City of Oregon City

Interim Evaluation Report to Comply with MS4 NPDES Permit Requirements

May 1, 2006

Submitted By:

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SECTION 1 INTRODUCTION AND OVERVIEW

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 a municipal NPDES stormwater permit. Clackamas County was one of the six jurisdictions required to obtain an NPDES permit, and the City of Oregon City is one of the ten co-permittees on the Clackamas County permit.

For Part 1 of the original MS4 NPDES permit application (1993), Clackamas County and its co-permittees performed a review of their stormwater systems including mapping, outfall inventories, monitoring of stormwater quality etc. The second part of the application (1995) required the development of a Stormwater Management Plan (SWMP), which included the requirement to develop specific categories of Best Management Practices (BMPs) to address specific sources of pollutants. However, the requirements did not specify the number or type of BMPs that should be implemented. Instead, the requirement states that BMPs should be implemented to reduce the discharge of pollutants to the "maximum extent practicable". The City of Oregon City received their NPDES stormwater permit from DEQ in 1995. The City of Oregon City's current SWMP is dated May 1993, representing the time for application for the permit.

The permit period for the 1995 NPDES permit was five years during which time jurisdictions were responsible for implementation of their SWMPs. The permit required a renewal at the end of the five-year permit period. The renewal application was fairly simple and required jurisdictions to provide updated copies of their SWMPs and to describe the rationale for any changes to their programs. The City of Oregon City presented their SWMP revisions in each annual report from 1995 to 2000, and further summarized their revisions in a letter to DEQ dated March 11, 2005.

During the permit renewal process, third-party environmental groups expressed significant concern that the permits should include numeric discharge limits at stormwater outfalls as opposed to a more general requirement to implement BMPs to the "maximum extent practicable". This concern was also linked to another Clean Water Act requirement related to the development of Total Maximum Daily Loads for creeks, rivers and streams that are currently in violation of water quality standards.

As a result of these third-party concerns, DEQ briefly convened an advisory group to help determine how to address water quality standards in the new permits. Concerns and issues related to the permits were discussed for over three years. In March 2004, the new NDPES permits were issued to the six larger Oregon jurisdictions, including Clackamas County and its co-permittees.

With respect to numerical water quality standards in the permit, DEQ attempted to balance the demands of the third-party groups with the needs of larger municipalities such as Clackamas County and the abilities of smaller co-permittees like the City of Oregon City. For some jurisdictions including the City of Oregon City, that discharge to water bodies currently in violation of water quality standards, the 2004 permits have new requirements. Where TMDLs are established, jurisdictions must attempt to quantify the effectiveness of their SWMPs, set pollutant load reduction benchmarks for performance of SWMPs, check in on progress towards meeting those benchmarks, and apply an adaptive management process until benchmarks are achieved. Oregon City does not currently have any TMDL's but does have areas that discharge to streams currently on the 303(d) list for various parameters. New requirements include discussion of parameters on the 303(d) list and the listing of BMPs that would address each parameter.

The new 2004 permits include some additional requirements that were not in the earlier permit including a requirement to conduct a SWMP evaluation, more specific monitoring requirements, additional annual reporting requirements, and preparation of a revised SWMP.

Third-party groups made a request for DEQ to reconsider the permit. DEQ agreed to reconsider the permit and as a result some additional changes were made. The changes include a request for more specific reporting of SWMP commitments, additional public involvement requirements, and a six-month extension for developing the revised SWMP. The City of Oregon City must address these new permit requirements to comply with the current MS4 NPDES permit.

With respect to reporting requirements, the new permit requires the submission of an Interim Evaluation Report due May 1, 2006. The report is required to contain the following:

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

See Section 2.0 that includes a summary of the program evaluation conducted on the City's previous SWMP and a revised SWMP.

ii) *A description of the current source identification components of the SWMP and the rationale regarding the adequacy of these components.*

See Section 6.0 - Source Identification Components of the SWMP (2006).

iii) *For each of the listed non-storm water discharges [Schedule A(3)] expected to occur in a co-permittee's area, the co-permittee must identify the appropriate control measures and the rationale for the selection of these BMPs (or the rationale for why BMPs are deemed not necessary).*

See Section 7.0 - Evaluation of Non-Stormwater Discharges.

iv) *The required information regarding TMDL pollutants as described in Schedule D(2)(d)(v) and the corresponding proposed revisions to the SWMP, and/or the* *required information regarding 303(d) listed pollutants as described in Schedule D(2)(e) and the corresponding proposed revisions to the SWMP.*

See Sections 9.0 - 303(d) Evaluations.

v) *An executive summary of the SWMP, not more than 15 pages in length, that describes the main elements of the SWMP.*

See Section 3.0 - Executive Summary of the revised SWMP (2006).

vi) *Maps providing updated information as described in 40 CFR Section 122.26(d)(1)(iii)(B), where applicable.*

See Section 10.0 for relevant maps.

The purpose of this binder is to provide all of the documentation necessary to meet the Interim Evaluation Report requirements shown above. The section where each requirement is addressed is listed below each requirement. Also refer to the table of contents.

1.2 COORDINATION WITH CLACKAMAS COUNTY AND CO-PERMITTEES

Summary of the City of Oregon City's Stormwater Management Program

The City of Oregon City's Public Works Department maintains responsibility for the development and implementation of the City's SWMP. There are, however, required components of the program where implementation and tracking occurs in other City organizations. The City's Community Development Department reviews development submittals to ensure stormwater provisions are addressed, as outlined in the City of Oregon City's Municipal Code and the City's Public Works and Design Standards. Clackamas County Fire District #1 maintains responsibility for spill response and clean-up of hazardous materials. Finally, the City's Parks Department assists public works with maintenance activities related to parks and pest management.

Summary of City Coordination with Co-Permittees

There are ten co-permittees included on the Clackamas County MS4 NPDES permit. Per the permit itself, the co-permittees are responsible for meeting the same permit requirements as the Phase 1 jurisdictions, including significant monitoring efforts. However, with the limited resources, it is unlikely that even the most ambitious co-permittee will be able to match efforts of the larger Phase 1 jurisdictions. Therefore Clackamas County co-permittees have coordinated efforts (intergovernmental agreements, comprehensive programs) when possible to meet the new permit objectives. Specifically, the City of Oregon City and other co-permittees have established regional objectives in order to coordinate and ensure consistency with regards to development standards, erosion control standards, design criteria for pollution control facilities, and monitoring efforts. The City of Oregon City plans to continue this coordinated effort throughout the new permit period, particularly with respect to monitoring and data analysis activities.

SECTION 2 SUMMARY OF PROPOSED CHANGES TO THE STORMWATER MANAGEMENT PLAN

The Department of Environmental Quality (DEQ) has written into the Clackamas and co-permittee's MS4 NPDES permit (#101348) a specific requirement for each municipality to verify that their Stormwater Management Plan (SWMP) from the Phase I permit is in conformance with the federal regulations (specifically CFR 40.122.26).

The City of Oregon City must submit this comprehensive program analysis for their 2006 interim evaluation report per Schedule D(2)(b):

> *"…Each co-permittee must review Schedule D(2)(c) and, for each component, determine whether implementation of the components in the SWMP as submitted is sufficient to reduce the discharge of pollutants to the maximum extent practicable. Each co-permittee must submit to the Department details on how each of the components are, or will be, addressed and the rationale for the continued existing or revised level of implementation. (If certain components are not included in the plan, then the rationale for exclusion must also be submitted.) The level of implementation for each component must, when practicable, have measurable performance indicators to assist with the reporting on the status of implementation as part of the annual reports."*

As a result of the permit requirement provided above, Oregon City reviewed their Stormwater Management Plan (SWMP) to evaluate how the plan is addressing relevant Federal and State regulations and programs including: CFR 40.122.26, new MS4 NPDES permit requirements, Total Maximum Daily Loads (TMDLs) and/or 303(d) Listed Impaired Water Bodies. The purpose of this section is to indicate how the City's SWMP was revised to better address the regulatory and program requirements.

From the program evaluation, the MS4 NPDES requirements are adequately being addressed by the activities that the City is currently conducting. Potential issues that were identified when conducting the program evaluation were minimal and largely related to clarification or verification of activities that are taking place and better documentation of commitments. Examples include the following:

- Verify and specify the responsible parties associated with specific tasks outlined under the BMPs. Responsibilities may have changed from the time the initial SWMP was issued.
- Verify and update the type, frequency, and coverage area of the operations and maintenance activities (catch basin cleaning, street sweeping, structural control inspections, etc).
- Describe the landscape and pest management activities conducted by the City, aside from public education activities, that are preventing pollutant discharges.
- When inspections are required (industrial requirements, illicit discharge requirements, erosion control), better document the frequency, locations (if applicable), and procedures that are in place.

- Outline training activities as related to spill response, pest management, and erosion control.

There are two types of BMPs in Oregon City's program: BMPs for policy related activities (e.g., development of a stormwater master plan) and BMPs that are for on-going implementation activities (operations and maintenance). To better address both the planning and implementation aspects of the stormwater management program, the format of the existing Stormwater Management Plan was also adjusted to specifically state the distinct activities (BMPs) occurring under each regulatory requirement instead of focusing on each regulatory requirement and the variety of activities occurring that could potentially address that requirement. In addition, the "record-keeping" sub-sections for each BMP were redefined as "performance measures" in order to meet permit requirements and to track the tasks associated with each of the BMPs. Therefore, the reader will understand how each BMP is being implemented when reviewing the SWMP and annual reports. As a result of this overall program evaluation, minor adjustments were made to the BMPs. See Table 2-1 for a more detailed summary and rationale for those changes.

TABLE 2-1: SUMMARY AND RATIONALE OF SWMP REVISIONS

Revised SWMP Component	Modifications made to the existing BMPs for the revised SWMP	Rationale for BMP Modification	BMP Names in the revised SWMP
Oregon City Structural and Source Control BMPs			
Stormwater Management Plan **Table 4-1**	1. Reformat existing BMPs and identify performance measures. 2. Verify specific inspection and/or maintenance frequencies for the stormwater conveyance system components. 3. Update master planning and CIP implementation reference to reflect citywide instead of basin specific efforts. 4. Update frequency of street sweeping activities.	1. Minimized overlap between reported activities; allowed specific Stormwater Management activities to more closely align with regulatory requirements; and address new permit requirements regarding performance measures. 2. The NPDES permit requires specific maintenance frequencies to be established. Although frequencies had been specified in the existing SWMP, in some cases the frequencies were not reflective of current activities. The SWMP was updated per actual frequencies. 3. Master planning was previously conducted by drainage basin instead of citywide. The SWMP was updated to reflect citywide master planning efforts. In addition, reference to CIP and utility replacement activities was made. 4. The frequency of street sweeping and roadway repair activities was modified to be reflective of existing conditions.	• Conduct Stormwater Conveyance System Cleaning and Maintenance. • Conduct Catch basin Cleaning and Maintenance. • Conduct Structural Control Facility Cleaning and Maintenance. • Conduct Master Planning and Implement Capital Projects and Utility Improvements for Stormwater Quality Enhancement. • Implement Municipal Development Codes

Revised SWMP Component	Modifications made to the existing BMPs for the revised SWMP	Rationale for BMP Modification	BMP Names in the revised SWMP
	5. Update description of landfill monitoring activities. 6. Revise BMP Section 4.1.6 to outline activities the City is currently conducting for pest management.	5. Inspection and monitoring activities related to the City's closed landfills and transfer station have changed since the existing SWMP. Inspection frequencies and data analysis activities were updated in the SWMP. 6. The existing BMP primarily discussed the public education measures being performed as part of Oregon City's pest management program. The BMP was modified to reflect pest and landscape management activities being conducted by the City.	and Stormwater Design and Construction Standards. • Conduct Street Sweeping and Roadway Repair Activities. • Control Pollutant Discharges from Municipal Waste Facilities. • Minimize Pollutant Discharges Associated with Landscape Management Practices.

Revised SWMP Component	Modifications made to the existing BMPs for the revised SWMP	Rationale for BMP Modification	BMP Names in the revised SWMP
Oregon City Illicit Discharges Control BMPs			
Stormwater Management Plan **Table 4-2**	1. Reformat existing BMPs and identify performance measures. 2. Update reference to the relative number of outfalls inspected during illicit discharge inspections and investigations. 3. Outline Public Works activities related to spill response.	1. Minimized overlap between reported activities; allowed specific Stormwater Management activities to more closely align with regulatory requirements; and address new permit requirements regarding performance measures. 2. Outlined the number of major and minor outfalls inspected during dry-weather field screening activities and added reference to wet weather field screening activities. Described abatement measures for discovered illicit discharges. 3. Described the Public Works spill response effort including various measures to respond to non-hazardous spills and the reporting of spills.	• Implement the Illicit Discharges Elimination Program. • Implement the Spill Response Program. • Control Infiltration and Cross Connections to the City's Stormwater Conveyance System.

Revised SWMP Component	Modifications made to the existing BMPs for the revised SWMP	Rationale for BMP Modification	BMP Names in the revised SWMP
Oregon City Industrial Control BMPs			
Stormwater Management Plan **Table 4-3**	1. Reformat existing BMPs and identify performance measures. 2. Revise the industrial section of the SWMP to reflect the City's efforts related to the minimization of pollution from industrial sources within the City.	1. Minimized overlap between reported activities; allowed specific Stormwater Management activities to more closely align with regulatory requirements; and address new permit requirements regarding performance measures. 2. Updated the industrial section of the existing SWMP to reflect additional efforts related to updating industrial inventories and conducting inspections on industrial facilities.	• Implement a Program to Control Pollutants from Industrial Facilities.

Revised SWMP Component	Modifications made to the existing BMPs for the revised SWMP	Rationale for BMP Modification	BMP Names in the revised SWMP
Oregon City Construction Site BMPs			
Stormwater Management Plan **Table 4-4**	1. Reformat existing BMPs and identify performance measures. 2. Updated reference to City's erosion and sediment control manual being used. 3. Update reference to the frequency of erosion control inspections conducted.	1. Minimized overlap between reported activities; allowed specific Stormwater Management activities to more closely align with regulatory requirements; and address new permit requirements regarding performance measures. 2. The City of Oregon City previously referenced the dated version of the *Clackamas County Erosion Prevention and Sediment Control Planning and Design Manual*. The reference to the manual has been updated to reflect the City's version of the manual. 3. Previously, erosion control inspections were reported as conducted every two weeks. Inspections typically occur at varying intervals, depending on characteristics of the construction project. The SWMP was updated to reflect current erosion control efforts.	• Implement the Erosion Control Ordinances. • Conduct Erosion Control Inspections.

Revised SWMP Component	Modifications made to the existing BMPs for the revised SWMP	Rationale for BMP Modification	BMP Names in the revised SWMP
Oregon City Public Education BMPs			
Stormwater Management Plan **Table 4-5**	1. Reformat existing BMPs, removing reference to public education and outreach activities from existing BMPs and outlining them under a separate BMP category. 2. Reformat existing BMPs, removing reference to training activities from existing BMPs, and outlining them under a separate category. 3. Identify performance measures. 4. Add a separate BMP regarding intergovernmental coordination.	1. Minimized overlap between reported educational and outreach activities by outlining them in a separate section and referencing which permit requirements a specific educational or training activity addressed. 2. For consistency with other education related BMPs, all training activities (related to spill response, pest management, and construction operations) were outlined in a separate section). 3. Addressed permit requirements regarding performance measures. 4. The City continues to meet with Clackamas County co-permittees regarding regional water quality efforts and participates in a number of different agencies and groups with regards to stormwater issues.	• Provide Public Education and Outreach Materials Regarding Stormwater Management. • Conduct Staff Training for Pest Management. • Conduct Staff Training in Spill Response. • Provide Educational Information to Construction Site Operators. • Participate in Intergovernmental Coordination Efforts.

SECTION 3 EXECUTIVE SUMMARY OF THE STORMWATER MANAGEMENT PLAN (SWMP)

The City's stormwater management plan (SWMP) is made up of 19 BMPs, grouped into five components as shown below:

Component #1: Structural and Source Control BMPs to Reduce Pollutants from Commercial and Residential Areas

- Conduct Stormwater Conveyance System Cleaning and Maintenance.
- Conduct Catch basin Cleaning and Maintenance.
- Conduct Structural Control Facility Cleaning and Maintenance.
- Conduct Master Planning and Implement Capital Projects and Utility Improvements for Stormwater Quality Enhancement.
- Implement Municipal Development Codes and Stormwater Design and Construction Standards.
- Conduct Street Sweeping and Roadway Repair Activities.
- Monitor Pollutant Discharges from Municipal Waste Facilities.
- Minimize Pollutant Discharges Associated with Landscape Management Practices.

Component #2: A Program to Detect and Remove Illicit Discharges and Improper Disposal Into the Storm Sewer System

- Implement the Illicit Discharges Elimination Program.
- Implement the Spill Response Program.
- Control Infiltration and Cross Connections to the City's Stormwater Conveyance System.

Component #3: A Program to Monitor and Control Pollutants Industrial Facilities

- Implement a Program to Control Pollutants from Industrial Facilities.

Component #4: A Program to Reduce Pollutants in Stormwater Discharges from Construction Sites

- Implement the Erosion Control Ordinances.
- Conduct Erosion Control Inspections.

Component #5: Public Education and Training

- Provide Public Education and Outreach Materials Regarding Stormwater Management.
- Conduct Staff Training for Pest Management.
- Conduct Staff Training in Spill Response.
- Provide Educational Information to Construction Site Operators.
- Participate in Intergovernmental Coordination Efforts.

The City of Oregon City's Public Works Department maintains responsibility for the development and implementation of the City's SWMP. There are, however, required components of the program where implementation and tracking occurs in other City Divisions and Departments. The City's Community Development Department is responsible for implementation of municipal development codes and development review activities. The City's Parks Department assists Public Works with landscape maintenance activities.

SECTION 4 CITY OF OREGON CITY'S STORMWATER MANAGEMENT PLAN (2006)

4.1 SWMP OVERVIEW

An evaluation of the original Oregon City Stormwater Management Plan (SWMP) was conducted in January 2006 in order to identify areas where modifications to the original SWMP were considered necessary. Specifically, existing BMPs were reviewed by those responsible for implementing the BMP, in order to propose changes to the BMP and enhance its effectiveness, and BMP revisions were reviewed internally to ensure that commitments and activities are accurate and achievable. Detailed results of the evaluation, including a summary of the SWMP revisions and a rationale for the revisions, are described in Section 2.0. The following is the revised SWMP, based on the results of the original SWMP evaluation.

In addition to clarifying and adjusting some specific BMPs, the SWMP has been restructured for simplification, to more closely align with specific permit requirements. As a result, the stormwater management plan is now organized into five major components. The first four components match the four major components of the stormwater management plan that are outlined in the MS4 NPDES permit requirements (i.e., Schedule D(2)(c)(i through iv). As public education activities meet a variety of permit requirements, BMPs addressing public education requirements under the first four components of the plan have been grouped into a fifth component. A summary of the new SWMP organization, including a listing of the Oregon City's BMPs under each SWMP component, is as follows.

4.2 CITY OF OREGON CITY SWMP (2006)

As mentioned above, this stormwater management plan is organized into the five major components listed below. The first four components match the four major components of the stormwater management plan that are outlined in the MS4 NPDES permit requirements (i.e., Schedule D(2)(c) i through iv). To simplify the SWMP, BMPs to address all of the public education requirements under the first four components of the plan have been grouped into a fifth component.

Component #1:	Structural and Source Control BMPs to Reduce Pollutants from Commercial and Residential Areas
Component #2:	A Program to Detect and Remove Illicit Discharges and Improper Disposal Into the Storm Sewer System
Component #3:	A Program to Monitor and Control Pollutants from Industrial Facilities
Component #4:	A Program to Reduce Pollutants in Stormwater Discharges from Construction Sites
Component #5:	Public Education, Coordination, and Public Involvement BMPs

Component #1
Structural and Source Control BMPs to Reduce Pollutants from Commercial and Residential Areas

NPDES permit #101348 requirements are listed below, followed by Oregon City's relevant BMPs that address the permit requirement.

(1) Maintenance activities and a maintenance schedule for structural controls to reduce pollutants (including floatables) in discharges from municipal separate storm sewers.

BMP(s):

- Conduct Stormwater Conveyance System Cleaning and Maintenance.
- Conduct Catch basin Cleaning and Maintenance.
- Conduct Structural Control Facility Cleaning and Maintenance.

(2) Planning procedures including a comprehensive master plan to develop, implement and enforce controls to reduce the discharge of pollutants from municipal separate storm sewers that receive discharges from areas of new development and significant redevelopment. Such a plan must address controls to reduce pollutants in discharges from municipal separate storm sewers after construction is completed. Controls to reduce pollutants in discharges from municipal separate storm sewers containing construction site runoff are addressed in paragraph Schedule D(2)(c)(iv).

BMP(s):

- Conduct Master Planning and Implement Capital Projects and Utility Improvements for Stormwater Quality Enhancement.
- Implement Municipal Development Codes and Stormwater Design and Construction Standards.

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

BMP(s):

- Conduct Street Sweeping and Roadway Repair Activities.

(4) Procedures to assure that flood management projects assess the impacts on the water quality of receiving water bodies and that existing structural flood control devices have been evaluated to determine if retrofitting the device to provide additional pollutant removal from storm water is feasible.

BMP(s):

See "Conduct Master Planning and Implement a Capital Project and Utility Improvements for Stormwater Quality Enhancement" under requirement 2, Component 1.

(5) A program to monitor pollutants in runoff from operating or closed municipal landfills or other treatment, storage or disposal facilities for municipal waste. The description must identify priorities and procedures for inspections and establishing and implementing control measures for such discharges (this program can be coordinated with the program developed under Schedule D(2)(c)(iii)).

BMP(s):

- Monitor Pollutant Discharges from Municipal Waste Facilities.

(6) A program to reduce to the maximum extent practicable, pollutants in discharges from municipal separate storm sewers associated with the application of pesticides, herbicides and fertilizer that will include, as appropriate,

controls such as educational activities, permits, certifications and other measures for commercial applicators and distributors, and controls for application in public right-of-ways and at municipal facilities.

BMP(s):

- Minimize Pollutant Discharges Associated with Landscape Management Practices

(Note: See component #5 and Table 4-5 for other educational BMPs associated with this requirement).

See Table 4-1 for the City of Oregon City's BMPs that address the requirements listed above.

TABLE 4-1 - Structural and Source Control BMPs to Reduce Pollutants from Commercial and Residential Areas

City of Oregon City BMP Description	BMP Implementation	Annual Performance Measures
NPDES Permit Requirement – *(1) Maintenance activities and a maintenance schedule for structural controls to reduce pollutants (including floatables) in discharges from municipal separate storm sewers.*		
Conduct Stormwater Conveyance System Cleaning and Maintenance	**BMP Owner:** Oregon City Public Works Department **Permit Year:** Ongoing **Implementation Activities:** Oregon City inspects their stormwater conveyance system including manholes, drainage pipes, culverts, and ditches periodically according to historical records of problem areas and/or public complaints. Conveyance system components are inspected for accumulated sediment and debris that may prompt flooding and broken system components in need of repair. Conveyance system components (manholes and pipes) are cleaned when needed. Significant ditches are generally cleaned annually and more frequently if needed. Repair or replacement of public conveyance system components will be scheduled following inspection of the system. If repair or replacement of private system components (e.g., culverts) is required, Public Works will inform the owner of the need. A map showing the stormwater conveyance system and structural controls is used when conducting maintenance activities. During maintenance, if a discrepancy in the map is discovered, the map will be updated accordingly.	(1) Estimate the volume of debris removed during conveyance system cleaning activities annually. (2) Estimate the length of system and/or number of facilities inspected/cleaned annually. (3) Track the conveyance system repair efforts conducted.
Conduct Catch basin Cleaning and Maintenance	**BMP Owner:** Oregon City Public Works Department **Permit Year:** Ongoing **Implementation Activities:** Oregon City inspects and/or cleans public catch basins at least once per year, more frequently if needed. Catch basins are generally inspected for accumulated sediment and debris that may prompt flooding. Catch basin cleaning activities primarily occur during the dry weather season. Utility crews utilize tracking forms (computer printouts) to document inspection and maintenance activity for the annual reports. Repair or replacement of public catch basins will be scheduled, as needed, following inspection. A map showing the stormwater conveyance system and structural controls is used when conducting maintenance activities. During maintenance activities, if a discrepancy in the map is discovered, the map will be updated accordingly.	(1) Track the number of catch basins inspected and/or maintained. (2) Track the volume of debris removed during cleaning activities.

City of Oregon City BMP Description	BMP Implementation	Annual Performance Measures
Conduct Structural Control Facility Cleaning and Maintenance	**BMP Owner:** Oregon City Public Works Department **Permit Year:** Ongoing **Implementation Activities:** Oregon City inspects and/or maintains public structural water quality facilities annually, more frequently if needed. Such public structural facilities include ponds, swales, detention tanks, filters, and pollution control manholes. Facilities are inspected for accumulated sediment and debris, indication of illegal dumping and disposal in the facility, and any broken or non-functioning structures in need of repair and/ or replacement. A map showing the stormwater conveyance system and structural controls is used when conducting maintenance activities. During maintenance activities, if a discrepancy in the map is discovered, the map will be updated accordingly. The map is also updated periodically to indicate the drainage areas to public structural controls.	(1) Track the number of structural facilities inspected and maintained. (2) Track the volume of debris removed during cleaning activities.

City of Oregon City BMP Description	BMP Implementation	Annual Performance Measures
NPDES Permit Requirement – *(2) Planning procedures including a comprehensive master plan to develop, implement and enforce controls to reduce the discharge of pollutants from municipal separate storm sewers that receive discharges from areas of new development and significant redevelopment. Such a plan must address controls to reduce pollutants in discharges from municipal separate storm sewers after construction is completed. Controls to reduce pollutants in discharges from municipal separate storm sewers containing construction site runoff are addressed in paragraph Schedule D(2)(c)(iv).*		
Conduct Master Planning and Implement Capital Projects and Utility Improvements for Stormwater Quality Enhancement	**BMP Owner:** Oregon City Public Works Department **Permit Year:** Ongoing **Implementation Activities:** Oregon City conducts Master Planning efforts to update the current City drainage system and prioritize future capital improvement projects for flood control and water quality benefits. The City currently has a citywide master plan and has completed a number of smaller basin plans for select subbasins. The City of Oregon City anticipates updating their citywide master plan. Master plans include an evaluation and inventory of proposed capital improvement projects (CIPs) for water quality and flood control. CIPs are generally prioritized and implemented according to the ability of the City to fund by leveraging other funding sources and by the general magnitude of water quality/flood control benefit. As funding is available, the City implements the CIPs. Maps are updated to include the location and drainage area of new CIPs. Utility improvements (ex: replacement of catch basins, upsizing stormdrain components, bank stabilization) generally occur as a result of maintenance inspections. Such utility improvements are primarily conducted for flood control and public safety, but indirectly influence water quality by minimizing erosive flows and sediment transport.	(1) Track master planning activity (new plans or revisions to older plans). (2) Track the number and associated cost of CIP projects implemented each year and discuss the added benefit (flood control, water quality, habitat restoration, etc) of each. (3) Map the location and drainage area of CIPs. (4) Track the number and associated cost of utility improvements completed.

City of Oregon City BMP Description	BMP Implementation	Annual Performance Measures
Implement Municipal Development Codes and Stormwater Design and Construction Standards	**BMP Owner:** Oregon City Community Development Department **Permit Year:** Ongoing **Implementation Activities:** Oregon City continues to review new development submittals for conformance with the Oregon City Stormwater and Grading Design Standards and associated ordinances updating portions of the Oregon City Municipal Code regarding stormwater drainage and water resources protection. The Stormwater and Grading Design Standards contain criteria and design standards for stormwater controls, and the Oregon City Municipal Code mandates development restrictions in Water Quality Resource Areas, Steep Slopes (Geologic Hazards), and Flood Plain Overlay Districts. Stormwater requirements, as outlined in the City's design standards, contain guidelines for both treatment and detention. Per the City's Development Code, stormwater quality and quantity need to be addressed for all new development. Updates and modifications to the City's design standards and guidelines are completed through code modifications by ordinance and associated changes to the Stormwater and Grading Design Standards.	(1) Track the number of development applications reviewed and approved for compliance with the stormwater regulations. (2) Track any code modifications by ordinance.

<table>
<tr><th>City of Oregon City
BMP Description</th><th>BMP Implementation</th><th>Annual Performance Measures</th></tr>
<tr><td colspan="3">NPDES Permit Requirement – (3) Practices for operating and maintaining public streets, roads and highways and procedures for reducing the impact on receiving waters of discharges from municipal storm sewer systems, including pollutants discharged as a result of deicing activities.</td></tr>
<tr><td>Conduct Street Sweeping and Roadway Repair Activities</td><td>BMP Owner: Oregon City Public Works Department
Permit Year: Ongoing
Implementation Activities: Oregon City conducts road maintenance and repair activities continuously throughout the year to prevent erosion and excessive transport of sediment and organics into the stormwater system. All City-owned streets are swept throughout the year, on average every 3-4 months. High traffic streets within the downtown area and major corridors are swept more frequently. In addition, during leaf pickup activities the streets are swept more frequently. The City currently owns and operates two street sweepers.
Road maintenance and repair work is generally scheduled during the dry season when possible, to minimize polluted discharges from entering the stormwater conveyance system. Erosion control activities are implemented as needed.</td><td>(1) Track the average number of citywide sweeps per year.
(2) Track the number of miles swept per year.
(3) Track the volume of debris removed during sweeping activities.</td></tr>
<tr><td colspan="3">NPDES Permit Requirement - (4) Procedures to assure that flood management projects assess the impacts on the water quality of receiving water bodies and that existing structural flood control devices have been evaluated to determine if retrofitting the device to provide additional pollutant removal from storm water is feasible.</td></tr>
<tr><td colspan="3">See BMP “Conduct Master Planning and Implement Capital Projects and Utility Improvements for Stormwater Quality Enhancement” under Requirement 2 for applicable BMP meeting this requirement.</td></tr>
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City of Oregon City BMP Description	BMP Implementation	Annual Performance Measures
NPDES Permit Requirement - *(5) A program to monitor pollutants in runoff from operating or closed municipal landfills or other treatment, storage or disposal facilities for municipal waste. The description must identify priorities and procedures for inspections and establishing and implementing control measures for such discharges (this program can be coordinated with the program developed under Schedule D (2)(c)(iii)).*		
Monitor Pollutant Discharges from Municipal Waste Facilities	**BMP Owner:** Oregon City Public Works Department **Permit Year:** Ongoing **Implementation Activities:** There are three closed landfills and one transfer station within the city limits. Sites are inspected quarterly for stormwater runoff or leachate containing color, turbidity, foam, oil and grease sheen, and odor that may indicate disposal or pollution problems at the site. If visual inspections indicate that the site may be contributing to pollution, laboratory sampling will be conducted. Metro's South Transfer Station operates under a general (1200-G) stormwater permit. To comply with the 1200-G permit requirements, Metro is currently required to conduct sampling twice per year. Oregon City currently conducts stormwater monitoring at select locations downstream from these municipal waste facilities. Phillips Creek (informally named and shouldn't be confused with the other Clackamas County creek called Phillips Creek that is currently on the 303(d) list) is one of the quarterly instream monitoring locations, which runs adjacent to the Rossman Landfill. Instream samples are gathered downstream of the landfill location. Runoff from the Metro Transfer facility discharges into a detention pond. The outfall from the detention pond is one of the wet-weather field screen locations, inspected annually.	(1) Track the results of the quarterly site inspections. (2) Report if any site requires additional sampling or follow-up, based on the quarterly inspections and/ or submitted sampling data, and describe any follow-up measures taken.

City of Oregon City BMP Description	BMP Implementation	Annual Performance Measures
NPDES Permit Requirement - *(6) A program to reduce to the maximum extent practicable, pollutants in discharges from municipal separate storm sewers associated with the application of pesticides, herbicides and fertilizer that will include, as appropriate, controls such as educational activities, permits, certifications and other measures for commercial applicators and distributors, and controls for application in public right-of-ways and at municipal facilities.*		
Minimize Pollutant Discharges Associated with Landscape Management Practices	**BMP Owner:** Oregon City Public Works Department and Parks Department **Permit Year:** Ongoing **Implementation Activities:** Oregon City implements a number of measures to minimize pollutant impacts associated with landscape maintenance activities. The City conducts landscape maintenance activities on all public open space and park areas. Insecticides are not used. Herbicides are currently applied to only select locations (generally surrounding fence lines). The City only uses approved and low-risk chemicals and makes significant efforts to reduce the need for chemicals entirely through manual weed removal (when feasible) and application of bark dust to reduce weed growth. All chemical applicators, both contractors and city staff, are licensed in accordance with state regulations. The City maintains copies of all Material Safety Data Sheets (MSDS), to be made available upon request, to public and commercial pesticide and fertilizer applicators. Specific education measures and staff training measures related to landscape maintenance is discussed under Category 5: Public Education BMPs.	(1) Track any programmatic changes regarding pest management within the City.

Component #2
A Program to Detect and Remove Illicit Discharges and Improper Disposal Into the Storm Sewer System

This component of the permit requires the following:

(1) A program, including inspections, to implement and enforce an ordinance, orders or similar means to prevent illicit discharges to the municipal separate storm sewer system; this program description must address all types of illicit discharges, however the following category of non-storm water discharges or flows must be addressed where such discharges are identified by the municipality as sources of pollutants to waters of the United States: water line flushing, landscape irrigation, diverted stream flows, rising ground waters, uncontaminated ground water infiltration, uncontaminated pumped ground water, discharges from potable water sources, start up flushing of groundwater wells, aquifer storage and recovery (ASR) wells, potable groundwater monitoring wells, draining and flushing of municipal potable water storage reservoirs, foundation drains, air conditioning condensation, irrigation water, springs, water from crawl space pumps, footing drains, lawn watering, individual residential car washing, flows from riparian habitats and wetlands, dechlorinated swimming pool discharges, street wash waters, discharges of treated water from investigation, removal and remedial actions selected or approved by the Department pursuant to Oregon Revised Statute (ORS) Chapter 465, the state's environmental cleanup law; and discharges or flows from emergency fire fighting activities where discharges or flows from fire fighting are identified as not significant sources of pollutants to the waters of the state.

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

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

Requirements 1, 2, and 3 are combined in Table 2.

BMP(s):
- Implement the lllicit Discharge Elimination Program

(4) Procedures to prevent, contain, and respond to spills that may discharge into the municipal separate storm sewer.

BMP(s):
- Implement the Spill Response Program.

(5) A program to promote, publicize, and facilitate public reporting of the presence of illicit discharges or water quality impacts associated with discharges from municipal separate storm sewers.

BMP(s):
- Public Reporting occurs in conjunction with public education activities as described under Component #5, Table 4-5.

(6) Educational activities, public information activities, and other appropriate activities to facilitate the proper management and disposal of used oil and toxic materials.

BMP(s):
- Public Education measures regarding proper material disposal occur in conjunction with public education activities as described under Component #5, Table 4-5.

(7) Controls to limit infiltration of seepage from municipal sanitary sewers to municipal separate storm sewer systems where necessary.

BMP(s):

- Control Infiltration and Cross Connections to the City's Stormwater Conveyance System.

See Table 4-2 for the City of Oregon City's BMPs that address the requirements that are listed above.

TABLE 4-2 - BMPs to Detect and Remove Illicit Discharges and Improper Disposal Into the Storm Sewer System

City of Oregon City BMP Descriptions	BMP Implementation	Annual Performance Measures
NPDES Permit Requirement - *(1) A program, including inspections, to implement and enforce an ordinance, orders or similar means to prevent illicit discharges to the municipal separate storm sewer system; this program description must address all types of illicit discharges, however the following category of non-storm water discharges or flows must be addressed where such discharges are identified by the municipality as sources of pollutants to waters of the United States: water line flushing, landscape irrigation, diverted stream flows, rising ground waters, uncontaminated ground water infiltration, uncontaminated pumped ground water, discharges from potable water sources, start up flushing of groundwater wells, aquifer storage and recovery (ASR) wells, potable groundwater monitoring wells, draining and flushing of municipal potable water storage reservoirs, foundation drains, air conditioning condensation, irrigation water, springs, water from crawl space pumps, footing drains, lawn watering, individual residential car washing, flows from riparian habitats and wetlands, dechlorinated swimming pool discharges, street wash waters, discharges of treated water from investigation, removal and remedial actions selected or approved by the Department pursuant to Oregon Revised Statute (ORS) Chapter 465, the state's environmental cleanup law; and discharges or flows from emergency fire fighting activities where discharges or flows from fire fighting are identified as not significant sources of pollutants to the waters of the state.* **NPDES Permit Requirement** - *(2) Procedures to conduct on-going field screening activities during the life of the permit, including areas or locations that will be evaluated by such field screens;* **NPDES Permit Requirement** - *(3) Procedures to be followed to investigate portions of the separate storm sewer system that, based on the results of the field screen, or other appropriate information, indicate a reasonable potential of containing illicit discharges or other sources of non-storm water [such procedures may include: sampling procedures for constituents such as e. coli, surfactants (MBAS), residual chlorine, fluorides and potassium; testing with fluorometric dyes; or conducting in storm sewer inspections where safety and other considerations allow.] Such a description must include the location of storm sewers that have been identified for such evaluation.*		

City of Oregon City BMP Descriptions	BMP Implementation	Annual Performance Measures
Implement the Illicit Discharge Elimination Program	**BMP Owner:** Oregon City Public Works Department **Permit Year:** Ongoing **Implementation Activities:** Oregon City conducts illicit discharge inspections, monitoring, and investigations annually during dry-weather conditions (typically between July and September) and wet-weather conditions (typically between October and June) at most major and select minor outfalls previously identified and approved by DEQ. Trained personnel complete data inspection forms while inspecting each of the outfalls. Dry weather flows are inspected for a variety of visual characteristics, and sources of flows are characterized as either permissible (listed in Schedule A3 of the MS4 NPDES permit) or non-permissible. If non-permissible discharges are discovered, sampling, analysis, and investigation are conducted according to the following procedure: 1. A water sample is taken and analyzed for the suspected contaminant group. 2. Using a drainage map and other source identification data, an attempt is made to locate the potential sources upstream of the discharge location. 3. Investigate potential sources using one or more of the following techniques: onsite inspections, dye-testing, smoke testing, and/or TV inspection of lines. The Public Works director will be notified of all positive identifications of illicit connections and will take all necessary steps to eliminate them. Typically, code enforcement is sent to the site and the site owner is given a notice of violation and a time frame with which to correct the problem. A follow-up inspection will occur to ensure the illicit connection has been removed, and if the illicit connection still exists, the site owner may face legal ramifications.	(1) Track any updates and modifications to the data inspection forms. (2) Track the number and location of outfalls inspected annually. (3) Summarize inspection results and track outfalls requiring monitoring (sampling) and/or investigations. (4) Report the outcome and resolution of any investigation activities conducted.

City of Oregon City BMP Descriptions	BMP Implementation	Annual Performance Measures
NPDES Permit Requirement - *(4) Procedures to prevent, contain, and respond to spills that may discharge into the municipal separate storm sewer.*		
Implement the Spill Response Program	**BMP Owner:** Clackamas Fire District #1 (Hazardous Materials Team), and Oregon City Public Works Department **Permit Year:** Ongoing **Implementation Activities:** Clackamas Fire District #1, Hazardous Materials Team initially responds to all phone calls and reports regarding chemical and hazardous waste spills within the City limits. Procedures for spill response are outlined in the Fire Departments "Emergency Operations Plan". The Fire Department reports the spill to DEQ and if necessary may rely on DEQ for technical assistance on clean-up, sampling, restoration, disposal, enforcement and coordination of state agency resources. For non-hazardous materials (oil and grease, paint, sewage), the Public Works Department responds to spills reported by citizens or observed by Public Works staff. Public Works staff follows the City of Oregon City Spill Response Plan, which references DEQ's spill response procedures. When Public Works responds to spills, they stop the source, then use absorbent pads and booms to prevent any contaminated runoff from entering the stormwater conveyance system. Following initial site clean up, the catch basins are cleaned to remove any residual pollutants that may have discharged into the system. Spill reports are maintained on file at the Public Works office.	(1) Indicate the number of spills reported to Public Works. (2) Indicate sources, causes, and resulting water quality problems resulting from spill activities.
NPDES Permit Requirement - *(5) A program to promote, publicize, and facilitate public reporting of the presence of illicit discharges or water quality impacts associated with discharges from municipal separate storm sewers.*		
A Description of the City's Public Reporting Program is included in Component #5, Table 4-5.		
NPDES Permit Requirement - *(6) Educational activities, public information activities, and other appropriate activities to facilitate the proper management and disposal of used oil and toxic materials.*		
A Description of the City's Public Informational Activities regarding management of hazardous materials is included in Component #5, Table 4-5.		

City of Oregon City BMP Descriptions	BMP Implementation	Annual Performance Measures
NPDES Permit Requirement - *(7) Controls to limit infiltration of seepage from municipal sanitary sewers to municipal separate storm sewer systems where necessary*		
Control Infiltration and Cross Connections to the City's Stormwater Conveyance System	**BMP Owner:** Oregon City Public Works Department **Permit Year:** Ongoing **Implementation Activities:** Oregon City implements an Inflow and Infiltration (I&I) abatement program, a portion of which includes a cooperative annual I/I investigation with Clackamas County Water Environment Services (WES). This program investigates sanitary lines when circumstances dictate, using smoke-testing, T.V. techniques, dye-testing, and flow metering for any cracking or breakage that would possibly result in infiltration from the sanitary to the storm system. The City's Community Development Department reviews new and re-development plans for possible cross-connections, and if cross connections are discovered, they are eliminated. The City's illicit discharge program also works to control and prevent any cross-connections during their outfall inspections and dry-weather field screening activities.	(1) Report whether any cross-connections were discovered during illicit discharge investigations, and describe follow-up activities.

Component #3
A Program to Monitor and Control Pollutants Industrial Facilities

This component of the permit requires an industrial monitoring program that does the following:

(1) Identify priorities and procedures for inspections and establishing and implementing control measures for such discharges.

BMP(s):

- Implement a Program to Control Pollutants from Industrial Facilities.

(2) Describe a monitoring program for storm water discharges associated with the industrial facilities identified in Schedule D(2)(c)(iii), to be implemented during the term of the permit, including, at a minimum, the submission of quantitative data on the pollutant parameters included in the Department's NPDES 1200-Z industrial general stormwater permit.

BMP(s):

- Industrial Monitoring occurs in conjunction with illicit discharge activities as described under Component #2, Table 4-2.

See Table 4-3 for the City of Oregon City's BMPs that address the requirements that are listed above.

TABLE 4-3 - A Program to Monitor and Control Pollutants from Industrial Facilities

City of Oregon City BMP Descriptions	BMP Implementation	Annual Performance Measures
NPDES Permit Requirement - *(1) Identify priorities and procedures for inspections and establishing and implementing control measures for such discharges.* **NPDES Permit Requirement** - *(2) Describe a monitoring program for storm water discharges associated with the industrial facilities identified in Schedule D(2)(c)(iii), to be implemented during the term of the permit, including, at a minimum, the submission of quantitative data on the pollutant parameters included in the Department's NPDES 1200-Z industrial general stormwater permit.*		

City of Oregon City BMP Descriptions	BMP Implementation	Annual Performance Measures
Implement a Program to Control Pollutants from Industrial Facilities	**BMP Owner:** Oregon City Public Works Department **Permit Year:** Ongoing **Implementation Activities:** The City of Oregon City's industrial program will consist of reviewing a list of DEQ 1200Z permit holders, reviewing the City Business License inventory, and performing on-site investigations on industries that are identified, through means described below, as having the potential to contribute wastes to the MS4 system. DEQ's website of 1200-Z permit holders will be reviewed annually. The City's Business License inventory includes SIC codes for licensed industrial facilities. Oregon City Public Works will query the Business License Inventory each year to identify business and industry types located in the City that may seem to have a higher potential to contribute process waste to a public stormwater facility. If existing pollution problems or concerns are identified by City staff, the public, or another public agency, Oregon City Public Works will investigate the nearby and downstream stormwater system for signs of pollution and take action to follow up as needed. Complaints will be reviewed, and if warranted, an on-site investigation will be conducted with follow-up as necessary. Other public agencies with regular inspection activities in Oregon City include Clackamas County Fire District 1 (CCFD#1) and Clackamas County Water Environment Services (WES). Bi-yearly, CCFD #1 conducts onsite inspections of businesses with a higher potential for structure fires. Regularly the WES conducts onsite inspections of certain businesses in Oregon City as part of a coordinated effort with the Clackamas County Wastewater Discharge Pretreatment Program. Annually the City of Oregon City will notify CCFD #1 and WES in writing about Oregon City's industrial program and request that the City be notified of their knowledge of Oregon City businesses that may be contributing to pollutants from industrial facilities. If, during the industrial inspection, a site is discovered to be contributing excess pollutants to the stormwater system the City of Oregon City will refer the site to their code enforcement agency and DEQ who may either require sampling and monitoring or removal of a specific source of discharge.	(1) Annually update the inventory of priority industries. (2) Track the number of industrial inspections conducted. (3) Report on investigative results and follow-up actions.

Component #4
A Program to Reduce Pollutants in Stormwater Discharges from Construction Sites

This component of the permit requires the following:

(1) Procedures for site planning which incorporate consideration of potential water quality impacts.
(2) Requirements for nonstructural and structural best management practices.

BMP(s):
- Implement the Erosion Control Ordinances.

(3) Procedures for identifying priorities for inspecting sites and enforcing control measures that considers the nature of the construction activity, topography, and the characteristics of soils and receiving water quality.

BMP(s):
- Conduct Erosion Control Inspections.

(4) Appropriate educational and training measures for construction site operators.

BMP(s):
- Public education and training measures for construction site operators occur in conjunction with public education activities as described under Component #5, Table 4-5.

See Table 4-4 for the City of Oregon City's BMPs that address the requirements that are listed above.

TABLE 4-4 - A Program to Reduce Pollutants in Stormwater Discharges from Construction Sites

City of Oregon City BMP Descriptions	BMP Implementation	Performance Measures
NPDES Permit Requirement – *(1) Procedures for site planning which incorporate consideration of potential water quality impacts.* **NPDES Permit Requirement** – *(2) Requirements for nonstructural and structural best management practices.*		
Implement the Erosion Control Ordinances.	**BMP Owner:** Oregon City Public Works Department **Permit Year:** Ongoing **Implementation Activities:** Oregon City's erosion control ordinances require all land development applications to obtain an erosion control permit, issued based on City approval of erosion and sediment control plans submitted for the project. This requirement is consistent with Metro's Urban Growth Management Plan Title 3. Incentive practices allow the City to reduce fees associated with the erosion control permit if the applicant (contractor) has received formal training in erosion or sediment control per the contractor certification program. Erosion control plans must be submitted and approved prior to issuance of the erosion control permit and must show permanent and non-permanent control structures for all developments greater than 1000 square feet. The City requires compliance with the adopted Oregon *City Erosion and Sediment Control Standards* in preparing the erosion control plans. The document includes suggestions for structural and non-structural erosion control BMPs. During the plan review process, new and redevelopment will be reviewed for compliance with the erosion control guidance standards. Plans not in compliance will not be approved and will be required to implement appropriate erosion control techniques prior to approval.	(1) Report any updates or modifications to the Oregon City Erosion and Sediment Control Manual. (2) Record the number of erosion control plan reviews completed.

City of Oregon City BMP Descriptions	BMP Implementation	Performance Measures
NPDES Permit Requirement - *(3) Procedures for identifying priorities for inspecting sites and enforcing control measures that considers the nature of the construction activity, topography, and the characteristics of soils and receiving water quality*		
Conduct Erosion Control Inspections	**BMP Owner:** Oregon City Public Works Department **Permit Year:** Ongoing **Implementation Activities:** The Oregon City Municipal Code and Public Works Standards require erosion control permits for particular construction and grading activities. In addition, prior to receipt of a footing inspection, appropriate erosion control measures must be in place and inspected. An initial inspection is required at new construction sites. Residential and commercial sites where construction activities have just started generally are inspected two to three times weekly. Public Works projects are generally inspected daily for erosion control measures. For sites with an erosion control violation or where ineffective erosion control is observed, a Notice of Non-Compliance is issued, and contractors are required to install effective control measures. If not resolved within the required time frame, Stop Work Orders are issued.	(1) Track the number of erosion control permits issues annually. (2) Record the number of erosion control inspections conducted annually. (3) Report the number of notices of non-compliance issued during inspections and the number of stop work orders issued annually.
NPDES Permit Requirement - *(4) Appropriate educational and training measures for construction site operators.*		
A Description of the City's Educational Program for Construction Site Operators is included in Component #5, Table 4-5		

Component #5
Public Education, Coordination, and Public Involvement

Three of the four major components of the SWMP requirements include public education-related requirements as follows while public involvement measures are described under a separate SWMP requirement:

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

BMP(s):
- Provide Public Education and Outreach Materials Regarding Stormwater Management.
- Conduct Staff Training for Pest Management.

Educational Requirement from Component #2 –
(5) A program to promote, publicize, and facilitate public reporting of the presence of illicit discharges or water quality impacts associated with discharges from municipal separate storm sewers.

(6) Educational activities, public information activities, and other appropriate activities to facilitate the proper management and disposal of used oil and toxic materials.

BMP(s):
- Conduct Staff Training in Spill Response.

Also see BMP listed above "Provide Public Education and Outreach Materials Regarding Stormwater Management".

Educational Requirement from Component #4 –
(4) Appropriate educational and training measures for construction site operators.

BMP(s):
- Provide Educational Information to Construction Site Operators.

Additional Coordination Activities -
BMP(s):
- Participate in Intergovernmental Coordination Efforts.

See Table 4-5 for the City of Oregon City's BMPs that address the requirements that are listed above.

TABLE 4-5 – Public Education, Coordination, and Public Involvement

City of Oregon City BMP Descriptions	BMP Implementation	Annual Performance Measures
NPDES Permit Requirement, Component 1, Requirement 6 - *(6) A program to reduce to the maximum extent practicable, pollutants in discharges from municipal separate storm sewers associated with the application of pesticides, herbicides and fertilizer that will include, as appropriate, controls such as educational activities, permits, certifications and other measures for commercial applicators and distributors, and controls for application in public right-of-ways and at municipal facilities.* **NPDES Permit Requirement, Component 2, Requirement 5 -** *(5) A program to promote, publicize, and facilitate public reporting of the presence of illicit discharges or water quality impacts associated with discharges from municipal separate storm sewers.* **NPDES Permit Requirement, Component 2, Requirement 6 -** *(6) Educational activities, public information activities, and other appropriate activities to facilitate the proper management and disposal of used oil and toxic materials.*		
Provide Public Education and Outreach Materials regarding Stormwater Management.	**BMP Owner:** Oregon City Public Works Department **Permit Year:** Ongoing **Implementation Activities:** Oregon City continues to employ a public education program aimed at reducing the discharge of pollutants associated with a variety of activities including but not limited to: 1. The application of pesticides, herbicides and fertilizers by citizens. 2. Illicit discharges and dumping of waste materials into the storm drainage system. 3. Disposal of waste oil and toxic materials. The City utilizes newsletter publications, brochures, posters, bill inserts, a City newsletter, and various Clackamas County mailings to promote public awareness of water quality issues related to the above-mentioned practices. The City of Oregon City participates in the Regional Coalition of Clean Rivers and Streams, which implements public educational campaigns on a more regionalized basis. The City also participates in a number of educational programs in partnership with organizations including Clackamas Community College, the Lower Columbia River Estuary Program, and Oregon State University to educate and promote topics including watershed health and low-impact development. The City also installs signs surrounding local water quality facilities (detention ponds), reminding residents that they are for stormwater quantity and quality control and should not be used for garbage or debris disposal. Periodically, general educational signs are also installed on public vehicles promoting water quality. To aid in public education related to proper disposal of waste materials, the City of Oregon City also sponsors a citywide catch basin stenciling program. Public Works staff inspect the local catch basins, determines the level of effort needed, and coordinates with area volunteers to complete the stenciling. Stenciling is currently conducted on an as needed basis and based on volunteer availability.	(1) Track the number, types, and topics of public educational materials dispersed to the public. (2) Indicate any large-scale public educational campaigns. (3) Track coordinated public outreach activities with other permittees. (4) Record the number of catch basins stenciled in a given year.

City of Oregon City BMP Descriptions	BMP Implementation	Annual Performance Measures
Conduct Staff Training for Pest Management	**BMP Owner:** Oregon City Public Works Department and Parks Department **Permit Year:** Ongoing **Implementation Activities:** Oregon City requires crews from Public Works and the Parks Department that are conducting pest management activities to be certified and licensed for spraying activities in accordance with OSHA requirements. Licensed staff attends annual refresher courses. During Public Works safety meetings, staff discuss appropriate application measures, techniques, and disposal activities for vegetative and pest management, not specific to spraying activities.	(1) Track the number of employees licensed for spraying activities.
Conduct Staff Training in Spill Response	**BMP Owner:** Oregon City Public Works Department **Permit Year:** Ongoing **Implementation Activities:** Oregon City coordinates with the Clackamas County Office of Emergency Management and the Oregon City Police Department for training related to non-hazardous spill response procedures. At least once annually the City's Public Works Department will utilize its monthly safety meeting format to provide training related to non-hazardous spill response procedures. Oregon City Public Works coordinates training opportunities for staff that initially respond to spills using Occupational Safety and Health Administration (OSHA) hazardous materials educational resources and services.	(1) Report any spill related training and education.
Also refer to BMP "Provide Public Education and Outreach Materials regarding Stormwater Management" for educational activities addressing the above permit requirements.		
NPDES Permit Requirement, Component 4 – *(4) Appropriate educational and training measures for construction site operators.*		
Provide Educational Information to Construction Site Operators	**BMP Owner:** Oregon City Public Works Department **Permit Year:** Ongoing **Implementation Activities:** The Oregon City Public Works Standards for Erosion and Sediment Control are available on the Oregon City website. Contractors may participate in the contractor certification program to receive discounts on erosion control permit fees.	(1) Track the number of contractors receiving a discount on erosion control permit fees.

City of Oregon City BMP Descriptions	BMP Implementation	Annual Performance Measures
Additional Coordination Efforts		
Participate in Intergovernmental Coordination Efforts	**BMP Owner:** Oregon City Public Works Department **Permit Year:** Ongoing **Implementation Activities:** Oregon City Public Works coordinates with other Clackamas County co-permittees regarding regional water quality efforts. Areas for coordination include monitoring, public education, and BMP effectiveness studies. Oregon City staff participates in training and advisory committee opportunities made available through federal state, and Metro agencies and groups involved with a broad range of water quality issues including stormwater.	(1) Indicate groups, committees, and organizations that the City is currently participating.

SECTION 5 CITY OF OREGON CITY STORMWATER MONITORING PLAN

The monitoring requirements of the permit have been divided into two components: program monitoring and environmental monitoring. Program monitoring is those activities as described in the Stormwater Management Plan that have specific indicator metrics (e.g., number of miles of streets swept, number of cross-connections found, tons of material removed from storm sewers, etc.). The program monitoring that will be conducted by the City of Oregon City is provided in Tables 4-1 through 4-5 in the form of performance measures for each best management practice (BMP).

Environmental monitoring is another component of the overall monitoring program. Environmental monitoring includes sampling and testing of both instream waters and MS4 discharges. The City of Oregon City is currently conducting the following monitoring activities as described in Table B-1 of the permit.

- Clackamas River Outfall monitoring in two locations.
  Frequency of Sampling – 3 times per year; (1) one during the first storm event, (2) two other seasonal samplings typically completed in January and May; laboratory and field sampling.

- Ambient Instream monitoring in ten stream locations throughout the City.
  Frequency of Sampling - 4 times per year, field sampling.

- Singer Creek Watershed at manhole above Singer Creek Falls
  Frequency of Sampling – 4 times per year, laboratory and field sampling.

Conducting these activities fulfills the City's permit requirements for monitoring through Permit Year 2. Then, the permit requires that each co-permittee review and, if necessary, update its monitoring components to address the following objectives:

i) Determine the status of implementing the components of the SWMP;
ii) Evaluate the effectiveness of BMPs for specific source controls;
iii) Evaluate the source of specific pollutants;
iv) Assess the chemical, biological, and physical effects of MS4 runoff on receiving waters;
v) Characterize MS4 runoff discharges; and
vi) Evaluate long-term trends in receiving water quality associated with storm water discharges.

The updated monitoring component must also be designed to track the long-term progress of the SWMP towards achieving improvements in receiving water quality, including progress towards meeting pollutant load reduction benchmarks associated with TMDL parameters where applicable. The results of the monitoring component must be used to support the adaptive management process and lead to refinements of the SWMP.

The monitoring that is currently being conducted by Oregon City will not, by itself, be sufficient to address each of the new permit monitoring objectives entirely. In addition, given the wide ranging variability of stormwater quality data, conducting monitoring that is sufficient to address any of these six objectives will require significant resources in order to obtain data that are statistically valid. This amount of monitoring would be beyond what is considered to be the maximum extent practicable for Oregon City. DEQ itself acknowledged this issue and provided the following clause in the permit:

"If representative of the entire area subject to these permit requirements, the co-permittees may develop a cooperative MS4 discharge and in-stream monitoring strategy that assigns monitoring responsibilities to selected co-permittees."

Therefore, in order to maximize resources and to develop data that are more robust, statistically significant, and useful, six of the Clackamas County co-permittees coordinated and are developing a comprehensive monitoring plan. These parties include Clackamas County Service District #1, West Linn, Milwaukie, Oregon City, Gladstone, and Lake Oswego.

Development of the first phase of the plan involved a review of the monitoring that has been conducted to date by the Clackamas co-permittees, in accordance with their Table B-1 requirements. Existing efforts were reviewed comprehensively in light of addressing the six monitoring objectives listed above and answering questions that will support stormwater management decisions. As a result of this review, monitoring recommendations were made. The Phase I, comprehensive monitoring plan for Clackamas County and co-permittees has been included as Attachment A. Phase II of the plan will include information regarding implementation of the plan including sampling locations, sampling methods, and parameters for analysis. Phase II of the plan will be submitted with the 2006 Oregon City annual compliance report.

SECTION 6 SOURCE IDENTIFICATION COMPONENTS OF THE CITY OF OREGON CITY SWMP

6.1 INTRODUCTION

Schedule B(2)(b)(i-vi) of the Clackamas County and co-permittee's MS4 NPDES permit outlines the content requirements for the Interim Evaluation Report. Item (ii) requires the following:

(ii) A description of the current source identification components of the SWMP and the rationale regarding the adequacy of these components.

To address this requirement, DEQ was contacted to verify the intent of this specific requirement. This requirement is to provide an update the source identification requirements from the original Part 1 and Part 2 MS4 NPDES Permit Applications. A summary of the original requirements is below.

6.2 UPDATE OF THE PERMIT APPLICATION SOURCE IDENTIFICATION REQUIREMENTS

For the previously submitted Part 1 MS4 NPDES permit applications the following information was required to be submitted with respect to the identification of sources:

A USGS 7.5 minute topographic map (or equivalent topographic map with a scale between 1:10,000 and 1:24,000 if cost effective) extending one mile beyond the service boundaries of the municipal storm sewer system covered by the permit application. The following information shall be provided:

1. *The location of known municipal storm sewer system outfalls discharging to waters of the United States;.*
2. *A description of the land use activities (undeveloped, residential, commercial, agricultural, and industrial uses) accompanied with estimates of population densities and projected growth for a 10-year period within the drainage area served by the separate storm sewer. For each land use type, an estimate of average runoff coefficient shall be provided.*
3. *The location and description of the activities of the facility of each currently operation or closed municipal landfill or other treatment, storage, or disposal (TSD) facility for municipal waste.*
4. *The location and permit number of any known discharge to the municipal storm sewer that has been issued a NPDES permit.*
5. *The location of major structural controls for storm sewer discharges (retention basins, detention basins, major infiltration devices, etc.).*
6. *The identification of publicly owned parks, recreational areas, and other open lands.*

The information for each of these items has been updated and is provided in the Mapping Section (Section 10.0) of this Interim Evaluation Report.

For the previously submitted Part 2 MS4 NPDES permit applications, an inventory was conducted of industrial discharges to Oregon City's stormwater system. The City currently has four General NPDES permittees.

SECTION 7 EVALUATION OF NON-STORMWATER DISCHARGES

With respect to non-stormwater discharges, Oregon City's MS4 NPDES permit requires the following:

A(3) - Each co-permittee must effectively prohibit non-storm water discharges into the MS4 unless such discharges are otherwise permitted by an existing NPDES permit. Unless identified by any co-permittee, or the Department, the following non-storm water discharges need not be addressed by the co-permittee's illicit discharge program, provided appropriate BMPs, if needed, to minimize the impacts of such sources are developed under the SWMP: water line flushing; landscape irrigation; diverted stream flows; rising ground waters; uncontaminated groundwater infiltration; uncontaminated pumped ground water; discharges from potable water sources; start up flushing of groundwater wells; aquifer storage and recovery (ASR) wells; potable groundwater monitoring wells; draining and flushing of municipal potable water storage reservoirs; foundation drains; air conditioning condensate; irrigation water; springs; water from crawl space pumps; footing drains; lawn watering; individual residential car washing; flows from riparian habitats and wetlands; dechlorinated swimming pool discharges; street wash waters; discharges of treated water from investigation, removal and remedial actions selected or approved by the Department pursuant to Oregon Revised Statute (ORS) Chapter 465, the state's environmental cleanup law; and discharges or flows from emergency fire fighting activities where discharges or flows from fire fighting are identified as not significant sources of pollutants to waters of the state.

With respect to reporting on compliance with the above requirement, the permit requires the following:

B(2)(b)(iii) - For each of the listed non-storm water discharges [Schedule A(3)] expected to occur in a co-permittee's area, the co-permittee must identify the appropriate control measures and the rationale for
the selection of these BMPs (or the rationale for why BMPs are deemed not necessary).

The City reviewed each of the above 24 categories of non-stormwater discharges. The reviews consisted of interviewing City staff with respect to activities conducted, obtaining additional information from other municipal stormwater management programs, and reviewing data collected from other municipal stormwater management programs. As a result, one of the following four statements was made regarding each category of stormwater discharges:

1. The City does not have this type of non-stormwater discharge.
2. The City does have this type of non-stormwater discharge. However, based on best professional judgment and/or regional monitoring results, the quality of such discharges is not expected to adversely impact receiving waters.
3. The City does have this type of non-stormwater discharge. However, the impact on receiving waters is not expected to be significant relative to other impacts that are being addressed by the City's SWMP and/or control of this discharge is not practicable.

4. The City has this type of non-stormwater discharge and has determined that the impact should be addressed. A BMP has been proposed in the revised SWMP.

The attached table provides a summary of the review that was conducted and associated results. It should be noted that some of the non-stormwater discharge categories were combined based on their similarities with respect to their potential impacts.

TABLE 7-1: Summary of Non-Stormwater Discharges

Category of Non-Stormwater Discharge	Statement 1 – 4 That Applies	Rationale for Selecting Statement 1 - 4	Relevant SWMP BMP that Addresses the Discharge (See the SWMP for details)
• Water line flushing. • Discharges from potable water sources. • Water from the draining and flushing of municipal potable water storage reservoirs.	2	These discharges have been grouped together as they all relate to the discharge of potable water. Depending on the magnitude of discharge, capacity of the receiving water body, and the travel distance between the source and water body, discharges from potable water sources could potentially impact streams due to elevated levels of chlorine. In the City of Oregon City, super chlorinated water flushed from new water lines is discharged to the sanitary system. Hydrant and water line flushing that is not discharged to the sanitary system is infrequent and if it occurs, it is generally discharged to pervious surfaces, in conjunction with DEQs recommended guidelines. If the discharge happens to be close to the stormwater conveyance system or a stream, the City will dechlorinate the discharge at the hydrant. Finally, to disinfect the water, the City uses free chlorine instead of chloramines, which more quickly dissipates into the atmosphere.	N/A

Category of Non-Stormwater Discharge	Statement 1 – 4 That Applies	Rationale for Selecting Statement 1 - 4	Relevant SWMP BMP that Addresses the Discharge (See the SWMP for details)
• Landscape irrigation. • Runoff from lawn watering.	4	These discharges have been grouped together as they both relate to the watering of yards and landscape areas. Generally, lawn watering and landscape irrigation activities may promote increased levels of fertilizer, pesticides, and herbicides into receiving waters. To address impacts related to these non-stormwater sources, the City of Oregon City focuses on the use of public education as a means to promote behavioral changes. When conducting landscape activities on public property, the City maintenance staff also minimize the use of pesticides and other chemical additives for pest management. This would limit the amount of chemicals potentially discharged to receiving waters.	See **Minimize Pollutant Discharges Associated with Landscape Management Practices** under Component #1 and **Conduct Staff Training for Pest Management** and **Provide Public Education and Outreach Materials Regarding Stormwater Management** under Component #5 of the Stormwater Management Plan.
• Diverted stream flows	2	Historically, the City has not diverted stream flows unless authorized under a State permit to construct in a waterway.	N/A

Category of Non-Stormwater Discharge	Statement 1 – 4 That Applies	Rationale for Selecting Statement 1 - 4	Relevant SWMP BMP that Addresses the Discharge (See the SWMP for details)
• Rising ground waters. • Uncontaminated groundwater infiltration.	2	These discharges have been grouped together as they relate to the direct discharge of groundwater into the stormwater conveyance system. These type discharges are generally associated with surface water saturation and cannot typically be prevented. These discharges are not expected to adversely affect water quality. The City of Oregon City implements a number of operation and maintenance BMPs to indirectly address impacts associated with additional flows in the stormwater conveyance system. Such BMPs minimize the amount of sediment and other pollutants that could potentially be discharged with increased flows due to rising groundwaters and groundwater infiltration.	See **Conduct Stormwater Conveyance System Cleaning and Maintenance** under Component #1 of the Stormwater Management Plan.

Category of Non-Stormwater Discharge	**Statement 1 – 4 That Applies**	**Rationale for Selecting Statement 1 - 4**	**Relevant SWMP BMP that Addresses the Discharge (See the SWMP for details)**
• Water from foundation drains. • Water from crawl spaces. • Water from footing drains.	3	These discharges have been grouped together as they relate to the discharges associated with eliminating accumulated groundwater or stormwater from building structures. Generally, not all structures discharge directly to the MS4 system; most drain to lawns or greenspaces when possible. Typically, stormwater entering these structures is filtered through soil and is not likely to be a significant source of pollutants. Risk of stormwater pollution associated with these discharges would primarily be due to a homeowner's landscape practices, spills, or illegal dumping. However, these impacts are not expected to be significant relative to other impacts being addressed by the City's SWMP. The City of Oregon City implements a number of practices to indirectly address impacts associated these type flows in the stormwater conveyance system. Such practices (BMPs) minimize the likelihood of additional pollutants discharges as a result of these possible, increased flows into the MS4.	See **Conduct Stormwater Conveyance System Cleaning and Maintenance** under Component #1 of the Stormwater Management Plan. **Provide Public Education and Outreach Materials Regarding Stormwater Management** under Component #5 of the Stormwater Management Plan.

Category of Non-Stormwater Discharge	Statement 1 – 4 That Applies	Rationale for Selecting Statement 1 - 4	Relevant SWMP BMP that Addresses the Discharge (See the SWMP for details)
• Water from the start up flushing of groundwater wells. • Water from aquifer storage and recovery (ASR) wells. • Water from potable groundwater monitoring wells. • Uncontaminated pumped ground water	1	The City of Oregon City does not own or operate any of these type wells thus not have any anticipated discharge associated with these type wells.	N/A
• Air conditioning condensate.	2	Due to regulated industry standards, there is not currently reason to suspect that condensate released from air conditioning systems contains contaminants and/or enters the storm system. Generally condensate consists only of H_2O and is typically discharged to landscaping or pervious surface. Although this discharge may occur, this discharge is not expected to adversely affect water quality. The City implements a number of practices to indirectly address this possible discharge.	See **Implement the Illicit Discharge Program** under Component #2 of the Stormwater Management Plan.

Category of Non-Stormwater Discharge	Statement 1 – 4 That Applies	Rationale for Selecting Statement 1 - 4	Relevant SWMP BMP that Addresses the Discharge (See the SWMP for details)
• Water from springs. • Flows from riparian habitats and wetlands.	2	Water from springs and/or riparian habitat may occasionally discharge into the City's MS4 system. However, these flows generally only occur following heavy rainfall periods when surface soils have become saturated. It is not clear whether such volume of discharge from these sources would potentially impact the City's MS4 system. In addition, riparian habitats and wetlands in particular generally serve a water quality and natural resources benefit by absorbing stormwater volumes, filtering sediment, and providing for uptake of nutrients. Although this discharge may occur, this discharge is not expected to adversely affect water quality. The City implements a number of practices to indirectly address additional flows in the MS4 system and limit possible contaminants that could discharge due to these flows.	See **Conduct Stormwater Conveyance System Cleaning and Maintenance** under Component #1 of the Stormwater Management Plan. See also **Provide Public Education and Outreach Materials Regarding Stormwater Management** under Component #5 of the Stormwater Management Plan

Category of Non-Stormwater Discharge	Statement 1 – 4 That Applies	Rationale for Selecting Statement 1 - 4	Relevant SWMP BMP that Addresses the Discharge (See the SWMP for details)
• Agricultural irrigation water.	3	Runoff from agricultural irrigation operations has the potential to contribute nutrients, pesticides, sediment, and a variety of other pollutants to stormwater runoff. Most pollutants contributed by agricultural sources enter local receiving waters directly or via the MS4 system. There are some agricultural areas upstream of the City of Oregon City; however, there is no area zoned agricultural. Agricultural related operations within the City limits are primarily related to nurseries. Given the small area affected and the inability to impose requirements on agricultural practices, the City does not have a program to address agricultural practices. Senate Bill 1010 states that water quality impacts from agricultural practices must be addressed in TMDL watersheds. During the next permit period, it is likely that the Willamette River and tributaries will have a TMDL; thus, the State will be required to regulate agricultural discharges. Agricultural discharges are projected to be relatively small and regulated by the Department of Agriculture. The City implements a number of practices to indirectly address additional flows in the MS4 system and limit possible contaminants that could discharge due to these flows. In addition, if the City itself notices a water quality problem due to an agricultural source, they will contact the Department of Agriculture or the Soil and Water Conservation District for follow up.	See **Minimize Pollutant Discharges Associated with Landscape Management Practices** under Component #1 of the Stormwater Management Plan. See also **Provide Public Education and Outreach Materials Regarding Stormwater Management** under Component #5 of the Stormwater Management Plan.

Category of Non-Stormwater Discharge	Statement 1 – 4 That Applies	Rationale for Selecting Statement 1 - 4	Relevant SWMP BMP that Addresses the Discharge (See the SWMP for details)
• Water from individual residential car washing.	4	Runoff from individual car washing will likely contain surfactants, sediments, metals, oil and grease and other pollutants that could impact the City's MS4 system. Cumulative impacts from the City as a whole could potentially be significant. The City of Portland conducted monitoring of runoff quality from four charity car washes. They found elevated levels of suspended sediment and metals (chromium, copper, lead, nickel, and zinc) and at one site, found elevated levels of bacteria. To address impacts related to this non-stormwater discharge, the City of Oregon City focuses on the use of public education as means to promote behavioral changes.	See **Provide Public Education and Outreach Materials Regarding Stormwater Management** under Component #5 of the Stormwater Management Plan
• Dechlorinated swimming pool water.	2	Water discharged directly from swimming pools is generally not suitable for direct discharge into the MS4 system due to the initial levels of chlorine and other chemicals. After dechlorinated, however, the water is not expected to pose any significant water quality problems. Although this discharge may occur, this discharge is not expected to adversely affect water quality. The City implements a number of practices to indirectly address additional flows in the MS4 system and limit possible contaminants that could discharge due to these flows.	See **Conduct Stormwater Conveyance System Cleaning and Maintenance** under Component #1 of the Stormwater Management Plan.
• Street wash waters.	1	The City of Oregon City does not currently implement the practice of wetting streets prior sweeping or using water from washing and cleaning of streets.	N/A

Category of Non-Stormwater Discharge	Statement 1 – 4 That Applies	Rationale for Selecting Statement 1 - 4	Relevant SWMP BMP that Addresses the Discharge (See the SWMP for details)
• Discharges of treated water from investigation, removal and remedial actions selected or approved by the Department pursuant to Oregon Revised Statute (ORS) Chapter 465, the state's environmental cleanup law.	1	The City of Oregon City does not currently have any of these type operations.	

Category of Non-Stormwater Discharge	Statement 1 – 4 That Applies	Rationale for Selecting Statement 1 - 4	Relevant SWMP BMP that Addresses the Discharge (See the SWMP for details)
• Discharges or flows from emergency fire fighting activities where discharges or flows from fire fighting.	4	Large fires may generate runoff that flows to the MS4 system. However, not all fire fighting activities generate enough runoff to leave the site itself, due to the intensity of some fires and the use of chemical application for some fire fighting activities. If runoff does occur, there may be impacts to receiving water bodies, particularly if the volume of discharge is significant and the fire location is in close proximity to the receiving stream. Typically, the Fire Department's first responsibility is to protect the public. Generally, protective measures are taken after a fire is suppressed. If possible, absorbents and site sweeping are applied to minimize pollutant discharge into the storm system. There are not currently any BMPs in the City of Oregon City program to directly address increased runoff due to fire fighting activities, as fire fighting is a public safety measure. The City does implement a number of BMPs to indirectly address impacts related to increased flows in the MS4 system and possible contamination related to these increased flows.	See **Conduct Stormwater Conveyance System Cleaning and Maintenance** and **Conduct Street Sweeping and Roadway Repair Activities** under Component #1 of the Stormwater Management Plan. See also **Provide Public Education and Outreach Materials Regarding Stormwater Management** under Component #5 of the Stormwater Management Plan.

SECTION 8 SUMMARY OF PUBLIC INVOLVEMENT PROCESS

Permit requirements outlined in Schedule D(2)(g)(i-iii) require each co-permittee to conduct a public involvement process for:

i) Interim Evaluation Report (IER) and MS4 permit renewal submittal; and
ii) On-Going Adaptive Management

To meet the first requirement, the City of Oregon City conducted a public process to receive and to respond to public comment on the City's revised Stormwater Management Plan (SWMP). Specific details regarding the activities conducted are discussed in Section 8.1. To meet the second permit requirement, the City's stormwater management program must be continually evaluated and updated, meeting the adaptive management requirement of the permit. Adaptive management activities are discussed in more detail in Section 8.2.

8.1 PUBLIC INVOLVEMENT ACTIVITIES RELATED TO THE IER SUBMITTAL

To meet the first requirement, the City conducted a 30-day public review period to receive public comments on the City's revised Stormwater Management Plan (SWMP). The revised SWMP was placed online on March 8, 2006 for public viewing, and a notice was placed in the local newspaper (Oregon City News) on March 15, 2006 indicating that the SWMP was available for public comment. Contact information and a time period for submittal of comments to the City was published as well. The public comment period ended on April 7, 2006, and the City received no comments.

In addition to the public comment period, the City presented the SWMP to the City's Natural Resource Committee (NRC) on March 16, 2006 and to the City Commission in a public hearing format on April 5, 2006. Comments received from the Committee and Commissioners during the NRC presentation and the public hearing from were supportive of the City's efforts.

8.2 PUBLIC INVOLVEMENT ACTIVITIES RELATED TO ON-GOING ADAPTIVE MANAGEMENT

To allow for on-going adaptive management activities, the SWMP contains language to ensure that BMPs may be modified based on the results of inspections and changing priorities. With the pending approval of the Willamette River TMDL, the City will conduct adaptive management of their stormwater program to develop and address future benchmarks and may modify their stormwater program and SWMP accordingly. Substantive revisions to the City of Oregon City's SWMP, not including the addition of BMPs or the modification of existing BMPs that does not change the substance of the BMPs, would require a public review process to meet the adaptive management requirement.

SECTION 9 303(d) EVALUATION FOR THE CITY OF OREGON CITY

As mentioned previously, the City of Oregon City drains to the Willamette River directly or to one of a number of tributaries to the Willamette River. The Willamette River itself is listed as water quality impaired for bacteria, mercury, iron and manganese, PAHs, and a number of organochlorine compounds (collectively, 303(d) pollutants; DEQ, 2002). The Clackamas River and Abernethy Creek, both tributaries of the Willamette River, are also 303(d) listed for bacteria (Clackamas River) and temperature (Clackamas River and Abernethy Creek). As temperature is not considered a point source pollutant, it is not included in the 303(d) evaluation. The City of Oregon City's MS4 NPDES permit requires a review of their program with respect to these 303(d) constituents. Specifically, the requirements for this review consist of three parts:

ScheduleD(2)(e)

1) *Determine whether there is a reasonable likelihood for storm water from the MS4 to cause or contribute to water quality degradation of receiving waters through the discharge of pollutants on the 2002 303(d) list. Provide the rationale for the conclusion, including the results of an evaluation.*

2) *If the discharges from the MS4 is a contributor to specific listed pollutants, determine and describe the relationship between the 303(d) listed pollutant and the MS4 discharges.*

3) *Determine whether the BMPs in the existing SWMP are effective to address the 303(d) pollutants. If not, describe how the plan could be adapted to more appropriately address these pollutants. A summary of the rationale for this determination must also be included in the report.*

The sections below analyze each 303(d) parameter with respect to the above mentioned permit requirements. Analysis regarding the contribution of stormwater runoff via the MS4 system to the ambient pollutant concentrations and analysis regarding the effectiveness of stormwater BMPs in treating these 303(d) parameters is conducted using information from national databases, regional data, draft or existing TMDL documents and other local studies. BMPs specific to the City of Oregon City's stormwater management program are evaluated with respect to their potential to reduce loads of each of the 303(d) pollutants.

The following text addresses the 303(d) evaluation requirement for the following 303(d) parameters:

- Bacteria
- Mercury
- Iron and Manganese
- PAH's
- PCBs, DDT, DDE, aldrin, dieldrin

9.1 BACTERIA

Water quality standards for bacteria are designed with the intent of protecting human health by limiting the amount of pathogens in the water. With secondary water treatment, the primary beneficial use protected by water quality standards is recreational contact with water. Both *Fecal coliform* (pre-1996) and *Escherichia coli* (*E. coli*) have been used as indicators of harmful pathogens in receiving waters. The Oregon Department of Environmental Quality's (DEQ's) current water quality standard is for *E. coli* in freshwater where water contact recreation is the most sensitive beneficial use. The *E. coli* standard is less than 406 *E. coli* organisms (most probable number – MPN) per 100 milliliters (mL) in any single sample; and a 30-day log mean of 126 E. coli organisms per 100 mL, based on a minimum of five samples. These standards were established for ambient or receiving water concentrations, not for in-pipe concentrations of stormwater prior to mixing at the discharge point.

Part 1: Likelihood of water quality degradation related to stormwater.

<u>Analysis</u>

Recent TMDL documents state that bacteria concentrations exceeding water quality criteria are ubiquitous in urban streams in the lower Willamette River Valley (DEQ 2004a, c). This is consistent with nationwide findings of elevated bacteria concentrations in receiving waters of urban areas. Bacteria analyses performed for TMDLs are a result of sampling receiving water bodies rather than MS4 systems. However, elevated bacteria levels have been found to be associated with specifically with the MS4 systems, and national and local data sources support this observation. At a national level, Pitt et al. (2004) evaluated data from MS4s across the nation. This data evaluation was restricted to samples from storm sewer pipes or outfalls only (rather than receiving waters), so it is truly representative of the contribution of the permitted MS4 systems. Results are summarized in Table 9-1. An assessment was also completed specific to the Pacific Northwest (EPA Rain Region 7) Region, and bacteria concentration values summarized for all land uses ranged from 10 to approximately 50,000 mpn/100mL, with a median value of approximately 2,000 mpn/100mL.[1]

TABLE 9-1: Summary of Fecal Coliform Concentrations in U.S Urban Stormwater Systems

Land Use	Median (MPN/ 100 mL)	Number of Observations	% Above Detection	Coefficient of Variation
Overall	5,091	1,704	91%	4.6
Residential	8,345	446	88.3%	5.0
Mixed Residential	11,000	313	94.9%	3.3
Commercial	4,300	233	88.0%	2.8
Mixed Commercial	4,980	109	94.5%	3.3
Industrial	2,500	297	87.9%	5.6

[1] Bacteria concentrations are variously reported as "colonies," "colony-forming units (cfu)", or "most probably number (mpn)" per 100mL of water, depending on the test used.

Land Use	Median (MPN/ 100 mL)	Number of Observations	% Above Detection	Coefficient of Variation
Mixed Industrial	3,033	115	95.7%	2.5
Freeways	1,700	49	100.0%	2.0
Mixed Freeways	730	16	81.3%	2.0
Open Space	7,200	23	91.3%	1.1
Mixed Open Space	2,600	95	97.9%	2.3

Source: Pitt et al., 2004

A regional data compilation and summary of land-use based stormwater sampling of MS4 systems in Oregon (not receiving waters) indicated median bacteria concentrations in storm drain systems of up to 1,300 *E. coli* colonies per 100 mL, and 1,600 *Fecal coliform* colonies per 100 mL (WCC, 1997). These values are presented in Table 9-2. In addition, sampling of bacteria in MS4 systems from the City of Portland and Clean Water Services since MS4 permits were issued in 1995 continues to suggest that urban stormwater exceeds the ambient bacteria standard by a wide margin.

TABLE 9-2: Median Bacteria Concentrations in Oregon Urban Stormwater Systems

Land Use	Fecal coliform (MPN/100 mL)	E. Coli (MPN/100 mL)
Residential	1,600	600
Multi-Family Residential	1,600	600
Commercial	1,600	1,300
Industrial	885	610
Public Open Space	1,090	1,000
Vacant	1,090	1,000
Rural	1,090	1,000

Source: WCC, 1997 and Raj Kapur, Clean Water Services, pers. comm., 2005

Recent sampling of Fanno Creek, a tributary to the Tualatin River in the Portland metropolitan area, by the U.S. Geological Survey (USGS 2000, 2002) indicates a link between bacteria and runoff conditions, and suggests impacts of failing septic systems on the bacterial load specifically for Fanno Creek. The USGS sampling occurred within the receiving water body rather than the storm drainage system. The USGS performed spatially detailed sampling during low flow conditions in the summer of 1996, and storm sampling at three locations during three storms between June 1998-December 1999. The median *E. coli* concentration in Fanno Creek during low flow conditions was 520 CFU/100mL, with 70% of the samples exceeding the single-sample ambient standard; the median *E. coli* concentration in nearby but less developed Bronson Creek during the same period was 180 CFU/100mL, with 33% exceeding the single-sample ambient standard (USGS, 2000). Bacteria concentrations were found to be much higher during conditions of storm runoff. During the three storm events, the median *E. coli* concentration in Fanno Creek was 1,800 CFU/100mL and 96% of these samples exceeded the single-sample ambient standard.

DEQ has also evaluated the relationship between bacteria and wet weather in the course of developing TMDLs for the Columbia Slough and the Johnson Creek basins, both of which are located in the Portland metropolitan area. In each case, data supports a correlation between wet weather conditions and exceedance of the bacteria standard.

Conclusion

Based on this analysis, it is clear that urban stormwater can contribute to elevated levels of bacteria in local receiving water bodies.

Part 2: What is the relationship between the 303(d) listed pollutant and the MS4 discharges?

Analysis

As described above, MS4 discharges can contribute to elevated bacteria levels in receiving waters. Unfortunately, the relative contribution of bacteria from different sources is difficult to determine.

The intent of the water quality standard for bacteria is to limit the potential discharge of pathogenic (particularly human) bacteria. Bacteria from humans are thought to enter MS4 systems from a number of sources including:

- Failing septic systems or leaky sewer systems and associated infiltration and inflow to the MS4 system;
- Combined sewer overflows and sanitary sewer upsets;
- Illegal dumping (e.g., from mobile sanitary services) and illicit connections to the storm drain instead of the sanitary sewer service.

It is important to note however that bacteria in receiving waters have also been associated with domestic animals (including feral populations), and wildlife (such as avian species and rodents). Multiple studies over the past decade have revealed that only a small percentage of bacteria in ambient waters are actually associated with human sources. Four microbial source tracking (MST) studies using ribosomal tracking of coliform bacteria illustrate this point well as follows:

1. Blaine, WA: The City needed to evaluate contamination sources to shellfish beds (HEC, 1999). In Cain Creek, an urban stream, no human sources of bacteria were found. Instead, half of the matched bacterial strains were attributed to dogs and cats (evenly divided), and the remaining half of the matched strains were attributed to ducks/geese and gulls (in a 2:1 ratio). Results from Portal Drain, a storm sewer outfall, were nearly identical. Bacterial concentrations were noticeably higher during a wet period on the flood tide, suggesting that there may be some transport from bacterial sources in the bay upstream with the tides. HEC noted, however, that these samples were collected later in the spring than other samples, so the warmer weather and difference in wildlife activity may have also influenced the total concentration of bacteria. In a stream draining an unsewered area with some agricultural land use, 8% of the identified bacteria strains were of human origin.

2. Boise, ID: A study in support of implementation of the Boise River TMDL included two sites that are stormwater outfalls, as well as several sites in receiving waters (CH2MHill, 2003). At one of these sites, where the stormwater was combined with irrigation return flow,

sources of 72% of the bacterial strains were identified: dog was the dominant source (30%), humans were next at 21%, 12% was avian (mixed, including ducks/geese), 5% cat, 3% rodent, and 1% duck-goose-rabbit. At the second site, which had a combination of residential and recreational land uses, sources of 83% of the bacterial strains were identified. In this case, 29% of the bacteria were associated with avian sources, 29% with dog, 10% with human, 8% with cat, 3% rodent, and approximately 1% each of opossum-rabbit and duck-goose-squirrel-cat.

3. Puyallup, WA: In a study of receiving waters in urban areas of Puyallup, Washington, geese were shown to be the dominant bacterial source at 41% of the total bacterial strains (Milne et al., 2004). This is important because the study area contains the Western Washington Fairgrounds, considered to be a potentially significant bacterial source. The next largest bacterial source was rabbit-rodent (28%), followed by: canine (11%), unknown (9%), human (5%), raccoon (3%), deer-elk (2%), and < 1% each of feline, bovine, or horse. During high rainfall events, human sources were not distinguishable.

4. Tualatin Basin, OR: In a yet to be published study conducted by Clean Water Services in 2005, avian species with about 50% of the total bacteria strains were predominant, followed by rodents, and domestic animals. None of the stormwater samples analyzed showed any human sources of bacteria.

5. Seattle, WA: A study in Pipers Creek, an urban stream in northwestern Seattle, contained a primary wastewater treatment plant in the middle of this watershed. While the wastewater treatment plant discharged to Puget Sound through a deep-water outfall, concerns were raised about leaks in this conveyance system. A MST study using a ribosomal tracking method found that 30 percent of the samples contained bacteria matching a cat source strain, 7 percent were from dogs, and 3 percent were from ducks. Fifty-seven percent of the bacteria could not be definitively identified (HEC, 1993). HEC concluded that the relatively high percentage of cat source was attributed to the success of Seattle's scoop laws for dogs. The cat source of bacteria was presumably a combination of domestic cats and feral cats.

Seasonal variations in bacterial concentrations independent of suspended sediment concentrations were observed by USGS (2002). In a relatively minor storm in June at Fanno Creek, bacteria numbers were substantially higher than during winter storms, and higher than the concentrations typical of MS4 systems. This may be due to a number of processes including: dilution by larger volume of winter storms, suspension of bed sediments containing bacterial colonies that developed *in situ* in streambed sediments during warm weather, runoff from a more concentrated reservoir of bacteria present in upland soils during warm weather (Hunter and others, 1999 as cited in USGS, 2002), or due to a greater buildup of bacteria on impervious surfaces due to a longer antecedent dry period than is typical of winter storms. Understanding this seasonal variation and determining whether it occurs at other sites could bring about useful management insights specifically targeted at reducing bacteria levels.

Conclusion

Regionally available bacteria source tracking studies have shown that bacterial sources in urban environments are not predominantly human. The more predominant sources of bacteria include wildlife and/or domestic pets (e.g., canine/feline).

Part 3. Determine whether the BMPs in the existing SWMP are effective to address the 303(d) pollutants.

Analysis

This section describes the effectiveness of structural stormwater BMPs for which information was available relative to bacterial removal based on either local data or data from the ASCE International BMP Database (ASCE, 2005). Based on a review of both national and local data on BMP effectiveness, a number of observations were made:

1. Reducing overall stormwater volumes through infiltration (i.e., low impact development techniques) can help to reduce bacteria loads to surface waters by reducing the volume of stormwater entering a stream and hence suspended bacteria loads. Soil is an excellent filtration medium for bacteria, as demonstrated by numerous studies that have been conducted to develop design standards for septic systems.
2. Although there are significant limits with respect to bacteria removal through the use of structural BMPs, there are some factors that promote increases in bacteria die-off that have implications for BMP effectiveness. These include:
    - Sunlight - Maximum die-off requires clear water, however, the turbidity and organic matter found in urban runoff can greatly interfere with the sunlight effect (Bank and Schemhel, 1990, in CWP, 1999). Substantial treatment would be needed to remove suspended solids before UV light could be effective. In addition, exposing water bodies to increased UV light results in warming, which is contrary to the goal of water quality standards for temperature.
    - Chemical/Ultraviolet Disinfection - Although effective for treatment of drinking water and wastewater, chlorine dosing of stormwater is difficult due to the variable flows and turbidity levels. Therefore, it has only been used for this purpose in rare cases. In addition there are stringent water quality standards with respect to the discharge of chlorine. Exposure to ultraviolet disinfection would be even more problematic due to the concentrations of suspended sediment typical of stormwater.
    - Growth Inhibitors - cooler temperatures, low nutrient levels, low carbon supplies, low pH levels and moisture loss are all factors that inhibit the growth of bacteria.
3. There are upper limits on what stormwater treatment systems that rely on sedimentation can achieve with respect to bacteria removal (ASCE, 2005).[2] Even an advanced secondary wastewater treatment plant that filters its effluent still discharges fecal coliform at the 10^3 to

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[2] It is important to note that only the data reported in the National BMP Database that was collected as Event Mean Concentrations (EMCs) was examined for this summary. Data reported in the National BMP Database that was collected as grab samples was not examined.

10^5 levels before final disinfection. That being said, the most common removal mechanisms and their estimated effectiveness are as follows:

- Sedimentation - One study indicated that 15 to 30 percent of fecal coliform cells present in stormwater are adsorbed to larger suspended particles, most of which are greater than 30 microns in diameter (Schillinger and Gannon 1982, in CWP 1999). The bacteria that do adsorb to these larger particles can settle rapidly out of the water column. Of the bacteria that do not attach or absorb to larger particles, the remainder either attach to smaller particles less than 30 microns in diameter or do not attach at all. Specifically, fifty percent of fecal coliform bacteria were found unattached. These bacteria have slower settling velocities and may remain in suspension for days or weeks. A subsequent study found that approximately 90 percent of bacteria (both attached and unattached) are expected to settle out from a typical stormwater pond in about two days under ideal conditions (Auer and Niehaus 1993, in CWP 1999).

- Sand Filtration - Most field studies of sand filters show removal of 50 to 65 percent of bacteria.

- Soil Filtration - Similar to sand filtration although more effective since the higher organic matter and clay content of most soils increases potential bacteria adsorption (Robertson and Edberg, 1997, in CWP, 1999).

4. Structural BMP-specific study results conducted nationally and locally suggest that there are limited practicable options for bacterial removal from stormwater. Results below cite results from specific BMP evaluations using local data where available, supplemented with national data as necessary. Effluent data from the BMPs that were studied were so variable with respect to bacteria that it can't be determined whether one is more effective than another or whether any of them are very effective at all:

    - Detention Ponds – Gresham monitors the Mt. Hood Community College and Kelly Creek detention ponds. Outflow concentrations of *E. coli* in 2003-2004 averaged approximately 100 CFU/100mL, down from outflow concentrations measured in 2001-2002 that ranged from 220-440 CFU/100mL (Gresham 2004). At both ponds, outflow values were less than inflow values, indicating that the ponds are responsible for some load reductions. *E. coli* data collected as part of ongoing BMP effectiveness evaluations by Clean Water Services showed ranges from 600 MPN/100 mL to 250,000 MPN/100 mL in effluent samples, with a median value of 2,550 MPN/100mL (Kapur 2005).[3] Data indicate that effluent bacteria levels were actually higher than influent levels in many of the samples.

    - Retention Ponds - Outflow concentrations of *E. coli* from the Water Garden wet (retention) pond at the City of Portland's Water Pollution Control Laboratory average 1209 CFU/100mL (BES 2001).

    - Sand Filters - The City of Portland currently monitors a sand filter (the Parkrose sand filter) that has effluent concentrations that are consistently below the 406 CFU/100 mL standard.

[3] As a means of qualifying these results, Jan Miller (personal communication 5/3/05) notes that the detention pond, while designed to be dry, has a spring source and so remains damp and vegetated year-round with wetlands species.

- Swales - Outflow concentrations of fecal coliform averaged 2,506 colonies/100 mL based on 3 events (CWP, 1999). Average *E. Coli* concentrations in effluent from Portland swales ranged from 5,500 to 12,000 colonies/100 mL. The range of effluent concentrations in the swale sampled by CWS was even greater (15-70,000 MPN/100mL). As a group, the grass swales were found to have no ability to reduce fecal coliform levels, with zero or negative changes in concentrations reported in four out of five studies. Pet droppings, wildlife use, in-situ growth of the bacterial colonies, and short travel times within the swale were all cited as reasons for the poor performance of swales.

- Grass Filter Strips - Studies suggest only a modest capability to remove fecal coliforms from runoff.

- Vortechnics Settling Chamber - Samples collected from 1997-2004 by CWS revealed often higher bacteria levels in effluent samples than influent samples[4]. Concentrations ranged from 7 MPN/100 mL to 28,300 MPN/100 mL.

5. Very little monitoring has been conducted to determine if source controls and other non-structural BMPs (ex: public education) can actually reduce watershed bacteria levels. There are four primary types of source control used to control bacteria: pet management, wildlife management, illicit connection control, and converting septic-systems to sanitary system hook-ups. A study on controlling pet waste in the Chesapeake Bay showed that approximately 41% of dog walkers do not pick up the waste. Eighty percent of that 41% indicated that several factors (i.e., complaints, simpler collection methods, more convenient disposal methods and/or fines) would still not induce them to change their behavior. This indicates that source control programs will need to be very creative to alter these deeply rooted attitudes. A recent survey by CWS ratepayers favored fines (presumably associated with an ordinance) and, secondarily, disposable scoops or bags and disposal locations in places popular with dogs as inducements for compliance (CWS, 2002). The Pipers Creek study cited above provides some support for the recommendations of CWS. The effectiveness of illicit connection control is evaluated qualitatively below. Hook-ups of failing septic systems can be very effective for localized problems, as suggested in data from Fanno Creek.

   Although broadly recognized as effective and necessary, few successful studies exist that quantitatively show the effectiveness of public education and information efforts to change behaviors related to stormwater quality. Based on a meta-analysis of numerous surveys concerning environmental knowledge, attitudes and behavior, Doug McKenzie-Mohr (Univ. of Toronto) found that human behavior is more influenced by convenience and perceptions of what others will think than by what people believe to be correct. Although Gresham has targeted campaigns to encourage proper disposal of pet waste through education accompanied by provision of conveniently located waste receptacles, it has been difficult to translate use of the receptacles to a quantity of bacteria that has been prevented from entering stormwater.

Based on the overall review of BMP effectiveness, there appears to be three important data gaps that should be noted:

[4] The Vortechnics chamber is difficult to sample and oversized relative to receiving flow volume.

1. Studies did not discuss/evaluate whether maintenance practices such as street sweeping and catch basin cleaning are effective at reducing levels of bacteria in runoff. To the extent that these practices remove sediment-bound bacteria before they reach receiving waters, they should be further evaluated with respect to effectiveness.
2. Studies did not discuss the potential effectiveness of successful source control or public education programs (e.g., it is difficult to quantify the effect that 50,000 distributed landscaping brochures have on bacteria loads in urban areas). In particular, the effectiveness of garbage disposal for rodent control, wildlife control (e.g., "Don't feed the wildlife" signs), and pet waste disposal campaigns have not been quantified.
3. Studies did not evaluate the potential effectiveness of low impact development (LID) techniques aimed at reducing flow volumes.

<u>Conclusion</u>

As stated earlier studies have shown that only small percentages of bacteria loads in stormwater are from human sources. Larger proportions of bacteria are from pets and wildlife. Most structural and non-structural stormwater BMPs have not been shown to be very effective at reducing bacteria loads and in some cases even increase loads. The exception would be for BMPs that reduce runoff volumes including low impact development practices and infiltration.

Based on the overall analysis of bacteria as discussed above, the City of Oregon City's Stormwater Management Plan (SWMP) focuses on the following sources to reduce the discharge of bacteria to the maximum extent practical:

- <u>Human Sources</u> - Even with the small proportion of the bacteria load that is associated with human sources, this source is the target of the water quality standard and should be eliminated to the extent possible. This would include fixing or eliminating failing septic systems and searching for and eliminating illicit discharges.
- <u>Domestic and Feral Animal Sources</u> - Reducing sources of bacteria associated with pet waste should focus on educating pet owners regarding proper pet waste management. Other activities that could assist in behavior modification include providing free bags for waste pickup at convenient locations and/or assessing fines for those caught not picking up the waste. To address feral animal sources issues such as proper management of food wastes, etc. should be considered so as to reduce areas that attract nuisance rodents, etc.
- <u>Wildlife Sources</u> - As there are natural sources of bacteria it is assumed that the intent of the water quality standard was not to eliminate these sources. However, enhancement of riparian areas could potentially provide for slowing of flows and hence enhancing infiltration and filtration.

Based on this conclusion, the City of Oregon City's SWMP should be effective at reducing bacteria to the MEP because it already includes BMPs to address all three of these potential bacteria sources. BMPs addressing bacteria include the following:

- **Monitor Pollutant Discharges from Municipal Waste Facilities**
- **Implement the Illicit Discharge Elimination Program**

- **Control Infiltration and Cross Connections to the City's Stormwater Conveyance System**
- **Provide Public Education and Outreach Materials Regarding Stormwater Management**

It should be noted that these BMPs are not likely to reduce bacteria levels to the extent that they will meet water quality standards since a large portion of the bacteria load is likely due to feral and wild animal sources which will not be eliminated.

9.2 MERCURY

Mercury in the aquatic food chain is now recognized as a widely distributed problem throughout North America (Brumbaugh et al. 2001). In the Willamette basin, mercury is on the 303(d) list due to fish advisories for the mainstem of the Willamette River and headwater tributary, the Coast Fork Willamette.

Water quality standards for mercury are designed to protect human health by limiting the amount of mercury that can bioaccumulate in the food chain of the Willamette River and tributaries, eventually lodging in human-consumable fish in the form of methylmercury, which is highly toxic. Existing Oregon water quality standards are 144 ng/L, 146 ng/L, and 2000 ng/L for water and fish ingestion, fish ingestion, and drinking water respectively. However, recent food web modeling (DEQ, 2004d) suggests that these criteria are not low enough to achieve fish tissue concentrations of 0.3 mg/kg: DEQ estimates that the water column "guidance value" for total mercury should be 0.92 ng/L. Ambient water column concentrations in the Willamette River currently average 1.3 ng/L.[5]

Part 1: Likelihood of water quality degradation related to stormwater.

<u>Analysis</u>

Recent TMDL documents state that ambient mercury concentrations in the Willamette River result in excessive levels in fish tissue (DEQ, 2004a). Sources of mercury in the environment are identified in the TMDL as:

- Air deposition of ionic mercury (Hg^{2+}) from local and far-field sources, at a rate approximately 10 $\mu g/m^2$-yr (DEQ, 2004b). Far-field sources include coal combustion in Asia. Near-field sources could include everything from Mt. St. Helens to broken fluorescent light bulbs and incinerators/crematoria (Krabbenhoft, personal communication, 4/18/05).

[5] A critique of DEQ's analysis was filed as part of ACWA comments on the draft TMDL in January, 2005. This critique, prepared by URS and Entrix on behalf of ACWA, finds major flaws in DEQ's link between methylmercury concentrations in fish tissue and total water column concentration of mercury, with particular emphasis on the poor relationship between water column methlymercury and total mercury. For purposes of this memo, however, these flaws will not be considered.

- Mine wastes from cinnabar (HgS) mining and milling, and amalgam-based gold milling activities in the Cascades. These wastes include mercury-enriched soils, waste or ore rock, and water discharges from mine openings (adits).
- Soil erosion, where soil mercury concentrations in the Willamette River valley floodplain are typically 0.09 mg/kg at the surface (i.e., A-horizon), and 0.05-0.06 mg/kg in the subsurface (i.e., B-horizon) outside of mining districts (Khandoker, 1997).
- Limited point sources, including industrial and municipal wastewater discharges. Mercury in municipal wastewater discharges can be traced to a large number of small sources—diet (e.g., swordfish or tuna), personal care products, pharmaceuticals, waste amalgam from dentists, broken thermometers—in addition to industrial sources covered by pretreatment requirements. Most of this influent mercury is removed during wastewater treatment (Downing, 2005). In preliminary results from the San Jose/Santa Clara Water Pollution Control Plant, influent mercury concentrations of 193.7 ng/L (1.3 ng/L methylmercury) were reduced to 2 ng/L total mercury (THg) and 0.03 ng/L methylmercury following treatment by tertiary filters.
- River sediments reflecting total mercury derived from all of these sources. A compilation of Willamette Basin data from the 1990s by the USGS indicates that streambed sediment averages 0.29 mg/kg, but ranges from 0.01 to 2.5 mg/kg (Rice, 1999). This average value is confirmed by DEQ (2004a) for the Willamette River mainstem.

Stormwater runoff is the primary pathway by which aerially deposited mercury in the urban environment reaches aquatic systems. Brumbaugh et al. (2001) notes that urban streams that have no other specific point sources typically have elevated levels of total and methyl mercury in streambed sediments. Little is known about mercury concentrations in most tributary streams of the lower Willamette River valley (DEQ 2004a, b). Sampling by the USGS (2004) in metro-Portland area creeks (Johnson, Fanno, and Beaverton Creeks) indicates that these urban creeks have both slightly higher concentrations of water column mercury and a slightly higher percentage of methylmercury than comparable creeks in the forested basins of East Fork Dairy Creek, and Lookout Creek. Dissolved mercury averaged 0.77 ng/L in urban streams (9% methylmercury), and 0.62 ng/L in forest streams (6.5% methylmercury). This pattern has been partially corroborated in one of the few studies to address mercury partitioning in stormwater, undertaken in the Sacramento, California area. In the Sacramento-area study, urban and non-urban streams had comparable water column total mercury concentrations, but methylmercury concentrations were higher in the urban streams (Archibald and Walberg 2004).

A recent evaluation of data from MS4s across the nation revealed that relatively poor data are available for mercury in stormwater (Pitt et al. 2004; Pitt 2005). This data evaluation was restricted to samples from storm sewer pipes or outfalls only (rather than receiving waters), so it is truly representative of the contribution of the permitted MS4 systems. Of 3765 samples compiled in this effort, fewer than 1/3 were analyzed for mercury. In the subset of samples analyzed for mercury, mercury was undetected at analytical detection levels of 100-300 ng/L in most samples (i.e., close to Oregon water quality standards but well above target water column concentrations from the draft Willamette River TMDL). In the 103 samples in which mercury was detected (as total mercury), concentrations ranged from 30 to 9,200 ng/L, with the mean and median concentrations equal to 370 and 200 ng/L, respectively. No data were presented that could illuminate the partitioning of mercury between the total, dissolved, or methylmercury fractions. Looking at Oregon results from the compilation of samples from MS4 systems by Pitt (2005), mercury concentrations ranged from non-detects at 200-500 ng/L, to detected values of 200-700 ng/L. The Oregon results exhibit a similar proportion of sampled/detected values as the national data compilation.

Conclusion

Based on this analysis, it appears very little is known regarding the connection of urban stormwater runoff to instream mercury concentrations. However, urban stormwater is suspected of providing a pathway for aerial sources of mercury to be discharged to receiving waters.

Part 2: What is the relationship between the 303(d) listed pollutant and the MS4 discharges?

Analysis

Stormwater conveyance, whether in a piped system or surface conveyances (e.g., ditches and channelized streams) is designed to get stormwater quickly off impervious surfaces in the urban environment. Therefore, urban runoff has relatively little contact time with soil and other environments where mercury can be bound up as less-reactive compounds prior to reaching receiving waters. This is important because "young" mercury seems to be more bioavailable than "old" mercury (Krabbenhoft, personal communication, 2005). In other words, this young mercury is more rapidly methylated and incorporated into the aquatic food chain. From the data summarized above, it does appear that MS4 systems may provide an important pathway source of mercury.

Three example calculations are illustrative of the relative contribution of different mercury sources in the urban environment:

1. Air deposition:

   - Assume that the average mercury load to urban environments from air deposition is diluted by the average annual rainfall for the Portland metropolitan area.
   - Annual mercury load from air deposition is calculated in the draft Willamette TMDL as 10 $\mu g/m^2$ (DEQ, 2004a);
   - Average annual rainfall is 41.22 inches, or 1.05 m (National Climate Data Center means for 1971-2000 at Oregon City, Hillsboro, Troutdale, Portland, and Beaverton averaged);
   - Urban runoff from impervious surfaces is approximately 95% of incident precipitation (1.05 m rainfall * 95% = 1.0 m runoff);
   - Assume that there is no re-volatilization or other mercury losses.
   - Average concentration of mercury in runoff from urban impervious surfaces in the metropolitan area is 10 $\mu g/1.03m^3$, or 10 ng/L. This is approximately one order of magnitude higher than the target water column concentration (i.e., 0.92 ng/L) necessary to achieve required fish tissue concentrations.

2. Sediment resuspension:

   - Mercury concentrations in streambed sediments of the Willamette River average approximately 0.3 mg/kg (DEQ, 2004b).

- Typical suspended sediment concentrations in Willamette River streams are 10 mg/L in moderate streamflows (DEQ, 2004b).
- The contribution to the water column mercury concentration from suspended sediment, assuming that it is derived from re-suspended bed sediment, would be 3 ng/L, or approximately 3 times the target water column mercury concentrations.

3. Soil erosion:

- Mercury concentrations in surface soil in the Willamette valley are approximately 0.09 mg/kg.
- Typical suspended sediment concentrations in Willamette River streams are 10 mg/L in low and moderate streamflows (DEQ, 2004a). Wet weather conditions generally increase instream concentrations; data from the City of Portland indicates that instream TSS concentrations range from 30-60 mg/L during wet weather conditions (Wildensee, 2005).
- The contribution to the water column mercury from suspended sediment if soil erosion contributes the only source of sediment would be 0.9 ng/L during dry conditions and about 3 to 6 ng/L during wet conditions, or up to six times the target water column mercury concentration.

<u>Conclusion</u>

Data discussed in Part 1 and 2 of the mercury analysis indicates that urban stormwater systems in Oregon provide efficient transport pathways for mercury to reach receiving waters. Elevated urban peak flows can promote resuspension of mercury-enriched streambed sediments, effectively moving the problem "downstream." Soil erosion can also contribute to elevated mercury loading in the urban environment, although erosion is estimated to be an even more substantial issue in agricultural or forest harvest settings (DEQ, 2004b).

Part 3. Determine whether the BMPs in the existing SWMP are effective to address the 303(d) pollutants.

<u>Analysis</u>

The goal of stormwater BMPs should be to reduce the load of both mercury and methylmercury to receiving waters. This is done by reducing the mercury load in absolute terms and reducing methylation in the environment. Mercury binds strongly to sulfur-containing organic ligands such as weathered plant material, so that mercury that reaches biologically active soils tends to be well sequestered (i.e., less bioavailable for methylation). Therefore, sediment-trapping BMPs can be expected to be effective at trapping mercury and reducing methylmercury loads. If, as has been hypothesized, "young" mercury is more bioavailable than "old" mercury, the potential for enhanced methylation in stormwater BMPs must also be addressed, in addition to the reduction of total mercury. Krabbenhoft (2005) notes that delivery of methylmercury to aquatic systems requires—in addition to mercury—sulfur, carbon, the anaerobic conditions that favor sulfate-reducing mercury, and a method to periodically flush methylmercury from where it is being formed. Methylmercury can also be reduced to elemental mercury by photo-degradation.

Structural BMP effectiveness data for mercury are essentially non-existent: only 5 sites included in the ASCE International BMP database have mercury data, and for most of those observations, mercury was not detected (ASCE, 2005). The City of Austin sampled residual sediments in inlet filters for mercury at 3 sites between 1994 and 1996. Detection limits were variable, ranging from 0.14 to 0.20 mg/kg (i.e., above the mercury concentration in typical Willamette Valley soils). Mercury was detected in 3 of 16 samples at concentrations ranging from 0.18 to 0.66 mg/kg. One wet retention basin in Michigan was sampled for mercury, with 8 inlet and 6 outlet samples. Inlet concentrations averaged 0.29 µg/L, and outlet concentrations averaged 0.22 µg/L. However, this study is somewhat dated (from the early 1990's) and mercury data gathered in the Midwest may not be the most representative of conditions in the Pacific Northwest, due to the large number of mining and coal-burning facilities and activities. More recent, local sampling and analysis by the City of Portland found that mercury concentrations in stormwater are typically <0.01 µg/L or <0.005 µg/L (Wildensee, personal communication). Most outlet concentrations for the Parkrose sand filter were below method detection limits at <0.01 µg/L; a 50% reduction between inflow and outflow was observed for those samples with mercury detected in both the inflow and outflow.

Because data are severely limited, the effectiveness of stormwater BMPs currently cannot be quantitatively assessed with any degree of certainty. Stormwater BMP effectiveness should be tested using well controlled and documented evaluation protocols. Furthermore, target effluent concentrations should be at or below ambient concentrations that are already quite low. For this reason, none of these structural BMPs may result in sufficiently low effluent concentrations to meet the water quality target in the draft Willamette River TMDL.

Evaluating BMP effectiveness is also more involved than simply analyzing patterns of inflow and outflow concentration differences. Particularly because the goal is to remove very small quantities of mercury from the aquatic environment, a more holistic (i.e., life cycle) view of mercury removal is required. All material removed from these BMPs should be disposed of properly. Incineration during disposal or recycling, for instance, can re-vaporize the mercury that was previously trapped, resulting in a local airborne source. In general, mercury should be sequestered in upland soil or subsurface environments.

In the absence of data, structural stormwater BMPs that would conceptually be most effective at reducing mercury loads would include the following characteristics:

- They would promote the sort of retention times necessary for the dissolved mercury fraction to be adsorbed to particulates.
- They would trap sediment (particularly fine sediment) for alternative disposal.
- They would promote reduction in flow volumes such that mercury would be incorporated into the soil matrix.
- They would provide aerobic conditions that limit methylation.
- They would not result in the remobilization of particulate, dissolved, or methylmercury.

In addition, non-structural BMPs to be implemented within the municipal NPDES-permitted community should focus on source reduction efforts by dentists (i.e., amalgam collection, mandatory in San Francisco proper), households, and other commercial interests. This latter category included collection and proper recycling or disposal of mercury switches in automobiles, impact lights (e.g., tennis shoes and toys), fluorescent lights (containing mercury vapor), and pharmaceuticals. From a stormwater perspective, BMPs that focus on reducing mercury vapor emissions are also important because they reduce a local source of mercury in air deposition. In addition, BMPs that focus on sediment control (ex: erosion control, operation and maintenance activities) will also be beneficial at reducing mercury by reducing the potential for methylation to occur.

Conclusion

Effectiveness of stormwater BMPs in reducing mercury loads has not yet been determined quantitatively. Therefore, the comprehensive monitoring plan prepared by Oregon City and other co-permittees includes some consideration of mercury for analysis. If analysis of mercury is pursued by the joint monitoring effort, then the focus would be on obtaining more local knowledge regarding the levels and sources of mercury in stormwater. The results of monitoring, and appropriate levels of evaluation of non-structural BMPs, could be used to re-evaluate the SWMP with respect to mercury for the next permit term. BMPs that the City of Oregon City implements are listed below:

- **Conduct Stormwater Conveyance System Cleaning and Maintenance**
- **Conduct Catch basin Cleaning and Maintenance**
- **Conduct Structural Control Facility Cleaning and Maintenance**
- **Conduct Street Sweeping and Roadway Repair Activities**
- **Implement the Erosion Control Ordinances**
- **Conduct Erosion Control Inspections**
- **Provide Educational Information to Construction Site Operators**

9.3 IRON AND MANGANESE

Iron and manganese are fundamental components of soils and the rocks from which soils are derived. Typical concentrations of iron and manganese in surficial geological materials of the Willamette River valley are 5% iron (i.e., 50,000 mg/kg) and 1,000 mg/kg manganese (Shacklette and Boerngen, 1984); these concentrations are high compared to national averages due to the prevalence of volcanic or volcanic-derived geological materials. Soil concentrations of these elements vary by soil horizon (i.e., they are typically concentrated in subsoils) and are relatively higher where soils are derived from basalts (e.g., the Columbia River basalts, Troutdale gravels, etc.). Iron concentrations in streambed sediments of the lower and middle Willamette River (below Salem) range from 3.5 % to 8.5 %; 7% iron is a typical value for the lower Willamette River (Rice, 1999). These sediment concentrations most likely reflect the influence of iron (and manganese)-enriched bedrock[6], although there may be some anthropogenic contribution as well.

Part 1: Likelihood of water quality degradation related to stormwater.

Analysis

Water quality standards for these chemicals are designed to protect aquatic life as well as human health due to water and fish ingestion. Ambient Oregon chronic freshwater criteria for iron are 1.0 mg/L. The criteria for the protection of human health based on water and fish ingestions are

[6] Iron enrichment in sediments between Columbia River basalt lava flows was sufficient to support turn of the century iron mining in Lake Oswego and Scappoose, for instance (Orr and Orr, 1999).

0.3 and 0.05mg/L for iron and manganese, respectively. The lower Willamette River is on the 303(d) list for both these constituents (DEQ, 2002).

Both instream iron and manganese concentrations, from which the Willamette River listings are based, are measured as the total recoverable metal fraction. Therefore, some of the resulting exceedances of water quality criteria could be related to elevated suspended sediment concentrations. Total suspended sediment concentrations as low as 5 mg/L could result in an exceedence of the iron criterion, assuming that the iron content in suspended sediment is equivalent to the iron content of streambed sediments. Similarly, the manganese criterion would be exceeded when total suspended sediment concentrations exceed 50 mg/L. Iron and manganese concentrations in stormwater have typically not been evaluated by municipalities in the Willamette Valley. However, total suspended solids have been measured in stormwater as a function of land use (WCC, 1997). Average concentrations of total suspended sediment (TSS) range from 53 mg/L in open space settings to 169 mg/L for transportation land uses[7], suggesting that ambient water quality criteria for iron and manganese are often likely to be exceeded in stormwater.

Conclusion

Stormwater runoff likely contributes to exceedances of water quality criteria for iron and manganese in the Willamette River during periods heavy rainfall, causing elevated suspended sediment concentrations due to transport of eroded soil or resuspension of streambed sediments.

Part 2: What is the relationship between the 303(d) listed pollutant and the MS4 discharges?

Analysis

Given the lack of measured iron and manganese concentrations in urban stormwater in the Portland metropolitan area, the relationship between MS4 discharges and these listed pollutants cannot be quantified locally. However, qualitative relationships are possible based on gross observations of urban runoff processes. Stormwater conveyance, whether in a piped system or surface conveyances (e.g., ditches and channelized streams) is designed to get stormwater quickly off impervious surfaces in the urban environment. This process provides efficient transport of eroded soil that could be deposited on impervious surfaces from air deposition or erosion of bared soil surfaces. Urban runoff can also contribute indirectly to elevated iron and manganese concentrations in the water column by quickly elevating streamflow volumes in receiving waters, resulting in either resuspension of streambed sediments or accelerated erosion of streambanks.

Conclusion

As described above, iron and manganese concentrations can be elevated above ambient water quality criteria due to natural concentrations of these parameters in soils, the amount of suspended sediment in stormwater runoff, and erosion of streambed sediments with increased runoff volumes.

[7] Median concentrations of TSS range from 16 mg/L in open space areas to 120 mg/L in transportation corridors.

Part 3. Determine whether the BMPs in the existing SWMP are effective to address the 303(d) pollutants.

<u>Analysis</u>

The goal of stormwater BMPs designed to address iron and manganese should be to reduce the suspended sediment load in receiving waters, and to moderate the effects of increased urban runoff volumes. A modest amount of structural BMP effectiveness data are available with respect to iron from the International BMP database (ASCE, 2005), and BMP effectiveness data for the Portland metropolitan area have been summarized based on prior monitoring under various MS4 programs. Based on available information, structural stormwater BMPs that would conceptually be most effective at reducing iron and manganese loads would include the following characteristics:

- They collect and/or trap sediment (particularly fine sediment) that is not easily remobilized.
- They promote reduction in flow volumes such that sediment transport capacity of the conveyance system or receiving waters is appropriately reduced.

<u>Conclusion</u>

UICs, which reduce stormwater volumes discharged to surface water bodies, are the preferred BMP for treatment of iron and manganese-rich stormwater, assuming that concentrations of other stormwater pollutants are acceptable for discharge to groundwater. Wetlands, wet ponds, sand filters, and biofilters/swales are all effective structural BMPs for treating TSS-rich stormwater because they both retain sediment and provide some amount of flow modification. Detention ponds provide the best flow attenuation of the structural BMPs but may be prone to sediment resuspension. Properly deployed and maintained erosion and sediment control BMPs (and training/education that improves their effectiveness) are necessary during construction activities. Maintenance activities that include the collection of sediments are also effective (i.e., street sweeping and catch basin cleaning).

The City of Oregon City's stormwater management plan is already focused on sediment reduction to the maximum extent practicable through the use of BMPs (structural and nonstructural) described below. BMPs that the City of Oregon City currently implements that can be effective at reducing iron and manganese loads are listed below:

- **Conduct Stormwater Conveyance System Cleaning and Maintenance**
- **Conduct Catch basin Cleaning and Maintenance**
- **Conduct Structural Control Facility Cleaning and Maintenance**
- **Conduct Street Sweeping and Roadway Repair Activities**
- **Implement the Erosion Control Ordinances**
- **Conduct Erosion Control Inspections**
- **Provide Educational Information to Construction Site Operators**

It should be noted that while stormwater BMPs can reduce the loads of iron and manganese (measured either directly or using TSS as a surrogate), they may not be sufficient to allow effluent to consistently meet ambient water quality concentrations due to naturally elevated levels in local soils.

The 303(d) listing of iron and manganese in the Tualatin River did not result in a TMDL because DEQ concluded that these analytes are naturally occurring and not due to anthropogenic impacts (DEQ, 2001). Based on similar geology in the Lower Willamette Basin, it is likely that a TMDL will not be established for the Willamette River.

9.4 PAHS

Polycyclic aromatic hydrocarbons (PAHs) are a group of chemicals that are both naturally occurring and anthropogenically derived. These ringed hydrocarbons are found both within and as combustion products of organic material, including petroleum hydrocarbons. They are persistent in the environment, hydrophobic (i.e., partition out of water to sediment), and carcinogenic to wildlife and humans. Hydrophobicity increases with the molecular weight of the PAH, while acute toxicity is greater with the lower molecular weight PAHs (LPAHs; Nagpal, 1993; Smith et al, 2000). Several high molecular weight PAHs (HPAHs) are carcinogenic. They are transported by air and deposited as wet or dry deposition on land, resulting in worldwide occurrence at trace levels. As with many toxics, they have been intensively studied in the Great Lakes region. Concentrations of PAHs in air increase in proximity to urban areas. Many regional water quality investigations by the U.S. Geological Survey have found them widespread in streambed sediments.

Water quality standards for these chemicals are designed to protect human health by limiting the amount present in the food chain of the Willamette River and tributaries that can eventually lodge in human-consumable fish. In addition, these chemicals have toxic effects on wildlife. The Oregon standard for protection of human health for total PAHs is 2.8 ng/L. No freshwater standard exists.

Part 1: Likelihood of water quality degradation related to stormwater.

<u>Analysis</u>

The lower Willamette River is on the 303(d) list for PAHs, based on estimated 35-day average aqueous concentrations during low flows of 52.9 ng/L at RM 6 on the Willamette River (DEQ, 2002). Concentrations observed during 1998 high flow conditions were estimated to be about half these values (McCarthy and Gale, 1999). In the Portland metropolitan area, these compounds are found in streambed sediments. The USGS found PAHs in mid-channel Willamette River sediments at a concentration of 809 µg/kg in 1997 (measured as the sum of 15 PAH compounds; McCarthy and Gale, 1999); Portland harbor contains PAH hot spots associated with industrial sources with PAH concentrations several orders of magnitude greater.

Smith et al. (2000) report differences in PAH loading in urban runoff as a function of hydrocarbon residue, with loadings from a gas station site substantially higher than loadings from high traffic volume parking lots, which are greater in turn than the loadings from freeway onramp sites, which are greater in turn than loadings from low traffic volume parking lots. Sampling of stormwater runoff by the City of Portland (described in detail below) found PAH concentrations that exceed water quality standards by nearly 2 to 5 orders of magnitude, depending on land use.

Conclusion

Stormwater runoff is the primary pathway by which PAHs in the urban environment reach aquatic systems, and PAHs have been detected in urban stormwater in the Portland area. Storm runoff also transports eroded soil containing PAHs to the aquatic environment, and some of this runoff occurs via MS4 systems. Because water quality degradation occurs with very low concentrations of these PAH chemicals, stormwater can easily contribute to water quality degradation in the Willamette River.

Part 2: What is the relationship between the 303(d) listed pollutant and the MS4 discharges?

Analysis

Stormwater conveyance, whether in a piped system or surface conveyances (e.g., ditches and channelized streams) is designed to get stormwater quickly off impervious surfaces in the urban environment. Therefore, urban runoff has relatively little contact time with soil and other environments where PAHs can be chemically bound prior to reaching receiving waters. The City of Portland sampled stormwater for PAHs as a function of land use in preparation for application of their initial NPDES MS4 permit. Total PAH concentrations ranged from 105 ng/L in runoff from open space, through 1,929 ng/L at residential stations, to 6,925 ng/L at commercial sites, 10,058 ng/L on a traffic corridor, and 34,539 ng/L at stations representing industrial land uses (WCC, 1993). HPAHs were 72% of the total PAH concentration at the open space sites, 54% of the total at the residential sites, 40-41% of the total at the traffic, commercial, and mixed use sites, and 8% of the total at the industrial sites.

Conclusion

These data indicate that urban stormwater systems in Oregon provide efficient transport pathways for PAHs to reach receiving waters via MS4 systems. The limited sampling by the City of Portland also demonstrates that urban background concentrations of PAHs in runoff (i.e., from open space) exceed water quality standards – either because natural PAHs would result in exceedances, or because airfall deposition contributes broadly to PAH loadings. The data also indicates the importance of stormwater treatment for high traffic and industrial areas to remove PAHs. Treatment of stormwater from areas directly exposed to hydrocarbons and hydrocarbon combustion products is more important than reduction of soil erosion for reducing PAH concentrations in urban runoff.

Part 3. Determine whether the BMPs in the existing SWMP are effective to address the 303(d) pollutants.

Analysis

Structural BMP effectiveness data for PAHs is extremely limited: only 3 sites included in the International BMP database appear to have been sampled for PAHs in inflow and outflow; a few additional sites analyzed retained sediment for PAHs (ASCE, 2005). Recent sampling of treated municipal stormwater prior to injection into the subsurface via dry wells or other underground injection control devices detected no benzo(a)pyrene (a PAH) above the detection limit of 100 ng/L (GeoSyntec, 2004). Because the BMP effectiveness data are severely limited, the effectiveness of stormwater BMPs to reduce PAH concentrations cannot now be quantitatively assessed. Furthermore, if the goal of structural BMPs is to achieve effluent concentrations that are at or below ambient concentrations, which are already quite low (i.e. in the 1×10^{-6} mg/L range), it may not prove to be entirely cost effective or feasible to monitor for this parameter.

In the absence of data, stormwater BMPs that would conceptually be most effective at reducing PAH loads would include the following characteristics:

- They trap sediment (particularly fine sediment) and floating hydrocarbons and ensure that they are not easily remobilized.
- They promote reduction in flow volumes such that PAHs would be incorporated into the soil matrix.
- They promote degradation or sequestration in the soil matrix.

Conclusion

With the lack of quantitative structural BMP effluent data, the goal of stormwater BMPs should be to reduce the load of PAHs to receiving waters by controlling hydrocarbons and, to a lesser extent, soil and sediment. The City of Oregon City's SWMP includes BMPs for sediment reduction (catch basin cleaning, structural BMP maintenance) and roadway maintenance activities (street sweeping). BMPs that the City implements to address the PAHs include:

- **Conduct Stormwater Conveyance System Cleaning and Maintenance**
- **Conduct Catch basin Cleaning and Maintenance**
- **Conduct Structural Control Facility Cleaning and Maintenance**
- **Conduct Street Sweeping and Roadway Repair Activities**
- **Implement the Illicit Discharges Elimination Program**
- **Implement the Spill Response Program**
- **Implement a Program to Control Pollutants from Industrial Facilities**
- **Implement the Erosion Control Ordinance**
- **Conduct Erosion Control Inspections**
- **Provide Public Education and Outreach Materials Regarding Stormwater Management**
- **Conduct Staff Training in Spill Response**
- **Provide Educational Information to Construction Site Operators**

9.5 PCBS, DDT, DDE, ALDRIN, DIELDRIN

PCBs and organochlorine (OC) pesticides in the aquatic food chain are now recognized as a widely distributed problem throughout North America in much the same manner as mercury (USGS, 1999). In the City of Oregon City, polychlorinated biphenyls (PCBs), dichlorodiphenyltrichloroethane/dichlorodiphenyldichloroethylene (DDT/DDE), aldrin, and dieldrin are on the 303(d) list for the lower Willamette River (DEQ, 2002)[8]. Concentrations of

[8] The lower Willamette River is also listed for pentachlorophenol (PCP). However, this listing is associated with creosote-contaminated sediments in the vicinity of the McCormick and Baxter wood-treating site rather than with

these compounds are found in excess of ambient water quality standards, and are the sources of fish consumption advisories. All of these organochlorine (OC) compounds have anthropogenic sources:

- PCBs are a family of chemicals with widespread industrial uses—for example, as insulators in electrical equipment, as hydraulic fluids, and as a component of carbonless copy paper—until their manufacture was banned in the U.S. in 1977 due to deleterious effects on wildlife and human health. PCB-containing equipment was aggressively retrofitted throughout the 1980s and 1990s to remove PCBs, so little equipment containing PCBs remains in use in the U.S. (ATSDR, 2005).
- DDT was widely used as an insecticide, particularly for agricultural application to control mosquito outbreaks. DDE is also a contaminant, generated during the manufacturing of DDT and found in the environment as one of the breakdown products of DDT. DDT was banned in 1972 after it was found to significantly impair eggshell development in birds exposed to DDT through the food chain (ATSDR, 2004b).
- Aldrin and dieldrin are pesticides that were commonly used for agricultural purposes (corn, root crops) from the 1950s to 1970s. They were banned in 1974 except for use in termite control; all uses were banned in 1987. Both are neurotoxins. Aldrin breaks down quickly to dieldrin (ATSDR, 2004a).

These OC compounds have common properties that govern their fate and transport in the environment: they are highly persistent, they bioaccumulate in the food chain, and they are highly hydrophobic (i.e., partition out of water to sediment). Furthermore, they volatilize in sufficient quantities so that they are transported by air and deposited as wet or dry deposition on land, resulting in worldwide occurrence at trace levels. Where studied intensively in the Great Lakes region, these compounds are found to be transported in air, and deposited as air deposition, with an environmental half life of approximately 6 years (e.g., Hillery et al., 1997). National water quality investigations by the US Geological Survey have found them widespread in streambed sediments (USGS, 1999). Because of the common properties of these compounds, their relationship to urban stormwater in the Portland metropolitan area will be evaluated as a group.

Water quality standards for these chemicals are designed to protect human health by limiting the amount present in the food chain of the Willamette River and tributaries that can eventually lodge in human-consumable fish. In addition, these chemicals have toxic effects on wildlife. Oregon DEQ (ODEQ) has recently revised water quality standards for toxic compounds that are pending EPA approval. All standards are set at levels that can be exceeded with trace amounts of these OC compounds present in the water column. Ambient water quality criteria that are protective of aquatic life are:

- PCB: 2,000 and 14 ng/L (acute and chronic criteria, respectively)
- DDT: 1,100 and 1 ng/L (acute and chronic criteria, respectively)

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any conditions arising from activities within the City of Oregon City. For this reason, the contribution of the MS4 system to PCP loading in the lower Willamette is not evaluated.

- Dieldrin: 2,500 and 1.9 ng/L (acute and chronic criteria, respectively)
- Aldrin: 3,000 ng/L (acute criterion)

The most restrictive of the water quality standards—for consumption of fish and water, with a cancer risk of 1 per million exposed individuals are:

- PCB: 0.079 ng/L
- DDT: 0.024 ng/L
- Aldrin: 0.074 ng/L
- Dieldrin: 0.071 ng/L.

Part 1: Likelihood of water quality degradation related to stormwater.

<u>Analysis</u>

Recent TMDL documents state that ambient aqueous concentrations of DDT and dieldrin in Johnson Creek exceed fresh water chronic water quality standards of 1 ng/L and 1.9 ng/L, respectively (DEQ, 2004). Repeated sampling of Johnson Creek (and its Kelly Creek tributary and two associated storm drains) by the USGS, ODEQ, and the City of Portland have found these OC compounds at trace amounts (ng/L levels, frequently exceeding chronic criteria) in the water column (McCarthy and Gale; 1999 Tanner and Lee, 2004). Aldrin and PCBs were rarely detected in the sampling results presented in these reports (although the detection limit used in the Tanner and Lee study exceeded the chronic criteria by an order of magnitude). Dieldrin was commonly found in Johnson and Kelly Creeks and the Willamette River but not in the storm drain samples. The DDT species was the dominant species (50-70%) of the total DDT (sum of DDX species) (Tanner and Lee, 2004). DDT concentrations from Johnson Creek measured in 2002 were approximately an order of magnitude lower than those measured in 1989-90 (Tanner and Lee, 2004). Tanner and Lee found positive correlations between DDT concentrations and both turbidity and suspended sediment: a TSS concentration of 8 mg/L at Palmblad Road in upper Johnson Creek, and 15-18 mg/L at lower-basin sites would be sufficient to result in exceedances of the chronic water quality standard.

Sources of these compounds in the environment are identified in the TMDL as primarily related to streambed sediments, which themselves have an upland (soil) source. DDT concentrations in sediments in Johnson Creek range from 11 to 510 μg/kg, with the highest concentrations found in agricultural areas upstream of the Gresham City limits. Dieldrin was also found to exceed preliminary effects concentrations (i.e., a common screening level at which toxic effects are found) only at an upstream site (Pugh, 2005). PCB concentrations in Johnson Creek exceed the screening level value of 7 μg/kg locally in the upper basin and regularly below river mile 3, with a maximum concentration in recent sampling of 406 μg/kg. PCBs in Willamette River sediments were measured in 1997 at 15 μg/kg (McCarthy and Gale, 1999) upstream of Portland Harbor.

The USGS reports that nationally concentrations of dieldrin are typically highest in urban areas, presumably as a result of their use to control termites (USGS, 1999). This points to the potential for exceedances of dieldrin concentrations to result from urban stormwater discharges. Soil represents a major environmental reservoir of DDT and PCBs; therefore, reduction in DDT and PCB loads are related to reducing soil erosion.

Conclusion

Stormwater runoff is the primary pathway by which aerially deposited toxics in the urban environment reaches aquatic systems. Storm runoff also transports eroded soil to the aquatic environment, and some of this runoff occurs via MS4 systems. Finally, water quality degradation occurs at very low concentrations of these OC chemicals. Based on this analysis, it is possible that OC-enriched sediment resuspended in urban stormwater can contribute to water quality degradation in the Willamette River and tributaries for PCBs, DDT, aldrin, and dieldrin.

Part 2: What is the relationship between the 303(d) listed pollutant and the MS4 discharges?

Analysis

Stormwater conveyance, whether in a piped system or surface conveyances (e.g., ditches and channelized streams) is designed to get stormwater quickly off impervious surfaces in the urban environment. Therefore, urban runoff has relatively little contact time with soil and other environments where OC can be chemically bound up prior to reaching receiving waters. From the data summarized above, it does appear that MS4 systems may be minor sources of these organochlorine compounds, particularly PCBs due to their use in industrial (i.e., urban) settings. However, the only detected concentrations of these OC compounds in an MS4 system were DDT from land use-based sampling in Portland in 1991-1993 (WCC, 1993) (residential concentrations up to 0.13 μg/L DDT+DDE, industrial concentrations up to 0.315 μg/L DDT+DDE), and from Johnson Creek in 2002 (0.018 μg/L DDT+DDE in a Portland storm drain at SE 45^{th}) (Tanner and Lee, 2004).

Conclusion

Data discussed in Part 1 and 2 indicates that while urban stormwater systems in Oregon provide efficient transport pathways for OC compounds to reach receiving waters, they have been detected in only limited quantities in the MS4 system. Elevated urban peak flows can promote resuspension of OC-enriched streambed sediments, effectively moving the problem "downstream." Soil erosion can also contribute to elevated OC loading in the urban environment, although erosion control is a more substantial issue in agricultural or forest harvest settings (DEQ, 2004b).

Part 3. Determine whether the BMPs in the existing SWMP are effective to address the 303(d) pollutants.

Analysis

The goal of stormwater BMPs should be to reduce the load of OC compounds and other hydrophobic toxic compounds discharging to receiving waters. Therefore, sediment-trapping BMPs are expected to be effective at trapping these compounds as well as BMPs that reduce runoff volumes in a manner that limits peak flows causing instream erosion.

BMP effectiveness data for OC compounds are essentially non-existent: only one site included in the International BMP database appears to have been sampled for OC compounds for inflow and outflow, and for those observations, OC compounds were either not detected or detected at low concentrations in both effluent and influent (results summarized below; ASCE, 2005). Because data are severely limited, the effectiveness of stormwater BMPs cannot currently be quantitatively assessed. Stormwater BMP effectiveness should be tested using well controlled and documented evaluation protocols. Furthermore, target effluent concentrations should be at or below ambient concentrations that are already quite low. For this reason, none of these BMPs may result in sufficiently low effluent concentrations necessary to achieve human health-based water quality criteria. Based on available information, stormwater BMPs that would conceptually be most effective at reducing OC compounds would include the following characteristics:

- They trap sediment (particularly fine sediment) and ensure that they are not easily re-mobilized.
- They promote reduction in flow volumes such that OC compounds would be incorporated into the soil matrix.
- They promote reduction in flow volumes such that instream sediments are not unnecessarily resuspended beyond natural conditions.

Conclusion

Effectiveness of stormwater BMPs to address OC compounds cannot be determined quantitatively at this time. However, based on available information, BMPs that focus on preventing soil erosion and treating stormwater containing eroded soils are expected to be most effective at reducing these OC compounds in stormwater. City of Oregon City BMPs that would be expected to be beneficial at reducing the discharge of OC compounds are listed below.

- **Conduct Stormwater Conveyance System Cleaning and Maintenance**
- **Conduct Catch basin Cleaning and Maintenance**
- **Conduct Structural Control Facility Cleaning and Maintenance**
- **Conduct Street Sweeping and Roadway Repair Activities**
- **Minimize Pollutant Discharges Associated with Landscape Management Practices**
- **Implement the Illicit Discharges Elimination Program**
- **Implement the Erosion Control Ordinances**
- **Conduct Erosion Control Inspections**
- **Provide Public Education and Outreach Materials Regarding Stormwater Management**
- **Provide Educational Information to Construction Site Operators**

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SECTION 10 MAPS

The following maps are included in this Section.

1. Oregon City Stormwater Monitoring Sites
2. Oregon City Drainage Basins
3. Oregon City Zoning
4. Oregon City Parks and Open Space
5. Oregon City TAZ Data