] | | | | |
|---|---|---|---|---|
| **Determination** | **Matrix** | **Container** | **Preservation** | **Maximum Holding Time** |
| Alkalinity, as $CaCO_3$ | Sludge, Supernatant | Plastic | Cool, $\leq$ 6 ˚C | 14 days |
| Aluminum, Dissolved | Aqueous | Plastic | $HNO_3$ to pH <2 after filtration through a 0.45-µm membrane filter | 6 months |
| Alkalinity, as $CaCO_3$ | Aqueous | Plastic, Glass | Cool, $\leq$ 6 ˚C | 14 days |
| Aluminum, Total | Aqueous | Plastic | $HNO_3$ to pH <2 | 6 months |
| Aluminum, Dissolved | Aqueous | Plastic | $HNO_3$ to pH <2 after filtration through a 0.45-µm membrane filter | 6 months |
| Aluminum, Total | Aqueous | Plastic | $HNO_3$ to pH <2 | 6 months |
| Ammonia, as N | Aqueous | Plastic, Glass | Cool, $\leq$ 6 ˚C | 28 days |
| Ammonia, as N | Soil | Plastic | Dry, grind, screened | 2 months |
| Ammonia, as N | Sludge | Plastic | Cool, $\leq$ 6 ˚C | 28 days |
| Arsenic, Dissolved | Aqueous | Plastic | $HNO_3$ to pH <2 after filtration through a 0.45-µm membrane filter | 6 months |
| Arsenic, Total | Aqueous | Plastic | $HNO_3$ to pH <2 | 6 months |
| Arsenic, Total | Sludge | Plastic | $HNO_3$ to pH <2 | 6 months |
| Arsenic, Total | Soil | Plastic | Dry, grind, screened | 2 months |
| Arsenic, Dissolved | Aqueous | Plastic | $HNO_3$ to pH <2 after filtration through a 0.45-µm membrane filter | 6 months |
| Arsenic, Total | Aqueous | Plastic | $HNO_3$ to pH <2 | 6 months |
| Biochemical Oxygen Demand | Aqueous | Plastic | Cool, $\leq$ 6 ˚C | 48 hours |
| Cadmium, Dissolved | Aqueous | Plastic | $HNO_3$ to pH <2 after filtration through a 0.45-µm membrane filter | 6 months |
| Cadmium, Total | Aqueous | Plastic | $HNO_3$ to pH <2 | 6 months |
| Cadmium, Total | Sludge | Plastic | $HNO_3$ to pH <2 | 6 months |
| Cadmium, Dissolved | Aqueous | Plastic | $HNO_3$ to pH <2 after filtration through a 0.45-um membrane filter | 6 months |
| Cadmium, Total | Aqueous | Plastic | $HNO_3$ to pH <2 | 6 months |
| Cadmium, Total | Soil | Plastic | Dry, grind, screened | 2 months |
| Cadmium, Total | Sludge | Plastic | $HNO_3$ to pH <2 | 6 months |
| Calcium, Dissolved | Aqueous | Plastic | $HNO_3$ to pH <2 after filtration through a 0.45-µm membrane filter | 6 months |

[1] (Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846.)

| Table 5.1<br>Sample Preservation and Holding Times[1] | | | | |
|---|---|---|---|---|
| **Determination** | **Matrix** | **Container** | **Preservation** | **Maximum Holding Time** |
| Calcium, Total | Aqueous | Plastic | $HNO_3$ to pH <2 | 6 months |
| Calcium, Extractable | Soil | Plastic | Dry, grind, screened | 2 months |
| Carbonaceous Biochemical Oxygen Demand | Aqueous | Plastic | Cool, ≤ 6 ˚C | 48 hours |
| Cation Exchange Capacity | Soil | Plastic | Dry, grind, screened | 2 months |
| Chemical Oxygen Demand | Aqueous | Plastic | Cool, ≤ 6 ˚C<br>$H_2SO_4$ to pH <2 | 28 days |
| Chloride | Aqueous | Plastic | None Required | 28 days |
| Chloride, Automated | Aqueous | Plastic | None Required | 28 days |
| Chlorine Residual | Aqueous | Plastic | None Required | Analyze immediately |
| Chromium, Hexavalent | Aqueous | Plastic | Cool, ≤ 6 ˚C | 24 hours |
| Chromium, Dissolved | Aqueous | Plastic | $HNO_3$ to pH <2<br>after filtration through a 0.45-µm membrane filter | 6 months |
| Chromium, Total | Aqueous | Plastic | $HNO_3$ to pH <2 | 6 months |
| Chromium, Dissolved | Aqueous | Plastic | $HNO_3$ to pH <2<br>after filtration through a 0.45-µm membrane filter | 6 months |
| Chromium, Total | Aqueous | Plastic | $HNO_3$ to pH <2 | 6 months |
| Chromium, Total | Soil | Plastic | Dry, grind, screened | 2 months |
| Chromium, Total | Sludge | Plastic | $HNO_3$ to pH <2 | 6 months |
| Copper, Dissolved | Aqueous | Plastic | $HNO_3$ to pH <2<br>after filtration through a 0.45-µm membrane filter | 6 months |
| Copper, Total | Aqueous | Plastic | $HNO_3$ to pH <2 | 6 months |
| Copper, Dissolved | Aqueous | Plastic | $HNO_3$ to pH <2<br>after filtration through a 0.45-µm membrane filter | 6 months |
| Copper, Total | Aqueous | Plastic | $HNO_3$ to pH <2 | 6 months |
| Copper, Total | Soil | Plastic | Dry, grind, screened | 2 months |
| Copper, Total | Sludge | Plastic | $HNO_3$ to pH <2 | 6 months |
| Cyanide,<br>Amenable to Chlorination | Aqueous | Plastic, Glass | Cool, ≤ 6 ˚C<br>NaOH to pH >12<br>0.6g ascorbic acid (2) | 14 days |
| Cyanide, Total | Aqueous | Plastic, Glass | Cool, ≤ 6 ˚C<br>NaOH to pH >12<br>0.6g ascorbic acid (2) | 14 days |

[2] For chlorinated water samples only.

| Table 5.1<br>Sample Preservation and Holding Times[1] | | | | |
|---|---|---|---|---|
| **Determination** | **Matrix** | **Container** | **Preservation** | **Maximum Holding Time** |
| Cyanide, Total | Aqueous | Plastic, Glass | Cool, ≤ 6 ˚C<br>NaOH to pH >12<br>0.6g ascorbic acid (2) | 14 days |
| Cyanide, Total | Sludge | Plastic, Glass | Cool, ≤ 6 ˚C<br>NaOH to pH >12<br>0.6g ascorbic acid (2) | 14 days |
| Fluoride, Total | Aqueous | Plastic | Cool, ≤ 6 ˚C | 28 days |
| Hardness,<br>as $CaCO_3$ | Aqueous | NA | NA | Calculation |
| IA/PA Ratio | Sludge,<br>Supernatant | Plastic | Cool, ≤ 6 ˚C | 14 days |
| pH | Aqueous | Plastic | None Required | Analyze immediately |
| pH | Soil | Plastic | Dry, grind, screened | 2 months |
| SMP,<br>Lime Requirement | Soil | Plastic | Dry, grind, screened | 2 months |
| pH, pH Units | Sludge | Plastic | None Required | Analyze immediately |
| Iron, Dissolved | Aqueous | Plastic | $HNO_3$ to pH <2<br>after filtration through a 0.45-µm membrane filter | 6 months |
| Iron, Total | Aqueous | Plastic | $HNO_3$ to pH <2 | 6 months |
| Iron, Dissolved | Aqueous | Plastic | $HNO_3$ to pH <2<br>after filtration through a 0.45-µm membrane filter | 6 months |
| Iron, Total | Aqueous | Plastic | $HNO_3$ to pH <2 | 6 months |
| Total Kjeldahl Nitrogen | Aqueous | Plastic | Cool, ≤ 6 ˚C<br>$H_2SO_4$ to pH <2 | 28 days |
| Total Kjeldahl Nitrogen | Soil | Plastic | Dry, grind, screened | 2 months |
| Total Kjeldahl Nitrogen | Sludge | Plastic | Cool, ≤ 6 ˚C<br>$H_2SO_4$ to pH <2 | 28 days |
| Lead, Dissolved | Aqueous | Plastic | $HNO_3$ to pH <2<br>after filtration through a 0.45-µm membrane filter | 6 months |
| Lead, Total | Aqueous | Plastic | $HNO_3$ to pH <2 | 6 months |
| Lead, Dissolved | Aqueous | Plastic | $HNO_3$ to pH <2<br>after filtration through a 0.45-µm membrane filter | 6 months |
| Lead, Total | Aqueous | Plastic | $HNO_3$ to pH <2 | 6 months |
| Lead, Total | Soil | Plastic | Dry, grind, screened | 2 months |
| Lead, Total | Sludge | Plastic | $HNO_3$ to pH <2 | 6 months |

[2] For chlorinated water samples only.

| Table 5.1<br>Sample Preservation and Holding Times[1] | | | | |
|---|---|---|---|---|
| **Determination** | **Matrix** | **Container** | **Preservation** | **Maximum Holding Time** |
| Magnesium, Dissolved | Aqueous | Plastic | $HNO_3$ to pH <2<br>after filtration through a 0.45-µm membrane filter | 6 months |
| Magnesium, Total | Aqueous | Plastic | $HNO_3$ to pH <2 | 6 months |
| Magnesium, Extractable | Soil | Plastic | Dry, grind, screened | 2 months |
| Mercury, Dissolved | Aqueous | Plastic | $HNO_3$ to pH <2<br>after filtration through a 0.45-µm membrane filter | 28 days |
| Mercury, Total | Aqueous | Plastic | $HNO_3$ to pH <2 | 28 days |
| Mercury, Total | Soil | Plastic | Dry, grind, screened | 2 months |
| Mercury, Total | Sludge | Plastic | $HNO_3$ to pH <2 | 28 days |
| Molybdenum, Dissolved | Aqueous | Plastic | $HNO_3$ to pH <2<br>after filtration through a 0.45-µm membrane filter | 6 months |
| Molybdenum, Total | Aqueous | Plastic | $HNO_3$ to pH <2 | 6 months |
| Molybdenum, Total | Sludge | Plastic | $HNO_3$ to pH <2 | 6 months |
| Molybdenum, Dissolved | Aqueous | Plastic | $HNO_3$ to pH <2<br>after filtration through a 0.45-µm membrane filter | 6 months |
| Molybdenum, Total | Aqueous | Plastic | $HNO_3$ to pH <2 | 6 months |
| Molybdenum, Total | Soil | Plastic | Dry, grind, screened | 2 months |
| Molybdenum, Total | Sludge | Plastic | $HNO_3$ to pH <2 | 6 months |
| Nickel, Dissolved | Aqueous | Plastic | $HNO_3$ to pH <2<br>after filtration through a 0.45-µm membrane filter | 6 months |
| Nickel, Total | Aqueous | Plastic | $HNO_3$ to pH <2 | 6 months |
| Nickel, Dissolved | Aqueous | Plastic | $HNO_3$ to pH <2<br>after filtration through a 0.45-µm membrane filter | 6 months |
| Nickel, Total | Aqueous | Plastic | $HNO_3$ to pH <2 | 6 months |
| Nickel, Total | Soil | Plastic | Dry, grind, screened | 2 months |
| Nickel, Total | Sludge | Plastic | $HNO_3$ to pH <2 | 6 months |
| Nitrate + Nitrite,<br>as N | Aqueous | Plastic | Cool, $\leq$ 6 ˚C<br>$H_2SO_4$ to pH <2 | 28 days |
| Nitrate + Nitrite,<br>as N | Soil | Plastic | Dry, grind, screened | 2 months |
| Nitrate + Nitrite,<br>as N | Sludge | Plastic | Cool, $\leq$ 6 ˚C<br>$H_2SO_4$ to pH <2 | 28 days |
| Silica Gel Treated<br>Hexane Extractable Material | Aqueous | Glass | Cool, $\leq$ 6 ˚C<br>HCl to pH <2 | 28 days |
| Hexane Extractable Material | Aqueous | Glass | Cool, $\leq$ 6 ˚C<br>HCl to pH <2 | 28 days |

| Table 5.1<br>Sample Preservation and Holding Times[1] | | | | |
|---|---|---|---|---|
| **Determination** | **Matrix** | **Container** | **Preservation** | **Maximum Holding Time** |
| Total Organic Carbon | Aqueous | Plastic | Cool, ≤ 6 ˚C<br>$H_2SO_4$ to pH <2 | 28 days |
| Phosphorus, Ortho | Aqueous | Plastic | Filter immediately<br>Cool, ≤ 6 ˚C | 48 hours |
| Phenols | Aqueous | Glass | Cool, ≤ 6 ˚C<br>$H_2SO_4$ to pH <2 | 28 days |
| Phenols | Aqueous | Glass | Cool, ≤ 6 ˚C<br>$H_2SO_4$ to pH <2 | 28 days |
| Phenolics, Total | Sludge | Glass | Cool, ≤ 6 ˚C<br>$H_2SO_4$ to pH <2 | 28 days |
| Phosphorus, Total | Aqueous | Plastic | Cool, ≤ 6 ˚C<br>$H_2SO_4$ to pH <2 | 28 days |
| Phosphorus, Extractable | Soil | Plastic | Dry, grind, screened | 2 months |
| Phosphorus, Total | Sludge | Plastic | Cool, ≤ 6 ˚C<br>$H_2SO_4$ to pH <2 | 28 days |
| Potassium, Dissolved | Aqueous | Plastic | $HNO_3$ to pH <2<br>after filtration through a 0.45-µm membrane filter | 6 months |
| Potassium, Total | Aqueous | Plastic | $HNO_3$ to pH <2 | 6 months |
| Potassium, Extractable | Soil | Plastic | Dry, grind, screened | 2 months |
| Potassium, Total | Soil | Plastic | Dry, grind, screened | 2 months |
| Potassium, Total | Sludge | Plastic | $HNO_3$ to pH <2 | 6 months |
| Residue,<br>Total Solids | Aqueous | Plastic | Cool, ≤ 6 ˚C | 7 days |
| Residue,<br>Total Solids | Sludge | Plastic | Cool, ≤ 6 ˚C | 7 days |
| Residue,<br>Total Dissolved Solids | Aqueous | Plastic | Cool, ≤ 6 ˚C | 7 days |
| Residue,<br>Total Suspended Solids | Aqueous | Plastic | Cool, ≤ 6 ˚C | 7 days |
| Residue,<br>Volatile Solids | Aqueous | Plastic | Cool, ≤ 6 ˚C | 7 days |
| Residue,<br>Volatile Solids | Sludge | Plastic | Cool, ≤ 6 ˚C | 7 days |
| Selenium, Dissolved | Aqueous | Plastic | $HNO_3$ to pH <2<br>after filtration through a 0.45-µm membrane filter | 6 months |
| Selenium, Total | Aqueous | Plastic | $HNO_3$ to pH <2 | 6 months |
| Selenium, Total | Sludge | Plastic | $HNO_3$ to pH <2 | 6 months |
| Selenium, Total | Soil | Plastic | Dry, grind, screened | 2 months |
| Silver, Dissolved | Aqueous | Plastic | $HNO_3$ to pH <2<br>after filtration through a 0.45-µm membrane filter | 6 months |

| Table 5.1<br>Sample Preservation and Holding Times[1] | | | | |
|---|---|---|---|---|
| **Determination** | **Matrix** | **Container** | **Preservation** | **Maximum Holding Time** |
| Silver, Total | Aqueous | Plastic | $HNO_3$ to pH <2 | 6 months |
| Silver, Dissolved | Aqueous | Plastic | $HNO_3$ to pH <2<br>after filtration through a 0.45-µm membrane filter | 6 months |
| Silver, Total | Aqueous | Plastic | $HNO_3$ to pH <2 | 6 months |
| Silver, Total | Soil | Plastic | Dry, grind, screened | 2 months |
| Silver, Total | Sludge | Plastic | $HNO_3$ to pH <2 | 6 months |
| Sodium, Dissolved | Aqueous | Plastic | $HNO_3$ to pH <2<br>after filtration through a 0.45-µm membrane filter | 6 months |
| Sodium, Total | Aqueous | Plastic | $HNO_3$ to pH <2 | 6 months |
| Sodium, Extractable | Soil | Plastic | Dry, grind, screened | 2 months |
| Sodium, Exchangeable | Soil | Plastic | Dry, grind, screened | 2 months |
| Specific Conductivity | Aqueous | Plastic | Cool, $\leq$ 6 ˚C | 28 days |
| Total Soluble Salts, Conductivity | Soil | Plastic | Dry, grind, screened | 2 months |
| Sulfate, Low Level | Aqueous | Plastic | Cool, $\leq$ 6 ˚C | 28 days |
| Sulfide | Aqueous | Plastic | Cool, $\leq$ 6 ˚C<br>add zinc acetate plus NaOH to pH >9. | 7 days |
| Volatile Acids | Sludge | Plastic | Cool, $\leq$ 6 ˚C | 14 days |
| Zinc, Dissolved | Aqueous | Plastic | $HNO_3$ to pH <2<br>after filtration through a 0.45-µm membrane filter | 6 months |
| Zinc, Total | Aqueous | Plastic | $HNO_3$ to pH <2 | 6 months |
| Zinc, Dissolved | Aqueous | Plastic | $HNO_3$ to pH <2<br>after filtration through a 0.45-µm membrane filter | 6 months |
| Zinc, Total | Aqueous | Plastic | $HNO_3$ to pH <2 | 6 months |
| Zinc, Total | Sludge | Plastic | $HNO_3$ to pH <2 | 6 months |
| *Escherichia coli* | Aqueous | Plastic | Cool, <10 C<br>0.008% $Na_2S_2O_3$ (2) | 6 hours |
| Fecal Coliform | Aqueous | Plastic | Cool, <10 C<br>0.008% $Na_2S_2O_3$ (2) | 6 hours |
| Total Coliform | Aqueous | Plastic | Cool, <10C<br>(b) 0.008% $Na_2S_2O_3$ (2) | 6 hours |
| Enterococci | Aqueous | Plastic | Cool, <10C<br>0.008% $Na_2S_2O_3$ (2) | 6 hours |

[2] For chlorinated water samples only

## 1.0 Bibliography

*Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846.* (n.d.). U.S. Environmental Protection Agency.

**Table 7.1**
**Data Quality Objectives**
**Chemical and Microbiological Methods**

| Method | Analyte | Matrix | Detection Limit | Quantitation Limit | Units | Precision (RPD) | Accuracy (% Recovery) |
|---|---|---|---|---|---|---|---|
| SM 2320 B-1997 | Alkalinity, as $CaCO_3$ | Aqueous | NA | 1<br>10 | mg/L | 15% | 85 - 115% |
| SM 2320 B-1997 | Alkalinity, as $CaCO_3$ | Sludge | NA | NA | mg/L | 20% | 75 - 125% |
| SM 4500-NH3 D-1997 | Ammonia, as N | Aqueous | 0.047 | 0.1 | mg/L | 15% | 85 - 115% |
| Methods of Soil Analysis 33-3.1 | Ammonia, as N | Soil | NA | See Note A | ppm, dry weight | 20% | 75 - 125% |
| 4500-$NH_3$B-1997 followed by 4500-$NH_3$ C-1997 | Ammonia, as N | Sludge | NA | See Note A | % dry weight | 20% | 75 - 125% |
| EPA 200.8 | Antimony, Dissolved | Aqueous | 0.0078* | 0.0500 | µg/L | 15% | 70 - 130% |
| EPA 200.8 | Antimony, Total | Aqueous | 0.0214* | 0.0500 | µg/L | 15% | 70 - 130% |
| EPA 200.8 | Arsenic, Dissolved | Aqueous | 0.0178* | 0.0500 | µg/L | 15% | 70 - 130% |
| EPA 200.8 | Arsenic, Total | Aqueous | 0.0222* | 0.0500 | µg/L | 15% | 70 - 130% |
| SW-846 6010C / SW-846 3050B | Arsenic, Total | Sludge | NA | See Note A | ppm, dry weight | 20% | 75 - 125% |
| SW-846 6010C / SW-846 3050B | Arsenic, Total | Soil | NA | See Note A | ppm, dry weight | 20% | 75 - 125% |
| EPA 200.7 | Arsenic, Dissolved | Aqueous | NA | 0.02 | mg/L | 15% | 70-130% |
| EPA 200.7 / EPA 200.7 Part 11.2 | Arsenic, Total | Aqueous | 0.0015 | 0.02 | mg/L | 15% | 70-130% |
| EPA 200.8 | Beryllium, Dissolved | Aqueous | 0.0604* | 0.100 | µg/L | 15% | 70 - 130% |

*Subject to Change

**Table 7.1**
**Data Quality Objectives**
**Chemical and Microbiological Methods**

| Method | Analyte | Matrix | Detection Limit | Quantitation Limit | Units | Precision (RPD) | Accuracy (% Recovery) |
|---|---|---|---|---|---|---|---|
| EPA 200.8 | Beryllium, Total | Aqueous | 0.0616* | 0.100 | µg/L | 15% | 70 - 130% |
| SM5210 B-2001/HACH 10360 | Biochemical Oxygen Demand | Aqueous | NA | 2 | mg/L | NA | See note[1] |
| EPA 200.8 | Cadmium, Dissolved | Aqueous | 0.0176* | 0.0500 | µg/L | 15% | 70 - 130% |
| EPA 200.8 | Cadmium, Total | Aqueous | 0.0201* | 0.0500 | µg/L | 15% | 70 - 130% |
| EPA 200.7 | Cadmium, Dissolved | Aqueous | NA | 0.01 | mg/L | 15% | 70-130% |
| EPA 200.7 / EPA 200.7 Part 11.2 | Cadmium, Total | Aqueous | 0.0003 | 0.01 | mg/L | 15% | 70-130% |
| SW-846 6010C / SW-846 3050B | Cadmium, Total | Soil | NA | See Note A | ppm, dry weight | 20% | 75 - 125% |
| SW-846 6010C / SW-846 3050B | Cadmium, Total | Sludge | NA | See Note A | ppm, dry weight | 20% | 75 - 125% |
| EPA 200.7 | Calcium, Dissolved | Aqueous | NA | 0.01 | mg/L | 15% | 70-130% |
| EPA 200.7 / EPA 200.7 Part 11.2 | Calcium, Total | Aqueous | 0.0081 | 1.0 | mg/L | 15% | 70-130% |
| SW-846 6010C | Calcium, Extractable | Soil | NA | See Note A | ppm, dry weight | 20% | 75 - 125% |
| SM5210 B-2001/HACH 10360 | Carbonaceous Biochemical Oxygen Demand | Aqueous | NA | 2 | mg/L | NA | See note[1] |
| Oregon State University | Cation Exchange Capacity | Soil | NA | NA | meq/100g | 20% | 75 - 125% |

Notes:
1: For BOD and CBOD refer to quality assurance control limits specified by the manufacturer Certificate of Analysis.

*Subject to Change

**Table 7.1**
**Data Quality Objectives**
**Chemical and Microbiological Methods**

| Method | Analyte | Matrix | Detection Limit | Quantitation Limit | Units | Precision (RPD) | Accuracy (% Recovery) |
|---|---|---|---|---|---|---|---|
| Hach 8000 | Chemical Oxygen Demand | Aqueous | NA | 5 | mg/L | 15% | 85 - 115% |
| EPA 300.0 | Chloride | Aqueous | 0.0494 | 0.5 | mg/L | 15% | 85 - 115% |
| SM 4500-Cl-D-2000 | Chlorine, Total Residual | Aqueous | NA | 0.02 | mg/L | 15% | 85 - 115% |
| EPA 218.6 | Chromium, Hexavalent | Aqueous | NA | NA | mg/L | 15% | 85 - 115% |
| EPA 200.8 | Chromium, Dissolved | Aqueous | 0.0437* | 0.100 | µg/L | 15% | 70 - 130% |
| EPA 200.8 | Chromium, Total | Aqueous | 0.0760* | 0.100 | µg/L | 15% | 70 - 130% |
| EPA 200.7 | Chromium, Dissolved | Aqueous | NA | 0.01 | mg/L | 15% | 70-130% |
| EPA 200.7 / EPA 200.7 Part 11.2 | Chromium, Total | Aqueous | 0.0003 | 0.02 | mg/L | 15% | 70-130% |
| SW-846 6010C / SW-846 3050B | Chromium, Total | Soil | N/A | See Note A | ppm, dry weight | 20% | 75 - 125% |
| SW-846 6010C / SW-846 3050B | Chromium, Total | Sludge | N/A | See Note A | ppm, dry weight | 20% | 75 - 125% |
| EPA 200.8 | Copper, Dissolved | Aqueous | 0.0115* | 0.0500 | µg/L | 15% | 70 - 130% |
| EPA 200.8 | Copper, Total | Aqueous | 0.0241* | 0.0500 | µg/L | 15% | 70 - 130% |
| EPA 200.7 | Copper, Dissolved | Aqueous | NA | 0.05 | mg/L | 15% | 70-130% |
| EPA 200.7 / EPA 200.7 Part 11.2 | Copper, Total | Aqueous | 0.0016 | 0.05 | mg/L | 15% | 70-130% |
| SW-846 6010C / SW-846 3050B | Copper, Total | Soil | NA | See Note A | ppm, dry weight | 20% | 75 - 125% |

*Subject to Change

**Table 7.1**
**Data Quality Objectives**
**Chemical and Microbiological Methods**

| Method | Analyte | Matrix | Detection Limit | Quantitation Limit | Units | Precision (RPD) | Accuracy (% Recovery) |
|---|---|---|---|---|---|---|---|
| SW-846 6010C / SW-846 3050B | Copper, Total | Sludge | NA | See Note A | ppm, dry weight | 20% | 75 - 125% |
| SM 4500-$CN^-$ G-1999 | Cyanide, Amenable to Chlorination | Aqueous | NA | 0.010 | mg/L | 15% | 85 - 115% |
| EPA 335.4, Rev.1.0 | Cyanide, Total | Aqueous | 2.56 | 5 | µg/L | 15% | 90 – 110% |
| SW-846 9010C | Cyanide, Total | Sludge | NA | NA | ppm, dry weight | 20% | 75 - 125% |
| EPA 300.0 Rev 2.1 | Fluoride, Total | Aqueous | 0.0161 | 0.2 | mg/L | 15% | 85 - 115% |
| SM 2340 B-1997 | Hardness, as $CaCO_3$ | Aqueous | NA | 5 | mg eq/L | 15% | 85 - 115% |
| EPA 1664 Rev.B | Hexane Extractable Material | Aqueous | 0.785 | 5 | mg/L | 18% | 78 - 114% |
| SM 4500-$H^+$ B-2000 | Hydrogen Ion (pH) | Aqueous | NA | NA | pH Units | 15% | NA |
| SW-846 9045D | Hydrogen Ion (pH) | Soil | NA | NA | pH Units | 20% | NA |
| SW-846 9045D | Hydrogen Ion (pH) | Sludge | NA | NA | pH Units | 20% | NA |
| EPA 310.1 Modified pH endpoint 4.3 and 5.75 | IA/PA Ratio | Sludge | NA | NA | Ratio | 20% | NA |
| SM 4500$N_{org}$ B-1997 Followed by 4500$NH_3$ C-1997 | Total Kjeldahl Nitrogen | Aqueous | 0.24 | 0.2 | mg/L | 15% | 85 - 115% |
| Oregon State University | Total Kjeldahl Nitrogen | Soil | NA | See Note A | % dry weight | 20% | 75 - 125% |

*Subject to Change

**Table 7.1**
**Data Quality Objectives**
**Chemical and Microbiological Methods**

| Method | Analyte | Matrix | Detection Limit | Quantitation Limit | Units | Precision (RPD) | Accuracy (% Recovery) |
|---|---|---|---|---|---|---|---|
| SM 4500$N_{org}$ B-1997 Followed by 4500$NH_3$ C-1997 | Total Kjeldahl Nitrogen | Sludge | NA | See Note A | % dry weight | 20% | 75 - 125% |
| EPA 200.8 | Lead, Dissolved | Aqueous | 0.0051* | 0.0500 | µg/L | 15% | 70 - 130% |
| EPA 200.8 | Lead, Total | Aqueous | 0.0217* | 0.0500 | µg/L | 15% | 70 - 130% |
| EPA 200.7 | Lead, Dissolved | Aqueous | NA | 0.02 | mg/L | 15% | 70-130% |
| EPA 200.7 / EPA 200.7 Part 11.2 | Lead, Total | Aqueous | 0.0015 | 0.05 | mg/L | 15% | 70-130% |
| SW-846 6010C / SW-846 3050B | Lead, Total | Soil | NA | See Note A | ppm, dry weight | 20% | 75 - 125% |
| SW-846 6010C / SW-846 3050B | Lead, Total | Sludge | NA | See Note A | ppm, dry weight | 20% | 75 - 125% |
| EPA 200.7 | Magnesium, Dissolved | Aqueous | NA | 0.5 | mg/L | 15% | 70-130% |
| EPA 200.7 / EPA 200.7 Part 11.2 | Magnesium, Total | Aqueous | 0.0012 | 0.5 | mg/L | 15% | 70-130% |
| SW-846 6010C | Magnesium, Extractable | Soil | NA | See Note A | ppm, dry weight | 20% | 75 – 125% |
| EPA 245.1, Rev. 3.0 | Mercury, Dissolved | Aqueous | NA | 0.05 | µg/L | 15% | 85 – 115% |
| EPA 245.1 Rev. 3.0 | Mercury, Total | Aqueous | 0.0096 | 0.05 | µg/L | 15% | 85 – 115% |
| EPA 1631 | Mercury, Dissolved | Aqueous | 0.128 | 0.50 | ng/L | 24% | 71 – 125% |
| EPA 1631 | Mercury, Total | Aqueous | 0.128 | 0.50 | ng/L | 24% | 71 – 125% |

*Subject to Change

**Table 7.1**
**Data Quality Objectives**
**Chemical and Microbiological Methods**

| Method | Analyte | Matrix | Detection Limit | Quantitation Limit | Units | Precision (RPD) | Accuracy (% Recovery) |
|---|---|---|---|---|---|---|---|
| SW-846 7471B | Mercury, Total | Soil | NA | See Note A | ppm, dry weight | 20% | 75 – 125% |
| SW-846 7471B | Mercury, Total | Sludge | NA | See Note A | ppm, dry weight | 20% | 75 – 125% |
| EPA 200.8 | Molybdenum, Dissolved | Aqueous | 0.0105* | 0.100 | µg/L | 15% | 70 – 130% |
| EPA 200.8 | Molybdenum, Total | Aqueous | 0.0337* | 0.100 | µg/L | 15% | 70 – 130% |
| EPA 200.7 | Molybdenum, Dissolved | Aqueous | NA | 0.01 | mg/L | 15% | 70-130% |
| EPA 200.7 / EPA 200.7 Part 11.2 | Molybdenum, Total | Aqueous | 0.0002 | 0.01 | mg/L | 15% | 70-130% |
| SW-846 6010C/ SW-846 3050B | Molybdenum, Total | Soil | NA | See Note A | ppm, dry weight | 20% | 75 – 125% |
| SW-846 6010C / SW-846 3050B | Molybdenum, Total | Sludge | NA | See Note A | ppm, dry weight | 20% | 75 – 125% |
| EPA 200.8 | Nickel, Dissolved | Aqueous | 0.0134* | 0.0500 | µg/L | 15% | 70 – 130% |
| EPA 200.8 | Nickel, Total | Aqueous | 0.0292* | 0.0500 | µg/L | 15% | 70 – 130% |
| EPA 200.7 | Nickel, Dissolved | Aqueous | NA | 0.01 | mg/L | 15% | 70-130% |
| EPA 200.7 / EPA 200.7 Part 11.2 | Nickel, Total | Aqueous | NA | 0.05 | mg/L | 15% | 70-130% |
| SW-846 6010C / SW-846 3050B | Nickel, Total | Soil | NA | NA | ppm, dry weight | 20% | 75 – 125% |
| SW-846 6010C / SW-846 3050B | Nickel, Total | Sludge | NA | See Note A | ppm, dry weight | 20% | 75 - 125% |
| EPA 353.2 Rev. 2.0 | Nitrate+Nitrite, as N | Aqueous | 0.0072 | 0.05 | mg/L | 15% | 90 - 110% |

*Subject to Change

**Table 7.1**
**Data Quality Objectives**
**Chemical and Microbiological Methods**

| Method | Analyte | Matrix | Detection Limit | Quantitation Limit | Units | Precision (RPD) | Accuracy (% Recovery) |
|---|---|---|---|---|---|---|---|
| Methods of Soil Analysis 33-3.1 | Nitrate+Nitrite, as N | Soil | NA | See Note A | ppm, dry weight | 20% | 75 - 125% |
| EPA 353.2 Rev. 2.0 | Nitrate+Nitrite, as N | Sludge | NA | See Note A | % dry weight | 20% | 75 - 125% |
| SM 5310-2000 | Total Organic Carbon | Aqueous | 0.07 | 0.5 | mg/L | 15% | 85 – 115% |
| EPA 420.1 | Phenols | Aqueous | 0.05 | 0.2 | mg/L | 15% | Vendor Provided limits. See COA |
| EPA 365.3 | Phosphorus, Ortho | Aqueous | NA | 0.01 | mg/L | 15% | 85-115% |
| EPA 365.3 | Phosphorus, Total | Aqueous | NA | 0.01 | mg/L | 15% | 85 - 115% |
| Oregon State University | Phosphorus, Extractable | Soil | NA | See Note A | ppm, dry weight | 20% | 75 - 125% |
| EPA 365.3 | Phosphorus, Total | Sludge | NA | See Note A | % dry weight | 20% | 75 - 125% |
| EPA 200.7 | Potassium, Dissolved | Aqueous | NA | 1 | mg/L | 15% | 70-130% |
| EPA 200.7 / EPA 200.7 Part 11.2 | Potassium, Total | Aqueous | 0.0233 | 1.0 | mg/L | 15% | 70-130% |
| SW-846 6010C | Potassium, Extractable | Soil | NA | See Note A | ppm, dry weight | 20% | 75 - 125% |
| SW-846 6010C / SW-846 3050B | Potassium, Total | Soil | NA | See Note A | ppm, dry weight | 20% | 75 - 125% |
| SW-846 6010C / SW-846 3050B | Potassium, Total | Sludge | NA | See Note A | ppm, dry weight | 20% | 75 - 125% |
| SM 2540 B-1997 | Residue, Total Solids | Aqueous | NA | 10 | mg/L | 15% | 85 - 115% |
| SM 2540 B-1997 | Residue, Total Solids | Sludge | NA | NA | % | 20% | NA |

*Subject to Change

**Table 7.1**
**Data Quality Objectives**
**Chemical and Microbiological Methods**

| Method | Analyte | Matrix | Detection Limit | Quantitation Limit | Units | Precision (RPD) | Accuracy (% Recovery) |
|---|---|---|---|---|---|---|---|
| SM 2540 C-1997 | Residue, Total Dissolved Solids | Aqueous | NA | 10 | mg/L | 15% | 85 - 115% |
| SM 2540 D-1997 | Residue, Total Suspended Solids | Aqueous | NA | 1 | mg/L | 15% | 85 - 115% |
| EPA 160.4 | Residue, Volatile Solids | Aqueous | NA | NA | mg/L | 15% | 85 - 115% |
| EPA 160.4 | Residue, Volatile Solids | Sludge | NA | NA | % | 20% | NA |
| EPA 200.7 | Selenium, Dissolved | Aqueous | NA | 0.03 | mg/L | 15% | 70-130% |
| EPA 200.7 | Selenium, Total | Aqueous | 0.0014 | 0.03 | mg/L | 15% | 70-130% |
| EPA 200.8 | Selenium, Dissolved | Aqueous | 0.0416* | 0.100 | µg/L | 15% | 70 - 130% |
| EPA 200.8 | Selenium, Total | Aqueous | 0.0476* | 0.100 | µg/L | 15% | 70 - 130% |
| SW-846 6010C / SW-846 3050B | Selenium, Total | Sludge | NA | See Note A | ppm, dry weight | 20% | 75 - 125% |
| SW-846 6010C / SW-846 3050B | Selenium, Total | Soil | NA | See Note A | ppm, dry weight | 20% | 75 - 125% |
| EPA 1664 Rev B | Silica Gel Treated Hexane Extractable Material | Aqueous | 0.820 47mm 0.509 90mm | 5 | mg/L | 34% | 64 - 132% |
| EPA 200.8 | Silver, Dissolved | Aqueous | 0.0059* | 0.0500 | µg/L | 15% | 70 - 130% |
| EPA 200.8 | Silver, Total | Aqueous | 0.0190* | 0.0500 | µg/L | 15% | 70 - 130% |
| EPA 200.7 | Silver, Dissolved | Aqueous | NA | 0.02 | mg/L | 15% | 70-130% |

*Subject to Change

**Table 7.1**
**Data Quality Objectives**
**Chemical and Microbiological Methods**

| Method | Analyte | Matrix | Detection Limit | Quantitation Limit | Units | Precision (RPD) | Accuracy (% Recovery) |
|---|---|---|---|---|---|---|---|
| EPA 200.7 / EPA 200.7 Part 11.2 | Silver, Total | Aqueous | 0.0002 | 0.02 | mg/L | 15% | 70-130% |
| SW-846 6010C / SW-846 3050B | Silver, Total | Soil | NA | See Note A | ppm, dry weight | 20% | 75 - 125% |
| SW-846 6010C / SW-846 3050B | Silver, Total | Sludge | NA | See Note A | ppm, dry weight | 20% | 75 - 125% |
| EPA 200.7 | Sodium, Dissolved | Aqueous | NA | 0.5 | mg/L | 15% | 70-130% |
| EPA 200.7 / EPA 200.7 Part 11.2 | Sodium, Total | Aqueous | 0.0369 | 0.5 | mg/L | 15% | 70-130% |
| SW-846 6010C | Sodium, Extractable | Soil | NA | See Note A | ppm, dry weight | 20% | 75 - 125% |
| SW-846 6010C | Sodium, Exchangeable | Soil | NA | NA | meq/100g | 20% | 75 - 125% |
| SM 2510 B-1997 | Specific Conductance | Aqueous | NA | 5 | µmhos/cm @ 25 °C | 15% | 85 - 115% |
| Oregon State University | Total Soluble Salts, Conductivity | Soil | NA | 5 | µmhos/cm @ 25 °C | 20% | 75 - 125% |
| EPA 300.0 Rev 2.1 | Sulfate, Low Level | Aqueous | 0.0067 | 0.5 | mg/L | 15% | 85 - 115% |
| EPA 200.8 | Thallium, Dissolved | Aqueous | 0.0071* | 0.0500 | µg/L | 15% | 70 – 130% |
| EPA 200.8 | Thallium, Total | Aqueous | 0.0208* | 0.0500 | µg/L | 15% | 70 – 130% |
| SM 5310 B-2000 | Total Organic Carbon | Aqueous | 0.07 | 0.5 | mg/L | 15% | 85 – 115% |
| EPA 180.1 Rev. 2.0 | Turbidity | Aqueous | NA | 1 | NTU | 15% | 85 - 115% |
| SM 5560 C-1997 | Volatile Acids | Sludge | NA | NA | mg/L | 20% | NA |
| EPA 200.8 | Zinc, Dissolved | Aqueous | 0.0287* | 0.200 | µg/L | 15% | 70 - 130% |

*Subject to Change

**Table 7.1**
**Data Quality Objectives**
**Chemical and Microbiological Methods**

| Method | Analyte | Matrix | Detection Limit | Quantitation Limit | Units | Precision (RPD) | Accuracy (% Recovery) |
|---|---|---|---|---|---|---|---|
| EPA 200.8 | Zinc, Total | Aqueous | 0.0792* | 0.200 | µg/L | 15% | 70 - 130% |
| EPA 200.7 | Zinc, Dissolved | Aqueous | NA | 0.10 | mg/L | 15% | 70-130% |
| EPA 200.7 / EPA 200.7 Part 11.2 | Zinc, Total | Aqueous | 0.0012 | 0.10 | mg/L | 15% | 70-130% |
| SW-846 6010C/ SW-846 3050B | Zinc, Total | Sludge | NA | See note[2] | ppm, dry weight | 20% | 75 - 125% |
| Colilert QT | *Escherichia coli* | Aqueous | NA | 1 | Colonies per 100 mL | Specific to Matrix | NA |
| SM 9222 D-1997 | Fecal Coliform | Aqueous | NA | 1 | Colonies per 100 mL | Specific to Matrix | NA |
| SM 9222 B-1997 | Total Coliform | Aqueous | NA | 1 | Colonies per 100 mL | Specific to Matrix | NA |
| Enterolert | Enterococci | Aqueous | NA | 1 | Colonies per 100 mL | Specific to Matrix | NA |

Notes:
2: Quantitation Limits for Solid samples (sludge and soils) are calculated for each sample based on the aqueous QL for the analyte (mg/L), the amount of sample used, preparation volume and the % solids in the sample.

*Subject to Change

| Table 8.1<br>Laboratory Instrument Calibration Guidelines | |
|---|---|
| **Instrument** | **Calibration Guidelines** |
| pH Meters | Three point calibration. |
| Inductively Coupled Argon Plasma Spectrophotometer | Calibration curve constructed from at least three standards and blank. |
| Total Organic Carbon Analyzer | As a minimum, measure three different dilutions of the standard when an analysis is initiated. Subsequently, verify the standard curve daily by analyzing a standard within the linear range. |
| Dissolved Oxygen Meter | Saturated air calibration. Calibration checked daily with a saturated water check. Checked monthly by Winkler titration. |
| Chlorine Residual Analyzer | Checked against a known standard monthly. |
| Flow through Ion Analyzer | Calibration curve constructed from at least four standards and a baseline blank. |
| Ion Chromatograph | Minimum of three concentration levels and a blank. Calibration Curve verified each working day. Recalibrate if response or retention times vary from expected values by more that +/- 10% |
| Cold Vapor Atomic Fluorescence Mercury (Low-Level System) | Minimum of 5 non-zero points and the results of analysis of 3 system blanks. Low Cal. Point at the minimum level of quantification. Calibration Factor (CF) to be used to evaluate calibration acceptance. RSD of mean CF must be equal to or lower than 15%. The low standard must be in the range of 75-125% of the concentration. |
| Ovens, Furnace and Refrigerators | Temperatures are recorded daily when the equipment is being used. Temperatures verified annually with certified reference thermometer. Liquid immersed thermometers are used in refrigerators. Thermocouples are used in the ovens and furnace. |
| Incubators | Temperatures are recorded daily (BOD incubators) and twice daily separated by at least four hours (bacteriology) when used. Liquid immersed thermometers or thermocouples are used, and checked annually against a reference thermometer. |
| Autoclave | Date, time, contents, and temperature recorded for each use cycle. |
| Analytical Balances | Serviced quarterly and checked with certified weights. Calibrated daily. |
| Ion Selective Electrodes | Calibrate as per procedure. |
| Spectrometers | Adjust wavelength for particular test. Set to: Concentration, Absorbance, or Transmittance. Warm up lamp approximately 30 minutes. |
| Inductively Coupled Plasma Mass Spectrometer | Calibration curve constructed from at least three standards and a blank. |

| Table 12.1<br>LIMS Qualifier Codes | |
|---|---|
| **Abbreviation Code for Data Entry** | **Full Description** |
| HBR | Blank Result higher than MRL. Associated Samples are greater than 10 times the Blank concentration. Results are not affected. |
| HBRQD | Blank Result higher than MRL. Suspect data as results are affected. |
| HRPD | High relative percent difference (RPD) due to analysis results near the method reporting limit (<5 times MRL). RPD Limits not applicable. |
| INHOM | High relative percent difference (RPD) due to non-homogeneous sample matrix. RPD Limits not applicable. |
| LCS | Laboratory Control Standard (LCS) “Out of Control” |
| LSRR | Spike Recovery out of range. Sample concentration exceeds the Spike concentration by a factor of 4 or more. Spike Recovery Limits not applicable. |
| SRMI | Spike Recovery out of range due to matrix interference. |
| SRND | Spike Recovery >115% reported sample results <MRL. Data is acceptable for use. |
| QCOUT | Quality Control data out of acceptable limits – data suspect |
| UNC | Uncharacteristic Sample |

**Figure 12.2**
**Evaluation of Method Calibration**

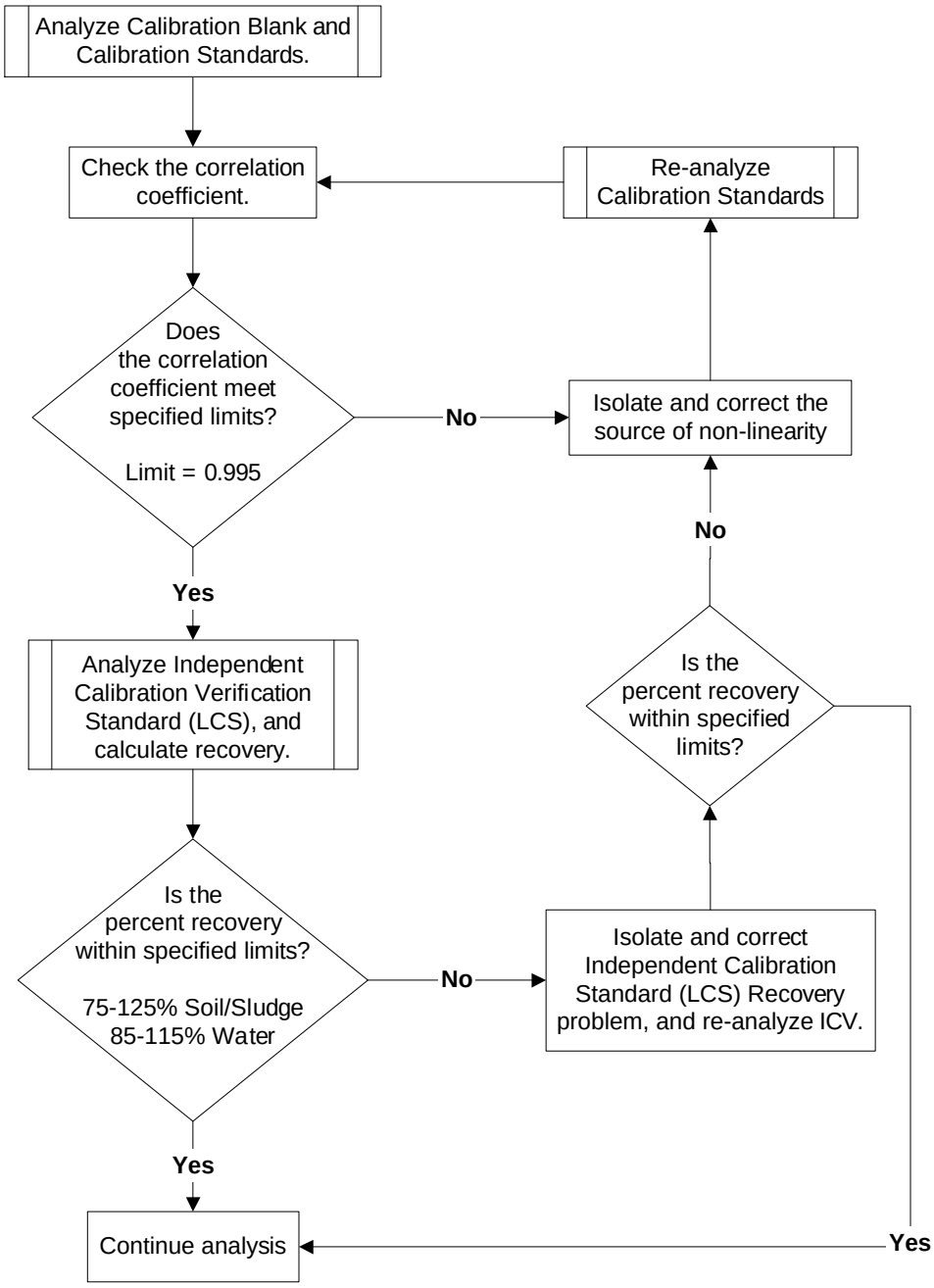


**Figure 12.3**
**Evaluation of Method Blank and Instrument Blank**

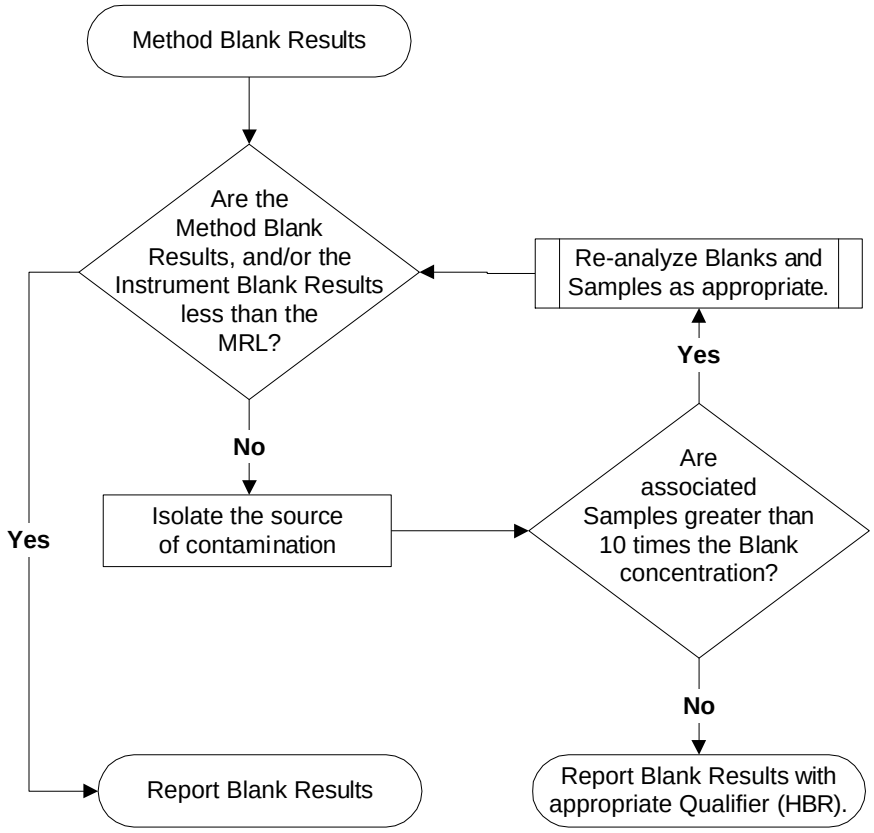
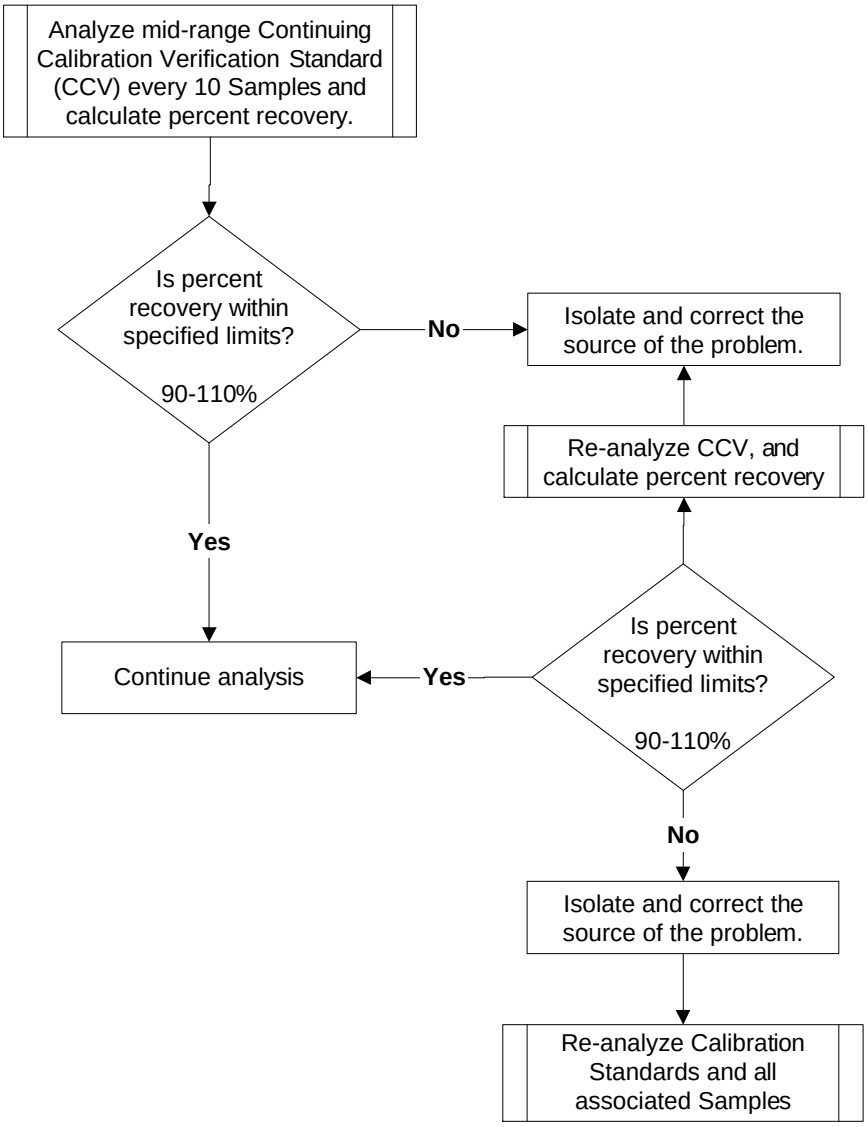


**Figure 12.4**

**Evaluation of Continuing Calibration**



## Figure 12.5

## Evaluation of Duplicate Sample and/or Duplicate Matrix Spike Results

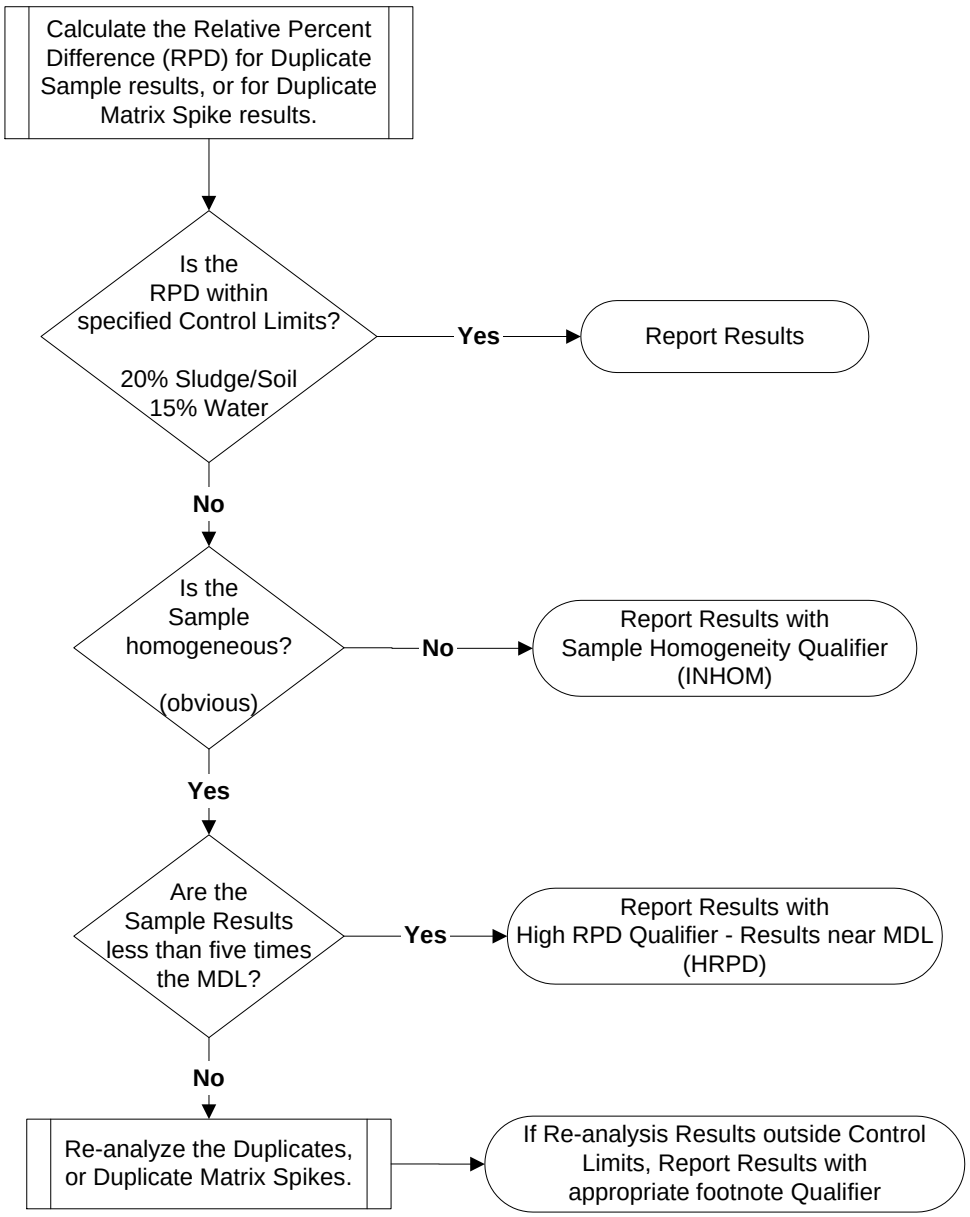


**Figure 12.6**
**Evaluation of Laboratory Control Sample (LCS) Results**

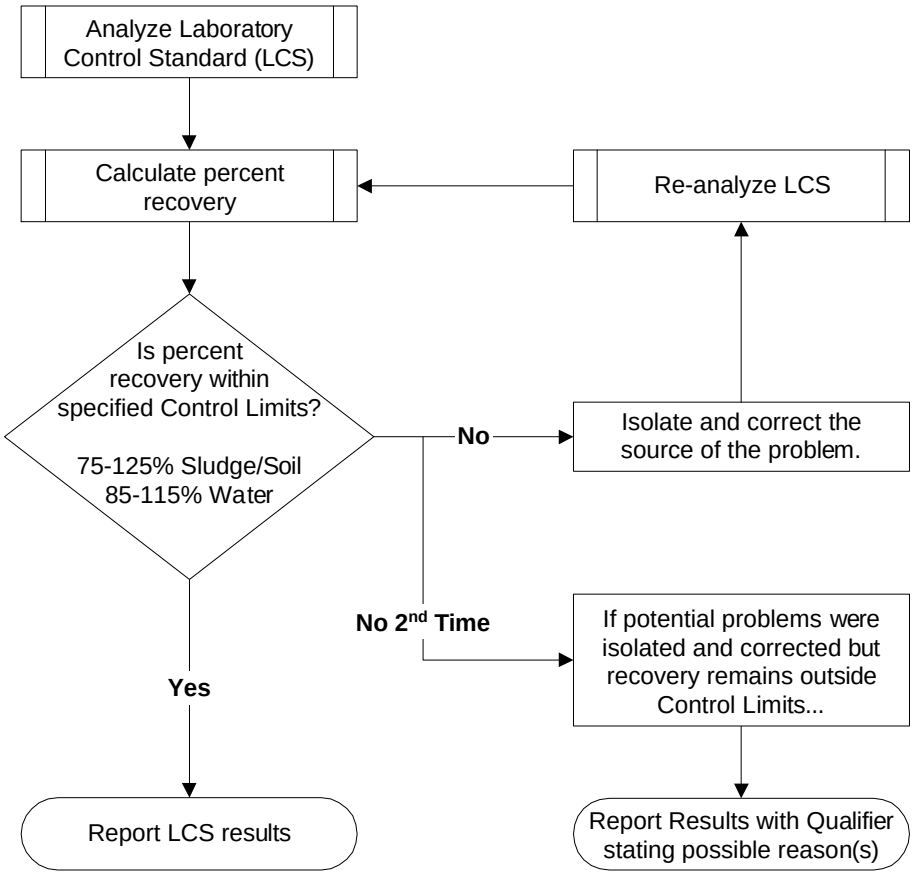


**Figure 12.7**
**Evaluation of Matrix Spike Recoveries**

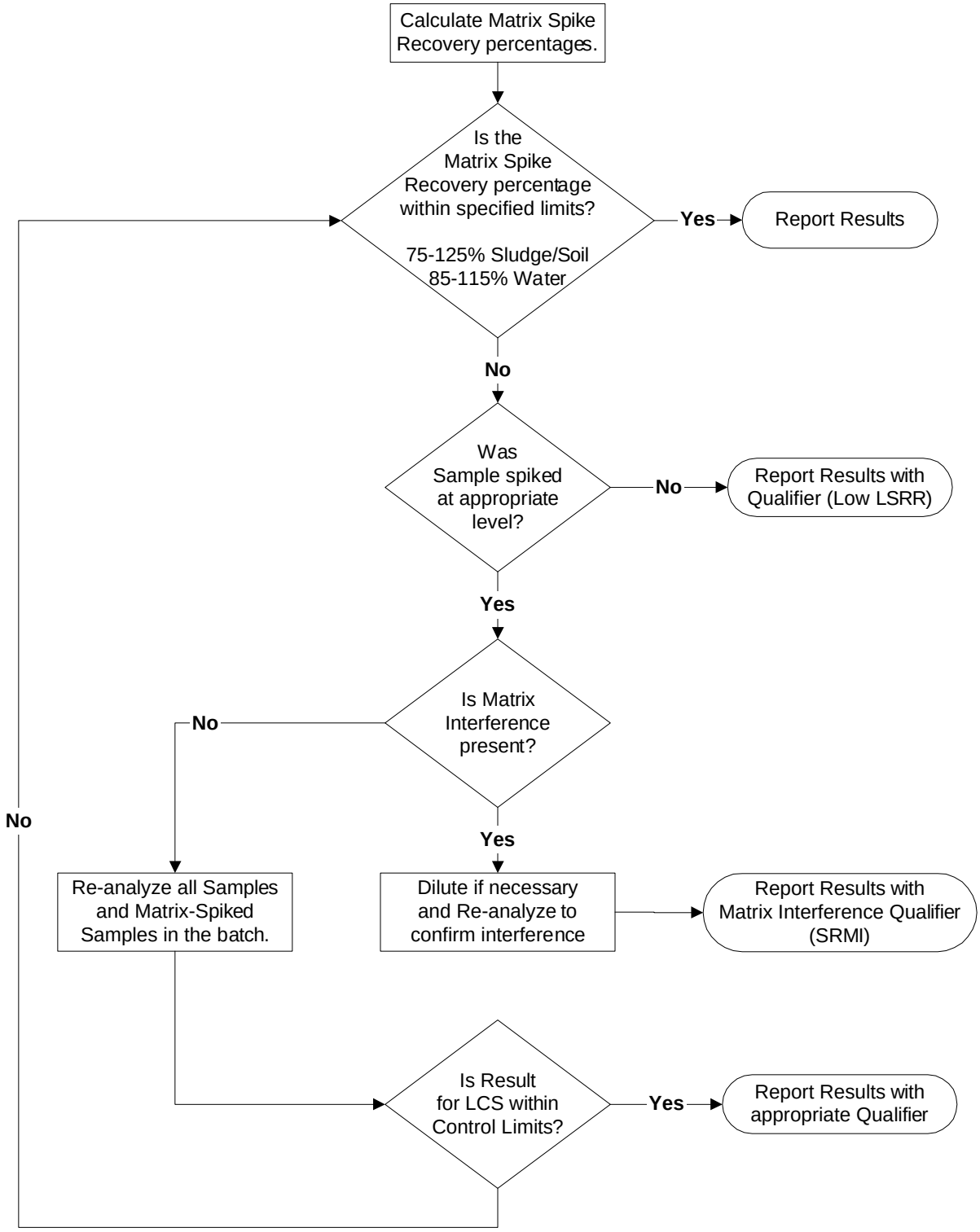
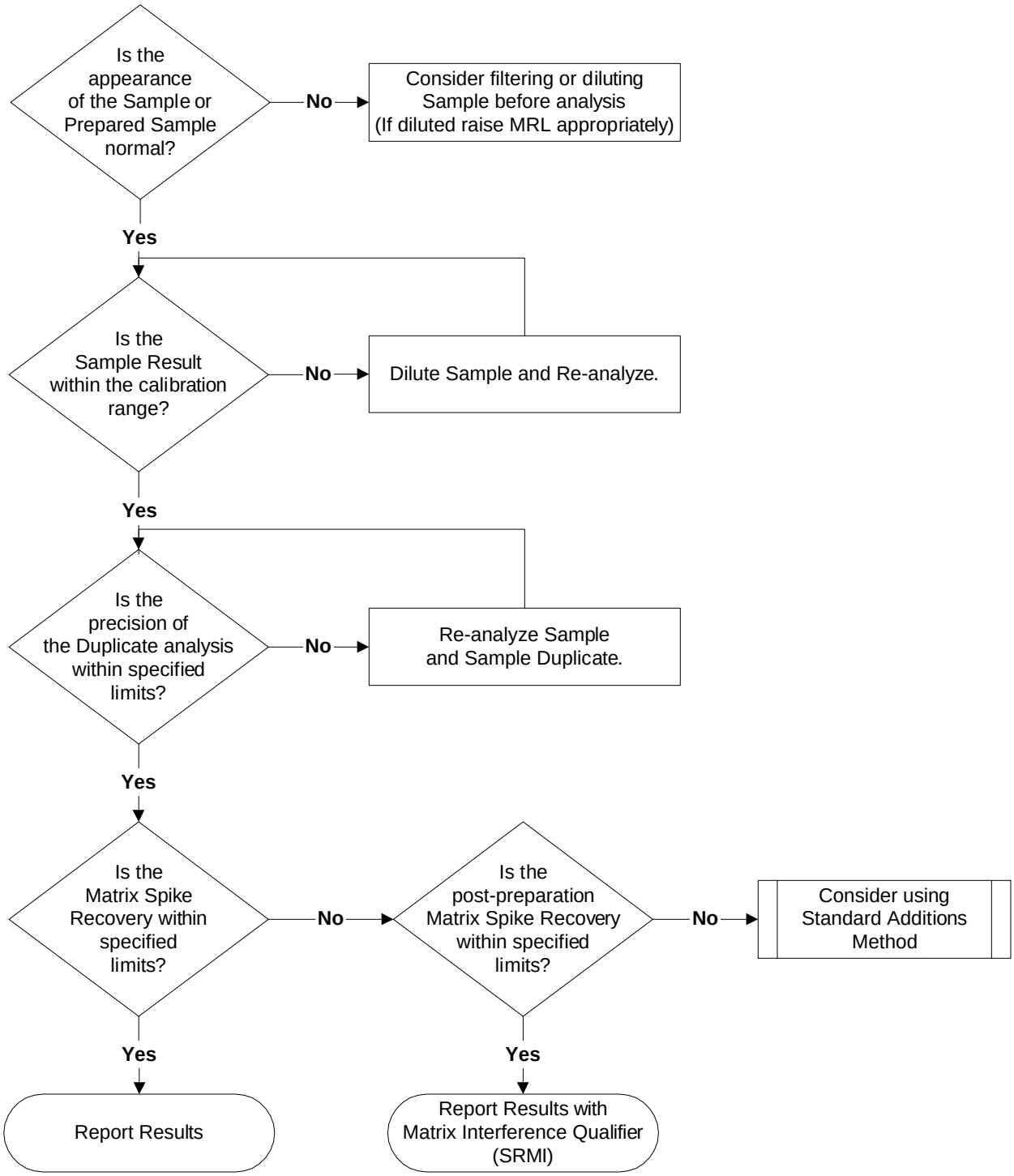


**Figure 12.8**
**Evaluation of Sample Results for Inorganic Analyses**



# Appendix C

# Chlorinated Hydrocarbons
# &
# Multiresidue Pesticide Screen

# Lists and Reporting Limits

| Chlorinated Hydrocarbons | | | | | |
|---|---|---|---|---|---|
| **Analyte** | **Method** | **Preparation Method** | **Detection Limit** | **Reporting Limit** | **Units** |
| 1,1-Dichloroethene | 8260C | 5030B | 0.08 | 0.5 | µg/L |
| cis-1,2-Dichloroethene | | | 0.067 | | |
| trans-1,2-Dichloroethene | | | 0.072 | | |
| Tetrachloroethene (PCE) | | | 0.099 | | |
| Trichloroethene (TCE) | | | 0.1 | | |

## Multiresidue Screen Pesticide List and Reporting Limits, Water

This is a multiresidue profile that incorporates the following methods:

Halogenated Pesticides in Water EPA 8081B (GC-ECD)
Organophosphorous Pesticides in Water EPA 8141B (GC-FPD)
Organonitrogen Pesticides in Water EPA 8270D (GC-MS, SIM mode)
Miscellaneous Pesticides in Water EPA 8321B (HPLC-MS)

| **Organophosphorous and Organosulfur Pesticides** | | | |
|---|---|---|---|
| **Analyte** | **Reporting Limit µg/L** | **Analyte** | **Reporting Limit µg/L** |
| Aspon | 0.30 | Fensulfothion | 0.30 |
| Azinphos-methyl | | Fenthion | |
| Carbofenothion | | Malathion | |
| Chlorfenvinphos | | Methidathion | |
| Chlorpyrifos | | Merphos | |
| Chlorpyrifos-methyl | | Mevinphos | |
| Coumaphos | | Monocrotophos | |
| Demeton | | Parathion | |
| Diazinon | | Parathion-methyl | |
| Dichlorfenthion | | Phorate | |
| Dichlorvos | | Phosmet | |
| Dicrotophos | | Phosphamidon | |
| Dimethoate | | Pirimiphos-methyl | |
| Disulfoton | | Propargite | 0.60 |
| EPN | | Ronnel | 0.30 |
| Thion | | Sulprofos | |
| Ethoprop | | Terbufos | |
| Famphur | | Tetrachlorvinphos | |
| Fenamiphos | | Tokuthion | |
| Fenitrothion | | Tricloronate | |

| Halogenated Pesticides | | | |
|---|---|---|---|
| **Analyte** | **Reporting Limit µg/L** | **Analyte** | **Reporting Limit µg/L** |
| Acetochlor | 0.30 | Endrin ketone | 0.12 |
| Alachlor | 0.30 | Esfenvalerate | 0.12 |
| Aldrin | 0.12 | Ethalfluralin | 0.12 |
| Benfluralin | 0.12 | Etridiazole | 0.12 |
| Bifenthrin | 0.12 | Fenarimol | 0.12 |
| α-BHC | 0.12 | Fenvalerate | 0.12 |
| β-BHC | 0.12 | Flutolanil | 1.2 |
| δ-BHC | 0.12 | Folpet | 0.30 |
| γ-BHC (Lindane) | 0.12 | Heptachlor | 0.12 |
| Captafol | 0.12 | Heptachlor epoxide | 0.12 |
| Captan | 0.30 | Hexachlorobenzene | 0.12 |
| Chlordane | 0.60 | Iprodione | 0.12 |
| Chorobenzilate | 0.30 | Methoxychlor | 0.12 |
| Chloroneb | 0.30 | Metolachlor | 0.30 |
| Chlorothalonil | 0.12 | Mirex | 0.12 |
| Cyfluthrin | 0.60 | Norflurazon | 0.12 |
| Cyhalothrin | 0.60 | Ovex | 0.12 |
| Cypermethrin | 1.2 | Oxadiazon | 0.12 |
| p,p’-DDD | 0.12 | Oxyfluorfen | 0.12 |
| p,p’-DDE | 0.12 | PCA | 0.12 |
| p,p’-DDT | 0.12 | PCNB | 0.12 |
| Dacthal | 0.12 | Permethrin | 1.2 |
| Deltamethrin | 1.2 | Prodiamine | 0.12 |
| Dichlobenil | 0.12 | Pronamide | 0.12 |
| Dicloran | 0.12 | Propachlor | 0.30 |
| Dicofol | 0.30 | Propanil | 0.12 |
| Dieldrin | 0.12 | Propiconazole | 0.30 |
| Dithiopyr | 0.12 | Terbacil | 0.12 |
| Endosulfan I | 0.12 | Toxaphene | 6.0 |
| Endosulfan II | 0.12 | Trifloxystrobin | 0.12 |
| Endosulfan sulfate | 0.12 | Triflumazole | 0.12 |
| Endrin | 0.12 | Trifluralin | 0.12 |
| Endrin aldehyde | 0.12 | Vinclozalin | 0.12 |

| Organonitrogen Pesticides | | | |
|---|---|---|---|
| **Analyte** | **Reporting Limit µg/L** | **Analyte** | **Reporting Limit µg/L** |
| Amitraz | 0.60 | Imidacloprid | 0.30 |
| Ametryn | 0.30 | Isoxaben | 0.12 |
| Atrazine | 0.30 | Mefenoxam | 0.30 |
| Azoxystrobin | 0.12 | Metalaxyl | 0.30 |
| Bensulide | 0.30 | Metribuzin | 0.60 |
| Boscalid | 0.30 | Myclobutanil | 0.60 |
| Bromacil | 0.30 | Oryzalin | 0.30 |
| Bromopropylate | 0.60 | Pendimethalin | 0.12 |
| Carfentrazone-ethyl | 0.30 | Pirimicarb | 0.30 |
| Clothianidin | 0.30 | Prometon | 0.60 |
| Cyanazine | 0.60 | Prometryn | 0.30 |
| Diclofop-methyl | 0.60 | Propazine | 0.30 |
| Dimethenamid | 0.30 | Pyraclostrobin | 0.12 |
| Diphenylamine | 0.30 | Pyridaben | 0.60 |
| Ethofumesate | 0.30 | Pyrimethanil | 0.12 |
| Fenbuconazole | 0.60 | Sethoxydim | 6.0 |
| Fenoxaprop-ethyl | 0.60 | Simazine | 0.60 |
| Fipronil | 0.60 | Simetryn | 0.30 |
| Fluazifop-P-butyl | 0.60 | Sulfentrazone | 0.30 |
| Fludioxanil | 0.60 | Tebuconazole | 0.60 |
| Flumioxazin | 0.30 | Tebuthiruon | 0.60 |
| Flumeturon | 0.12 | Thiabendazole | 0.12 |
| Fluoxypyr-meptyl | 0.30 | Triadimefon | 0.60 |
| Hexazinone | 0.30 | | |

| Phenylurea Pesticides | | | |
|---|---|---|---|
| **Analyte** | **Reporting Limit µg/L** | **Analyte** | **Reporting Limit µg/L** |
| Chlorpropham | 0.30 | Monuron | 0.12 |
| Diuron | 0.12 | Neburon | 0.12 |
| DCPMU | 0.12 | Propham | 0.30 |
| Fenuron | 0.12 | Siduron | 0.12 |
| Linuron | 0.30 | | |

| Carbamate Pesticides | | | |
|---|---|---|---|
| **Analyte** | **Reporting Limit µg/L** | **Analyte** | **Reporting Limit µg/L** |
| Aldicarb | 0.12 | 3-Hydroxycarbofuran | 0.12 |
| Aldicarb sulfone | | Methiocarb | |
| Aldicarb sulfoxide | | Methomyl | |
| Bendiocarb | | Oxamyl | |
| Carbaryl | | Propoxur | |
| Carbofuran | | Thiobencarb | 0.30 |
| Fenobucarb | | | |

| Chlorinated Pesticides | | | |
|---|---|---|---|
| **Analyte** | **Reporting Limit µg/L** | **Analyte** | **Reporting Limit µg/L** |
| 2,4-D | 0.080 | Dichlorprop | 0.080 |
| 2,4-DB | | Dinoseb | |
| 2,4,5-T | | MCPA | |
| 2,4,5-TP | | MCPP | |
| Acifluorfen | | Pentachlorophenol | |
| Bentazon | | Picloram | |
| Clopyralid | | Quinclorac | |
| Dicamba | | Triclopyr | |

# Appendix D

# Standard Operating Procedures (SOPs)

# CITY OF EUGENE – WASTEWATER DIVISION
## Procedure

| | | | |
|---|---|---|---|
| **Subject:** | Chain-of-Custody Form Instructions | **Document No:** | WW - 833 |
| **Reviewed By:** | Michelle Miranda / Tom Mendes | **Original Date:** | 07/22/02 |
| **Approved By:** | EMS Management Team | **Date Approved:** | 7/10/14 |

## Purpose

The purpose of this procedure is to give clear instructions on how to fill out Wastewater Division Chain-of-Custody forms.

## Scope

This procedure covers all Chain-of-Custody forms used in the Wastewater Division and is applicable to all Wastewater Division staff that are responsible for regulatory sample collection activities.

## References

Eugene Wastewater Division Quality Assurance Plan: WW-416
Chain-of-Custody Forms (Wastewater Applications: Shared Documents)

## Definitions

**Chain-of-Custody (COC):** The COC documents sample processing from the time of collection to the time of analysis. It describes who collected the sample, where and when the sample was collected, the type of sample and container, preservative, filtering requirements, the types of analyses required, and addressee for the laboratory report

**DVSW:** The laboratory cost code number relating to the project being collected.

**LIMS:** Laboratory Information Management System used to track laboratory samples and associated information including COC, analytical results, and quality assurance data.

**CPS CODE**: The CPS code is a client / project / site code designated in the LIMS for all routine sample site locations. All sampling staff is provided with a list of CPS codes for their respective sampling programs. If a sample is non-routine then a CPS code will not be required.

## Procedure

**Notes:** All Chain-of-Custody forms can be accessed through the Wastewater Applications site via Shared Documents.

The most important part of the required legal documentation in sample collection is the Chain-of-Custody. Improper sample and data handling or inadequate COC procedures, affects the credibility of analytical results regardless of their accuracy and precision. Thus, it is essential that all samples be properly collected, handled, and analyzed.

In addition, all persons handling the samples must record their signature, date, and time on the COC upon receiving the sample, and upon relinquishing the sample.

| **Accountability:** | **Responsibility:** |
|---|---|
| Sample Collector | **HEADER INFORMATION**<br><br>**Date: _____ Page _of _:** Record the date and page number information at the top of the chain of custody form. (example: Date: 01/28/02 Page 1 of 3)<br><br>**Project Name:** Record the Project Name in the space provided. For routine scheduled samples the project name should match the project name in the Laboratory Information Management System (LIMS). If the project is special or a non-routine project, record the name you would like to see on the final report.<br><br>**Sampler:** Sampler name. Print your full name(s) in the space provided. Initials are not appropriate.<br><br>**Signature:** Sampler Signature. Sign your full name(s) in the space provided. Initials are not appropriate.<br><br>**Work Section:** (DVSW). Record the laboratory cost code number (DVSW) relating to the project being collected (example: BMF well project 8733. See definition above). For other clients that bring samples to the laboratory their specific City program cost codes need to be provided on the COC. If samples are collected for a special project that do not have a cost code we will provide one for the agency prior to the project sample collection.<br><br>The program areas for which the laboratory has assigned DVSW numbers are as follows:<br><br>• Biosolids Management Facility (BMF): 8733<br>• Plant Operations (OPS): 8734<br>• Seasonal Industrial Waste Site (SIWS): 8735<br>• Industrial Source Control (ISC): 8738<br>• Storm Water (SW): 8732 |
| Laboratory Staff | **Batch Number:** Completed when the samples are logged into the LIMS system by a laboratory staff member. |

| | |
|---|---|
| Sample Collector | **MAIN BODY INFORMATION**<br><br>**Sample Location / CPS CODE:** Record individual sample locations or sites. For routinely scheduled samples, the sample location name is the CPS Code that is in the Laboratory Information Management System (LIMS). If the sample is not routine or is a special sample, record the specific site location(s) from which the sample(s) was taken. (See CPS code definition above).<br><br>Clients that bring samples to the laboratory will have specific City program cost codes that need to be provided on the COC. If an outside agency is submitting samples a cost code number will be assigned to them prior to sample collection. See the Laboratory Staff for the appropriate CPS Code |
| Laboratory Staff | **Sample ID:** The Sample ID will be filled in by Laboratory Staff at the time the sample is logged into the LIMS system. |
| Sample Collector | **Sample Matrix:** Use one (1) COC per sample matrix. Record the matrix that most accurately represents the samples (i.e., wastewater = WW, soil = SO, sludge = SL). For multiphase samples (e.g., oil and water), or a non-listed matrix, record "other = OT" and describe the matrix in the comment section provided.<br><br>**Date and Time Collected:** Used for grab samples. Record the date and exact time each sample was collected. Use military time.<br><br>**Start Date and Start Time Collected:** Used for composite samples. Record the date and time the sample collection was started in military time.<br><br>**End Date and End Time Collected:** Used for composite samples. Record the date and time sample collection ended in military time.<br><br>**Multiple Grab Samples Composited in Lab:** Record the date, time, volume, bottle number, preservation information, and composite information.<br><br>**Duration:** Used for composite samples. Record the duration of the sample event in hours. Use fraction of an hour for additional minutes.<br><br>**Bottle Numbers:** Record individual bottle numbers only if this field is available on the COC as it does not apply to all projects.<br><br>**Analysis Requested:** In the vertical spaces denoted "Test Requested", indicate all test codes for which the samples will be analyzed. The test codes listed should match the test codes listed in the LIMS.<br><br>**Miscellaneous Fields:** Some chain-of-custody forms have additional fields to fill out that are specific to a particular project:<br><br>• Sampling equipment information such as set up times, depth to well, purge information, vacuum start times, filtered/unfiltered, etc.<br><br>• Field Analysis such as pH, flow, etc.<br><br>• Sample Preservation Information such as preservative used, volume etc.<br><br>If COC's have fields for this data it must be filled in. |

| | |
|---|---|
| Sample Collector<br>Laboratory Staff | **SIGNATURES AND SPECIAL INSTRUCTIONS**<br><br>**Signatures:** When releasing custody of the samples, use the "Relinquished By" space to sign your full name, date, and time released. After verifying that all samples indicated are present, the person receiving the samples will sign in the "Received By" space to take custody of the samples. |
| Sample Collector | **Rush Y N and Date:** Use this space to indicate a need for rush analysis. Circle Y if a rush is needed and enter a due date for analysis. Circle N for routine turn around times.<br><br>**Comments:** The comment section can be used to specify any special instructions to the laboratory regarding the processing of the samples.<br><br>**Report Attention:** This information is required for non-routine projects. It is not required for routine projects, though it is helpful for appropriate distribution of reports. |

# CHAIN OF CUSTODY / ISC ANALYSIS REQUEST FORM – AMBIENT RIVER ROUTE

**PUBLIC WORKS**
WASTEWATER DIVISION

**Page** _____ **Of** _____

PROJECT NAME: **AMBIENT RIVER ROUTE**

SAMPLER:

SIGNATURE:

WORK SECTION: (DVSW) 8732

BATCH NUMBER:

MATRIX: AMB

REPORT ATTENTION:

Special Sample Handling Requirements:
Rush: Yes ☐ No ☐

ANALYSIS REQUESTED AND BOTTLE NUMBERS

| SAMPLE LOCATION/ CPS CODE | SAMPLE ID | GRAB DATE | GRAB TIME | Field Measurement: pHF | TEMP | DO | Air Temp | A: BOD TDS TSS CON TURB | K: $NH_3$ COD TKN TP $NO_3$ | C: COE COF | TEFLON: HGL ASUMS CDUMS CRUMS CUUMS FEUMS PBUMS MNUMS MOUMS NIUMS SEUMS AGUMS ZNUMS | TEFLON: HGLF ASFMS CDFMS CRFMS CUFMS FEFMS PBFMS MNFMS MOFMS NIFMS SEFMS AGFMS ZNFMS | ICT: CAT MGT HRD | OP: OP | INITIAL WHEN PRESERVED |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Delta Pond FAMBDP1 | | | | | | | | 15 a,b,c | 15 a,b | 15 | FAMBDP1 | | 15 | 15 | |
| Willamette Downstream FAMBMWDS | | | | | | | | 7 a,b,c | 7 a,b | 7 | FAMBWDS | | 7 | 7 | |
| Owosso FAMBOB | | | | | | | | 6 a,b,c | 6 a,b | 6 | FAMBOB | | 6 | 6 | |
| Knickerbocker FAMBKB | | | | | | | | 5 a,b,c | 5 a,b | 5 | FAMBKB | | 5 | 5 | |
| Upstream UGB FAMBUUGB | | | | | | | | 10 a,b,c | 10 a,b | 10 | FAMBUUGB | | 10 | 10 | |
| River Blank FAMBFB | | | | | | | | 9 a,b,c | 9 a,b | 9 | FAMBFB | | 9 | 9 | |
| Duplicate FAMBFD | | | | | | | | 8 a,b,c | 8 a,b | 8 | FAMBFD | | 8 | 8 | |
| Trip Blank | | | | | | | | | | | | Trip Blank | | | |
| | | | | | | | | | | | | | | | |

Comments: LCS information
LCS value_____
LCS Lot #_____

| PRESERVATIVE: | None | $H_2SO_4$ | None | In Lab | $HNO_3$ | None |
|---|---|---|---|---|---|---|
| VOLUME (per bottle): | -- | 1 mL | -- | -- | 3 mL | -- |
| pH (<2 or >12): | -- | < 2 | -- | -- | < 2 | -- |

| Relinquished By (Signature) D | ate | Time | Received By (Signature) | Date | Time |
|---|---|---|---|---|---|
| | | | | | |
| **Relinquished By (Signature)** | **Date** | **Time** | **Received By (Signature)** | **Date** | **Time** |
| | | | | | |

Bottles – 3 A, 2 K, 1 C, 1 ICT, 1 K Ortho, 1 TOC, 1 Teflon per location; 2 AMB

*A contract lab supplied chain and pre-preserved vials are required for AMB samples, log in separately

# CHAIN OF CUSTODY / ISC ANALYSIS REQUEST FORM – AMBIENT LAND ROUTE

**PUBLIC WORKS**
WASTEWATER DIVISION

**Page** _____ **Of** _____

PROJECT NAME: **AMBIENT LAND ROUTE**

SAMPLER:

SIGNATURE:

WORK SECTION: (DVSW) 8732

BATCH NUMBER:

MATRIX: AMB

REPORT ATTENTION:

Special Sample Handling Requirements:
Rush: Yes ☐ No ☐

ANALYSIS REQUESTED AND BOTTLE NUMBERS

| SAMPLE LOCATION/ CPS CODE | SAMPLE ID | GRAB DATE | GRAB TIME | Field Measurement: pHF | Field Measurement: TEMP | Field Measurement: DO | Field Measurement: Air Temp | A: BOD TDS TSS CON TURB | K: $NH_3$ COD TKN TP $NO_3$ | C: COE COF | TEFLON: HGL ASUMS CDUMS CRUMS CUUMS FEUMS PBUMS MNUMS MOUMS NIUMS SEUMS AGUMS ZNUMS | TEFLON: HGLF ASFMS CDFMS CRFMS CUFMS FEFMS PBFMS MNFMS MOFMS NIFMS SEFMS AGFMS ZNFMS | ICT: CAT MGT HRD | OP: OP | VOA*: 1,1-DICHLOROETHENE Cis & trans-1,2- DICHLOROETHENE TRICHLOROETHENE TETRACHLOROETHENE | INITIAL WHEN PRESERVED |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Amazon @ Royal FAMBA_R | | | | | | | | 3 a,b,c | 3 a,b | 3 | FAMBA_R | | 3 | 3 | | |
| A Channel @ Royal FAMBACR | | | | | | | | 2 a,b,c | 2 a,b | 2 | FAMBACR | | 2 | 2 | | |
| A Channel @ Terry St FAMBA_US | | | | | | | | 13 a,b,c | 13 a,b | 13 | FAMBA_US | | 13 | 13 | | |
| Amazon @ RR FAMBACUS | | | | | | | | 14 a,b,c | 14 a,b | 14 | FAMBACUS | | 14 | 14 | | |
| Willow Creek FAMBWC | | | | | | | | 4 a,b,c | 4 a,b | 4 | FAMBWC | | 4 | 4 | | |
| M2 (Amazon) FAMBM2 | | | | | | | | 1 a,b,c | 1 a,b | 1 | FAMBM2 | | 1 | 1 | | |
| East Beacon Drive FAMBEBD | | | | | | | | 16 a,b,c | 16 a,b | 16 | FAMBEBD | | 16 | 16 | | |
| Land Blank FAMBFB | | | | | | | | 12 a,b,c | 12 a,b | 12 | FAMBFB | | 12 | 12 | | |
| Duplicate FAMBFD | | | | | | | | 11 a,b,c | 11 a,b | 11 | FAMBFD | | 11 | 11 | | |
| Trip Blank | | | | | | | | | | | | Trip Blank | | | | |

Comments: LCS information
LCS value_____
LCS Lot #_____

| PRESERVATIVE: | None | $H_2SO_4$ | None | In Lab | $HNO_3$ | None | HCl* |
|---|---|---|---|---|---|---|---|
| VOLUME (per bottle): | -- | 1 mL | -- | -- | 3 mL | -- | -- |
| pH (<2 or >12): | -- | < 2 | -- | -- | < 2 | -- | < 2 |

| Relinquished By (Signature) | Date | Time | Received By (Signature) | Date | Time |
|---|---|---|---|---|---|
| | | | | | |
| **Relinquished By (Signature)** | **Date** | **Time** | **Received By (Signature)** | **Date** | **Time** |
| | | | | | |

Bottles – 3 A, 2 K, 1 C, 1 ICT, 1 K Ortho, 1 TOC, 1 Teflon per location;
3 VOA at select locations dependent on monitoring requirements

*A contract lab supplied chain and pre-preserved vials are required for VOA samples

# CHAIN OF CUSTODY – FLOW-BASED STORM EVENT MONITORING, FOCUSED BASIN, COMPOSITE

**PUBLIC WORKS**
WASTEWATER DIVISION

**Page** _____ **Of** _____

PROJECT NAME: **Flow-Based Storm Event Monitoring, Focused Basin, Composite**

SAMPLER:

SIGNATURE:

WORK SECTION:
(DVSW) 8732

BATCH NUMBER:

MATRIX: SW

REPORT ATTENTION:

Special Sample Handling Requirements:
Rush: Yes ☐ No ☐

ANALYSIS REQUESTED AND BOTTLE NUMBERS

| SAMPLE LOCATION | CPS CODE | SAMPLE ID | GRAB DATE | GRAB TIME | COMP START DATE | COMP START TIME | COMP END DATE | COMP END TIME | DURATION (HOURS) | A: BOD TDS TSS CON TURB | K: $NH_3$ COD TKN TP $NO_3$ | OP: OP | I-CHEM: HGL ASUMS CDUMS CRUMS CUUMS FEUMS PBUMS MNUMS MOUMS NIUMS SEUMS AGUMS ZNUMS | I-CHEM: HGLF ASFMS CDFMS CRFMS CUFMS FEFMS PBFMS MNFMS MOFMS NIFMS SEFMS AGFMS ZNFMS | I-CHEM: CAT MGT HRD | INITIAL WHEN PRESERVED |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |
| Field Blank | CSWCLBLK | | | | | | | | | | | | | | | |
| Field Duplicate | CSWCLDUP | | | | | | | | | | | | | | | |

Comments:

☐ Sample Bottles Sealed and Placed in Lab Refrigerator

| PRESERVATIVE: | None | $H_2SO_4$ | None | In Lab | $HNO_3$ |
|---|---|---|---|---|---|
| VOLUME (per bottle): | -- | 1 mL | -- | -- | 3 mL |
| pH (< 2 or >12): | -- | < 2 | -- | -- | < 2 |

| Relinquished By (Signature) | Date | Time | Received By (Signature) | Date | Time |
|---|---|---|---|---|---|
| | | | | | |
| Relinquished By (Signature) | Date | Time | Received By (Signature) | Date | Time |
| | | | | | |

Bottles – 2 A, 2 K, 1 OP, 3 I-CHEM

# CHAIN OF CUSTODY – FLOW-BASED STORM EVENT MONITORING, FOCUSED BASIN, GRAB

**PUBLIC WORKS**
WASTEWATER DIVISION

**Page** _____ **Of** _____

PROJECT NAME: **Flow-Based Storm Event Monitoring, Focused Basin, Grab**

SAMPLER:

SIGNATURE:

WORK SECTION:
(DVSW) 8732

BATCH NUMBER:

MATRIX: SW

REPORT ATTENTION:

Special Sample Handling Requirements:
Rush: Yes ☐ No ☐

ANALYSIS REQUESTED AND BOTTLE NUMBERS

| SAMPLE LOCATION | CPS CODE | SAMPLE ID | GRAB DATE | GRAB TIME | Field Measurement pHF | DO | TEMP | C COE COF | VOA[1] $8260C/5030B 1,1-DICHLOROETHENE cis-1,2-DICHLOROETHENE trans-1,2- DICHLOROETHENE TRICHLOROETHENE TETRACHLOROETHENE | PAL[1] Multiresidue Pesticide Screen $8081B $8141B $8270D $8321B | INITIAL WHEN PRESERVED |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| Field Blank | CSWGFB | | | | | | | | | | |
| Field Duplicate | CSWGFD | | | | | | | | | | |

Comments:

☐ Sample Bottles Sealed and Placed in Lab Refrigerator

LCS information

LCS Lot #:_____

LCS Value:_____

| PRESERVATIVE: | None | HCl[2] | None |
|---|---|---|---|
| VOLUME: | -- | -- | -- |
| pH (<2 or >12): | -- | <2 | -- |

| Relinquished By (Signature) | Date | Time | Received By (Signature) | Date | Time |
|---|---|---|---|---|---|
| | | | | | |
| Relinquished By (Signature) | Date | Time | Received By (Signature) | Date | Time |
| | | | | | |

Bottles – 1 C, 3 VOA[1,2], 2 PAL[1]

[1] Contract lab chain-of-custody and supplied sample containers are required
[2] VOA vials are prepreserved

# CITY OF EUGENE – WASTEWATER DIVISION
## Procedure

| | | | |
|---|---|---|---|
| **Subject:** | Field Measurement of Conductivity | **Document No:** | SAMP - 834 |
| **Reviewed By:** | Michelle Miranda / Tom Mendes | **Original Date:** | 07/08/03 |
| **Approved By:** | Management Team | **Date Approved:** | 7/10/14 |

## Purpose

This procedure describes instrument calibration and measurement of specific conductance

## Scope

Conductivity is a numerical expression of the ability of an aqueous solution to carry an electric current. This ability depends on the presence of ions, their concentration, mobility, valence, and the temperature of the water sample. This procedure can be used to measure specific conductance of surface and ground water samples.

## References

Eugene Wastewater Division Quality Assurance Plan: WW-416
Sample Quality Assurance / Quality Control Procedure: SAMP-854
Instrument Manufacturer's Materials

## Equipment & Supplies

- Portable field conductivity probe and meter/sonde with automatic temperature correction
- Standard conductivity solutions: Solutions can be obtained from the laboratory.
- Laboratory Control Sample (LCS): This QA/QC Control Sample is available from the laboratory.
- Deionized (DI) water and squirt bottle
- Appropriate Field Data Sheet(s)

## Procedure

### Notes

- If the sample temperature differs from the standard conductivity solution by more than 2 °C, the measured conductivity values must be corrected. Instruments are equipped with automatic or manual compensators that electronically adjust for temperature differences. Refer to the instrument manufacturer's instructions. If necessary, the Field Measurement of Temperature in Ground Water Procedure: SAMP-856 should be done in conjunction with this procedure.

- The field technician will use a 1-point instrument calibration. The range of standard conductivity solutions used for calibration is largely determined by the range of conductivity values anticipated for the samples. Use a Standard of at least 1,000 µmhos/cm (µS/cm) to calibrate the meter/sonde.

- Instrument calibration must be performed daily just before use.

### A. Instrument Calibration

1. Read and follow all of the manufacturer's operating and calibration instructions.

2. Clean the conductivity cell with the supplied soft brush before calibrating.

3. Thoroughly rinse calibration cup with DI water.

4. Pour a small amount of rinse standard conductivity solution into the calibration cup.

5. Tighten the calibration cup onto the meter/sonde.

6. Gently rock the meter/sonde to allow the probe to be rinsed with the solution. Repeat the rinse with fresh standard solution.

7. Discard the rinse standard, then refill the calibration cup with fresh calibration standard. Tighten the calibration cup onto the meter/sonde.

8. Carefully immerse the probe end of the meter/sonde into the solution, making sure the standard is above the vent holes on the conductivity sensor. Gently rotate and/or move the meter/sonde up and down to remove any bubbles from the conductivity cell.

9. Allow at least one minute for temperature equilibration before proceeding.

10. When the readings are stable, apply to accept this calibration point.

11. Rinse the meter/sonde and sensors in DI water and gently shake to dry.

12. After the instrument has been calibrated, measure the specific conductance of the LCS. Record the conductivity and temperature readings on the Field Data Sheet and the Calibration Log Book. Calculate the relative difference between the measured value and the known value. The RPD must be within 15%. Repeat instrument calibration if the QC objective is not met.

## B. Field Sample Measurement

1. Pour sufficient sample into a plastic sample cup and immerse the probe, ensuring the probe is completely submersed. Gently shake the probe to release air bubbles. Withdraw the probe from the sample cup and discard the sample.

2. Pour a fresh aliquot of sample into the plastic cup and immerse the probe, again ensure the probe is completely submersed and shake the probe gently to release any air bubbles.

3. The conductivity readings should stabilize fairly quickly. Record the specific conductance value to the nearest significant figure on the Field Data Sheet.

4. Discard the sample and rinse the probe well with DI water between samples.

5. Refer to instructions in Section D for additional QA/QC requirements.

6. Place the probe in its sleeve containing DI water or the solution recommended by the manufacturer for storage.

## C. Calculation

1. Display will vary by meter. Make sure to follow the instrument instructions for correct calculation.

2. Make sure the correct reporting units are recorded on the Field Data Sheet.

## D. Quality Assurance / Reporting

1. Method Reporting Limit <5 µmhos/cm.

2. Data Quality Objectives Precision (RPD) 15%, Accuracy (% Recovery) 85% - 115%.

3. Rough transport conditions may result in maladjustment of field equipment calibration. Check the conductivity of at least one standard on a frequent basis to ensure accuracy of sample specific conductance values.

4. QC Frequency:
   a. Field Sample Duplicates: Every 10 samples or batch.
   b. Laboratory Control Sample: Every 10 samples or batch.

**Users of this document are responsible to ensure it is the most current version. Otherwise this document is invalid.**

# CITY OF EUGENE – WASTEWATER DIVISION
## Procedure

| | | | |
|---|---|---|---|
| **Subject:** | Decontamination of Field Equipment | **Document No:** | SAMP-851 |
| **Reviewed By:** | Marc Furney / Tom Mendes | **Original Date:** | 07/08/03 |
| **Approved By:** | Michelle Miranda | **Date Approved:** | 7/1/14 |

### Purpose

The purpose of this procedure is to describe the general cleaning techniques for field equipment used to collect surface and ground water samples. Decontamination of field equipment is critical to

- ensure that samples will be as free as possible from contaminants that are not contained within the sample itself;
- ensure the statistical validity of analytical results by reducing systematic error; and
- ensure longevity of the sampling equipment.

### Scope

This cleaning procedure is general – the technician is required to review and follow all cleaning and maintenance instructions specified by the manufacturer. When cleaning instructions are deficient or are not specified by the manufacturer, these cleaning guidelines will be implemented.

Field equipment such as sampling pumps, water level meters, and other equipment used to collect surface and ground water samples, can be cleaned following this general procedures.

### References

Eugene Wastewater Division Quality Assurance Plan: WW-416
Instrument Manufacturer Materials

### Safety Requirements

Wear safety glasses, latex gloves, and protective clothing while cleaning field equipment.

### Equipment & Supplies

- 3-5 gallon plastic bucket
- Plastic scrub brushes
- Solution of laboratory-grade detergent
- Potable rinse water
- Deionized water

## Procedure

The following table describes the cleaning procedure and maintenance tasks for various field sampling equipment.

| Equipment | Frequency | Cleaning Technique |
|---|---|---|
| Water Level Meter | After each use | 1. Rinse the probe and cable thoroughly with deionized water. |
| | Before taking the meter into the field for use | 1. This cleaning procedure is done quarterly to remove bio-films that may build up on the cable and probe.<br>2. Prepare a wash solution using laboratory-grade detergent as per manufacturer's instructions to fill a 3 to 5 gallon bucket.<br>3. Un-spool the cable into the bucket taking care to minimize tangles.<br>4. While re-spooling the cable, run the cable through a clean laboratory cloth.<br>5. Discard the wash solution.<br>6. Repeat the process using potable water.<br>7. Repeat the process using deionized water. |
| Peristaltic Pump | After each use | 1. Prepare one gallon of wash solution using laboratory-grade detergent as per manufacturer's instructions.<br>2. Insert the suction tube of the pump into the solution, adjust the pump to low flow and turn the pump on.<br>3. Pump a few cups of the solution through the tubing, discarding the solution.<br>4. Repeat the process using potable water.<br>5. Repeat the process using deionized water. |
| | As necessary | 1. Replace the section of tubing in the peristaltic pump if discolored, or if the tubing becomes worn and collapses easily. |
| Other field equipment | After each use or as necessary | 1. All sampling equipment that comes into contact with the sample must be cleaned before sample collection.<br>2. Cleaning can generally be done using a mild solution of laboratory-grade detergent followed by thorough rinses with potable water and deionized water.<br>3. Read and follow the manufacturer's instructions for cleaning and performing maintenance!<br>4. Do not immerse electrical equipment unless specifically instructed to do so. |

# CITY OF EUGENE – WASTEWATER DIVISION
## Procedure

| | | | |
|---|---|---|---|
| **Subject:** | Field Measurement of pH (Electrometric) | **Document No:** | SAMP - 853 |
| **Reviewed By:** | Mike Lillie | **Original Date:** | 07/07/03 |
| **Approved By:** | EMS Management Team | **Date Approved:** | 3/25/14 |

## I. Purpose

This procedure describes instrument calibration and measurement of field samples for pH.

## II. Scope

This procedure can be used to measure pH of wastewater, industrial, sludge, biosolids, stormwater, surface water, and ground water samples.

## III. References

Eugene Wastewater Division Quality Assurance Plan: WW-416
Sample Quality Assurance / Quality Control Procedure: SAMP-854
Standard Methods 4500H+B for pH collection and analysis
EPA Method 150.1
Instrument Manufacturer's Materials

## IV. Equipment & Supplies

A. Portable field pH probe and meter with automatic or manual temperature correction
B. Standard buffer solutions: pH 4.0, 7.0, and 10.0; Buffers validated by comparison to NBS standards are available from commercial lab suppliers.
C. Instrument Calibration Log Book
D. Laboratory Control Sample (LCS): This QA/QC control sample is available from the laboratory for verification of instrument calibration. Note LCS name, batch number, expiration date, and date opened in the Instrument Calibration Log Book.
E. Deionized water and squirt bottle
F. Appropriate Field Data Sheet(s)

## V. Procedure

### A. Notes

**1.** If the sample temperature differs from the buffer solution by more than 2 °C, the measured pH values must be corrected. Instruments are equipped with automatic or manual compensators that electronically adjust for temperature differences. Refer to the instrument manufacturer's instructions. The Field Measurement of Water Temperature Procedure, SOP-856, must be done in conjunction with this procedure.

2. The field technician will use either a 3-point instrument calibration or 2-point calibration with a third buffer check. The calibration method selected is largely determined by the capabilities of the pH meter.

3. Instrument calibration must be performed daily just before use.

B. 3-Point Calibration of Field pH Meter

1. Review and follow manufacturer's instructions for instrument operation and calibration.

2. Pour fresh buffer solutions into clean containers.

3. Place probe into the buffer and swirl gently.

4. Calibrate the meter for the first buffer solution according to the manufacturer's instruction manual.

5. Observe the calibrated pH value and record in the Instrument Calibration Log Book.

6. Remove probe from first buffer solution, rinse probe with deionized water and gently shake the excess water off the probe.

7. Repeat steps 2 through 6 for the remaining buffers.

8. If the meter provides the slope, record the value in the Instrument Calibration Log Book.

9. Check meter calibration with know LCS value and record pH value in the instrument Calibration log book, COC's, and field data sheets.

10. Record LCS bottle lot # in Instrument Calibration Log book, COC's, field data sheets.

C. 2-Point Calibration of Field pH Meter

*Either*: Calibrate pH meter with 7.0 and 10.0 buffers and use a third buffer that's 3 pH units different to check calibration. The check must be within 0.1 pH unit of the third buffer or the meter will need to be recalibrated. If any sample measures less than pH 6.5, recalibrate meter with 7.0 and 4.0 buffers.

*Or*: Calibrate pH meter with 7.0 and 4.0 buffers and use a third buffer that's 3 pH units different from the others to check calibration. The check standard must be within 0.1 pH unit of the third buffer or the meter will need to be recalibrated. If any sample measures greater than pH 7.5, recalibrate meter with 7.0 and 10.0 buffers.

D. Sample pH Field Measurement

1. Calibrate the field meter as described above.

2. Rinse a clean sample cup with the sample and discard. Refill the sample cup and immerse the sensing element of the pH probe. Gently swirl the sample water around the sensing element for about 30 seconds and discard the sample.

3. Collect additional sample minimizing agitation to prevent aeration. Refill the sample cup with sample and immerse the sensing element. Allow the pH probe to sit in the sample undisturbed for 1 minute or until the pH value stabilizes. Record the pH value to the nearest 0.01 pH Unit on the Field Data Sheet.

4. Discard the sample and thoroughly rinse the probe with deionized water three times between samples.

5. For industrial samples, if pH results indicate a violation, check the meter against an LCS to verify the meter's accuracy. Record the LCS measurement on the Chain-of-Custody.

6. Refer to the QA/QC instructions below for measurement of Field Sample Duplicates.

E. Laboratory pH Measurement

Field Sample Duplicates for laboratory pH measurement are collected following the Sample Quality Assurance / Quality Control Procedure, SAMP-854.

F. Calculation

pH meters read directly in pH units. For final reporting purposes, pH is reported to the nearest 0.01 unit and temperature to the nearest 0.1 °C.

G. Quality Assurance / Reporting

1. A Field Sample Duplicate is simply obtained by pouring two aliquots of the sample and measuring the pH of both in an expedient manner to minimize drift. Field Sample Duplicates are collected following the Sample Quality Assurance / Quality Control Procedure, SAMP-854. Record the Field Sample Duplicate measurement on the Field Data Sheet.

2. Rough transport conditions may result in maladjustment of field equipment calibration. Check the pH of at least one standard on a frequent basis to ensure accuracy of sample pH values.

3. A post operation calibration check should be done before the meter is stored at the end of the day. Check the calibration of the meter against the standard buffer solutions and record the values in the Instrument Calibration Log Book.

4. Method Reporting Limit: NA.

5. Sample Data Quality Objectives Precision ± 0.2 Standard pH Units; Buffer Standards and LCS Accuracy ± 0.1 Standard pH Units.

6. QC Frequency:

a. Duplicates: Every time pH meter is calibrated and used.
b. Laboratory Control Sample (LCS): Once a day. Record the measurement on a Field Data Sheet, Chain-of-Custody, or in the Instrument Calibration Log Book.
c. Calibration Check: Once a day or additional as needed.

# CITY OF EUGENE – WASTEWATER DIVISION
## Procedure

| | | | |
|---|---|---|---|
| **Subject:** | Field Measurement of Water Temperature | **Document No:** | SAMP - 856 |
| **Reviewed By:** | Michelle Miranda / Tom Mendes | **Original Date:** | 07/07/03 |
| **Approved By:** | Michelle Miranda | **Date Approved:** | 7/10/14 |

### Purpose

This procedure describes field measurement of water temperature.

### Scope

This procedure can be used to measure water temperature of surface and ground water samples.

### References

Eugene Wastewater Division Quality Assurance Plan: WW-416
Sample Quality Assurance / Quality Control Procedure: SAMP-854
Instrument Manufacturer's Materials

### Definitions

NIST – National Institute of Standards and Technology

### Equipment & Supplies

- Meter or thermometer calibrated against a NIST-traceable thermometer capable of measuring temperature to the nearest 0.5 ˚C.
- Deionized water and squirt bottle
- Appropriate Field Data Sheet

**Note:** Many field meters have built-in thermometers that are suitable for measuring water temperature of surface and ground water samples.

### Instrument Calibration

**Quarterly Temperature Calibration/Check** – Calibration of field meters or thermometers used to measure temperature in the field must be done on a quarterly basis. All calibration information will be recorded in field notebooks.

**Meter:**
If a field meter equipped to measure water temperature will be used, review and follow manufacturer's instructions for instrument operation and calibration. Record any calibration/adjustments made on the Field Data Sheet. Calibration is usually accomplished by comparing temperature readings from the meter and NIST-traceable thermometer while simultaneously immersed in water. The calibration includes two temperatures which bracket the anticipated range of field sample.

**Thermometer:**
If a thermometer will be used to measure water temperature, examine the thermometer for breaks in the fluid column. If breaks are observed, shake the thermometer to force the fluid into the reservoir. Replace the thermometer if fluid breaks cannot be removed. Calibrate the thermometer following the sample procedure described above.

## Procedure

### A. Sample Temperature Measurement

1. Rinse a clean plastic container with sample water. Refill the container and immediately immerse the probe/thermometer into the middle of the sample, taking care not to rest the probe/thermometer against the sample container.

**Note:** The plastic container should be sufficiently large enough to minimize temperature drift due to heating/cooling while handling.

2. Allow the temperature to stabilize and record the temperature to the nearest 0.5 ˚C on the Field Data Sheet. Discard the sample and rinse the probe/thermometer with deionized water.

3. Refer to the QA/QC instructions below for measurement of Field Sample Duplicates. Collect the Field Sample and Field Duplicate simultaneously and measure the temperature in both in an expedient manner to minimize temperature drift due to heating/cooling while handling.

### B. Calculation

1. Temperature meters read directly in temperature units. Report temperature to the nearest 0.5 °C.

### C. Quality Assurance / Reporting

1. A Field Sample Duplicate is simply obtained by pouring two aliquots of the sample and measuring the water temperature of both in an expedient manner to minimize drift. Record the Field Sample Duplicate measurement on the Field Data Sheet.

2. Method Reporting Limit: NA.

3. Data Quality Objectives Precision (RPD) 15%.

4. QC Frequency: Duplicates: Every 10 samples or batch.

# CITY OF EUGENE – WASTEWATER DIVISION
## Procedure

| | | | |
|---|---|---|---|
| **Subject:** | Field Measurement of Dissolved Oxygen | **Document No:** | SAMP -1208 |
| **Reviewed By:** | Michelle Miranda / Tom Mendes | **Original Date:** | 4/15/ 05 |
| **Approved By:** | Tom Mendes | **Date Approved:** | 7/10/14 |

## Purpose

This procedure describes instrument calibration and measurement of field samples for Dissolved Oxygen.

## Scope

This procedure can be used to measure dissolved oxygen of surface and ground water samples.

## References

Eugene Wastewater Division Quality Assurance Plan: WW-416
Sample Quality Assurance / Quality Control Procedure: SAMP-854
Operations and Maintenance manuals for testing equipment

## Equipment & Supplies

- Portable field dissolved oxygen probe and meter.
- Deionized (DI) water and squirt bottle
- Appropriate Field Data Sheet(s)

## Procedure

NOTE: Instrument calibration must be performed daily just before use.

### A. Calibration of Field Dissolved Oxygen Meter

1. Review and follow manufacturer's instructions for instrument operation and calibration.
2. Check probe membrane. Be certain that membrane is free of air bubbles.
3. Make sure sponge inside probe housing is damp.
4. Turn meter on.
5. Observe the dissolved oxygen readout. When the dissolved oxygen values have stabilized adjust the instrument as necessary.
6. After the instrument has been calibrated record the dissolved oxygen reading on the Field Data Sheet.

### B. Sample DO Field Measurement

1. Calibrate the field meter as described above.
2. Place probe in sufficient sample to point of emersion.
3. Gently swirl the probe while monitoring the dissolved oxygen readings, taking care to ensure probe remains fully immersed in the sample. The dissolved oxygen readings should stabilize after a minute or two.

4. Record the dissolved oxygen value to the nearest 0.1 mg/L Dissolved Oxygen on the Field Data Sheet.

5. Discard the sample and rinse the probe with DI water between samples.

6. Refer to the QA/QC plan for measurement of Field Sample Duplicates.

## C. Quality Assurance / Reporting

1. A Field Sample Duplicate is simply obtained by pouring two aliquots of the sample and measuring the DO of both in an expedient manner to minimize drift. Field Sample Duplicates are collected following the Sample Quality Assurance / Quality Control Procedure: SAMP-854. Record the Field Sample Duplicate measurement on the Field Data Sheet.

2. Rough transport conditions may result in maladjustment of field equipment calibration. Check the DO of at least one reference on a frequent basis to ensure accuracy of sample DO values.

3. Method Reporting Limit: NA.

4. Data Quality Objectives Precision (RPD) 15%, Accuracy (% Recovery) 85% - 115%.

5. QC Frequency:

   a. Duplicates: Every 10 samples or batch.
   b. Internal Calibration Check Standard: Once a day or additional as needed.

# CITY OF EUGENE – WASTEWATER DIVISION
## Procedure

| | | | |
|---|---|---|---|
| **Subject:** | Sample Quality Assurance / Quality Control Procedure | **Document No:** | SAMP - 854 |
| **Reviewed By:** | Marc Furney | **Original Date:** | 07/08/03 |
| **Approved By:** | Management Team | **Date Approved:** | 11/2/11 |

## Purpose

This procedure describes the Quality Assurance / Quality Control (QA/QC) protocol to be implemented when collecting field samples. It describes what types of QA/QC samples are to be collected.

## Scope

This procedure is applicable to the collection of surface and ground water samples.

## Definitions

Field Equipment Blank – A field sample prepared by passing deionized water over/through the equipment used to collect environmental samples and submitting it to the laboratory for processing as a regular sample. The analytical results are used to determine whether cross contamination or introduction of foreign materials occurs during the field sampling process.

Trip Blank – A sample prepared by the laboratory to accompany the field-sampling event at all times. It is submitted to the laboratory for analysis as a regular sample.

Field Sample Duplicate – A sample collected at the same time as the regular field sample and submitted to the laboratory for processing as a regular sample. The analytical results are used to determine precision of the sampling and analysis procedures. Depending on the type of analyses and method of sample collection, sufficient volume of sample is first collected in a large container and poured into the suite of sample containers, or samples are collected in rapid succession using identical sampling procedures.

## References

Eugene Wastewater Division Quality Assurance Plan: WW-416

Chain-of-Custody Procedure: WW-833

Decontamination of Field Equipment: SAMP-851

## QA/QC Sample Schedule

| QA/QC Sample Type | Prepared By | Frequency of Collection |
|---|---|---|
| Laboratory Trip Blank | Laboratory | One per Sampling Event |
| Field Equipment Blank | Field Sampling Technician | One per Day |
| Field Sample Duplicate | Field Sampling Technician | One per Day<br>or<br>One per 10 Samples |

## Procedure

| QA/QC Sample Type | Preparation/Handling Instructions |
|---|---|
| Laboratory Trip Blank | 1. During preparation of sample containers, review the sampling schedule with the laboratory lead to determine which parameters require trip blanks. Have the laboratory prepare the necessary trip blanks.<br><br>2. Trip Blanks will accompany the field-sampling event at all times. If the laboratory has not already done so, label the sample container(s) as "Trip Blank".<br><br>3. Package the Trip Blank in a protective bag as regular samples. Store it in a sample cooler at all times with sufficient ice to maintain the cooler at 4 °C. Never open the Trip Blank containers!<br><br>4. Process the Trip Blank as regular samples, recording it on the chain-of-custody form (see Chain-of-Custody Procedure) and checking off the appropriate analyses. |
| Field Equipment Blank | 1. Field Equipment Blanks are prepared after decontamination of field equipment (see Decontamination of Field Equipment Procedure).<br><br>2. Obtain sufficient deionized water to fill the suite of sample containers used for the sampling event.<br><br>3. Pass the deionized water over/through the field equipment into the sample containers.<br><br>4. If the samples container(s) are not already numbered or labeled, use an indelible marker to label/number the container(s).<br><br>5. Package the Field Equipment Blanks in protective bags as regular samples. Store it in a sample cooler at all times with sufficient ice to maintain the cooler at 4 °C.<br><br>6. Process the Field Equipment Blank as regular samples, recording it on the chain-of-custody form (see Chain-of-Custody Procedure) and checking off the appropriate analyses. |

| | |
|---|---|
| Field Sample Duplicate | 1. Surface and ground-water samples requiring volatile and semi-volatile organic compound analysis are collected directly from the environmental media or from the pump discharge hose to minimize volatilization.<br><br>2. Duplicate samples can be collected using either of these two methods:<br><br>a. Fill a clean container (with cap) with sample sufficient to fill the suite of sample containers. Cap and invert the container several times to ensure thorough mixing and fill the sample containers.<br><br>b. Collect samples in rapid succession using identical sampling procedures<br><br>3. If the samples container(s) are not already numbered or labeled, use an indelible marker to label/number the container(s).<br><br>4. Package the Field Sample Duplicate in protective bags as regular samples. Store it in a sample cooler at all times with sufficient ice to maintain the cooler at 4 °C.<br>5. Process the Field Sample Duplicate as regular samples, recording it on the chain-of-custody form (see Chain-of-Custody Procedure) and checking off the appropriate analyses. |

# CITY OF EUGENE – WASTEWATER DIVISION
## Procedure

| | | | |
|---|---|---|---|
| **Subject:** | **Ambient Monitoring Sample Schedule** | **Document No:** | SAMP - 1206 |
| **Reviewed By:** | Tom Mendes | **Date Prepared:** | 05/04/05 |
| **Approved By:** | Management Team | **Date Approved:** | DRAFT – TBD |

## Introduction

The purpose of this procedure is to describe the sampling frequency and water quality parameters required for surface water samples collected from surface water bodies under the City of Eugene Ambient Monitoring Program.

## Scope

This procedure pertains to ambient surface water samples collected under the City's National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) Permit #101244.

## Ambient Monitoring Sample Schedule

| Ambient Monitoring – Field, Conventional, Nutrients, Metals<br>Water Quality Parameter, Bottle, and Preservation Schedule | | | | |
|---|---|---|---|---|
| **Frequency** | **Water Quality Parameter** | **Bottle Type** | **Preservation** | **Maximum Holding Time** |
| Six (6) events/year<br><br>(January, March, May, July, September, November) | Total and Dissolved<br>Arsenic<br>Cadmium<br>Chromium<br>Copper<br>Iron<br>Lead<br>Manganese<br>Mercury<br>Molybdenum<br>Nickel<br>Selenium<br>Silver<br>Zinc | 2-L Teflon | Total:<br>$HNO_3$ to pH <2<br><br>Dissolved:<br>HNO3 to pH <2 AFTER filtration through 0.45 µm membrane filter cartridge. | 6 Months |
| | Ammonia (as N)<br>Chemical Oxygen Demand<br>Nitrate+Nitrite ($NO_3$+$NO_2$ as N)<br>Phosphorus (Total)<br>Total Kjeldahl Nitrogen | K<br>500-mL Plastic | Cool, ≤6°C<br>$H_2SO_4$ to pH <2 | 28 Days |
| | Phosphorus (Ortho) | K<br>500-mL Plastic | Lab filter within 6 hours of collection<br>Cool, ≤6°C | 48 Hours |
| | *Escherichia coli*<br>Fecal coliform | C<br>500-mL Plastic | Cool, ≤6°C | 6 Hours |
| | Calcium (Total)<br>Magnesium (Total)<br>Hardness | I-Chem<br>1-L Plastic | $HNO_3$ to pH <2 | 6 Months |
| | Total Organic Carbon (TOC) | V<br>60-mL Glass VOA or 60-mL plastic | Cool, ≤6˚C<br>HCl to pH <2 | 28 Days |
| | Biochemical Oxygen Demand<br>Turbidity | A<br>1-L Plastic | Cool, ≤6˚C | 48 Hours |
| | Total Dissolved Solids<br>Total Suspended Solids | A<br>1-L Plastic | Cool, ≤6°C | 7 Days |
| | Specific Conductance | A<br>1-L Plastic | Cool, ≤6˚C | 28 Days |
| | Dissolved Oxygen<br>pH<br>Temperature | A<br>1-L Plastic | None | Analyze Immediately (Field Measurement) |

## Ambient Monitoring – Organics Sample Schedule

| Ambient Monitoring – Organics<br>Water Quality Parameter, Bottle, and Preservation Schedule | | | | |
|---|---|---|---|---|
| **Frequency** | **Water Quality Parameter** | **Bottle Type** | **Preservation** | **Maximum Holding Time** |
| Amazon Subbasin – Six (6) events/year @ two (2) sites[3] | Chlorinated Hydrocarbons<br>Method 8260C/5030B<br>cis & trans 1,2-Dichloroethene[1,2]<br>1,1-Dichloroethene<br>Trichlororethene[1]<br>Tetrachloroethene[1,2] | Glass VOA | Cool, ≤6˚C<br>HCl to pH <2 | 14 days |

[1] Amazon Creek
[2] A3 Channel
[3] Refer to Stormwater Monitoring Plan for specific organics sampling sites for the Willamette Basin and Amazon Sub-basin water bodies.

## References

National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) Discharge Permit 101244

Sample Preservation and Holding Times: Table 5-1

Ambient Monitoring Site Sampling Procedure: SAMP-1207

# CITY OF EUGENE – WASTEWATER DIVISION
## Procedure

| | | | |
|---|---|---|---|
| **Subject:** | Ambient Monitoring Site Sampling Procedure | **Document No:** | SAMP - 1207 |
| **Reviewed By:** | Mike Lillie | **Date Prepared:** | 5/4/05 |
| **Approved By:** | Ron Morrow | **Date Approved:** | 4/27/11 |

### Purpose

The purpose of this procedure is to describe how to collect representative water samples from surface water monitoring sites using "clean techniques" for analysis of water quality constituents. Additional prep time is required before sampling to set up all necessary equipment. Arrangements are necessary with the City of Springfield Fire Department for Willamette River transport.

### References

Method 1669: Sampling Ambient Water for Trace Metals at EPA Water Quality Criteria Levels, EPA, 1995.

Eugene Wastewater Division Quality Assurance Plan: WW-416

Sample Quality Assurance / Quality Control Procedure: WW-854

Ambient Monitoring Sample Schedule: SAMP-1206

Field Measurement of Conductivity Procedure: SAMP-834

Field Measurement of pH Procedure: SAMP-853

Field Measurement of Water Temperature Procedure: SAMP-856

Field Measurement of Dissolved Oxygen: SAMP-1208

Chain-of-Custody Procedures: WW-833

Bottle/Sampler Jug Cleaning Procedure: SAMP-1209

Sample Bag Preparation – Ambient Monitoring Program: SAMP-1210

Decontamination of Field Equipment Procedure: SAMP-851

Operations and Maintenance manuals for field sampling equipment

### Safety Requirements

Prior to performing this procedure the Boat Safety control measures must be reviewed and understood.

**CAUTION:** If handled inappropriately, acids can cause severe chemical burns to skin and any material that is not chemical resistant; care must be exercised when working with these chemicals. Protective eye-ware, gloves and clothing must be worn when working with all acids. Prior to performing this procedure the MSDS sheets for each type of acid must be reviewed and understood. The following PPE are required:

- Safety Glasses
- Ear Protection
- Latex / Rubber Gloves
- Personal Flotation Device

- Rubber Boots or Waders

## Sampling Equipment

| | |
|---|---|
| 1 – HCl-rinsed 10-L jug per sample site plus each QA/QC sample (see Bottle/Sample Jug Cleaning Procedure)<br><br>1 – HCl rinsed 20-L jug per sample site plus each QA/QC sample (see Bottle/Sample Jug Cleaning Procedure)<br><br>Sample Bag for each site (see Sample Bag Preparation – Ambient Monitoring Program)<br><br>2 - VOA vials (Provided by vender)<br>2 – Dioxin bottles (Provided by vender)<br>2 – Peristaltic pumps<br>pH Meter<br>DO Meter | Conductivity Meter<br>Air thermometer<br>Chain-of-Custody (COC) forms<br>Field Comments Notebook<br>Field Data Sheets<br>Sample Labels<br>Plastic Sheeting<br>Tape<br>3 – 100-gallon coolers<br>Ice |

## Special Sampling Precautions

Sampling personnel must cover all metal objects on their person that may lead to sample contamination. Do not touch the sample bottles or tubing with exposed hands or contaminated gloves. Take care to ensure the end of the sample tubing does not come in contact with any contaminated surface.

## Sampling Sites – Amazon Basin

- Amazon Creek – Site M2 - 29th Avenue
- Willow Creek – 450ft north of 18th Avenue
- Amazon Creek at Railroad Crossing
- Amazon Diversion Channel at Royal Avenue
- A3 Channel at Terry Street
- Amazon Creek at Royal Avenue

## Sampling Sites – Willamette River

- Upstream of Urban Growth Boundary (RM 186.9)
- At Knickerbocker Bridge (RM 183.9)
- At Owosso Bridge (RM 178.6)
- Downstream of Beltline Bridge (RM 176.8)

## Clean Techniques Procedure Sections

A. **Sampling Preparation (Day Before Sampling)**
B. **Instrument Calibration & Field Measurements (Day of Sampling)**
C. **Ambient Sampling Procedures (Non-QA/QC Sites)**

**D. Ambient Sampling Procedure for QA/QC Duplicate Sites**

**E. Collection of Field Equipment Blank**

**F. End of Day**

**G. Sample Delivery**

## Procedure

### A. Sampling Preparation (Day Before Sampling)

1. Review the sampling procedure and referenced procedures.

2. Review the Sample Quality Assurance / Quality Control Procedure. Determine which surface water monitoring site(s) will be used to meet the requirements of the QA/QC procedure.

3. Prepare Bottle Bags for each sampling site and as per QA/QC requirements

4. Gather supplies needed for the sampling project.

5. Inspect equipment and charge peristaltic pumps for 24 hrs.

6. Obtain COC and data sheets from Word Template.

### B. Instrument Calibration & Field Measurements (Day of Sampling)

1. Calibrate the field meters as described in Field Measurement of Conductivity Procedure, Field Measurement of pH Procedure, Field Measurement of Water Temperature Procedure, and Field Measurement of Dissolved Oxygen. Instruments should be calibrated prior to mobilization to ensure instrumentation is in proper working order. Field calibration verification using appropriate standards ensures the instrument has retained its calibration.

2. Upon arrival at sample site, ready all necessary equipment:
   - Sample jug
   - Bottle bag
   - DO, pH, conductivity, and air temperature meters
   - Cole Palmer pump
   - COC and Field Notebook

3. Deploy pH, temperature, conductivity, DO, and air temperature meters and take readings. Record readings on field data sheet.

4. Surface water samples are collected following the schedule specified in Ambient Monitoring Sample Schedule.

### C. Ambient Sampling Procedures (Non-QA/QC Sites)

1. Fill the clean 10-L jug with sample and place lid on jug.

2. DH removes the gallon bag with the sample bottle,.
3. DH opens outer bag of Ambient Site bottle.
4. CH opens inner bag, removes bottle, places it on designated clean area., then seals inner bag. .
5. DH seals the gallon bag and places it back in the sack.
6. CH and DH re-glove.
7. DH removes the bagged peristaltic pump tubing from sack and opens outer bag.
8. CH removes and opens inner bag; carefully removes tubing, and installs it on the peristaltic pump. .
9. CH removes the lid from the sample carboy and inserts the suction end of the tubing into the carboy.
10. DH lifts the sample carboy and swirls the sample while CH holds the tubing in place.
11. DH operates peristaltic pump while CH manipulates tubing to pump about 200 mL of sample into bag to flush tubing. CH re-gloves.
12. CH removes the lid to the Sample bottle and fills it with sample then quickly recaps. CH re-gloves.
13. DH retrieves sample bag from sack and opens large outer bag.
14. CH opens inner bag, places Ambient Site sample in bag and reseals. CH re-gloves.
15. DH seals large outer bag and places bagged Ambient Site sample in sack. .
16. Pour off all other sample bottles and tightly seal the cap. Make sure bottle numbers correspond with sampling locations and COC sheet.
17. Bag the sample bottles and place the bag in a sack with adequate ice to maintain a temperature of 4 ˚C.
18. Clean field equipment as described in the Decontamination of Field Equipment Procedure, before proceeding to the next sampling location.

## D. Ambient Sampling Procedure for QA/QC Duplicate Sites

1. Take duplicate readings from meter and record reading on data sheets
2. Fill the clean 20-L jug with sample and place lid on jug.
3. DH removes the gallon bag with the sample bottle,
4. DH opens outer bag of Ambient Site bottle.
5. CH opens inner bag, removes bottle, places it on designated clean area, then seals inner bag.
6. DH seals the gallon bag and places it back in the sack.
7. CH and DH re-glove.
8. DH removes the gallon bag with the Ambient Site Duplicate bottle, and opens bag.

9. DH opens outer bag of Ambient Site Duplicate bottle.

10. CH opens inner bag, removes bottle, places it on designated clean area, then seals inner bag. .

11. DH seals the gallon bag and places it back in the sack.

12. CH and DH re-glove.

13. DH removes the bagged peristaltic pump tubing and opens outer bag.

14. CH removes and opens inner bag; carefully removes tubing, and installs it on the peristaltic pump. DH.

15. CH removes the lid from the sample carboy and inserts the suction end of the tubing into the carboy.

16. DH lifts the sample carboy and swirls the sample while CH holds the tubing in place.

17. DH operates peristaltic pump while CH manipulates tubing to pump with ~200 mL of sample into bag to flush tubing. CH re-gloves.

18. CH removes the lid to the Total Sample bottle and fills it with sample then quickly recaps. CH re-gloves.

19. CH removes the lid to the Ambient Site Total Duplicate bottle and fills it with sample then quickly recaps. DH and CH re-gloves.

20. DH retrieves sample bag from sack and opens large outer bag.

21. CH opens inner bag, places Ambient Site Total sample in bag and reseals. CH re-gloves.

22. DH seals large outer bag and places bagged Ambient Site Total sample in sack. DH re-gloves.

23. DH retrieves sample bag from sack and opens large outer bag.

24. CH opens inner bag, places Ambient Site Total Duplicate sample in bag and reseals. CH re-gloves.

25. DH seals large outer bag and places bagged Ambient Site Total Duplicate sample in sack. DH re-gloves.

26. Pour off all other sample bottles and tightly seal the cap. Make sure bottle numbers correspond with sampling locations and COC sheet.

27. Bag the sample bottles and place the bag in a sack with adequate ice to maintain a temperature of 4 ˚C.

28. Clean field equipment as described in the Decontamination of Field Equipment Procedure, before proceeding to the next sampling location.

## E. Collection of Field Equipment Blank

Note: Use the Contract Lab-supplied Blank Water (2 – 1-L bottles) for the clean metals samples, and use the 10-L DI water jug to process the rest of the Field Equipment Blank samples. After all samples are poured off, record meter readings from the DI water in the jug.

1. DH removes the gallon bag with the sample bottle,.

2. DH opens outer bag of Ambient Site bottle.

3. CH opens inner bag, removes bottle, places it on designated clean area on sample area, then seals inner bag. .
4. DH seals the gallon bag and places it back in the sack.
5. DH opens outer bag of Equipment Blank bottle.
6. CH opens inner bag, removes bottle, places it on designated clean area, then seals inner bag.
7. DH seals the gallon bag and places it back in the sack.
8. CH loosens Equipment Blank bottle cap.
9. Retrieve the 10-L DI water jug.
10. Pour off all other sample bottles from the 10-L DI jug and tightly seal the caps. Make sure bottle numbers correspond with sampling locations and COC sheet.
11. Place meters in the liquid left in the DI jug.
12. Bag the sample bottles and place the bag in a sack with adequate ice to maintain a temperature of 4 ˚C.

## F. End of Day

1. Verify performance of pH and conductivity meters by checking pH and conductivity buffers and record this information on the Field Data Sheets.
2. Clean and properly store all sampling equipment. Reorder supplies and repair equipment as necessary.

## G. Sample Delivery

1. Samples must be handled and processed following the Chain-of-Custody Procedure.
2. Complete the chain-of-custody sheet as described in the Chain-of-Custody Procedure.
3. Submit samples to WPCF laboratory personnel assigned for log-in.

   3.1 Relinquish samples directly to laboratory personnel, signing and dating the COC.

   3.2 Samples that cannot be relinquished to the laboratory on the day sampled, e.g. sampling late, weekend sampling, etc., must be affixed with tamper indicating-sealing tape and stored in the Industrial Source Control refrigerated storage unit at 4 °C.

   3.3 It is the responsibility of the sampler to ensure stored samples are properly relinquished to laboratory personnel as soon as possible.

# CITY OF EUGENE – WASTEWATER DIVISION

## Procedure

| | | | |
|---|---|---|---|
| **Subject:** | Bottle/Sample Jug Cleaning | **Document No:** | SAMP - 1209 |
| **Reviewed By:** | Barb Connelly, Cindy Donahoe | **Date Prepared:** | 3/31/05 |
| **Approved By:** | Michelle Miranda | **Date Approved:** | 5/7/14 |

## Purpose

This procedure describes how to clean bottles or sample jugs for use in environmental sampling. This is a very critical step in the sampling process; incorrect or poor cleaning techniques may result in invalid laboratory results. This procedure incorporates bottle/jug cleaning for plant, industrial, stormwater/ambient, and clean techniques sampling.

## References

Eugene Wastewater Division Quality Assurance Plan: WW-416

## Personal Protective Equipment

**CAUTION:** If handled inappropriately, acids can cause severe chemical burns to skin and any material that is not chemical resistant; care must be exercised when working with these chemicals. Protective eye-ware, gloves and clothing must be worn when working with all acids. Bottles containing preservative must be labeled with clear indication of the type of preservative. Prior to performing this procedure the MSDS sheets for each type of acid must be reviewed and understood. The following PPE are required:

- Safety Glasses or Face Shield
- Latex / Rubber Gloves
- Lab coat, apron or other protective outwear

## Equipment and Supplies

- 10% $HNO_3$ (10:1) Nitric Acid for use in industrial bottle/jug cleaning
- 50% HCl (1:1) Hydrochloric Acid for use in stormwater/ambient bottle/jug cleaning
- 2% $HNO_3$ (50:1) Nitric Acid for use in clean techniques bottle/jug cleaning
- Laboratory-grade soap
- Brushes
- DI Water
- Drying rack

## Procedure for Industrial High-Density Polyethylene Bottle/Jug Cleaning

1. Empty sample container contents, if any. Rinse bottles/jugs of residue with tap water.

2. Examine the container and lid for any cracks or flaws that may cause sample leakage; if present, discard the container and/or lid.

3. Add a couple squirts of lab soap to bottle/jug and fill with adequate amount of water for cleaning.

4. Using an appropriately sized brush, thoroughly scrub inside of bottle/jug. Scrub lid with soap solution as well.

5. Use a stiff brush to scrub outside of bottle/jug.

6. Thoroughly rinse bottle/jug and lid clean of any soapy residue with tap water at least three times and shake out any excess water.

7. Pour at least 250 mL of 10% Nitric Acid into jug. Place lid on jug and swirl around so that the acid comes into contact with all bottle surfaces.

   NOTE: Be very careful not shake too vigorously as the lid may leak.

8. Pour spent acid into a sink that has a drain equipped with an acid neutralization device.

9. Thoroughly rinse bottle/jug and lid with Deionized water (DI) at least three times.

10. Place inverted on a drying rack.

11. After allowing for adequate drying time, put lid on bottle/jug and place on storage shelf.

## Procedure for 3.7-L (1-Gallon) Glass Bottle/Jug or Pickle Bottle/Jug Cleaning

1. Empty sample container contents, if any. Rinse bottles/jugs of residue with tap water.

2. Examine the container and lid for any cracks or flaws that may cause sample leakage; if present, discard the container and/or lid.

3. Glass containers can be either cleaned in a dishwasher or hand washed.

   3.1. Dishwasher:
   - 3.1.1. Place glass containers securely in dishwasher being careful to avoid breakage during wash cycle.
   - 3.1.2. Add appropriate amount of lab soap to dishwasher and select Power Scrub Plus cycle.

   3.2. Hand washed:
   - 3.2.1. Add appropriate amount of lab soap to each bottle/jug. Scrub thoroughly with brush inside and out.
   - 3.2.2. Thoroughly rinse at least three times with tap water.

4. Thoroughly rinse bottle/jugs and lids with DI water at least three times.

5. Place inverted on a drying rack.

6. After adequate drying time, place each bottle/jug on storage shelf.

   NOTE: Because NaOH preservative is used in these bottles, a layer of residue can build up on the bottom. This can be resolved by squirting a little 10% Nitric Acid down the sides. Make sure this is done before cleaning. If

not, repeat cleaning procedure.

## Procedure for Stormwater/Ambient High-Density Polyethylene Bottle/Jug Cleaning

1. Empty sample container contents, if any. Rinse bottles/jugs of residue with tap water.
2. Examine the container and lid for any cracks or flaws that may cause sample leakage; if present, discard the container and/or lid.
3. Add predetermined amount of lab soap to bottle/jug and fill with adequate amount of water for cleaning.
4. Using an appropriately sized brush, thoroughly scrub inside of bottle/jug. Scrub lid with soap solution as well.
5. Use a stiff brush to scrub outside of bottle/jug.
6. Thoroughly rinse bottle/jug and lid clean of any soapy residue with tap water at least three times and shake out any excess water.
7. Pour at least 250 mL of 50% Hydrochloric Acid to jug. Place lid on jug and swirl around so that the acid comes into contact with all surfaces of bottle.

   NOTE: Be very careful not shake too vigorously as the lid may leak.
8. Pour spent acid back into storage bottle for later use.
9. Thoroughly rinse bottle/jug and lid with deionized water (DI) at least three times.
10. Place inverted on a drying rack.
11. After allowing for adequate drying time, put lid on bottle/jug and place on storage shelf.

## Procedure for Clean Techniques Teflon Carboy/Bottle/Jug Cleaning

SPECIAL PRECAUTIONS: All metal objects on their person must be covered. During cleaning do not expose the jug, lid or bags to any metal objects. Do not use a metal drying rack. Avoid any metal contamination of this equipment.

1. Empty sample container contents, if any, and thoroughly rinse carboy at least 3 times with hot water.
2. Examine the container and lid for any cracks or flaws that may cause sample leakage; if present, discard the container and/or lid.
3. Add at least three squirts of laboratory-grade detergent solution to the sample container, fill with hot water and let stand for at least 1 hour. If carboy seems discolored and/or excessively dirty, clean with laboratory-grade detergent and hot water using a scrub brush before soaking it in a fresh solution of laboratory-grade detergent (hot water and bleach may be used if necessary). After soaking, discard laboratory-grade detergent solution and rinse thoroughly by completely filling at least 4 times with tap water.
4. Fill the clean carboy with 2% Nitric Acid (400 mL Nitric Acid from Lab + DI water) and soak for at least 24 hours.
5. Thoroughly rinse with DI at least 4 times.

6. Invert on a drying rack and let drip dry.
7. With squirt bottle, rinse the carboy lid with 2% Nitric Acid.
8. Rinse lid(s) with DI at least 4 times.
9. Place lid(s) dry on drying rack.
10. After adequate drying time, double-bag the carboy.
11. Place lid(s) in a re-sealable plastic bag.
12. Place carboy and lid(s) on storage shelf.

# CITY OF EUGENE – WASTEWATER DIVISION
## Work Instruction

| | | | |
|---|---|---|---|
| **Subject:** | Sample Preparation for Ambient Monitoring Program – Clean Techniques Sampling | **Document No:** | SAMP - 1210 |
| **Reviewed By:** | Marc Furney | **Date Prepared:** | 4/6/05 |
| **Approved By:** | Michelle Cahill | **Date Approved:** | 5/23/13 |

### Purpose

This work instruction describes the steps of bag preparation for Clean Techniques Sampling Programs.

### References

National Pollutant Discharge Elimination System (NPDES) Waste Discharge Permit 101244
Sample Preservation and Holding Times: Table 5-1
Ambient Monitoring Sampling Procedure: SAMP-1207

### Safety Requirements

**CAUTION:** If handled inappropriately, acids and bases can cause severe chemical burns to skin and any material that is not chemical resistant; care must be exercised when working with these chemicals. Protective eye-ware, gloves and clothing must be worn when working with all acids. Prior to performing this procedure the MSDS sheets for each type of acid must be reviewed and understood. The following PPE are required:

### Personal Protective Equipment

- Latex / Rubber Gloves
- Safety goggles
- Lab coat or protective outwear

### Supplies

| | |
|---|---|
| Re-sealable Bags<br>I-Chem bottles<br>A bottles<br>C bottles<br>K bottles<br>OP bottles<br>TOC bottles | Dioxin sample bottles<br>VOA vials (chlorinated hydrocarbons)<br>Sample Bags<br>Coolers<br>2-L ultra-clean Teflon® bottles<br>6-ft lengths of tubing |

### Special Precautions

Technicians must cover all metal objects on their person that may be exposed. Do not touch any ultra-clean supplies with dirty gloves.

## Instructions for Packing Re-sealable Bags

1. Get re-sealable bags, ultra-clean supplies, and labels in order.

2. For each site prepare a separate sample bag for each of the following:
   a. Metals
      - 2 L Teflon® bottle ultra-cleaned for trace metals
      - Sample Label
   b. 6-ft length tubing for Orthophosphate
   c. In-Line filter units with ultra-cleaned tubing attached for trace metals

   NOTE: Duplicate/ Blank Sample Locations get 2:ultra-clean Teflon® bottles One bottle contains the laboratory blank water, and the other bottle is empty.

3. Seal bag and put in sample bag.

4. Pack one bag containing items specified in Step 2 for Field Backup.

## Instructions for Packing for Ambient Sampling

- Get supplies in order
  a. Double bagged 2 L Teflon bottles labeled with bottle number
     - 2 – A bottles per site labeled with Bottle Number
     - 2 – K bottles per site labeled with Bottle Number
     - 2 - Dioxin bottles
     - 2 – VOA (chlorinated hydrocarbons)
     - 1 – OP bottle per site labeled with Bottle Number.
     - 1 – TOC bottle per site labeled with Bottle Number.
     - 1 – C bottle per site labeled with Bottle Number, and
     - 1 – I-Chem bottle per site labeled with Bottle Number
     - Laboratory Blank Water
     - Bag of Field Backup Supplies
     - Coolers
     - Trip Blank (one per sample day)

- Each bag is labeled with the sample site. Pack each bag using the bottle schedule below.

- Place one length of tubing in each bag.

- Pack laboratory ultra-clean Blank Water and Trip Blank in cooler.

- Cinch each bag and place in respective coolers (usually labeled on top).

- VOA and Dioxin bottles are in glass containers and should not be bagged. Empty VOA and Dioxin containers are shipped to us by the vender, and returned in the cooler provided.

- Refer to the Stormwater Monitoring Plan for VOA and Dioxin for sampling specifics.

## Ambient Bottle Schedule

| Site Location | A | K | C | OP | TOC | I-Chem | 1-Gallon Bag (2-L Teflon*) |
|---|---|---|---|---|---|---|---|
| | Bottle Number | | | | | | Bag ID |
| **Willamette River Basin Sites:** | | | | | | | |
| Downstream of Beltline Bridge | 13 14 | 13 14 | 7 | 7 | 7 | 7 | WDS Metals |
| Owosso Bridge | 11 12 | 11 12 | 6 | 6 | 6 | 6 | Owosso Metals |
| Knickerbocker Bridge | 9 10 | 9 10 | 5 | 5 | 5 | 5 | Knickerbocker Metals |
| Upstream Urban Growth Boundary | 19 20 | 19 20 | 10 | 10 | 10 | 10 | Upstream UGB Metals |
| Delta Pond | 29 30 | 29 30 | 15 | 15 | 15 | 15 | Delta Ponds Metals |
| Spring Creek at Beacon Drive East | 31 32 | 31 32 | 16 | 16 | 16 | 16 | Spring Creek Metals |
| River Blank ( ) | 17 18 | 17 18 | 9 | 9 | 9 | 9 | River Blank Metals |
| Duplicate ( ) | 15 16 | 15 16 | 8 | 8 | 8 | 8 | Duplicate Metals |
| **Amazon Basin Sites:** | | | | | | | |
| M2 (Amazon Creek) | 1 2 | 1 2 | 1 | 1 | 1 | 1 | M2 Metals |
| Amazon Diversion Channel @ Royal Avenue | 3 4 | 3 4 | 2 | 2 | 2 | 2 | “A” Channel @ Royal Metals |
| Amazon Creek @ Royal Avenue | 5 6 | 5 6 | 3 | 3 | 3 | 3 | Amazon @ Royal Metals |
| Willow Creek | 7 8 | 7 8 | 4 | 4 | 4 | 4 | Willow Creek Metals |
| A3 Channel @ Terry Street | 25 26 | 25 26 | 13 | 13 | 13 | 13 | A Chan @ Terry St Metals |
| Amazon Creek @ Railroad Crossing | 27 28 | 27 28 | 14 | 14 | 14 | 14 | Amazon @ RR Metals |
| Land Blank ( ) | 23 24 | 23 24 | 12 | 12 | 12 | 12 | Land Blank Metals |
| Duplicate ( ) | 21 22 | 21 22 | 11 | 11 | 11 | 11 | Duplicate Metals |

* 2-L Teflon® ultra-clean bottle

# CITY OF EUGENE – WASTEWATER DIVISION
## Procedure

| | | | |
|---|---|---|---|
| **Subject:** | Composite Sampling | **Document No:** | SAMP-1212 |
| **Reviewed By:** | Michelle Miranda / Tom Mendes | **Original Date:** | 6/3/05 |
| **Approved By:** | Michelle Miranda | **Date Approved:** | 7/10/14 |

## Purpose

This procedure describes how to collect a composite sample consisting of consecutive samples from a single sample point using automated equipment or by combining several grab samples taken from a single sample point. Composite sampling can be performed for most parameters (except pH, Oil and Grease, and some organic compounds). Some parameters collected using the auto-sampler must be pre-preserved, that is, the sample container must contain preservative.

**CAUTION:** Containers with sample preservative might be incompatible in a single auto-sampler. Consult the Sampling Team Supervisor or Laboratory Supervisor for appropriate guidelines.

## References

EPA Industrial User Inspection and Sampling Manual for POTW's, EPA-831-B-94-001, April 1994
Eugene/Springfield Pretreatment Program Procedures Manual, Chapter 2
Applicable Sampling Schedule for the Project Site
Eugene Wastewater Division Quality Assurance Plan: WW-416
Sample Quality Assurance / Quality Control Procedure: SAMP-854
Sample Preservation & Holding Times; Table 5-1: SAMP-826
Chain-of-Custody Procedures: WW-833
Sampler Cleaning Procedure: SAMP-1216
Bottle/Sample Jug Cleaning Procedure: SAMP-1209
Sampler Manufacturer's Operating Manual

## Safety Requirements

**CAUTION:** If handled inappropriately, acids and bases can cause severe chemical burns to skin and any material that is not chemical resistant; care must be exercised when working with these chemicals. Protective eye-ware, gloves and clothing must be worn when working with all acids. Prior to performing this procedure the MSDS sheets for each type of acid must be reviewed and understood. The following PPE are required:

## Personal Protective Equipment

- Safety Glasses
- ANSI-Code Z41 Steel-Toe Boots
- Latex / Rubber Gloves
- Lab coat, apron or other protective outerwear

## Equipment and Supplies

| | |
|---|---|
| 1 – Auto-sampler; cleaned with attached suction line and strainer<br>1 – Ni-Cad battery, charged<br>1 – 10 L or 20 L sample jug (or 3.7 L glass jars if using auto-sampler)<br>1 – Large laboratory flask<br>Sample bottles (as per appropriate schedule)<br>Sample preservatives<br>Plastic storage bags for sample jug lids | pH indicator strips<br>Indelible marker<br>Ice for Auto-sampler<br>Ice Cooler with Ice<br>Field Notebook<br>Chain-of-Custody (COC) Forms |

## Composite Sampling Using Auto-Sampler

1. Attach Ni-Cad or deep cycle battery to automatic sampler.

2. Program the auto-sampler to take time or flow-based samples as appropriate.

3. Insert the sample jug into the auto-sampler and place ice around the container. Make sure ice does not skew the position of the container as this can cause failure of the auto-sampler.

   **Note:** Some analytical parameters require that the sample jug contain the preservative. Review the appropriate sampling schedule to ensure the proper containers and preservatives are used.

4. Remove the sample jug lid and place in clean, sealable plastic bag for storage.

   **Note:** The lid must remain on the container during placement of ice in the auto-sampler to prevent sample contamination until the sampler head is installed.

5. Install the sampler head and run the auto-sampler program.

6. When the sampling program is complete:

7. Review sampling program.

   7.1. Remove the sample jug, replace the lid, and mix the liquid by shaking or swirling.

   7.2. Check sample pH prior to pour-off to ensure proper pH if pre-preservation was used.

   7.3. Fill appropriate labeled laboratory sample containers with the mixed sample.

   7.4. Preserve each sample following the procedures specified in the Sample Preservation & Holding Times Schedule: WW-826.

8. Cap the sample containers and place in a cooler containing ice for transport to the laboratory.

9. Record sample event in Field Notebook, noting date, time, facility and sample point number.

10. Relinquish samples as described below.

## Composite Sampling by Combining Several Grab Samples

1. Remove the sample container lid and collect the grab sample.

2. Tips for collecting grab samples:

   2.1. Avoid collecting large particles that could contaminate or skew analytical results.

   2.2. Collect sample facing upstream to avoid contamination.

2.3. If possible, fully submerge the sample container when collecting the grab sample.

2.4. Avoid skimming the surface or dragging the bottom at the sample location.

2.5. Avoid disturbing sediment/debris while collecting the grab sample.

2.6. Collect sufficient sample volume to fill sample containers.

3. Record the sample point number on the bottles using an indelible marker.

4. Record sample event in Field Notebook, noting date, time, location and sample point number.

5. Place sample container in the sample location and fill the container. Or if only collecting one bottle, fill bottle ½ full.

6. Add the appropriate sample preservative, cap and invert the container several times to mix.

7. For CNT, check for sulfides and chlorides prior to preserving.

8. Check the sample pH to make sure it is within the range specified in sample schedule.

9. Place the grab sample containers in a cooler containing ice for transport to the laboratory.

10. Laboratory composite of grab samples:

    10.1. Obtain a clean flask large enough to hold the total volume of all grab samples.

    10.2. Transfer contents of all grab sample containers to the flask and swirl until well mixed.

    10.3. Fill appropriate labeled laboratory sample containers with the mixed sample.

    10.4. Preserve each sample following the procedures specified in the Sample Preservation & Holding Times Schedule.

11. Relinquish samples as described below.

## Relinquish Sample

1. Samples must be handled and processed following the Chain-of-Custody Procedure: WW-833.

2. Complete the chain-of-custody sheet as described in the Chain-of-Custody Procedure.

3. Submit samples to WPCF laboratory personnel assigned for log-in.

    3.1. Relinquish samples directly to laboratory personnel, signing and dating the COC.

    3.2. For samples that cannot be relinquished to the laboratory on the day sampled, e.g. sampling late, weekend sampling, etc., use the “Relinquished By” space to sign your full name, date, and time released, and store samples in the Log-In Area refrigerated storage unit at ≤ 6 °C. Note in the comment box where the samples are being stored.

    3.3. It is the responsibility of the sampler to ensure samples are properly relinquished to laboratory personnel or, during non-business hours, placed in refrigerated storage for later receipt.

# CITY OF EUGENE – WASTEWATER DIVISION
## Procedure

| | | | |
|---|---|---|---|
| **Subject:** | Grab Sampling Procedure | **Document No:** | SAMP - 1214 |
| **Reviewed By:** | Michelle Miranda / Tom Mendes | **Date Prepared:** | 4/5/05 |
| **Approved By:** | Michelle Miranda | **Date Approved:** | 7/10/14 |

### Introduction

Grab samples provide a measurement of pollutant concentrations in the wastewater at a particular point in time from a single sample point. If multiple grab samples are collected from the same sample point, contact sampling supervisor for sample frequency and volume.

### References

EPA Industrial User Inspection and Sampling Manual for POTW's, EPA-831-B-94-001, April 1994

Eugene/Springfield Pretreatment Program Procedures Manual, Chapter 2

Industrial Pretreatment Procedures: ISC-706R1

Eugene Wastewater Division Quality Assurance Plan: WW-416

Sample Preservation and Holding Times; Table 5-1: SAMP-826

Chain-of-Custody Form Instructions Procedure: WW-833

Sample Quality Assurance / Quality Control Procedure: SAMP-854

### Personal Protective Equipment

- Safety Glasses
- Ansi Steel-Toe Boots
- Ear Protection
- Latex / Rubber Gloves

### Safety Requirements

Acids/Bases are dangerous materials and care must be exercised when working with these substance (see all MSDS sheets). Protective eye-ware, gloves, and clothing, must be worn when working with any laboratory chemicals.

### Equipment and Supplies

- Appropriate sample bottles
- Appropriate preservative
- Appropriate Chain-of Custody form (COC)
- Indelible marker
- Cooler and ice (two 7-lb bags)
- Field Comments Notebook
- pH Strips

## Sampling Procedure

1. Remove lid from sample bottle

2. If sample bottle is not pre-preserved, then the bottle may be pre-rinsed with wastewater effluent prior to collecting the sample, never pre-rinse samples for C bottles or Oil and Grease bottles.

3. Collect Sample. Samples should be collected with the following points in mind:

   3.1 Avoid collecting large particles which could contaminate or skew analytical results.

   3.2 Collect sample facing upstream to avoid contamination.

   3.3 Ensure sample jar is fully submerged when collecting sample. Avoid skimming the surface or dragging the bottom of the wastewater or stormwater stream, pipe or channel.

   3.4 If business hours of operation or batch discharging only allow a single grab event for the day, obtain adequate sample volume for laboratory analysis.

4. Add the appropriate preservative and cap. Invert the bottle several times to mix and check the pH to make sure it is within the range specified in Sample Preservation and Holding Times; Table 5-1: SAMP-826.

5. Record all information on Chain of Custody

6. Place sample in an iced cooler for transport back to lab.

7. Record sample event in Field Notebook.

## Relinquish Sample

1. Samples must be handled and processed following the Chain-of-Custody Procedure: WW-833.

2. Complete the chain-of-custody sheet as described in the Chain-of-Custody Procedure.

3. Submit samples to WPCF laboratory personnel assigned for log-in.

   3.1. Relinquish samples directly to laboratory personnel, signing and dating the COC.

   3.2. For samples that cannot be relinquished to the laboratory on the day sampled, e.g. sampling late, weekend sampling, etc., use the “Relinquished By” space to sign your full name, date, and time released, and store samples in the Log-In Area refrigerated storage unit at ≤ 6 °C. Note in the comment box where the samples are being stored.

   3.3. It is the responsibility of the sampler to ensure samples are properly relinquished to laboratory personnel or, during non-business hours, placed in refrigerated storage for later receipt.

# CITY OF EUGENE – WASTEWATER DIVISION
## Procedure

| | | | |
|---|---|---|---|
| **Subject:** | **Storm Event MS4 Site Sampling** | **Document No:** | SAMP – 1805 |
| **Reviewed By:** | Ron Morrow | **Original Date:** | 4/26/11 |
| **Approved By:** | Ron Morrow | **Date Approved:** | 4/27/11 |

## Purpose

The purpose of this procedure is to describe how to collect representative water samples from stormwater monitoring sites for analysis of water quality constituents. Additional prep time is required before sampling to set up and deploy all necessary equipment.

## Safety Requirements

**CAUTION:** If handled inappropriately, acids can cause severe chemical burns to skin and any material that is not chemical resistant; care must be exercised when working with these chemicals. Protective eye-ware, gloves and clothing must be worn when working with all acids. Prior to performing this procedure the MSDS sheets for each type of acid must be reviewed and understood.

**CAUTION:** Rain event sampling may involve working in the late evening and early morning hours with limited visibility and the use of additional safety equipment may be necessary such as traffic cones, flashing hazard lights, and hand lanterns. Conditions may be wet at the sample locations and the use of proper care to prevent slipping at some sites necessary.

The following PPE are required:

- Safety Glasses
- Latex / Rubber Gloves
- Steel Toe Shoes

## Equipment and Supplies

### Composite Sampling Equipment

| | |
|---|---|
| 4 – Isco 6712 automatic samplers with model 710 flow modules and ultrasonic sensors<br>4 – Batteries (Isco or 12V deep cell)<br>4 – 1 gallon plastic bottles or 1 – 20L rectangular carboy for each sampler (acid rinsed)<br>4 – Isco CDMA cellular modems and antennas (OPTIONAL)<br>Sample tubing for each sampler (acid rinsed)<br>Sampler hangers<br>Tape Measure<br>Zip Ties<br>Water depth measuring pole | DI water<br>Chain-of-Custody (COC) forms<br>Field Comments Notebook<br>Field Data Sheets<br>Sample site maps<br>Pen<br>Plastic Sheeting<br>Tape<br>Coolers<br>Ice |

## Grab Sampling Equipment

| | |
|---|---|
| pH Meter<br>DO Meter<br>Sample containers and caps<br>Coolers<br>Ice<br>Sample pole | Cordless screwdriver<br>Chain-of-Custody (COC) forms<br>Field Comments Notebook<br>Sample site maps<br>Plastic Sheeting<br>Tape |

## Special Sampling Precautions

Sampling personnel must cover all metal objects on their person that may lead to sample contamination. Do not touch the sample bottles or tubing with exposed hands or contaminated gloves. Take care to ensure the ends of the sample tubing, or strainer, do not come in contact with any contaminated surface.

## Procedure

### A. Procedure prior to Storm Event

1. Coordination and Planning
   a. At least one week prior to sample event arrange with contract lab for sample receiving, order additional bottles and coolers if necessary.

   b. At one week prior and again 48 hours prior: coordinate with Sampling Supervisor regarding adequacy of approaching storm event.

2. Sample Equipment Preparation for storm event.
   a. Review the sampling procedure and referenced procedures.

   b. Review the Stormwater Monitoring Plan. Determine which stormwater monitoring site(s) will be used to meet the requirements of the Monitoring Plan.

   c. Gather supplies needed for the sampling project.

   d. Inspect equipment and ensure automatic sampler batteries are charged.

   e. Obtain COC and data sheets from Word Template.

   f. Review the programming instruction for Isco automatic samplers, flow modules, and modems.

3. Equipment Blanks
   a. Select one of the four automatic samplers and 1 gallon bottles or 20L rectangular carboy

   b. Run Deionized water through the sample tubing and into the bottles or carboy.

   c. Pour off from the gallon bottles or carboy into individual sample bottles as described in the Stormwater Monitoring Sample Schedule.

4. Composite Sampling Equipment Deployment at Sampling Sites
   a. Prepare automatic sampler as necessary with sample jugs, ice, battery, flow sensor, and modem.

   b. Hang ultrasonic sensor.

   c. Dip water depth measuring pole into flow stream and measure depth of water (if water present).

d. Input water depth (in feet) into automatic sampler and program the sampler as appropriate.

e. Using clean hands/dirty hands method, remove strainer from plastic bag and lower into the flow stream or to bottom of the pipe.

f. If sampling in a manhole, attach hanger to automatic sampler and lower into manhole. Otherwise place automatic sampler in a dry, secure location adjacent to sample site.

g. If 12V deep cell battery or modem used, secure in the manhole or near the automatic sampler.

**B. Instrument Calibration & Field Measurements (Day of Sampling)**

1. Calibrate the field meters as described in Field Measurement of pH Procedure; SAMP-853, Field Measurement of Water Temperature Procedure; SAMP-854, and Field Measurement of Dissolved Oxygen; SAMP-1208. Instruments should be calibrated prior to mobilization to ensure instrumentation is in proper working order. Field calibration verification using appropriate standards ensures the instrument has retained its calibration.

2. Upon arrival at sample site, ready all necessary equipment:
   - Sample bottles
   - Sampling pole
   - DO and pH meters
   - COC and Field Notebook

**C. Coordination and Planning**

1. Sampling Supervisor or his designee will determine if an approaching storm is forecasted as adequate for sampling. Sampling team, and laboratory staff may be assembled or placed “On Call” if rain event is scheduled for after normal work hours.

2. When sampler initiates a call that it has started, or if Supervisor or his designee initiates a call out:
   a. Sample team reports to lab

   b. Upon arrival at sample site, ready all necessary equipment:
      i. Sample bottles
      ii. Sampling pole
      iii. DO and pH meters
      iv. COC and Field Notebook

3. Sampling team checks each sampler for proper operation

4. Collects grab samples
   a. Hg and MHg grabs are “clean technique” grab

   b. Follow laboratory instructions for pesticide screening grab protocol, dioxin and remaining organics as per COC.

5. Return to samplers following the storm event and transport samples to lab.
   a. Call lab if sample delivery to lab will be after 3:30pm, or on call lab person if after business hours.

   b. Check COCs and sample log in protocol.

## References

Method 1669: Sampling Ambient Water for Trace Metals at EPA Water Quality Criteria Levels, EPA, 1995.

Eugene Wastewater Division Quality Assurance Plan: WW-416

Sample Quality Assurance / Quality Control Procedure: SAMP-854

Field Measurement of pH Procedure: SAMP-853

Field Measurement of Water Temperature Procedure: SAMP-856

Field Measurement of Dissolved Oxygen: SAMP-1208

Chain-of-Custody Procedures: WW-833

Bottle/Sampler Jug Cleaning Procedure: SAMP-1209

Decontamination of Field Equipment Procedure: SAMP-851

Operations and Maintenance manuals for field sampling equipment

# CITY OF EUGENE – WASTEWATER DIVISION
## Procedure

| | | | |
|---|---|---|---|
| **Subject:** | Sampler Cleaning | **Document No:** | SAMP-1216 |
| **Reviewed By:** | Marcia Miller / Christian Chauvin / Michelle Miranda | **Date Prepared:** | 6/3/10 |
| **Approved By:** | Michelle Miranda | **Date Approved:** | 12/7/15 |

## Purpose

This procedure provides details of cleaning samplers in preparation for use in industrial sampling, clean techniques sampling, and plant sampling

## References

- Eugene Wastewater Division Quality Assurance Plan: WW-416
- Chemical Hygiene Plan: WW-20
- Operations and Maintenance Manual for Portable Auto-samplers
- Operations and Maintenance Manual for Stationary Samplers

## Safety Requirements

Procedures specified in the Chemical Hygiene Plan: WW-20 are applicable and must be followed. Wearing of PPE is required when preparing or using acids.

## Personal Protective Equipment

- Safety Glasses
- Latex / Rubber Gloves
- Lab coat, apron or other protective outerwear

## Equipment & Supplies

- One dedicated cleaning container filled with laboratory-grade soap solution
- One dedicated cleaning container filled with tap water
- One dedicated cleaning container filled with Deionized water (DI water)
- 10% $HNO_3$ (10:1) Nitric acid
- 50% HCl (5:1) Hydrochloric acid
- Lab towels
- Brushes
- Any necessary replacement parts
- Cleaning Log Sheet and/or Notebook

## Special Precautions

When performing any operations on the sampler head used for Clean Techniques, technicians must cover all metal objects on their person that may be exposed. Do not touch any end of tubing with anything that may contaminate it.

## Sampler Cleaning Procedure Sections

**A.** Sampler Cleaning Procedure for Industrial ISCO Portable Auto-sampler

**B.** Sampler Cleaning Procedure for Stormwater ISCO Portable Auto-sampler

**C.** Sampler Cleaning Procedure for Dedicated Clean Techniques ISC Portable Auto-sampler

**D.** Cleaning Procedure for Manning Stationary Vacuum Auto-sampler

## A. Sampler Cleaning Procedure for Industrial ISCO Portable Auto-sampler

1. Clean off the outside of the sampler with a hose and/or wet towel.
2. Dismantle the sampler by removing the cover and bottom chamber.
3. Check the desiccant indicator. **Replace desiccant** if indicator is pink.
4. Remove pump tubing, discharge tubing, and fittings from sampler head.
5. Either clean tubing and fittings or replace with pre-cleaned tubing and fittings.
   - 5.1 To clean tubing and fittings, wash with lab-grade detergent followed by three rinses with tap water.
   - 5.2 Next, rinse tubing and fittings with 10% HNO3 followed by three rinses with DI water.
6. Wipe down the sampler components and reassemble.
7. Record in the log any pertinent information.
8. Put sampler in its designated storage location.

## B. Sampler Cleaning Procedure for Stormwater ISCO Portable Auto-sampler

1. Clean off the outside of the sampler with a hose and/or wet towel.
2. Dismantle the sampler by removing the cover and bottom chamber.
3. Check the desiccant indicator. Replace desiccant if indicator is pink.
4. Soak dirty Teflon tubing and Teflon coated strainer in a clean, dedicated container containing hot water and laboratory grade detergent solution (5%) for at least one hour. Make sure tubing is completely filled (no air bubbles) with cleaning solution.
5. Remove tubing from laboratory grade detergent solution and drain completely (connect strainer to tubing at this point, if not connected already).
6. Rinse laboratory grade detergent solution from outside of tubing with tap water and then DI water, and drain as much solution from the tubing while rolling it in a coil.
7. Wipe down the sampler components and reassemble.
8. Place both the suction strainer and the discharge end of the tubing in a carboy containing 50% hydrochloric acid.

9. Choose the Manual Function→Pump Forward to circulate the acid solution through the tubing for at least 15 minutes. Remove the suction end of the tubing from the acid while continuing to pump out as much of the acid as possible.

10. Fill a clean acid washed dedicated DI carboy with DI water. Insert suction end of tubing (strainer) in the DI water and the discharge end of tubing to an open sink.

11. Choose the Manual Function→Pump Forward to circulate the DI water through the tubing for 15 minutes refilling the DI water carboy as necessary.

12. Pump out as much water as possible from the tubing.

13. Record in the log any pertinent information.

14. Put sampler in its designated storage location.

## C. Sampler Cleaning Procedure for Dedicated Clean Techniques ISCO Portable Auto-sampler

1. Soak dirty Teflon tubing and Teflon coated strainer in a clean, dedicated container containing hot water and laboratory grade detergent solution (5%) for at least one hour. Make sure tubing is completely filled (no air bubbles) with cleaning solution.

2. Remove tubing from laboratory grade detergent solution and drain completely (connect strainer to tubing at this point, if not connected already).

3. Rinse laboratory grade detergent solution from outside of tubing with tap water and then DI water, and drain as much solution from the tubing while rolling it in a coil.

4. Bag the tubing in a clear plastic sack.

5. Connect tubing to water source to flush inside of tubing with tap water for about 10 minutes.

6. Check the desiccant indicator. Replace desiccant if indicator is pink.

7. Connect a battery to the dedicated ISCO sampler.

8. Connect tubing to dedicated auto-sampler pump and place both the suction strainer and the discharge end of the tubing in the dedicated carboy containing 10% nitric acid.

9. Choose the Manual Function→Pump Forward to circulate the acid solution through the tubing for at least 15 minutes. Remove the suction end of the tubing from the acid while continuing to pump out as much of the acid as possible.

10. Fill a clean acid washed dedicated DI carboy with DI water. Insert suction end of tubing (strainer) in the DI water and the discharge end of tubing to an open sink.

11. Choose the Manual Function→Pump Forward to circulate the DI water through the tubing for 15 minutes refilling the DI water carboy as necessary.

12. Pump out as much water as possible from the tubing.

13. Open clean oven bag or re-sealable plastic bag and insert strainer inside. Carefully wrap the bag around the strainer and adjacent tubing.

14. Place bagged strainer and the bagged roll of suction tubing into a clear, plastic sack that envelopes all the tubing up to within one foot of the connection to the auto sampler pump tubing. This completes the outer bag of the double bagging process for the suction tubing and strainer.

15. Rinse discharge end of pump tubing with squirt bottle of 10% Nitric Acid, then with DI.

16. Carefully wrap the end with plastic laboratory film. Place discharge end of tubing into a clear, clean oven bag or re-sealable plastic bag and wrap plastic around tubing. Secure bag to tubing by taping it in place.

    NOTES:
    - Change gloves often. Never touch keypad, water faucet, DI faucet, DI jug, or anything else and then touch tubing.
    - Only touch tubing with clean gloves.
    - Once tubing has been acid-washed, prevent the tubing ends from contacting any contaminated (non-acid washed) surfaces until the ends are capped with plastic laboratory film or bagged.
    - Do not remove the plastic laboratory film or bag until the tubing is ready for use at the sampling site.

## D. Cleaning Procedure for Manning Stationary Vacuum Auto-sampler

1. Clean off the outside of the sampler and refrigerator with a wet towel.

2. Remove the sample jugs from the refrigerator. Clean out the inside of the refrigerator.

3. Check the sample tubing for any abrasions, solids build up, and general wear. Replace if necessary.

4. Perform at least 3 test cycles with the soapy water or bleach water.

   Note: If a bleach solution is used for cleaning, only clean samplers on Fridays or Mondays to ensure no bleach residue is present that could affect BOD results.

5. Dismantle the Measuring Chamber from the Chamber Collar.

6. Remove the Measuring Chamber and discharge tubing from the sampler and wash in soap water or bleach water. Remove the Spiral Tube from the Slotted (discharge) Tube and place in cleaning solution bucket/jug.

7. Wash out the Measuring Chamber, spiral tub, and discharge tubing with a brush. Rinse with the rinse water.

8. Use brush to wash underside of Chamber Top and inside the Slotted tube while making sure no water gets into the tubing connected to the pressure switch. Use a towel with rinse water to rinse the equipment.

9. Replace the Spiral Tube back on the Slotted Tube, replace the discharge tubing on the sampler, and replace the Measuring Chamber on top of the sampler. Replace the Chamber Lid and screw on the Chamber Collar.

10. Take note of sample amount in sample chamber. If sample amount needs to be adjusted (should be about 200 mL of sample) remove Chamber Collar and Chamber Lid and twist Spiral Tube.

11. Check all connections to be sure they are tight.

12. Put sampler in flow mode.

13. Enter cleaning information on log.

# Appendix C: TMDL Benchmarks (December 2015)

# Total Maximum Daily Load (TMDL) Benchmarks

Prepared for
City of Eugene, Oregon
December 29, 2015

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# List of Abbreviations

| | |
|---|---|
| BMP | best management practice |
| BOD | biochemical oxygen demand |
| CIP | Capital Improvement Plan |
| City | City of Eugene |
| DEQ | (Oregon) Department of Environmental Quality |
| DO | dissolved oxygen |
| EMC | event mean concentration |
| EPA | U.S. Environmental Protection Agency |
| LCL | lower confidence limit |
| MEP | maximum extent practicable |
| MS4 | municipal separate storm sewer system |
| N/A | not applicable |
| NPDES | National Pollutant Discharge Elimination System |
| ODOT | Oregon Department of Transportation |
| PLRE | pollutant load reduction evaluation |
| ROW | right-of-way |
| SWMP | Stormwater Management Plan |
| TBD | to be determined |
| TMDL | total maximum daily load |
| TSS | total suspended solids |
| UCL | upper confidence limit |
| VSS | volatile suspended solids |
| WLA | wasteload allocation |

# Section 1: Introduction

This introductory section provides a summary of the purpose and organization of this document. In addition, background information is provided regarding total maximum daily load (TMDL) requirements related to national pollutant discharge elimination system (NPDES) municipal separate storm sewer system (MS4) permits.

## 1.1 Purpose and Organization

The purpose of this document is to document how the City of Eugene (City) intends to meet its municipal stormwater permit requirements related to the development of future pollutant load reductions for specific pollutants identified in the Upper Willamette TMDL. The future pollutant load reduction estimates are called "TMDL benchmarks."

The general organization of this TMDL benchmark document is as follows:

- Section 1 includes background information about TMDLs in general, and related City-specific NPDES MS4 permit requirements and relevant work that the City has completed to date.
- Section 2 describes the City's process and development of updated TMDL benchmarks, including the identification of additional structural best management practices (BMPs).
- Section 3 provides the TMDL benchmark modeling results, including comparison of the TMDL benchmarks to the overall TMDL wasteload allocations.
- Section 4 provides discussion and conclusions associated with the development of TMDL benchmarks. Discussion includes reference to implementation of the City's stormwater management program and application of non-structural controls in the context of these quantitative pollutant load estimates.
- Attachment A summarizes (in tabular form) the specific, quantitative pollutant load estimates and pollutant load reduction estimates used to formulate the TMDL benchmarks.

## 1.2 TMDL Background

A TMDL is a calculation of the maximum amount of a pollutant that a water body can receive and still meet water quality standards for that particular pollutant. A TMDL is used to allocate the allowable pollutant load discharge to point sources (i.e., wastewater treatment plants (WWTP), areas covered by an NPDES permit) through wasteload allocations (WLAs), and to nonpoint sources (i.e., agriculture, forests) through load allocations (LAs). Permitted dischargers, including MS4s, are considered point sources and pollutant discharge is regulated via assigned WLAs.

The NPDES MS4 permits regulate stormwater-related TMDL pollutant discharges when the permittee discharges to receiving waters with an established TMDL. Under the coverage of this permit, pollutant discharges for applicable TMDL parameters must be reduced to the maximum extent practicable (MEP) through the implementation of best management practices (BMPs). BMPs may be both structural and non-structural in nature. Over time, BMPs are to be improved through an adaptive management process to continually work towards making progress in achieving WLAs.

In Oregon, to evaluate progress in meeting WLAs, NPDES MS4 permits include a requirement for the development of TMDL pollutant load reduction benchmarks. By definition, a TMDL benchmark is a future TMDL pollutant load reduction estimate projected for the end of the 5-year MS4 NPDES permit term. TMDL benchmarks are used as a tool to evaluate the effectiveness of planned BMP implementation and to guide progress and adaptive management of MS4 NPDES permitted stormwater programs.

Specific to the Phase I NPDES MS4 permittees in Oregon, the current NPDES MS4 permit requires that during permit year four (out of the five year permit term) permittees are required to complete a pollutant load reduction evaluation (PLRE). The purpose of the PLRE is to estimate TMDL pollutant load reduction

reflective of the current permit term and compare the pollutant load reduction to any previously established TMDL benchmarks. Then, during permit year five, in conjunction with the permit renewal application, the permittee is required to propose new TMDL benchmarks for the upcoming permit term. The new TMDL benchmarks must reflect additional BMPs or adaptive management changes to the stormwater program in order to meet previously established benchmarks that were not met per the PLRE and continued progress towards achieving WLAs.

Development of the PLRE and TMDL benchmarks are intended to be part of an iterative, adaptive management process to reduce stormwater pollutant discharges to receiving waters and help bring a waterbody into compliance with water quality standards.

## 1.3 Description of Eugene's NPDES MS4 Permit Requirements

In 2008, as part of its previous MS4 permit renewal application package, the City submitted TMDL benchmarks, estimating the pollutant load reduction expected to be achieved through the end of the permit term (estimated to be 2013) with the implementation of structural BMPs. As described in Section 1.2, the City's current NPDES MS4 permit, issued December 30, 2010, requires follow-up evaluations of TMDL pollutant load and load reduction, including completion of a TMDL PLRE and, depending on the results of the PLRE, updated TMDL benchmarks.

The City submitted its PLRE to the Oregon Department of Environmental Quality (DEQ) in December 2014; the City's PLRE reflects the estimated stormwater pollutant load reduction achieved for all applicable TMDL parameters, considering development conditions and BMP implementation in 2014. The PLRE confirmed the need for updated TMDL benchmarks, which is the subject of this report. This report will be included in the City's upcoming permit renewal application package and submitted to DEQ in December 2015.

Per the City's MS4 permit, Schedule D.3.d.i, TMDL benchmarks are to reflect:

1. *Additional pollutant load reduction necessary to achieve the benchmark estimated for the (current) permit term, if not achieved (based on the PLRE); and*
2. *The pollutant load reduction proposed to achieve additional progress towards the TMDL WLA during the next permit term.*

As described in the PLRE, current BMP implementation meets previously established TMDL benchmarks, but does not achieve TMDL WLAs. Therefore, adaptive management is required to assess current BMP implementation and update TMDL benchmarks to reflect continued pollutant load reduction and progress toward the TMDL WLA over the next 5-year permit term. The City's current MS4 permit expires on December 29, 2015 and will likely be administratively extended until DEQ acts to issue a new permit; therefore, the timeframe of the next permit term is assumed to be 2016 to 2021.

Per Schedule D.3.d.ii, specific requirements for this TMDL benchmark submittal are as follows:

1. *An explanation of the relationship between the TMDL wasteload 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 the current pollutant loadings that reflect the implementation of the current BMPs and the BMPs proposed to be implemented during the next permit term.*

# Section 2: TMDL Benchmark Development

The development of TMDL benchmarks for the City relies on similar modeling assumptions as detailed in the City's PLRE (December 2014). This section provides background related to the applicable TMDLs, modeling assumptions, and model simulations.

## 2.1 TMDL Applicability

TMDLs relevant to stormwater discharges from the City are contained in the Willamette Basin TMDL, approved in September 2006 by the U.S. Environmental Protection Agency (EPA). The Upper Willamette Subbasin TMDL and McKenzie Subbasin TMDL, which are both included in the Willamette Basin TMDL document, cover the following water bodies: Upper Amazon Creek, A3 Channel, Amazon Diversion Channel, Fern Ridge Reservoir, and McKenzie River.

The Upper Willamette Subbasin TMDL and McKenzie Subbasin TMDL include water-body-specific allocations for urban stormwater sources. Applicable TMDL parameters for the City include bacteria, dissolved oxygen (DO) (with biochemical oxygen demand [BOD], total phosphorus, and volatile suspended solids (VSS)[1] used as a surrogate), and turbidity (with total suspended solids (TSS) used as a surrogate). Given limited data for VSS, TSS is the common analyzed parameter.

Stormwater runoff from approximately 60 percent of the City discharges to the Willamette River indirectly via the Amazon Creek drainage system, including tributaries referenced specifically in the Willamette Basin TMDL (Upper Amazon Creek, A3 Channel, Amazon Diversion Channel, and Fern Ridge Reservoir). Runoff from approximately 40 percent of the City discharges relatively directly to the Willamette River via storm system outfalls and local tributaries, including Spring Creek and Flat Creek. Runoff from a relatively small portion of the City (approximately 500 acres) discharges to the McKenzie River, which is a major tributary to the Willamette River.

A summary of the Willamette TMDLs and associated WLAs applicable to Eugene is provided in Table 1.

**Table 1. Willamette River WLAs (applicable to the City's MS4)**

| Water body | Parameter | WLA |
|---|---|---|
| Upper Amazon Creek | Bacteria *(E. coli)* | 84% (annual reduction) |
| A3 Channel | Bacteria *(E. coli)* | 33% (annual reduction) |
| Fern Ridge Reservoir | Bacteria *(E. coli)* | 64% (annual reduction) |
| | Turbidity (TSS surrogate) | 54.6% (annual reduction) |
| Amazon Diversion Channel | Biological oxygen demand | 40% (annual reduction) |
| | Volatile suspended solids (TSS surrogate) | 40% (annual reduction) |
| | Nutrients (total phosphorus surrogate) | 40% (annual reduction) |
| Upper Willamette River (main and unreferenced tributaries) | Bacteria *(E. coli)* | 65% (annual reduction) |
| McKenzie River | Bacteria *(E. coli)* | 65% (annual reduction) |

*Note: The TMDL watershed area for the Amazon Diversion Channel is the same as the Fern Ridge Reservoir.*

1 In the Willamette Basin TMDL, page 10-147, sediment oxygen demand is caused partly by discharges of VSS. Load reduction is referred to as the reduction of VSS in the TMDL.

Additional background information related to the interpretation of the Upper Willamette subbasin TMDL specific for the City is provided in the PLRE, Section 2.

## 2.2 Modeling Methods and Assumptions

To generate pollutant loads for the development of TMDL benchmarks, the City used the spreadsheet pollutant loads model originally developed in 2008 and updated for the PLRE in 2014. Rainfall, land use, and structural BMP coverage information was entered into the model, which was configured with average pollutant concentration information for various land uses and BMP categories. Pollutant loads were then calculated by TMDL watershed.

The model area for the TMDL benchmarks is the City's NPDES MS4 permit area as identified for the PLRE, reflective of the City limits through September 2014. Certain areas within the City limits that are the responsibility of the Oregon Department of Transportation (ODOT) and Lane County were omitted from the modeled area, as ODOT and Lane County have separate NPDES MS4 permits for their stormwater discharges from these areas. These excluded areas are: the Interstate 5 (I-5) corridor, the I-105 corridor, the Beltline highway, and Delta Highway between I-105 and Beltline. In addition, the Willamette River itself was omitted from the modeled area.

Land use coverage and existing structural BMP coverage is consistent with simulated current (2014) conditions for the PLRE. Land use event mean concentrations (EMCs) and BMP effluent concentrations, used to simulate pollutant load generation from the modeled area, are also consistent with values used for the PLRE. Tables 4-4 and 4-5 of the PLRE document include the land use EMC and BMP effluent values applicable for the PLRE and TMDL benchmarks.

As TMDL benchmarks are pollutant load reduction estimates projected for the end of the next permit term, planned structural BMP installations or retrofits provide the basis for achieving future pollutant load reductions. To identify the additional BMPs that will result in additional TMDL pollutant load reduction, the City's Public Works staff reviewed the Retrofit Plan (December 2014), the adopted FY16-21 Capital Improvement Plan (CIP) and the current Stormwater Basin Master Plans (2002 & 2012), to identify potential future public stormwater facility installations. Staff estimated the location (by TMDL watershed), BMP facility type(s), and drainage area(s) for these projects. The potential, future stormwater facility installations, or equivalent projects, will be completed by 2021, or end of the City's next NPDES MS4 permit term, in accordance with Schedule D.3.d.i.2 of the NPDES MS4 permit. A total of four future stormwater capital projects were identified and are reflected in the TMDL benchmarks.

Table 2 lists the TMDL watersheds, and estimated future stormwater facility installations. Table 2 also summarizes the current status in meeting the overall TMDL WLA and 2013 benchmarks (if applicable), from Table 5-2 of the PLRE.

**Table 2. 2015 TMDL Benchmark Status and Future BMP Installations**

| TMDL watershed | Parameter (units) | 2014 pollutant load reduction estimate results | | 2015 TMDL benchmark development | | |
|---|---|---|---|---|---|---|
| | | Met (2013) benchmark?[d] | Met TMDL WLA? [d] | Est. Future BMP installation | Est. Future BMP location description | Est. Total drainage area (ac) |
| A3 Channel | Bacteria (counts) | Yes | No | Manufactured treatment facility (type TBD, modeled as hydromodynamic separator) | West Eugene, north of 5th and Seneca | 20 |
| Upper Amazon Creek | Bacteria (counts) | Yes | No | Filtration raingarden/lined planter | Street ROW along 7th Street, east of Bailey Hill | 1 |
| Upper Willamette River | Bacteria (counts) | Yes | No | Bioswale | River Play parking lot, Alton Baker Park | 0.7 |
| | | | | Filtration rain garden/lined planter | Street ROW along 2nd Avenue, west of Blair Blvd. | 1 |
| McKenzie River[a] | Bacteria (counts) | N/A | No | None, see Section 4 | N/A | N/A |
| Fern Ridge Reservoir[b] | Bacteria (counts) | N/A[c] | No | See future BMP installations for the A3 Channel and Upper Amazon | See future BMP installations for the A3 Channel and Upper Amazon | 21 |
| | TSS (pounds) | Yes | No | | | |
| Amazon Diversion Channel[b] | Total phosphorus (pounds) | Yes | No | See future BMP installations for the A3 Channel and Upper Amazon | See future BMP installations for the A3 Channel and Upper Amazon | 21 |
| | BOD (pounds) | Yes | No | | | |
| | TSS (pounds) | Yes | No | | | |

a. *This watershed was not modeled in 2008, thus no TMDL benchmarks were previously established. No future BMPs are projected for this watershed.*

b. *The Amazon Diversion Channel and Fern Ridge Reservoir watershed areas are the same, and reflect the combined area of the Upper Amazon Creek and A3 Channel TMDL watersheds.*

c. *Because the Fern Ridge Reservoir TMDL watershed area is the combined A3 Channel and Upper Amazon TMDL watershed areas, bacteria was not specifically simulated for this watershed in 2008, and thus no TMDL benchmarks were previously established.*

d. *Refer to the PLRE for results of the comparison to 2013 benchmarks and WLAs.*

The TMDL benchmarks are based solely on proposed public structural BMP installations, and not future private structural BMPs or the many non-structural BMPs implemented by the City. This conservative assumption was made, in part, because of the unpredictable pace and location of private development activities (and associated private structural BMP installation), and the relative lack of quantitative pollutant reduction data for non-structural controls such as street sweeping, catch basin cleaning, pet waste disposal, waterway clean-up, illicit discharge detection and elimination, and stormwater education. These essential non-structural program areas obviously reduce stormwater pollution but data is not available to quantify the pollutant load reduction achieved from these measures. Additional detail related to the conservative nature of the TMDL benchmarks is provided in Section 4.

Based on results of the PLRE, updated TMDL benchmarks are required in each of the six modeled TMDL watersheds for bacteria. Specific for the Fern Ridge Reservoir/Amazon Diversion Channel watershed, updated TMDL benchmarks are also required for total phosphorus, TSS, and BOD.

## 2.3 Model Simulation

To develop the updated TMDL benchmarks, area reflecting current land use and future (2021) structural BMP implementation was calculated for each TMDL watershed, and input into the spreadsheet loads model. The future, structural BMP implementation assumes that all existing BMPs are still in place and functioning, and includes the addition of the four new, public BMPs anticipated to be constructed during the next 5-year permit term, as defined in Table 2. An annual rainfall of 46 inches was used to simulate annual pollutant loading, consistent with assumptions of the PLRE. A model scenario reflecting future BMP implementation was simulated to estimate pollutant loads reflective of future planned BMPs, and to establish the updated TMDL benchmarks.

# Section 3: TMDL Benchmark Results

For consistency with 2008 methods and assumptions, TMDL benchmarks were calculated as the difference between the modeled loads associated with the no-BMP scenario, and the (future/2021) with-BMP scenario. Because of the variability in stormwater data, pollutant loads themselves are typically calculated and presented as a range. Pollutant load estimates reflecting the no-BMP, current/2014 with-BMP, and future/2021 with-BMP scenarios are provided in Attachment A. Calculation of the TMDL benchmarks was based on the pollutant load estimates in Attachment A.

Table 3 provides TMDL benchmarks both as a load reduction and as a percentage load reduction. Because the pollutant load estimates are presented as a range, the TMDL benchmarks are also presented as a range. Calculation of the TMDL benchmarks as a percentage load reduction allows for direct comparison between the WLA and the TMDL benchmarks per Schedule D.3.d.ii.1 of the City's NPDES MS4 permit. The WLA is also shown in Table 3 for reference.

**Table 3. TMDL Benchmarks (2016-2021)**

| TMDL watershed | Parameter (units) | Annual WLA[a] (% reduction) | 2015 TMDL benchmark development | |
|---|---|---|---|---|
| | | | TMDL benchmarks (% load reduction)[b], range | TMDL benchmarks (counts or pounds)[b], range |
| A3 Channel[c] | Bacteria (counts) | 33 | 0.63–0.90 | $1.42 \times 10^{11}$–$7.38 \times 10^{11}$ |
| Upper Amazon Creek | Bacteria (counts) | 84 | 0.23–0.35 | $3.00 \times 10^{11}$–$1.36 \times 10^{12}$ |
| Upper Willamette River | Bacteria (counts) | 65 | 0.55–0.82 | $1.05 \times 10^{12}$–$4.87 \times 10^{12}$ |
| McKenzie River | Bacteria (counts) | 65 | None, see Section 4 | None, see Section 4 |
| Fern Ridge Reservoir | Bacteria (counts) | 64 | 0.29–0.45 | $4.40 \times 10^{11}$–$2.09 \times 10^{12}$ |
| | TSS (pounds) | 54.6 | 0.55–0.90 | 13,948–48,389 |
| Amazon Diversion Channel | Total phosphorus (pounds) | 40 | 0.58–1.23 | 68–274 |
| | BOD (pounds) | 40 | 0.82–1.36 | 3,136–10,226 |
| | TSS (pounds) | 40 | 0.55–0.90 | 13,948–48,389 |

*a. Bacteria, total phosphorus, TSS, and BOD WLAs are all expressed as a percent load reduction.*

*b. The TMDL benchmarks are calculated as the difference between the current no-BMP scenario load and the future with-BMP scenario load (which includes existing BMPs). The benchmarks have been calculated as a load reduction and as a percent reduction for direct comparison with the WLA.*

*c. Future-conditions BMP implementation is assumed in the A3 Channel TMDL watershed. However, the proposed BMP is not effective at bacteria removal. Therefore, no quantitative TMDL benchmark has been developed. However, reference to the proposed facility is included in Section 2 of this TMDL benchmark TM.*

As noted in Table 3, a TMDL benchmark was not established for the McKenzie River watershed in 2008. No anticipated CIPs are set to be installed in this area from 2016 to 2021; however, the City's stormwater program, including the full suite of non-structural control measures, apply in this watershed and are expected to contribute to TMDL pollutant load reduction.

# Section 4: Discussion and Conclusions

The TMDL benchmarks are conservative estimates of the pollutant load reduction anticipated during the upcoming MS4 permit term with the use of public structural BMPs alone. This section provides details related to the conservative nature of the TMDL benchmarks in conjunction with the City's stormwater program and provides additional discussion and conclusions related to the interpretation of TMDL benchmarks.

## 4.1 Application to the City's Stormwater Program

The pollutant load reduction estimates associated with the PLRE and the TMDL benchmarks do not reflect non-structural BMP implementation representative of the City's current stormwater program and SWMP. The pollutant load reduction estimates only approximate pollutant load reduction achieved with use of public structural BMPs. The approach taken to estimate pollutant load reduction is thus a conservative one.

### 4.1.1 Non-Structural BMP Implementation and Effectiveness

Measuring the effectiveness of non-structural practices requires significant assumptions in order to reflect pollutant reduction associated with a behavior or conditional practice. There is significant interpretation needed to translate a variable practice or activity into single numeric reduction of a particular pollutant over the course of a season or year.

The City chose a conservative approach to the quantitative pollutant load modeling and TMDL benchmark development and opted to account for the effectiveness of non-structural BMPs in narrative form only. The City implements a variety of non-structural BMPs activities that are directly attributable to bacteria, nutrient, and TSS reduction. Such activities include erosion control, illicit discharge detection and elimination, street sweeping, catch basin cleaning, facility maintenance, system operations and maintenance, pet waste program, and public education.

Research has been conducted related to literature values for non-structural BMP effectiveness. One such data source is the Watershed Treatment Model (WTM) (Caraco, 2010), a planning-level model developed by the Center for Watershed Protection. The model is a simple spreadsheet used to estimate pollutant loading and evaluate effects of proposed structural and non-structural management practices and future development on pollutant loads.

The WTM provides default values for the effectiveness of certain non-structural BMPs. Although not used in this benchmark modeling effort, the WTM efficiencies of non-structural practices, including street sweeping, riparian buffer protection, catch basin cleaning, and erosion and sediment control, are provided in the form of percent removals in Tables 4 and 5 for additional reference.

**Table 4. Example Pollutant Load Removal Efficiencies of Street Sweeping**

| Sweeper type | Efficiency (% removal) | | | |
|---|---|---|---|---|
| | Residential | | Other roads | |
| | Nutrients | TSS | Nutrients | TSS |
| Mechanical | 24 | 30 | 4 | 5 |
| Regenerative air | 51 | 64 | 18 | 22 |
| Vacuum assisted | 62 | 78 | 63 | 79 |

*Source: WTM.*

**Table 5. Example Pollutant Load Removal Efficiencies of Non-Structural BMPs (Other)**

| BMP | Efficiency (% removal) | | |
|---|---|---|---|
| Erosion and sediment control | 70 | | |
| Catch basin cleanouts | Nutrients | Total suspended solids | |
| Monthly cleaning | 15 | 25 | |
| Semiannual cleaning | 8 | 13 | |
| Riparian buffers | TP | TSS | TN |
| | 10 | 70 | 30 |

*Source: WTM.*

These estimated efficiencies of non-structural BMPs are provided here to illustrate the conservatism of the benchmarks model and pollutant load reduction estimates. Additional load reductions from these practices may be significant. The City intends to continue to implement and adaptively manage its stormwater management program aimed at reducing stormwater pollution to the MEP including applicable TMDL parameters and other pollutants of concern.

### 4.1.2 Structural BMP Implementation and Effectiveness

In addition to not accounting for non-structural BMP implementation, the forecasted structural BMP implementation and coverage used to develop the TMDL benchmarks is also conservative. Structural BMPs are required for public and private new and redevelopment activities city-wide in accordance with the City's Stormwater Design Standards (January 2014). However, because TMDL benchmarks require a five year projection, only those foreseeable public structural BMP installations can reasonably be committed to by the City at this time.

The City anticipates continued private structural BMP installations for redevelopment that use infiltration and low-impact development principles in conjunction with its stormwater development standards. This additional structural BMP coverage will result in increased pollutant load reductions, based on the current definition and calculation of the TMDL benchmark. The omission of future structural BMPs associated with re-development activities from the TMDL benchmarks is due to the unknown location and extent of these future activities and facility selection.

The City also anticipates that additional, currently unscheduled public BMP installations may occur over the next NPDES MS4 permit term. These additional public structural BMPs may be installed in conjunction with other public-works projects (in accordance with the stormwater development standards), or as opportunistic stormwater retrofits as part of other programs and initiatives. Over the next permit term, the City is planning

on initiating an update to its stormwater master plan (basin plans) which will entail updating the stormwater capital projects list which will inform future CIPs.

Lastly, the model may be conservative due to the type of structural BMPs modeled for the anticipated future CIP projects. This is particularly noticeable in the A3 Channel TMDL watershed, where the proposed BMP installation is estimated to treat 20 additional acres of currently untreated area. The proposed BMP is currently defined as a manufactured treatment system, which may be configured as a treatment train system. However, because of the future facility's relatively large drainage area and lack of detailed design at this time, the City is unsure of the specific configuration of the system. As a result, the City opted to conservatively model the proposed BMP as a hydrodynamic separator. While a hydrodynamic separator is effective at treatment for BOD and TSS, two of the TMDL parameters applicable for the A3 Channel TMDL watershed (hence, the Fern Ridge and Amazon watersheds), they are not necessarily effective for treatment of bacteria.

## 4.2 TMDL Benchmark Interpretation and Conclusions

As shown in Table 3, bacteria, TSS, BOD, and total phosphorus load reductions are anticipated through the implementation of current and future structural BMPs. The City's TMDL benchmarks reflect current structural BMPs, and the additional future installation of four independent capital improvement projects, covering approximately 23 acres of previously untreated area. However, the change in pollutant load reductions due to the additional structural BMPs is low compared to the significant pollutant reductions necessary to achieve the WLAs.

While additional load reductions are likely achieved and just not reflected in the model, these reductions are not estimated to be significant enough to achieve WLAs, which leads to questions related to the underlying TMDL development methods and assumptions.

### 4.2.1 WLAs versus Instream Water Quality Trends

The City prepared a WLA attainment assessment (WLAAA) and submitted it to DEQ in November 2014. The purpose of this assessment was to evaluate and estimate what it would take, hypothetically, in terms of additional BMP implementation and costs, to achieve the WLAs. The WLAAA indicated that, in addition to certain impracticalities of implementing controls on all existing developed properties, achieving the WLA would require construction and maintenance costs that far exceed the City's definition of maximum extent practicable (MEP).

While the hypothetical pollutant load reduction estimates reflected in the WLAAA are well beyond the City's definition of MEP, ambient (otherwise known as instream) water quality trends analyses are showing some improvements over time. Ambient monitoring has been conducted by the City of Eugene at several (currently 12) instream sampling sites since 1997. Each year, the full set of ambient data is analyzed and water quality trends are identified. The data analysis and results including trends are summarized in the City's annual stormwater reports, submitted to DEQ in December. The most recent data analysis and trends were included in the City's 2014 Stormwater Annual Report and in the PLRE.

Table 6 summarizes results of the 2014 ambient water quality trends evaluation for water bodies and parameters where trends were identified. Decreasing concentration trends were found to exist, variously, for nutrients (nitrogen, phosphorus), BOD, certain metals (arsenic, nickel, etc.), TSS/turbidity, and temperature. Increasing trends existed for certain metals, most notably zinc, and certain instances of conductivity and dissolved oxygen (DO). Note that increasing trends for DO reflect water quality improvement. While increasing trends were identified for a small number of pollutants, decreasing trends are prevalent and can be attributed in part to stormwater program implementation citywide. It should be noted that no statistically significant trends (increasing or decreasing) were observed for bacteria.

It is especially interesting to note that some of the water quality trends in the City continue to show progress, even with increasing development and population growth. Eugene's population increased by approximately 25 percent or over 30,000 people during the time the data were collected.

**Table 6. Results from the 2014 Eugene Ambient Water Quality Trends Analysis**

| Monitoring location | Trends of water quality analyte[a] | | |
|---|---|---|---|
| | Decreasing concentration trends | | Increasing concentration trends |
| **Amazon Creek Basin sites** | | | |
| Willow Creek | Total Kjeldahl nitrogen | | • Lead, dissolved<br>• Zinc, dissolved and total |
| Amazon Creek at 29th Avenue | Lead, total[b] | | • Zinc, dissolved and total<br>• Chemical oxygen demand |
| Amazon Creek at railroad tracks | • Cadmium, total<br>• Chromium, dissolved and total<br>• Lead, total[b] | • Mercury, dissolved and total<br>• Nickel, dissolved | Zinc, dissolved and total |
| Amazon Diversion Channel at Royal Avenue | • Arsenic, dissolved and total[b]<br>• Mercury, dissolved[b]<br>• Molybdenum, dissolved | • Nickel, dissolved and total<br>• Biochemical oxygen demand<br>• Total Kjeldahl nitrogen | Zinc, total |
| A3 Channel at Terry Street | • Arsenic, dissolved and total[b]<br>• Cadmium, total<br>• Chromium, dissolved and total<br>• Lead, total[b]<br>• Mercury, dissolved and total[b]<br>• Molybdenum, dissolved | • Nickel, dissolved and total<br>• Silver, total<br>• <u>Biochemical oxygen demand</u><br>• <u>Phosphorus, total</u><br>• Temperature<br>• Total Kjeldahl nitrogen | None |
| Amazon Creek at Royal Avenue | • Chromium, dissolved and total<br>• Lead, total[b]<br>• Mercury, total<br>• Nickel, total | • Temperature<br>• <u>Total suspended solids</u><br>• <u>Turbidity</u> | Zinc, dissolved and total |
| **Willamette River Basin sites** | | | |
| Knickerbocker Bridge | <u>Ortho phosphorus</u> | | Specific conductance |
| Downstream of Beltline Bridge | <u>Ortho phosphorus</u> | | None |
| Delta Ponds | Molybdenum, dissolved and total | | Dissolved oxygen[b] |

*Source: 2014 Stormwater Annual Report, City of Eugene, December 2014. TMDL parameters are underlined.*

*a. Significant at 2ρ = 0.01*

*b. On Oregon 2004/2006 303(d) list. Note: increasing trend in DO indicates water quality improvement.*

### 4.2.2 Limitations related to Bacteria Load Reduction

Bacteria pollutant load reduction presents one of the greatest challenges for jurisdictions throughout Oregon that are subject to a bacteria TMDL. Stormwater programs are traditionally limited to the use of passive structural BMPs that are modestly effective in reducing bacteria concentrations. Jurisdictions subject to the Willamette Basin TMDL universally have bacteria as a TMDL parameter.

Oregon's water quality standards for bacteria are based on an indicator bacteria, *E. coli,* which is found in the guts (and feces) of all warm-blooded animals. The bacteria recreational water quality standard assumes

that *E. coli* concentrations are generally correlated with human pathogens, and it is intended to ensure that water bodies are safe for swimming, wading, and other uses where skin contact or ingestion could occur.

Exceedances of *E. coli* standards are common in urban water bodies. In addition to humans, pets, livestock, birds, rodents, and other wildlife can contribute *E. coli* to urban waters. Although animal feces can contain pathogens harmful to humans, waters contaminated by human feces are generally considered to be a greater risk to human health than waters contaminated by animal feces (Scott et al. 2002). However, the TMDLs for bacteria do not distinguish between bacteria sources, and the WLAs are conservatively established assuming that bacteria loads are from anthropogenic sources.

Studies have shown that bacteria sources in the local, urban environment have a very small human-derived component. Microbial Source Tracking (MST) techniques have been developed to identify the specific sources of fecal contamination. According to USEPA, "Although they are still experimental, (MST) methods represent the best tools available to determine pathogen TMDL load allocations and TMDL implementation plan development" (EPA, 2002, Wastewater Technology Fact Sheet). Four MST studies have been conducted in the Pacific Northwest (PNW) using the genetic fingerprinting method developed by Dr. Mansour Samadpour of the Institute of Environmental Health in Seattle, Washington.

As shown in Table 7, a relatively small percentage of the bacteria came from humans and human-related sources (e.g., pets and livestock). Most of the bacterial contamination in the referenced study areas came from non-human sources such as birds and rodents, over which jurisdictions have little control. The City of Eugene's bacteria pilot study qualitatively arrived at the same conclusion in terms of largest sources (avian followed by urban wildlife), and lesser sources (domestic pet waste, followed by human waste). Continued implementation and improvement through adaptive management of stormwater management programs is not likely to achieve bacteria WLAs. Therefore, in addition to continued adaptive management of stormwater programs and continued bacteria load reduction, a detailed review by DEQ of the bacteria TMDL utilizing the MST studies and various permittees' WLAAAs may be warranted in order to potentially adjust TMDL implementation requirements accordingly.

**Table 7. Typical Sources of Bacteria Identified in Four Pacific Northwest MST Studies**

| Study | State | Human | Avian | Canine/feline | Rodent | Farm/livestock | Wildlife | Unknown/other |
|---|---|---|---|---|---|---|---|---|
| Thurston County | Washington | 7% | 42% | 7% | 7% | 7% | 22% | 8% |
| Tualatin River | Oregon | 6% | 51% | 14% | 16% | - | 6% | 9% |
| Olympic Peninsula | Washington | 8% | 39% | 8% | - | 10% | 26% | 8% |
| City of Puyallup | Washington | 5% | 41% | 12% | 28% | 1% | 8% | 7% |
| Average of regions | | 7% | 43% | 10% | 17% | 6% | 16% | 8% |

In summary, continued progress toward the WLAs through implementation and adaptive management of non-structural and structural stormwater BMPs to the MEP is the City's approach to addressing TMDL requirements. Progress in meeting benchmarks is currently achieved, as shown in the City's PLRE developed in 2014, and should continue to be achieved over the following permit term as signified by the TMDL benchmarks presented in this report. TMDL benchmarks, presented in Table 3, are based on pollutant load estimates detailed in Attachment A. These pollutant load estimates do not assign quantitative reduction to the range of non-structural BMPs implemented by the City that obviously contribute to water quality protection and improvement.

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# Attachment A: Pollutant Load Summary

**Table A-1. City of Eugene Pollutant Load Summary**
**(for use with the PLRE and TMDL Benchmarks)**

| Waterbody | Season | WLA (%) | Pollutant Loading Estimate | | | | | | | | | Pollutant Load Reduction Estimate[c] | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Current, no BMPs (counts or pounds)[a] | | | Current, with BMPs (counts or pounds)[a] | | | Future, with BMPs (counts or pounds)[b] | | | Current conditions (counts or pounds)[d] | | | Future conditions (counts or pounds)[e] | | | Future conditions (%)[e] | | |
| | | | UCL | Mean | LCL | UCL | Mean | LCL | UCL | Mean | LCL | UCL | Mean | LCL | UCL | Mean | LCL | UCL | Mean | LCL |
| Bacteria (counts) | | | | | | | | | | | | | | | | | | | | |
| A3 Channel[f] | Annual | 33 | $8.18 \times 10^{13}$ | $4.29 \times 10^{13}$ | $2.03 \times 10^{13}$ | $8.11 \times 10^{13}$ | $4.27 \times 10^{13}$ | $2.02 \times 10^{13}$ | $8.11 \times 10^{13}$ | $4.27 \times 10^{13}$ | $2.02 \times 10^{13}$ | $7.38 \times 10^{11}$ | $2.71 \times 10^{11}$ | $1.42 \times 10^{11}$ | See Section 2 | | | See Section 2 | | |
| Upper Amazon | Annual | 84 | $3.86 \times 10^{14}$ | $2.32 \times 10^{14}$ | $1.30 \times 10^{14}$ | $3.84 \times 10^{14}$ | $2.31 \times 10^{14}$ | $1.30 \times 10^{14}$ | $3.84 \times 10^{14}$ | $2.31 \times 10^{14}$ | $1.30 \times 10^{14}$ | $1.34 \times 10^{12}$ | $5.20 \times 10^{11}$ | $3.00 \times 10^{11}$ | $1.36 \times 10^{12}$ | $5.30 \times 10^{11}$ | $3.00 \times 10^{11}$ | 0.35% | 0.23% | 0.23% |
| Upper Willamette | Annual | 65 | $5.93 \times 10^{14}$ | $3.49 \times 10^{14}$ | $1.92 \times 10^{14}$ | $5.88 \times 10^{14}$ | $3.48 \times 10^{14}$ | $1.91 \times 10^{14}$ | $5.88 \times 10^{14}$ | $3.48 \times 10^{14}$ | $1.91 \times 10^{14}$ | $4.82 \times 10^{12}$ | $1.85 \times 10^{12}$ | $1.04 \times 10^{12}$ | $4.87 \times 10^{12}$ | $1.87 \times 10^{12}$ | $1.05 \times 10^{12}$ | 0.82% | 0.54% | 0.55% |
| McKenzie | Annual | 65 | $2.16 \times 10^{13}$ | $1.25 \times 10^{13}$ | $6.65 \times 10^{12}$ | $2.16 \times 10^{13}$ | $1.24 \times 10^{13}$ | $6.64 \times 10^{12}$ | Same as current, with BMP | | | $4.80 \times 10^{10}$ | $1.97 \times 10^{10}$ | $1.04 \times 10^{10}$ | N/A | | | N/A | | |
| Fern Ridge Reservoir | Annual | 64 | $4.68 \times 10^{14}$ | $2.75 \times 10^{14}$ | $1.50 \times 10^{14}$ | $4.65 \times 10^{14}$ | $2.74 \times 10^{14}$ | $1.50 \times 10^{14}$ | $4.65 \times 10^{14}$ | $2.74 \times 10^{14}$ | $1.50 \times 10^{14}$ | $2.07 \times 10^{12}$ | $7.90 \times 10^{11}$ | $4.40 \times 10^{11}$ | $2.09 \times 10^{12}$ | $8.00 \times 10^{11}$ | $4.40 \times 10^{11}$ | 0.45% | 0.29% | 0.29% |
| TSS (pounds) | | | | | | | | | | | | | | | | | | | | |
| Fern Ridge Reservoir | Annual | 40 | 5,347,381 | 3,689,061 | 2,519,615 | 5,300,964 | 3,662,646 | 2,505,805 | 5,298,992 | 3,661,766 | 2,505,667 | 46,417 | 26,419 | 13,810 | 48,389 | 27,295 | 13,948 | 0.90% | 0.74% | 0.55% |
| Amazon Diversion Channel | Annual | 54.6 | 5,347,381 | 3,689,061 | 2,519,615 | 5,300,964 | 3,662,646 | 2,505,805 | 5,298,992 | 3,661,766 | 2,505,667 | 46,417 | 26,419 | 13,810 | 48,389 | 27,295 | 13,948 | 0.90% | 0.74% | 0.55% |
| Total phosphorus (pounds) | | | | | | | | | | | | | | | | | | | | |
| Amazon Diversion Channel | Annual | 40 | 22,190 | 16,359 | 11,665 | 21,947 | 16,218 | 11,605 | 21,916 | 16,200 | 11,597 | 243 | 141 | 60 | 274 | 159 | 68 | 1.23% | 0.97% | 0.58% |
| BOD (pounds) | | | | | | | | | | | | | | | | | | | | |
| Amazon Diversion Channel | Annual | 40 | 749,278 | 545,509 | 383,425 | 740,573 | 540,191 | 380,741 | 739,052 | 539,281 | 380,289 | 8,705 | 5,318 | 2,684 | 10,226 | 6,228 | 3,136 | 1.36% | 1.14% | 0.82% |

*a. The current (2014) no-BMP and with-BMP load estimates are presented in graphical form in the City's PLRE, Figures 5-1 to 5-8.*

*b. The future (2021) with-BMP load estimate is required per Schedule D.3.d.ii.4 of the NPDES MS4 permit. This load estimate provides the basis for development of the TMDL benchmarks.*

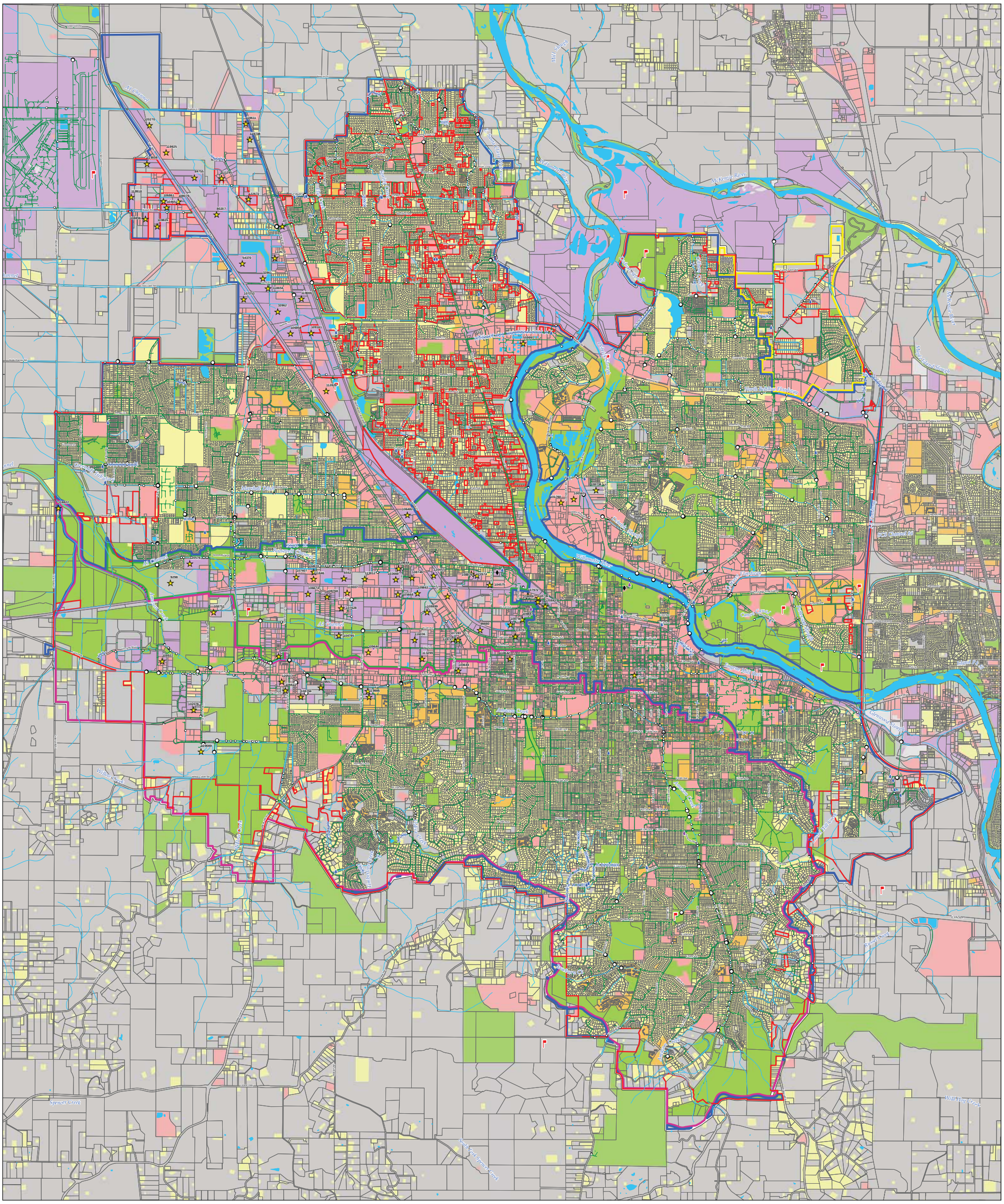
*c. The pollutant load reduction estimate is calculated as the difference between the no-BMP and with-BMP loads. The pollutant load reduction estimate is presented as a range, consistent with the pollutant loading estimate.*

*d. The current-conditions pollutant load reduction estimate is reflected in Section 5 of the City's PLRE in graphical and tabular form.*

*e. The future-conditions pollutant load reduction estimate is considered to be the TMDL benchmark. The TMDL benchmarks have been calculated as a load reduction and as a percentage load reduction, to allow for comparison to the WLA (defined as a percent load reduction) and, if necessary, future PLREs (defined as a load reduction).*

*f. Future-conditions BMP implementation is assumed in the A3 Channel TMDL watershed. However, the proposed BMP is not effective at bacteria removal. Therefore, no quantitative TMDL benchmark has been developed. However, reference to the proposed facility is included in Section 2.2 of this TMDL benchmark TM.*

# Appendix D: MS4 Map



Public Stormwater Quality Facilities (Mech.)

Public Stormwater Quality Facilities (Veg.)

Future Public Stormwater Quality Facilities (locations approximate)

City-Owned Operations & Maint. Facilities

NPDES Permit #s

Closed Landfills

Stormwater Pipes

Open Waterways

Stormwater Outfalls

36" or Larger

Smaller than 36"

Water Bodies

Taxlots

Eugene City Limits

Eugene UGB

**Generalized Land Use**

Commercial

Industrial

Multi-Family Residential

Open Space

Residential

Vacant

**TMDL Watersheds**

**(clipped to UGB)**

Upper Amazon Creek

A-3 Drain

Upper Willamette

McKenzie

# Appendix C: 2015 NPDES MS4 Permit Renewal Application Map

1 inch = 1500 feet

0 3,000 6,000 9,000 Feet

N

Caution:
This map is based on imprecise source data and is not intended as an authoritative delineation of engineering or surveying practices. Data is subject to change, and is for general reference only.

Map compiled for City of Eugene by Lane Council of Governments December 2015