ATTACHMENT B

CITY OF SEATTLE
2009 NPDES PHASE I MUNICIPAL STORMWATER PERMIT
Program Evaluation and Other Activities Narrative

Prepared by
Seattle Public Utilities

March, 2010

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Certification

I certify under penalty of law, that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathering information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for willful violations.

Nancy Ahern
Deputy Director- Utility System Management
Seattle Public Utilities

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B.1 Changes in Authorization (G19.C)(S9.E.9)

There have been no changes to the duly authorized representative pursuant to G19.C at the City during 2009.

B.2 Actions Taken Pursuant to S4F (S9.E.3)

The City, through Seattle Public Utilities (SPU), provided notifications to the Department of Ecology under S4.F of potential water quality, sediment problems or both that may be related to discharges from the City's municipal separate storm sewer system (MS4). The City continues to apply and implement its programs for stormwater management and to seek improvement to those programs through increased understanding of stormwater impacts and mitigation tools. A summary of the 2009 notifications and the Washington Department of Ecology (Ecology) required actions under S4.F.2 is below. In addition, this section contains S4.F.2 notifications from prior years where a report on additional actions is required by Ecology.

B.2.1 Notification for Lower Duwamish River.

This S4.F notification was submitted in 2007 to notify Ecology of potential water quality and/or sediment problems that may be related to discharges from the City's MS4 for the Lower Duwamish River. Ecology determined that a report under S4.F.2.a was not necessary, with that determination conditioned on certain City actions. Ecology required the City, beginning with its Phase I Permit Annual Report for 2008, to include a summary of its stormwater management efforts in basins that discharge to the Lower Duwamish River. The City must notify Ecology if Seattle's involvement in CERCLA and associated Source Control Strategy processes change or new information becomes available regarding phthalate recontamination in the Lower Duwamish Waterway.

The Lower Duwamish River extends from approximately the north end of Harbor Island in the City of Seattle to the upper turning basin in the City of Tukwila. This area is subject to and is undergoing, contaminated sediment studies and cleanup actions governed by Federal Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and State Model Toxics Control Act (MTCA) cleanup laws. This area includes the East and West Waterway operable units of the Harbor Island Superfund site and the Lower Duwamish Waterway (LDW) Superfund site. The City of Seattle and others are conducting source tracing and source control activities on adjacent upland public and private properties. As explained in the notification letter, Source Control activities are organized and prioritized across drainage areas to minimize the possibility for recontamination of the waterway.

Regarding City stormwater management efforts in basins that discharge to the Lower Duwamish River, the City implements several source tracing programs with specific emphasis to the Lower Duwamish Waterway. These programs include:

- Business Inspections: In support of the clean-up effort, multi-media inspections are conducted, which cover stormwater pollution prevention, hazardous waste management and industrial waste management. In 2009, 202 initial inspections were conducted with the Lower Duwamish Waterway and East Waterway Basins. Each business is inspected for compliance with the City's Stormwater Code and required to be brought into compliance with all relevant best management practices (BMP) for source control. Nine sites were referred to Ecology for potential NPDES Industrial Stormwater permit coverage. Eight facilities in the watershed were issued NOV's for non-compliance with the City's Stormwater Code.

- Stormwater Facility Inspections: While inspecting a business for source control BMPs, the flow control and/or treatment facility is also inspected. Within the LDW and EWW basins, 34 sites were inspected for Code compliance with regard to flow control and treatment system code requirements during 2009.

- Illicit Discharge Detection and Elimination (IDDE): SPU conducts sediment sampling of onsite catch basins, right of way catch basins and drainage system mainlines to identify sources of contamination and potential illicit discharges and illicit connections. Sampling is conducted in tandem with business inspections to identify and terminate sources of pollution. In 2009, SPU took 111 samples to assist in identifying and source tracing sources of pollution. Samples are analyzed for the LDW contaminants of concern, including TOC, SVOC's, TPH-Dx, select Metals, PCB's, Grain Size and occasionally site specific parameters, such as pH, additional metals, VOC's.

- Water Quality Complaints: Inspectors respond to complaints as they are received through the water quality hotline, web form or from agency referrals. In 2009, 67 water quality complaints were reported in the LDW and EWW basins. When a complaint is reported at a business, a full business inspection is completed.

- Spill Response: Spills are dispatched through the SPU Operations Response Center to on-call Spill Coordinators as they are received. In 2009, SPU responded to 24 spills within the LDW and EWW basins, including a fuel spill from a tanker fire under the West Seattle Bridge. The responsible party was issued a Notice of Violation and a penalty was assessed. When spills reach the MS4, a contractor is used to clean up and remove the contamination. Ecology was notified of this event on December 15, 2009. A summary of this notification is provided in section B.2.6 of this document.

- Education and Outreach: SPU funds the Resource Venture, a conservation service for Seattle businesses. Resource Venture implements the City's Spill Kit Incentive Program, which provides free spill kits, assistance in developing spill plan and site specific technical assistance to Seattle businesses. Approximately 93 businesses in the LDW and EWW basins received spill kits, either stemming from a business inspection or through targeted outreach. Surveys conducted of spill kit recipients statistically show that businesses who participate in this program show an improved understanding of stormwater pollution prevention.

B.2.2 Duwamish East Waterway Electroplating Wastewater Tank Spill

A 55,000 gallon wooden tank holding electroplating wastewater at a private business failed in March 2008. Following a call by SPU, Ecology personnel arrived on site. SPU issued a Notice of Violation for the spill and conducted a business inspection that resulted in a corrective action letter. Because the private business drained to the City's MS4, the City submitted an S4.F notification to Ecology in April 2008.

Ecology determined that Seattle's response to the incident occurred as required in Special Condition S5.C.8.b.viii and that a report under S4.F.2.a is not necessary because the incident was a spill, which is typically a one-time event, and Seattle has taken steps regarding the second wooden tank of the property to ensure that another such spill was unlikely to occur. Ecology stated that the City should prioritize this facility, and others like it, for annual source control inspections under S5.C.7.

The City has developed its initial list of businesses to be inspected under S5.C.7, prioritized facilities that have high pollution generating activities and conducted business inspections in 2009.

B.2.3 Coho Pre-Spawn Mortality

The City provided S4.F notification in regard to the coho salmon (*Oncorhynchus kisutch*) pre-spawn mortality phenomenon in creeks to which the City's MS4 drains, including the possible influence of the MS4 upon water quality problems in receiving waters. Notification was provided in May of 2008, following general notification in December 2007. The City has worked with NOAA Fisheries, by providing direct financial support and City staff resources, to collaboratively investigate the causes of coho pre-spawn mortality (PSM) for the period 2000-2009. Information about the possible causes of PSM is evolving. Experts cannot definitively say what is causing PSM in coho in urban streams in Seattle.

Ecology determined that a report under condition S4.F.2.a.was not necessary because the correlation between coho PSM and stormwater discharges is based upon urbanization and/or arterial roads, and a link to any single or combination of parameters that would be potentially present in stormwater has not yet been found. Ecology's determination that a S4.F.2.a report was not necessary is conditioned, based in part, on the following: the City will continue to be involved in investigating causes and/or collecting data associated with the coho PSM phenomenon; when the City becomes aware of the exact cause(s) of PSM, Ecology must be notified immediately; and should parameter-specific information about the cause(s) or contribution(s) to pre-spawn mortality become available, Ecology Reserves the ability to require a response under S4.F.2.a. Beginning with the Phase I Permit Annual Report for 2008, Seattle must include a summary of the reporting year's studies or findings associated with the coho PSM phenomenon.

As to such summary, in 2009, the daily surveys produced a total of 99 coho salmon, including 44 females. There were 38 females of known spawning condition, of which 79%

(30) died prior to spawning, and predation did not appear to be the cause of death. The annual coho PSM rate in Longfellow Creek has ranged from 67 to 89% between 2002 and 2009. The City and the researchers involved in these studies are still unaware of the exact cause(s) and the parameter-specific information about the cause(s) or contribution(s) to PSM. Work on this subject will continue in 2010.

B.2.4 Lowman Park Sewage Leak to the MS4

The City provided S4.F notification in regards to a sewage leak to the MS4 on August 20, 2009. The sewage leak was discovered during the City's on-going illicit discharge detection and elimination screening for compliance with S5.C.8.b.vi of the permit. The IDDE screening and source tracing determined that an illicit connection to the MS4 was causing a discharge of sewage to Puget Sound. The City immediately terminated the illicit connection and the sewage discharge to the MS4.

Ecology determined that an adaptive management response under condition S4.F.3 was not necessary because the potential water quality impacts will be eliminated through implementation of existing permit requirements.

B.2.5 Piper's Creek Microbial Source Tracking Study Results

On December 10th 2009, the City provided an S4.F notification for a discharge from the MS4 that is causing or contributing to a known or likely violation of the water quality standard for fecal coliform in Piper's Creek. The notification was based upon data collected during a Microbial Source Tracking Study. The study was implemented by the City to better understand the type and location of fecal coliform bacteria sources in the Piper's Creek watershed in support of the Piper's Creek fecal coliform bacteria TMDL, to improve water quality and to expand regional knowledge of bacteria in stormwater. The results of this study will be used by the City to inform the direction of Seattle's Stormwater Management Program, support the TMDL, and work towards improving the water quality of Piper's Creek. Additionally, the finalized study results will be shared with Ecology, the local community, and the stormwater community to help inform actions to improve water quality.

Although not a focus of this study, a point of non-compliance was identified by SPU staff during review of the draft study report. The point of non-compliance is based upon credible site-specific data collected during the course of this study that trigger notifying Ecology under S4.F of the Permit.

At the time of this report Ecology has not provided the City with a formal response, but has requested additional information to help with their response under condition S4.F.3.

B.2.6 Diesel Spill from Vehicle Accident on Harbor Island

On November 30th 2009 SPU Spill Response was contacted by Ecology with a report from KOMO news that there had been a truck accident, fire and possible fuel spill on Harbor

Island. Investigation by SPU staff determined that fuel and oil from the truck accident had entered the MS4 at the accident site. A survey of the MS4 by the SPU Responder identified motor oil and fuel in the MS4 from the accident site to the MS4 outfall on the Duwamish Waterway, but there was no discharge of oil from the outfall into the Duwamish. However during an Ecology approved cleanup process, oil discharged from the MS4 outfall into an absorbent boomed oil containment area in the Duwamish Waterway. Visual observation during the cleaning determined that no oil left the containment area.

Ecology determined that an adaptive management response under condition S4.F.3 was not necessary because the potential water quality impacts will be eliminated through implementation of existing permit requirements.

B.3 Assessment of Best Management Practice Appropriateness (S9.E.6 and S8.B.2)

This section provides an assessment of the appropriateness of the City's program design and/or specific BMPs identified for each component of the SWMP, including any changes made or anticipated to be made, and why.

B.3.1 Public Involvement and Participation (S5.C.4)

The permit requires the City to develop and implement a process to create opportunities for the public to participate in the development of the Stormwater Management Program (SWMP) Documentation by August 16, 2007. The City's BMP used for public involvement and participation is to create opportunities for the public to learn about, comment on and question the City's approach to the management of stormwater. Public participation is encouraged by providing multiple opportunities for public involvement. These include, but are not limited to, opportunities to comment on funding allocation for the NPDES related programs and projects, to give input and review codes describing the technical standards for control of stormwater discharges and enforcement of impacts to the MS4, and to review and comment on the ongoing development of stormwater management activities. Additional opportunities for the public to learn about the City's stormwater program are provided on the City's web site: (http://www.seattle.gov/util/About_SPU/Drainage_&_Sewer_System/Plans/StormwaterManagementProgram/index.htm). Over 780 people viewed this web page during 2009, with 900 people viewing the SWMP, 481 viewing the Annual Report and 478 viewing this Attachment. The web site contains the email address, swmp@seattle.gov that the public can use to email questions and comments to the City about stormwater management. A public presentation on the SWMP was made at the City's Restore our Waters Stakeholders meeting in December 2009.

The City has found that these methods of soliciting public comments are the most appropriate BMP for public participation because they reach a wide audience. The presentations to the Restore our Waters stakeholder meeting was well attended and generated many questions and comments. Additional information on public involvement

and participation can be found in the City's SWMP, submitted as Attachment A of the City's 2009 Phase I Permit Annual Report Form.

B.3.2 Controlling Runoff from New Development, Redevelopment and Construction Sites (S5.C.5)

The 2007 NPDES Phase I Municipal Stormwater Permit required the City to implement the following elements of the program for controlling runoff from new development, redevelopment and construction sites: begin a local program that adopts by ordinance or other enforceable document equivalent to Appendix 1 of the permit; establish legal authority to inspect private stormwater facilities and enforce maintenance standards for all new and redevelopment, implement a process of permits, plan review, inspections and enforcement; make available copies of Ecology's documents: "*Notice of Intent for Construction Activities*" and "*Notice of Intent for Industrial Activities*"; and train staff to properly implement the program to control stormwater runoff from new development, redevelopment and construction sites.

The City continued to implement its existing program to control runoff from new development, re-development and construction sites for most of 2009 as the Revised Stormwater Code (SMC 22.800) was effective starting on November 30, 2009. This program, which was documented in Section III.5 in the City's SWMP dated March 27, 2009, is led by the Department of Planning and Development (DPD). This program has conducted 913 temporary sediment and erosion control (TESC) inspections and 43 enforcement actions. DPD worked with SPU to adjust and revise the existing program to continue to meet the 2007 Permit requirements to implement the Revised Stormwater Code, effective November 30, 2009, during December of 2009.

Ecology has determined that the revised draft Stormwater Code dated March 16, 2009, is equivalent to Appendix 1 of the permit, Minimum Technical Requirements for New Development and Redevelopment. The Seattle City Council adopted the revised Stormwater Code on September 28, 2009, and Mayor Greg Nickels signed the Code into law on September 30, 2009, with an effective date of November 30, 2009. The Directors' of SPU and DPD approved four Directors' Rules in November 2009, with effective dates in December 2009.

The determination of equivalency by Ecology indicates that the revised Stormwater Code is appropriate for implementation of the minimum requirements in Appendix 1, and will protect water quality, reduce the discharge of pollutants to the maximum extent practicable (MEP), and satisfy the state requirement under chapter 90.48 RCW to apply all known, available, and reasonable methods of prevention, control and treatment (AKART).

During 2009, DPD made copies of Ecology's documents: "*Notice of Intent for Construction Activities*" and "*Notice of Intent for Industrial Activities*" available to the public. These documents were made available to the public at the DPD Applicant Services Center (ASC), which is located on the 20th floor of Seattle Municipal Tower at 700 Fifth Avenue in downtown Seattle. Providing the documents at the ASC is appropriate because the

majority of the people who seek permits from the City visit the ASC and have the opportunity to view and learn about the Ecology NOI requirements.

All staff whose primary job duties are implementing the program to control stormwater runoff from new development, redevelopment, and construction sites, including permitting, plan review, construction site inspections, and enforcement, are trained to conduct these activities. In addition, all site inspectors have had Certified Erosion and Sediment Control Lead (CESCL) training. This level of training is appropriate because it is BMP 160 in the Stormwater Management Manual for Western Washington.

Information on how the City is implementing the minimum performance measures for controlling runoff from new development, redevelopment and construction sites can be found in the City's SWMP, submitted as Attachment A of the City's 2009 Phase I Permit Annual Report Form.

B.3.3 Structural Stormwater Controls (S5.C.6)

The 2007 NPDES Phase I Municipal Stormwater Permit required the City to implement the development of a structural stormwater control program (SSCP).

The City has implemented a SSCP, which is appropriate because it uses a comprehensive planning process to support the SSCP. The geographic scale of the program is the area served by the City's MS4 and the MS4-related receiving water bodies. The SSCP projects are prioritized using asset management principles. Asset management is the process by which projects are evaluated for their whole-life cycle cost benefit including social, economic, and environmental factors (known at SPU as the "triple bottom line"). Projects are prioritized by SPU staff based on an assessment of receiving water body conditions, anticipated benefits of the project, regulatory compliance needs, opportunity, and application of asset management principles that have been adopted by SPU under the guidance of the Asset Management Committee (AMC). Projects must pass through several AMC evaluation screens and funding allocation phases before they are formally approved by SPU management for implementation.

Information on how the City is implementing the 2009 minimum performance measures for the structural stormwater controls program can be found in the City's SWMP, submitted as Attachment A of the City's 2009 Phase I Permit Annual Report Form.

B.3.4 Source Control Program for Existing Development (S5.C.7)

The 2007 NPDES Phase I Municipal Stormwater Permit required the City to implement the following elements of the source control program for existing development during 2009: adopt and enforce the Seattle Municipal Code and Directors' Rules; create an inventory or listing of the businesses using the categories in Appendix 8; establish a complaint-based response to identify other pollutant generating sources such as mobile or home-based businesses; implement an audit/inspection program for sites identified as pollution generating per the permit; implement a progressive enforcement policy and provide training to staff involved in the source control program.

Ecology has approved the source control BMPs in the revised Stormwater Code dated March 16, 2009 as required in S5.C.7.b.i. The Seattle City Council adopted the revised Stormwater Code on September 28, 2009, and Mayor Greg Nickels signed the Code into law on September 30, 2009, with an effective date of November 30, 2009. The Directors' of SPU and DPD approved four Directors' Rules in November 2009, with effective dates in December 2009.

The approval of the Source Control BMPs by Ecology indicates that the revised Stormwater Code will protect water quality, reduce the discharge of pollutants to the maximum extent practicable (MEP), and satisfy the state requirement under chapter 90.48 RCW to apply all known, available, and reasonable methods of prevention, control and treatment (AKART).

The City has established, and updated in 2009, a list of businesses that have the potential for outdoor pollution generating sources. The list is based on a comparison of the most current list of businesses, which was compared to Appendix 8. This list resulted in identification of over 4,400 businesses that have the potential to have outdoor pollution generating sources. Each of these businesses was provided with a flyer on the stormwater requirements for businesses during 2009.

In 2008, SPU conducted a review of the business list against the business inspection database and determined that a number of businesses have common urban land uses that lack pollutant generating sources or activities. Consequently, these businesses have been removed from the list, leaving approximately 3,790 businesses eligible for inspection. The groups of businesses removed from the inspection list are summarized below along with rationale for removing them from the list.

- Personal Services – Standard Industry Code Industry Group 723 and 724, Beauty Shops (7231) and Barber Shops (7241). The City has screened and inspected this sector in previous years and determined that these industry groups do not conduct outdoor pollution generating activities and that stormwater source control requirements are not relevant to this sector. The facilities generally do not have loading docks - shipments are hand carried through the front door and there is no outdoor storage of either product or waste. These facilities do not have wastes that could impact stormwater. Any sites with private drainage systems (flow control or treatment) will be inspected through the Stormwater Facility Inspection Program.
- Transportation Services – Standard Industry Code Industry Group 4121, Taxicabs. Within the City of Seattle, individual taxicab drivers must obtain a business license in order to drive for a taxicab company. Due to this licensing process, the licensed business address is actually the private residence of the individual and these locations are not pollution generating with regards to the targeted activity. Within this grouping, there are taxicab maintenance facilities, and these businesses will be kept on the list and inspected.

In 2007, SPU used a portion of the Local Government Stormwater Grant it received from Ecology to hire a consultant (R. W. Beck) to review the evaluation of business

stormwater runoff pollution potential that was completed by SPU for their Source Control program. SPU used federal guidelines based on the Standard Industrial Code (SIC) to rank each business as having low, medium-low, medium, or high stormwater runoff pollution potential. Based on its ranking, each business was assigned one of four levels of action within SPU's Source Control program. The intent is to assign a higher or more thorough level of inspection for businesses that have higher stormwater runoff pollution potential.

R.W. Beck's review determined that SPU's ranking of business stormwater runoff pollution potential is appropriate for implementing the business inspection program. Following initial implementation of the program and follow-up evaluation of its effectiveness, SPU may modify these rankings based on the activities observed at sites and ability to implement appropriate BMPs.

The City implemented its business inspection program for compliance with S5.C.7 during 2009. Although the revised Stormwater Code was not effective until December 2009, the changes in source control requirements were not significant enough to alter the City's approach to business inspections. The exception to this is the enforcement process that employs a matrix based system for assessing fines. This portion of the program was implemented during December 2009.

SPU conducted 570 business inspections in 2009, of which 262 required a corrective action letter and follow up visit to determine compliance with the Stormwater Code. Of the 262 that required corrective actions and follow up visits, 12 were issued Notices of Violation (NOV) with the Stormwater Code for failure to implement the BMPs detailed in the corrective action letter and during the follow up visit. The moderate number of follow up visits and low number of NOV incidents shows that the City's source control program for existing development is an appropriate BMP for meeting the permit requirements to reduce pollutants in runoff from areas that discharge to the MS4.

The City's complaint-based response program includes the water quality hotline, business inspections, and illicit discharge, detection and elimination programs. The City staffs a 24-hour water quality hotline to allow citizens and businesses to report illicit discharges into the MS4. Businesses, including mobile and home-based, and citizens who are found to be causing illicit discharges, receive education and are potentially subject to enforcement actions if they refuse to voluntarily correct the problem. During 2008, the City conducted an evaluation of the water quality hotline to determine if it is an effective program for identifying other pollutant generating sources via a complaint-based program. The evaluation determined that the majority of callers reporting incidents to the water quality hotline were calling primarily because they witnessed dumping or a spill (54%), with the rest calling to report negative environmental impacts or drainage problems.

The City's complaint-based response program received over 353 reports in 2009, all of which were investigated and 30 resulted in business inspections. This program is an appropriate BMP as it provides a mechanism for the public to take an active role in

stormwater pollution prevention, identifies businesses that require source control information or inspection and help the City increase awareness of activities that have negative impacts on stormwater.

Part of the Stormwater Code Revision project was designed to revise the enforcement provisions in the Code. The revised Stormwater Code provides for a matrix-based approach for assessing penalties for violations, which is similar to the one used by Ecology. Additionally, the revised code added a provision for an administrative appeal of a Notice of Violation to the Director of SPU or Director of DPD, depending on the nature of the violation. The City anticipates that the revised enforcement procedures are appropriate for enforcement of the Stormwater Code. However, the revised standards and programs were in effect for one month during 2009, so it would be premature to assess the BMP appropriateness.

All staff involved in the Source Control program receive the following basic training which are appropriate because the trainings are considered the industry standards and taught by instructors that are certified by the respective sponsoring organization; EPA Basic Inspector Training: Overview of all aspects of inspection preparation, conduct, and follow-up and various federal environmental laws and regulations, 40 Hour Hazardous Waste Operations and Emergency Response, 24 Hour Hazmat Emergency Spill Response, Blood-borne Pathogens, Confined Space Entry, First Aid and Traffic Control and Flagging Certification. In addition, all IDDE staff will receive the following program-specific training: IDDE Standard Operating Procedures – field and laboratory training, Field Hazards and Illicit Drug Lab Identification.

B.3.5 Illicit Connections and Illicit Discharge Detection and Elimination (S5.C.8)

The 2007 NPDES Phase I Municipal Stormwater Permit required the City to implement the following elements of the Illicit Connection and Illicit Discharge Detection and Elimination (IDDE) program during 2009: continue implementation of an on-going IDDE program; evaluate and updated existing ordinances or other regulatory mechanisms to effectively prohibit non-stormwater, illegal discharges and/or dumping into the MS4; ensure that all staff who are responsible for IDDE are trained to conduct the required activities; provide a publicly listed water quality citizen complaint/reports telephone number; prioritize complete field screening of the conveyance system; and develop and implement procedures to investigate and respond to spills and improper disposal into the MS4.

During 2009, SPU continued to lead the City's illicit connection, detection and elimination (IDDE) program, which was first implemented to meet the requirements of the 1995 NPDES Municipal Stormwater permit. Citizens can report water quality concerns and complaints, which may lead to a discharge to the City's MS4 by either calling the publicly listed 24 hour "water quality hotline" phone number or by using the internet-based form on the City website.

In 2009 the hotline received 352 surface water quality calls. The water quality hotline and web based reporting mechanism enable the general public to take an active role in stormwater pollution prevention and enhance the City's ability to prevent illicit connections and discharges. This BMP is appropriate as it provides a mechanism for the public to take an active role in stormwater pollution prevention and help the City increase awareness of activities that have negative impacts on stormwater. An evaluation of the water quality hotline can be found in sections B.3.4 and B.3.7.2.4 of this document.

There were 26 illicit connections investigations during 2009 which resulted in three (3) enforcement actions. The City notified Ecology of the IDDE events by way of the Environmental Response Tracking System (ERTS), which also serves as the City's process for notification under G3. The IDDE program resulted in elimination of 14 illicit connections in 2009 and the determined during the investigations that 12 of the 26 potential illicit connections did not exist. There were no referrals from the City of IDDE violations to Ecology after making a good faith and documented effort of progressive enforcement to terminate the violation(s) in 2009.

The SPU Spill Response Program is staffed by a Senior Spill Coordinator and a network of on-call Spill Coordinators. Spill Coordinators work in 3 or 4 day on-call shifts and are available 24 hrs/ 7 days a week. Spill Response calls are dispatched through the Operations Response Center (ORC) and are received via a publicly-available phone number 206-386-1800. The water quality hotline advises citizens who are reporting an active spill to call the ORC to report the spill. Once a spill call is received, the Dispatcher contacts the on-call Spill Coordinator and advises them of the situation. Spill Coordinators follow written procedures for investigation, clean-up and reporting to appropriate agencies.

Each of the major departments at the City has a spill prevention and response program that includes procedures on how to respond and report spills and training to keep staff involved in spill response current on how to conduct their responsibilities. Each department's procedure includes instructions on when and how to report spills to SPU that enter the MS4.

Resource Venture, a contracted consultant of SPU, provides free site visits, spill kits and education to Seattle businesses to assist them with development of a spill prevention plan and proper clean-up and disposal of spills. The spill kit program is promoted on the Resource Venture web site, and a workshop for high risk potential polluters group is offered each year. Spill Plans are reviewed by Resource Venture, and businesses receive training with the spill kit. Resource Venture is an effective method of providing businesses with BMPs so they can voluntarily comply with the City's Stormwater Code.

In 2008, the City conducted an evaluation of the spill kit program to determine if it is an appropriate BMP. The evaluation included a survey of kit recipients since 2004 to assess their understanding of stormwater pollution prevention and their use of spill plans and kits. A previous survey was conducted among Seattle businesses in 2005. The new

survey in 2008 of spill kit recipients included many elements of the previous survey to examine changes since 2005. The majority of those surveyed were auto repair and maintenance businesses (24%). Industry, restaurants and sales made up the next highest business types (~14% each).

Among respondents who reported experiencing spills that require spill kit materials, more respondents in 2008 than 2005 said that they utilize spill kits to clean-up routine spills. Similar percentages of respondents in 2008 and 2005 said that their business had written and posted a plan for dealing with a spill, but more respondents in 2008 said that the plan was posted near the spill kit.

Respondents in 2008 expressed similar confidence to respondents in 2005 about their ability to clean-up spills quickly, knowledge of whom to contact for help containing or cleaning up a spill, stock of spill clean-up materials on hand, and knowledge of where to obtain and dispose of clean-up material. However, respondents in 2008 expressed higher levels of agreement that having a spill plan and clean-up kit makes their employees more aware of surface water pollution and how their business practices can help reduce impacts on water quality.

This evaluation indicates that spill kits are an appropriate BMP for spill prevention and clean-up and verified that information provided directly to the general public helps to reduce behaviors that cause or contribute to adverse stormwater impacts.

Ecology has determined that the revised draft Stormwater Code dated March 16, 2009, is equivalent to requirements in the permit, and will protect water quality, reduce the discharge of pollutants to the maximum extent practicable, and satisfy the state requirement under chapter 90.48 RCW to apply all known, available, and reasonable methods of prevention, control and treatment (AKART).

All staff involved in the IDDE program receive the following basic training which is appropriate because the trainings are considered the industry standards and taught by instructors that are certified by the respective sponsoring organization; EPA Basic Inspector Training: Overview of all aspects of inspection preparation, conduct, and follow-up and various federal environmental laws and regulations, 40 Hour Hazardous Waste Operations and Emergency Response, 24 Hour Hazmat Emergency Spill Response, Blood-borne Pathogens, Confined Space Entry, First Aid and Traffic Control and Flagging Certification. In addition, all IDDE staff will receive the following program-specific training: IDDE Standard Operating Procedures – field and laboratory training, Field Hazards and Illicit Drug Lab Identification.

The City, in 2008, provided training to 953 City staff members who, as part of their normal job responsibilities, might come into contact with or otherwise observe an illicit discharge or illicit connection to the MS4. The City video-taped the training session and produced a DVD with the live presentation and Microsoft Power Point side show to serve as the on-going training program to meet this requirement. This training was appropriate because it provided examples of actual illicit discharges/connections to the

students and provided them with instruction on how to properly report these violations. The DVD can be viewed by new employees and used as refresher training during staff meetings or other training sessions.

In 2009 the City implemented a conveyance field screening program for compliance with S5.C.8.b.vi(1) that is based upon the methods identified in Illicit Discharge Detection and Elimination: A Guidance Manual for Program Development and Technical Assessments, Center for Watershed Protection, October 2004. SCM is implementing the program to meet the permit requirement to conduct on-going screening and source tracing per Special Condition S5.C.8.b.vi of the permit. If a suspected illicit connection is detected, source tracing is initiated within 21 days. Upon confirmation of the source or illicit connection, SCM uses the progressive enforcement process detailed in Directors' Rule 18-2009, SPU 2009-006, Volume IV – Stormwater Code Enforcement Manual to eliminate the connection.

Information on how the City is implementing the 2009 minimum performance measures for the illicit connection and illicit discharge detection and elimination program can be found in the City's SWMP, submitted as Attachment A of the City's 2009 Phase I Permit Annual Report Form.

B.3.6 Operation and Maintenance Program (S5.C.9)

The 2007 NPDES Phase I Municipal Stormwater Permit required the City to implement the following elements of the operation and maintenance program during 2009: establish maintenance standards for stormwater facilities, adoption and enforcement of the Seattle Municipal Code and Directors' Rules, development of an initial inspection schedule for all known, permanent stormwater treatment and flow control facilities regulated by the Permittee, establish practices to reduce stormwater impacts associated with runoff from parking lots, streets, roads, and highways owned or operated by the Permittee, and road maintenance activities conducted by the Permittee and establish and implement policies and procedures to reduce pollutants in discharges from lands owned or maintained by the Permittee.

Ecology has determined that the revised Stormwater Code dated March 16, 2009 is equivalent and the maintenance standards are as protective, or more, of facility function than those specified in Chapter 4 of Volume V of the 2005 *Stormwater Management Manual for Western Washington*. The Seattle City Council adopted the revised Stormwater Code on September 28, 2009, and Mayor Greg Nickels signed the Code into law on September 30, 2009, with an effective date of November 30, 2009. The Directors' of SPU and DPD approved four Directors' Rules in November 2009, with effective dates in December 2009.

The determination of equivalency by Ecology indicates that the revised Stormwater Code will protect water quality, reduce the discharge of pollutants to the maximum extent practicable (MEP), and satisfy the state requirement under chapter 90.48 RCW to apply all known, available, and reasonable methods of prevention, control and treatment (AKART).

The Source Control and Monitoring (SCM) group at SPU is responsible for inspecting private stormwater facilities regulated by the City. During a facility inspection, all aspects of the system are inspected: flow control devices, catch basins, etc. When any part of that system (including catch basins) is found to be out of compliance with Stormwater Code requirements for maintenance, a corrective action letter is sent to the facility owner and the owner or contractor must certify that the work has been completed. The City has established an initial inspection schedule for privately-owned stormwater treatment and flow control facilities and inspected 338 private facilities during 2009.

Maintenance of stormwater facilities owned or operated by the City is divided between the departments. SPU inspects and maintains stormwater facilities located in the right of way. Inspection and maintenance of stormwater facilities outside the right of way on City owned property is conducted by the City Department that manages the property. All departments have implemented a program to annually inspect all permanent stormwater treatment and flow control facilities in 2009. The inspection and maintenance is conducted per the requirements in Appendix D of Volume 3 of the Directors' Rules. These standards have been determined by Ecology to be equivalent to the maintenance standards in Chapter 4 of Volume V of the 2005 *Stormwater Management Manual for Western Washington* and as such, are the most appropriate BMPs for implementation of this permit requirement.

The Seattle Department of Transportation (SDOT) is the lead City agency for establishing practices to reduce stormwater impacts associated with runoff from streets, parking lots, roads or highways owned or operated by the City. In addition to the revised draft Stormwater Code and Directors' Rules, SDOT has developed Maintenance Management Systems Performance Sheets that reference BMPs and elements of the Regional Road Maintenance Initiative to meet Endangered Species Act (ESA) and NPDES requirements. These BMPs have been adopted by 23 different agencies in Western Washington so it is appropriate that the City use these BMPs.

Parks, FFD, SCL and SPU are governed by the Stormwater Codes and Directors' Rules to reduce pollutants in discharges from lands owned or maintained by the City. The departments are governed by the current Stormwater Code and implement appropriate BMPs when conducting construction and maintenance activities on or near streets, parking lots and roads. The individual City departments have and will continue to implement a spill program and provide training on spill and source control.

The City, in 2008, provided training to 953 City staff members who have primary construction, operations or maintenance job functions that could impact stormwater quality. The City is working to develop an on-going training program to meet this requirement. This training was appropriate because it provided examples of actual BMPs for sediment and erosion control from construction sites to the students and provided them with instruction on how to properly install, inspect and maintain these BMPs to reduce impacts to stormwater quality. The City video-taped the training session

and produced a DVD with the live presentation and Microsoft Power Point side show to serve as the on-going training program to meet this requirement. The DVD can be viewed by new employees and used as refresher training during staff meetings or other training sessions.

DPD and SDOT have revised the temporary erosion and sediment control (TESC) training that is provided to City staff and the public involved in ground disturbing activities to reflect the changes in the 2009 Stormwater Code. This new training, called Stormwater Construction Controls (SWCC), will be offered to city staff during the first quarter of 2010 and the public on a regular basis or as needed. The TESC class was an appropriate BMP for training staff and the public on the proper use of stormwater construction controls for retaining sediment on site and preventing erosion as it provides descriptive training and real life examples of the BMPs required by the City Stormwater Code. The City anticipates that the new SWCC course will be successful in training staff and the public as well.

Information on how the City is implementing the 2009 minimum performance measures for the operation and maintenance program can be found in the City's SWMP, submitted as Attachment A of the City's 2009 Phase I Permit Annual Report Form.

B.3.7 Education and Outreach Program (S5.C.10)

The 2007 NPDES Phase I Municipal Stormwater Permit directs the City of Seattle to implement a program for conducting education and outreach to specific audiences on specific topics. The City has prepared an education and outreach program of work to meet these requirements over the term of the Permit and is therefore the best management practice for managing stormwater by education and outreach. The following sections include a brief description of the education and outreach activities associated with each of the BMPs and what strategies are in place to track improvements in the target audience's understanding of the problems.

B.3.7.1 Audience: General Public

B.3.7.1.1 The Urban Watershed School Programs

Conducted on Longfellow, and Piper's Creeks, these programs educate the general public about the impacts of storm water flows into surface waters and the impacts associated with impervious surfaces. This program is conducted via a partnership between Seattle Public Utilities, Seattle Parks, and Seattle Public Schools.

The Urban Watershed School Program consists of a field trip to a local urban stream where children explore hydrologic concepts and the impacts of urbanization on lotic systems. In 2009, 1473 children attended urban watershed fieldtrips at Piper's Creek, and 417 at Longfellow Creek. Forty-one different public, private and parochial schools participated in the program. A take home interview was provided to teachers as an optional extension activity, 147 children participated. The interview activity records information on community awareness and behaviors, and disseminates program messages into the community. Seventeen teachers were surveyed before and after the program to measure the appropriateness of this BMP. Those surveys indicate that

student understanding of the three stormwater concepts measured increased 32% (range25%-35%).

The City feels that this program is the most appropriate BMP because it reaches a large diverse geographic audience and engages the public in hands on learning. The program links closely with school science curriculum to reinforce target messages and illustrate concepts with real, local examples.

The City has selected this program for the evaluation required in S5.C.10.b.ii. A complete evaluation of this program is included as Appendix A of this document.

B.3.7.1.2 Doo Diligence Pet Waste Program

Doo Diligence is a city-wide outreach program that educates the general public about the impacts of pet waste on water quality and promotes BMPs. The program provides tools, educational materials and resources that facilitate the adoption of source control BMPs. In 2009, new outreach materials were developed to encourage the adoption of environmental stewardship actions by highlighting the importance of proper pet waste disposal. These materials included a new interpretive sign for creek and beach access points developed by an interagency team and educational stickers for placement on pet waste pick-up baggie dispensers. This program expanded to include 46 neighborhood baggie dispensers and map of dispenser locations was developed. The City and volunteers stocked 49,980 baggies around the city in 2009, an increase from 31,200 in 2008. Partnerships were developed with local agencies, businesses and community groups including the Block Watch program and Seattle Animal Control. These partnerships have played an integral role in the program's outreach strategy and assisted SPU in reaching thousands of Seattle pet owners.

This program is the most appropriate BMP to address pet waste because it makes educational material accessible to the target audience and provides them with a means to personally implement a BMP. Signage in public places and on the web explains the impacts of bacteria from pet waste on water quality. The program was expanded in 2009 to include new partners and is continuing to evolve strategies in 2010.

B.3.7.1.3 RainWise

RainWise provides education and outreach on how to slow, spread, filter and permeate stormwater. While this program is currently focused on CSO basins, the knowledge and skills provided in the training are applicable to the MS4. In addition the program provides educational/technical elements to raise awareness about Green Stormwater Infrastructure (including stormwater treatment and flow control). The *Streetside Rain Garden Demonstration Projec*t (SRGDP) combines homeowner education with physical changes to landscapes. The program is designed to explore how the city can manage stormwater by working with Seattle residents to install and maintain rain gardens in street side public right-of-way or parking strips. Project outcomes include reference materials on construction and maintenance, training and cost documentation.

Print and web-based RainWise information for the general public and contractors was launched in 2010, starting with the guide *RainWise: Managing Storm Water at Home* and a supporting series of how-to factsheets available through SPU's Garden Hotline and at www.seattle.gov/util/rainwise. That site now links into a robust, user-interactive new website launched in late 2009 , "RainWise Tools" that allows users to locate information about their own property, select appropriate strategies and find contractors trained through the RainWise program.

Contractor training, building on SPU's previous LID workshop series, began with two full-day workshops on installing rain gardens and installing cisterns. Presentations from those workshops are available to all at http://depts.washington.edu/urbhort/html/education/stormwater.htm .

A demonstration/training project was also provided for students in horticulture and concrete trades at South Seattle Community College (SSCC), along with SSCC facilities staff, who worked with SPU staff to install a rain garden, cistern, and permeable paving demonstration area that is available to the public.

Three rain garden workshops for residents were held in partnership with non profit Stewardship Partners in 2009. 195 people attended. 64 out of 161 class participants that filled out the evaluations said they planned to install a rain garden on their property, 84 said they were interested in learning more about the subject and 114 took the Rain Garden Pledge : *Yes! I would like to create a rain garden on my own property or help out with a demonstration project. Please contact me with details for helping with the rain garden installations*: Workshop participants helped to install 3 demonstration rain gardens following the workshops.

The Streetside Rain Garden pilot project tested four rain gardens on a curbless street in NE Seattle. A curbless area was chosen for the simplest application for future residents to mimic without the need of permitting and constructing inlets and outlets. While SPU had hoped to turn this pilot into an incentive program for residents to install rain gardens in planting strips, it is clear that the cost, staffing needs and engineering require more than the Utility can afford on a city-wide basis at this point. However, the pilot enabled the City to test four designs with different plant palettes, determine how citizen-installed rain gardens might be permitted by SDOT and understand the tools necessary for residents to have when they decide to design and install a rain garden. These pilot sites will provide before, after and long-term photos for future residents to understand the process and the results.

RainWise is an appropriate BMP to educate general public, homeowners, landscapers and property managers about low impact development techniques, including site design, pervious paving, retention of forests and mature trees. The program uses a variety of tools to reach the target audiences ranging from printed material to class presentations and demonstration projects. Results from the SRGDP will inform future activities.

Evaluation results indicate that participants are planning to adopt the recommended behaviors.

B.3.7.1.4 Automotive Maintenance Program (AMP)

The Automotive Maintenance program targets the general public about BMPs for source control and storage of products related to vehicle maintenance. In 2009 educational materials including posters and brochures were developed. Key partnerships with auto parts, repair shops, and emissions stations have been established and strategies for reaching low-income residents are in place for 2010. Partnerships with local and state agencies have also been developed to ensure that City messaging is consistent with important regional campaigns such as 'Puget Sound Starts Here'. A soft launch in the fall of 2009 resulted in the inclusion of leak detection as part of Jiffy Lube's oil change package at all 12 Seattle area Jiffy Lube locations. Educational posters were displayed at each location. The SPU website has also been updated to capture new messages, highlight the location of auto fluid recycle centers, as well as introduce incentives for the general public that will encourage the adoption of BMPs. The SPU quarterly "At Your Service" newsletter featured information about curbside waste oil pick-up offered by SPU during regular garbage pick-up. The curbside service recycled 6,694 gallons of oil from April to Dec. 14. In addition 1,997 Jiffy Lube oil change discount coupons were redeemed (equivalent of 9,985 gallons of recycled oil and 1997 oil filters recycled).

This new program is an appropriate education outreach strategy for vehicle maintenance BMPs for the general public because it targets the use, storage and disposal of car products. Program activities are targeting gaps identified in 2008 survey work, which indicated that people are not recycling oil, antifreeze and oil filters because they don't know where to take them. In addition AMPs is targeting new audiences and providing them with a means to personally implement a BMP.

B.3.7.2 Audience: General Public & Business

B.3.7.2.1 Spill Kit Program

Resource Venture, an SPU funded conservation service, provides free site visits, spill kits and education to Seattle businesses to assist them with development of a spill prevention plan and proper clean-up and disposal of spills. This work continued in 2009. Because of the detailed evaluation conducted in 2008 and the modification of the permit, an evaluation of this program was not conducted in 2009.

The City conducted an evaluation of the spill kit program in 2008 to determine if it is an appropriate program for use and storage of automotive chemicals, hazardous cleaning supplies and other hazardous materials. The evaluation included a survey of spill kit recipients since 2004 to assess their understanding of stormwater pollution prevention and their use of spill plans and kits. A previous survey was conducted among Seattle businesses in 2005. A new survey in 2008 of spill kit recipients included many elements of the previous survey to examine changes since 2005. The majority of those surveyed

were auto repair and maintenance businesses (24%). Industry, restaurants and sales made up the next highest business types (~14% each).

Among respondents who reported experiencing spills that require spill kit materials, more respondents in 2008 said that they do not wash any spills away with a hose (85% in 2008 and 65% in 2005). In addition, fewer respondents say they wash away oil or coolant (2% in 2008 and 8% in 2005).

Similar percentages of respondents in 2008 and 2005 said that their business had written and posted a plan for dealing with a spill, but more respondents in 2008 said that the plan was posted near the spill kit.

Respondents in 2008 express similar confidence to respondents in 2005 about their ability to clean-up spills quickly, knowledge of whom to contact for help containing or cleaning up a spill, stock of spill clean-up materials on hand, and knowledge of where to obtain and dispose of clean-up material. However, respondents in 2008 expressed higher levels of agreement that having a spill plan and clean-up kit makes their employees more aware of surface water pollution and how their business practices can help reduce impacts on water quality.

The high percentage of positive behaviors by those surveyed suggests that the Spill Kit Program is an appropriate BMP for reducing or eliminating behaviors and practices that cause or contribute to adverse stormwater impacts and bringing businesses into Code compliance. In addition, the program is an effective stormwater education tool. The program will continue for the foreseeable future and will continue to be used for education and outreach and compliance.

B.3.7.2.2 Car Wash Kit Program

In 2009 Resource Venture provided free car wash kits and educational information to individuals and organizations on proper disposal of car wash water. In addition various organizations, such as city offices, community centers, high schools, and nonprofits host the car wash kits and make them available for community organizations to check out for use at car wash events. The car wash kits capture car wash water and direct it to the sanitary system rather than allowing the wash water to flow into the MS4. Kits are available to the public from a variety of locations throughout the City. Car Wash kits are advertised on the Resource Venture website, and in Camp Long & Carkeek Park seasonal program brochures and web, education and flyers are posted at common carwash businesses.

Based on the results of the evaluation of the Car wash program in 2008 and an analysis current challenges and opportunities for addressing this BMP, the City has decided to sunset the car wash kit program. Since car wash BMPs for residents are being publicized through the regional partnership campaign, Puget Sound Starts Here, the new program will focus outreach on car wash fundraiser groups. 2009 planning has resulted in a new program objective to compliment the Puget Sound Starts Here campaign.

Outreach activities in 2010 will educate fundraising groups on the harmful impacts of car washing activities and provide them with environmentally safe alternatives. By directing these groups to the Brown Bear / Puget Sound Car Wash Association's current fundraising program and identifying sites at which car wash fundraisers can occur without negatively impacting water quality, the city aims to reduce the amount of contaminants reaching our local waterways through stormwater conveyance

B.3.7.2.3 Environmental Justice Network in Action

This program provides outreach, education and resources on the use and storage of hazardous cleaning supplies for the general public, and specifically immigrant and refugee populations (providing the additional benefit of supporting the City's Race and Social Justice Initiative). The information and resources provided help to reduce behaviors that cause or contribute to adverse stormwater impacts.

In 2009 EJNA activities focused on the City's new garbage and recycling rules. Outreach on the BMPs for household hazards, special wastes and the new oil recycling program were integral to the program. The EJNA Outreach Team included staff from eight different community organizations, who were trained to disseminate information to the target audience by holding community meetings. The Outreach Team was trained through a program that included five classes and two fieldtrips and made linkages to water, energy conservation and stormwater. The program ultimately reached 21 organizations and conducted 108 presentations. 1,633 Green Home kits containing safer cleaners, compost, seeds, and conservation devices were distributed. Because of language capacity of community partners we were able to reach 15 language groups.

This is an appropriate BMP for use and storage of hazardous cleaning supplies, because resources and information are provided directly to the general public and reach audiences that traditional programs don't reach.

B.3.7.2.4 Water Quality Hotline

The City staffs a 24-hour water quality hotline to allow citizens and businesses to report illicit discharges into the MS4. Businesses and citizens who are found to be causing illicit discharges receive education, and potentially enforcement actions, if they refuse to voluntarily correct the problem. Because of the detailed evaluation conducted in 2008 and the modification of the permit, an evaluation of this program was not conducted in 2009.

During 2008, the City conducted an evaluation of the water quality hotline to determine if it is an appropriate program to educate the general and businesses, including mobile, about the impacts of illicit discharges and how to report them. The evaluation team contacted 85 citizens who had called the water quality hotline in the previous year to determine; the demographics of the caller, how they had heard about the water quality hotline, the primary reason for their call and their awareness of the MS4 and water quality impacts from illicit discharges.

The results indicate that most callers are white male residents from all parts of the City and less than five percent identified themselves as business owners. The majority of callers learned about the water quality hotline from the web site (21%), from other people in the community (11%) or advertisements (5%). Over half the callers reported illegal dumping and spills (54%). Approximately 16% of respondents called because they noticed negative effects of water quality or toxic substances, such as a foam or film on the water or dead birds and grass. Other respondents reported a drainage problem (9%), contaminated or construction runoff (8%), or a sewage problem (4%). The evaluation found that most callers expressed an understanding of water quality incidents that warrant a report to the hotline.

This BMP is appropriate as it provides a mechanism for the public to take an active role in stormwater pollution prevention and help the City increase awareness of activities that have negative impacts on stormwater. This BMP has resulted in over 1,466 resolved cases from 2,066 calls to the hotline over the last 7 years. This shows that making a hotline number available to the public is one of the BMP the City can use to identify and resolve illicit discharges. The evaluation indicated that the program may not be reaching as wide of an audience as hoped and the City will work to target a more diverse audience in response to the survey results.

B.3.7.3 Audience: Homeowners, landscapers, and Property Managers

B.3.7.3.1 Green Gardening Program

The Green Gardening Program specifically targets the homeowners, landscapers and property manager permit audiences as well as horticulture students in training. This program utilizes community based social marketing strategies and multiple languages broadening the audience and addressing the city's goals for Race and Social Justice Initiative (RSJI). The program promotes BMPs for environmentally-sensitive landscaping practices, with particular emphasis on reducing pesticide use, conserving water, and reusing/recycling landscaping materials.

In 2009 two IPM workshops were conducted – a full day workshop at South Seattle Community College attracted 291 landscape professionals and a half day workshop at Lake Washington Technical College attracted 104 landscape professionals. The program also reached 80 nursery staff through on site classes and 64 horticulture students in their classroom. 33 Spanish-speaking landscapers attended a class at SSCC and 17 Vietnamese landscapers attended a class on "Fertilizing Shrub Beds and Lawns" at the Rainier Vista SHA Housing Development. The Nursery Recognition Promotion had 26 participating nurseries, up from 24 in 2008. The program also contributed three landscape design guides to the new IPMopedia website www.IPMopedia.org .

This is an appropriate BMP for yard care techniques protective of water quality as it provides the target audience with information on how to change their behaviors to improve stormwater quality. The Green Gardening Program uses both exit and follow-up

surveys to evaluate program effectiveness and guide future work. In exit surveys 84% of nursery staff attending the programs said they would use the information they learned or make behavior changes. 91% of the horticulture students at South Seattle Community Colleges said they extremely or very likely to use the information they learned in the Green Gardening Program class. Survey work from foreign language participants indicates that they are an important target audience as well.

B.3.7.3.2 Natural Yard Care Neighbors

This program is targeted at homeowners and property managers. It focuses on reducing water and pesticide use on lawns and gardens. In 2009 the program held four workshops in Seattle neighborhoods (Central Area, Mount Baker, Beacon Hill and Matthews Beach). The neighborhoods were selected using SPU and City priorities with a focus on RSJI and proximity to sensitive water bodies. The four workshops were attended by 203 people. At each location, BMPs for water conservation, pest and weed control, soil building, natural lawn care, plant selection and compost/veggies were taught in three evening sessions. 42% of workshop attendees came to more than one class.

This program is an appropriate BMP because the workshops provide information and resources to the public that inform them on how to change their behaviors to reduce the impact of their yard on stormwater quality. The Program Managers have been evaluating effectiveness and evolving strategies for several years based on exit interviews, baseline pre-workshop surveys and longitudinal surveys. Those surveys indicate that attendees are receiving valuable new information. Follow up surveys revealed that stormwater BMPs are among the most common behavior changes reported when asked for behaviors they started or increased as a result of the workshop.

B.3.7.3.3 Green Your Rug

The City developed and implemented two programs in 2008 directed towards educating homeowners and property managers about BMPs for carpet cleaning. The Green Your Rug residential pilot program was aimed at the homeowners who rent do-it-yourself carpet cleaning machines. The second part of the Green your Rug program included developing a baseline measurement of property manager awareness, understanding of, and adoption of proper disposal of used wash water from carpet cleaning. Both programs determined that the majority of the Target Audience are adopting the proper behaviors and using practices to reduce or eliminate adverse stormwater impacts associated with carpet cleaning.

B.3.7.3.4 Green Your Rug Residential

Education and outreach on this subject was provided as needed by Resource Venture during 2009. Because of the detailed evaluation conducted in 2008 and the modification of the permit, an evaluation of this program was not conducted in 2009.

The residential portion of the Green Your Rug was run as a pilot in 2008 to determine the public's level of knowledge about the issue and determine if a larger education and

outreach project is warranted. Three do-it-yourself carpet cleaner machine rental locations in the north end of Seattle agreed to participate in the Green Your Rug pilot program. The program consisted of a survey to gather baseline data on residential carpet cleaner wastewater disposal behaviors and an educational flyer containing information on proper carpet cleaning wash water disposal. Analysis of survey results indicate that 77% of individuals who rented carpet cleaners reported disposing of their carpet cleaner machine wastewater in a toilet, sink, or tub; 18% percent reported disposing of it outdoors on a pervious surface or into a dumpster; and 5% percent reported dumping it directly into a storm drain.

A review of Home Depot's do-it-yourself carpet cleaning rental instructions revealed that they were instructing people to dispose of their carpet cleaning wastewater into storm drains. The City contacted Home Depot headquarters to inform them of the improper instructions. Home Depot has changed their instructions and do-it yourself carpet cleaners nationwide will be instructed on proper disposal of their wash water due to this City program.

The pilot project will not be continued because the majority of individuals surveyed had a good understanding that the proper BMP for carpet cleaning wash water was to dispose it in the sanitary sewer system and were engaging in this behavior. With such a high percentage of correct responses it is ineffective to continue a specific education and outreach program for this BMP. The City will continue to provide education and outreach to the public on proper BMPs for carpet cleaning through Resource Venture, and the water quality hotline.

B.3.7.3.5 Green Your Rug for Property Managers

Education and outreach on this subject was provided as needed by Resource Venture during 2009. Because of the detailed evaluation conducted in 2008 and the modification of the permit, an evaluation of this program was not conducted in 2009.

To develop the baseline assessment about property managers understanding and behaviors about BMPs for carpet cleaning, a survey of property managers of multifamily and commercial buildings regarding their carpet cleaning practices was conducted in 2008. The following information was gathered for the baseline assessment and reporting; average frequency of carpet cleanings by type of tenant (e.g., multifamily, type of business), typical timing of carpet cleaning, disposal practices for used wash water among property managers and cleaning contractors, property manager awareness of proper disposal practices, property manager awareness of storm drainage system (linkage to water bodies) and effect of used wash water on stormwater and property manager awareness of responsibility for contractors' proper disposal practices.

The evaluation determined that half of property managers know that they are legally responsible for the proper disposal of wash water (54%) and that water disposed in an outside drain flows to a creek, lake, or other surface water (55%). Nearly three quarters (72%) know that the best place to dispose wash water is a sink or toilet. In practice,

most property managers (83%) say that wash water from general cleaning is properly disposed into an indoor drain when either they or contractors clean; however, 13% of managers do not know where general cleaning contractors dispose of wash water. Most property managers also say that wash water from carpet cleaning is disposed into an indoor drain (37%) or hauled away for disposal elsewhere (19%), but another 33% do not know where the water is disposed.

The results of this evaluation indicate that it is not appropriate for the City to direct additional education and outreach resources to create a program for property managers on BMPs for carpet cleaning. The use of existing City programs (business inspection program, Resource Venture and the water quality hotline) are appropriate BMPs to educate property managers about BMPs for carpet cleaning.

B.3.7.3.6 Business Inspections

Because of the detailed evaluation conducted in 2008 and the modification of the permit, an evaluation of this program was not conducted in 2009. However, education and outreach on this subject continues.

SPU inspects businesses, including mobile businesses and works with them to prevent pollutants from entering private and public storm drains. Inspections include responses to complaints and concerns on the Water Quality Hotline. Inspections are focused on High-Risk Pollution Generating Activities and provide education and outreach on City Code requirements and use of BMPs. This BMP is appropriate because it provides information and resources directly to businesses at their location that educate them on how to change their behaviors to comply with City Code and reduce the impact of their activities on stormwater quality.

In 2009, the business inspection program will continue. However, the auto maintenance program described in B.3.7.1.4 will be used to educate homeowners and property managers about BMPs for auto repair and maintenance.

B.3.7.3.7 RainWise

Please see the description in B.3.7.3.7.

B.3.7.3.8 Natural Landscaping Professional Development

This program is a series of well attended professional workshops (and supporting guides and web content) which target the specified behaviors and practices in the Permit (low impact development (LID) techniques: including sustainable site design, soil BMPs and retention of native vegetation, plant selection and maintenance options that reduce pesticide and fertilizer use, and Natural Drainage/LID strategies for on-site stormwater management, and stormwater treatment and flow control). These workshops target Permit audiences including engineers, design professionals, landscape contractors (including Spanish-speakers), developers, builders, permitting and inspection staff, and land use planners. The program is built on extensive barriers and opportunities survey

and focus group work with these professionals and customers. Professionals who attend the workshops incorporate LID techniques into their designs and pass on information to the homeowners, landscapers and property managers that they work with. Participants fill out in-class evaluations and they identify (pledge) the actions they intend to take as a result of the training.

In 2009 the program fielded 47 LID and Natural Landscaping training events, in collaboration with professional organizations and the Puget Sound Partnership, that were attended by a total of 2655 professionals from around the Puget Sound region. Two thirds of those professionals do work in the City of Seattle service area, with the remaining third working primarily in other Central Puget Sound Basin jurisdictions. Training was provided in English and Spanish. Highlights included developing curriculum and launching the new 9-month University of Washington LID certificate program, while continuing the PSP/WSU LID training courses, completing a compost technical training series funded by an Ecology PPG grant, trainings for builders through the Association of General Contractors and Master Builders Associations as well as CESCL field trainings, training for planning and permitting staff on new stormwater code soil requirements, incorporation of our approach into the new national Sustainable Sites green building guidelines (www.sustainablesites.org), and trainings in Spanish for low-income landscape workers.

Evaluation results from post-workshop surveys of professionals indicated that 92% of participants rated the training "good" or "excellent", 90% said the training was at the right technical level for their professional needs and 79% pledged behavior change, saying they would take specific actions as a result of the training (most often, adopting one or more of the BMPs/specifications into their daily practice). Barriers reported included confusion about regulatory requirements and need for more outreach with the new Seattle stormwater code, lack of awareness among professionals about customers' interest in "green" practice, and cost limitations under current economic conditions.

B.3.7.3.9 Private Facility Inspections

Because of the detailed evaluation conducted in 2008 and the modification of the permit, an evaluation of this program was not conducted in 2009. However, education and outreach on this subject continues.

SPU conducts inspections of private stormwater and flow control facilities to ensure that they are installed and maintained to City Code. In additions to conducting the inspection, SPU provides education and outreach on how to change their behaviors to comply with City Code and maintain their facility to function properly and reduce the impacts to water quality. Outreach materials include handouts on BMPs and codes. Inspections are tracked and reviewed. This program will continue into 2009.

The SCM group tracks private facility inspection and enforcement records through a Microsoft Access database and file management system. The database tracks information for both source control inspections and drainage system maintenance inspections.

Records are managed in accordance with the State record keeping codes. Enforcement actions are tracked both in the database and electronically in a separate folder on the City network. Any enforcement paperwork is kept with the file.

The City evaluated the appropriateness of using the private facility inspection program as a method to meet the education and outreach requirement for educating homeowners, landscapers and property managers about stormwater treatment and flow control BMPs and determined that this education and outreach requirements is better served by the RainWise program described in B.3.7.3.7

B.3.7.4 Audience: Engineers, Contractors, Developers, Review staff and Land Use Planners.

B.3.7.4.1 Temporary Erosion and Sediment Control

The Department of Planning and Development (DPD) provides short courses to engineers, contractors, developers on appropriate BMPs for temporary erosion and sediment control from new development and re-development sites. This training exposes professionals to City Code requirements and is an appropriate BMP for the control of sediment and erosion.

DPD and SDOT have revised the temporary erosion and sediment control (TESC) training that is provided to City staff and the public involved in ground disturbing activities to reflect the changes in the 2009 Stormwater Code. This new training, called Stormwater Construction Controls (SWCC), will be offered to city staff during the first quarter of 2010 and the public on a regular basis or as needed. The TESC class was an appropriate BMP for training staff and the public on the proper use of stormwater construction controls for retaining sediment on site and preventing erosion as it provides descriptive training and real life examples of the BMPs required by the City Stormwater Code.

B.3.7.4.2 Natural Landscaping Professional Development

Please see the description in section B.3.7.3.8.

B.4 Information on Structural Stormwater Controls Program (S5.C.6)

The Structural Stormwater Controls Program is described in Section III.6 of the City's SWMP documentation, submitted as Attachment A of the City's 2009 Phase I Permit Annual Report Form.

B.5 Summary of Actions Taken to Comply with Applicable TMDL Requirements (S9.E.4)

There are no applicable Total Maximum Daily Loads (TMDL) listed in Appendix 2 of the 2007 NPDES Phase I Municipal Permit for receiving waters to which the City's MS4 drains. Therefore, compliance with this permit such as implementation of the actions comprising the components outlined in the City's SWMP, submitted as Attachment A of the City's 2009 Phase I Permit Annual Report Form, constitutes compliance with any applicable TMDLs not listed in Appendix 2 of the permit (S7.B).

B.6 Stormwater Monitoring Summary (S9.E.6)

In accordance with S8.B.1, this section provides a brief description of the stormwater monitoring or related monitoring studies conducted during 2009 by or for the City outside of the permit required monitoring:

B.6.1 Water Quality

Pollutant Source Control Sampling - This monitoring was conducted by SPU in support of and associated with the Water Quality Hotline, IDDE, and business inspections for source control from existing development.

Lower Duwamish source sediment samples - In 2009, SPU continued to collect source sediment samples (i.e., catch basins, inline sediment traps, and inline grab samples) to support the source control program for the Lower Duwamish Waterway superfund site. In 2009, SPU took 111 samples, which were analyzed for the LDW contaminants of concern, including TOC, SVOC's, TPH-Dx, select Metals, PCB's, Grain Size and occasionally site specific parameters, such as pH, additional metals, VOC's.

The Piper's Creek Microbial Source Tracking (MST) – The goals of this study are the following; identify sources of fecal coliform bacteria, measure bacteria concentrations and stream discharge, calculate annual bacteria loading for subbasins of Piper's Creek and evaluate how bacteria sources and concentrations vary by location, season and flow.

The study design includes a total of 18 monitoring locations – five on main stem Piper's Creek, two on Venema Creek, two on Mohlendorph Creek, and one each on nine unnamed tributaries to Piper's Creek. Bacteria data was collected at each of the 18 stations; bacteria DNA data was collected at four locations (3 on Piper's Creek and one on Venema Creek). The bacteria DNA data is anticipated to allow for the identification of sources of the bacteria contamination. Manual discharge is being measured at 15 locations; continuous discharge data is also being collected at three SPU stream gauging stations.

During a 15-month period, water samples were collected during storm flow and base flow conditions at 18 locations in Mohlendorph Creek, Venema Creek, Piper's Creek, and associated tributaries. Water samples were collected during 13 storm flow events and 12 base flow events. All water samples were analyzed for fecal coliform bacteria concentrations. At four of the 18 locations, E.coli bacteria isolates from the water samples underwent DNA analysis to identify the warm-blooded animal origin of each isolate.

The consultant has provided a draft report on the results of this study and City staff are reviewing the document, suggesting corrections and hope to finalize during 2010.

In November 2009, Seattle initiated a water quality study of two recently constructed synthetic turf fields, one AstroTurf® and one Field Turf®. These turf fields are located in Woodland Park which drains to Green Lake. The objective of the study is to determine if drainage from these fields contains high concentrations of pollutants associated with the synthetic turf and, thus, potentially impact environmental health. Concerns about the effects of synthetic turf on public and environmental health have been raised in Seattle and

throughout the nation. Due to these concerns, many jurisdictions have placed moratoriums on synthetic turf field construction until health effects have been adequately addressed.

Water samples will be collected during seven events at four representative locations in Woodland Park. Four sampling events will conducted during storm flow conditions, and three sampling events will be conducted during base flow conditions. The collected samples will be analyzed for selected pollutants including pH; hardness; total suspended solids; total and dissolved phosphorus; fecal coliform bacteria; total and dissolved copper, lead, and zinc; and semi volatile organic compounds (SVOCs), which include polycyclic aromatic hydrocarbons (PAHs), phthalates, phenols, chlorinated hydrocarbons, and miscellaneous organic compounds. Water quality sampling was completed in February 2010, and a study report will be prepared in 2010.

B.7 Operation and Maintenance Schedules

B.7.1 Justification of Reduced Inspection Frequency

Because this is the third year of the Permit, there are no data available to justify reducing the inspection frequency pursuant to Permit conditions S5.C.9.b.ii(3), S5.C.9.b.iii(1) and S5.C.9.b.iv(2).

B.7.2 Stormwater Facility Maintenance or Repairs greater than $25,000 (S5.C.9.b.v)

The City did not conduct any stormwater facility maintenance or repair greater than $25,000 during 2009. Information on the operation and maintenance program can be found in the City's SWMP, submitted as Attachment A of the City's 2009 Phase I Permit Annual Report Form.

B.8 Notification of any Annexations, Incorporations, or Jurisdictional Boundaries (S.9.E.8)

There were no annexations, incorporations or changes in jurisdictional boundaries in the geographic area served by the City's MS4 during the 2009 reporting period.

B.9 Summary of barriers to implementation of LID and actions taken to remove the barriers

The City has been on the forefront of developing solutions to real or perceived barriers to the implementation of Low Impact Development (LID) for stormwater management. The City uses the term Green Stormwater Infrastructure (GSI) when focusing on the stormwater management aspects of LID. The stormwater management aspects of LID are the focus of this discussion on the barriers and actions.

One of the first barriers encountered by the City was the lack of authority in the Stormwater Code (SMC 22.800-22.808) to require GSI in addition to a lack of guidance and standards for design and implementation of GSI. The Stormwater Code revision project

eliminated this barrier and implemented a variety of tools to educate and inform the public on GSI, including its design and application in the urban environment. The DR 17-2009, SPU 2009-005, *Vol. III - Stormwater Flow Control and Water Quality Treatment Technical Requirements Manual* (Stormwater Manual) provides the public with a suite of tools to guide the implementation of GSI that meets the Stormwater Code requirements. In fact, this document is considered by most practitioners to be the best resource in the Puget Sound region for GSI design, modeling and maintenance information. In addition to the revised Stormwater Code, the City has revised its Right of Way Improvement Manual and the Standard Plans and Specifications to inform and educate the development community on the requirements for a consistent application of GSI within the City. These tools are useful to those implementing GSI and are used by engineers and planning staff at the City for consistent review and inspection of projects.

The majority of parcels in the City are single family residential and a potential barrier is that owners of single family parcels may not be aware of the requirements for GSI in the Stormwater Code and what their responsibilities are if and when they install GSI during development. The City developed Client Assistance Memos (CAMs) for each of the GSI technologies that summarize the information in the Stormwater Manual, including site applicability, design, and construction inspection requirements, and facilitate an informative approach to understanding the Stormwater Code requirements for GSI on parcel projects. Additional tools, such as the GSI Requirement Calculator and the Pre-sized Flow Control Calculator, facilitate the sizing of GSI facilities and understanding when Stormwater Code compliance has been achieved for smaller, less complex projects. . Appendix D of The DR 17-2009, SPU 2009-005, *Vol. III - Stormwater Flow Control and Water Quality Treatment Technical Requirements Manual* provides detailed information on the facilities maintenance requirements and the inspection components that City inspectors will be using during compliance inspections.

For more complex projects that require modeling to demonstrate and document stormwater code compliance, SPU contracted with the developers of the Western Washington Hydrology Model (WWHM) to develop GSI modules and provide WWHMv3 with these modules for free. This provides designers a consistent and easy approach to designing GSI. SPU also co llaborated with DOE, PSP and WSU for scoping future modeling needs and is taking an initial step to develop and calibrate modeling of bioretention with underdrain and greenroofs.

The City has developed incentive programs to remove real or perceived barriers around the cost of implementing GSI vs. traditional stormwater facilities. As an incentive to the applicant's design team to integrate significant stormwater management with GSI facilities, all projects less than 10,000 ft^2 of new plus replaced impervious surface have the option of not constructing traditional stormwater infrastructure if the project mitigates 70 percent of the new plus replaced impervious surface with GSI.

Programs such as the Stormwater Facility Credit Program and Green Factor help to remove the barriers around the cost of implementing GSI. The Stormwater Facility Credit Program rewards utility customers with up to a 10 percent break on their drainage bill if their GSI

facility is installed and maintained in accordance with the Stormwater Code. A barrier that the Green Factor addressed is that the Land Use Code was inconsistent with GSI techniques. The Seattle Green Factor requires new development in neighborhood business districts, certain commercial, and multifamily residential zones to meet a landscaping target using a menu of landscaping strategies. Green Factor scoring has been revised to include green roofs, permeable paving, bioretention and rainwater harvesting, which helps to align the Land Use Code requirements with the Stormwater Code.

One of the barriers to wide spread use of permeable pavement is a lack of technical knowledge among professionals in the paving industry on the proper material supply and installation of these materials. To remove this barrier, SPU is involved in industry discussions on ASTM strength (and consequently material life) testing. These standards will give contractors and inspectors clear expectations on materials acceptance (i.e. what's "good enough"). SPU is also encouraging the use of experience installers.

Another barrier to implementation of GSI is that there are certain areas in the City where it is unacceptable to infiltrate stormwater due to site conditions such as steep slopes, landslide prone areas, setbacks and areas with low infiltration rates. To address these potential barriers, the City designed its GSI performance standard to provide credit, although smaller, for non-infiltrating GSI facilities.

Another barrier to implementation of GSI is the requirement of a water right to capture rain water for storage of rainwater. The City applied for and received a water right permit from Ecology so that residents and businesses can capture and put to use the rainwater that falls on rooftops of structures in the partially separated MS4 in the City of Seattle. This step removed the legal uncertainty regarding rainwater harvesting. Following this action, Ecology issued an Interpretive Policy Statement clarifying that a water right is not required for rooftop rainwater harvesting.

Stormwater facility design is a relatively new discipline when compared to wastewater and flooding facility design. The technologies and practices implemented for GSI are rapidly evolving, and new information is the key to advancing the tools available to municipalities and the public. A lack of innovation and information on design and facility performance can be a barrier to the implementation of GSI. To reduce this barrier, the City is participating in Ecology's LID stakeholders advisory process, which will inform the permit requirements surrounding LID implementation for the MS4 permit modification. The City is also supporting (technically and financially) the City of Puyallup and WSU's Stormwater Retrofit project on the WSU Puyallup campus. This functional research project is designed to implement current GSI techniques in a real world setting where researchers can evaluate the effectiveness of these techniques to inform regional manuals and ordinances.

B.10 Summary of the extent to which basin or watershed planning is being conducted in the Permittee's jurisdiction, either voluntarily or pursuant to

the Growth Management Act (Chapter 36.70A RCW) or any other requirement

The City is a key participant in watershed planning and salmon recovery planning efforts in both the Water Resource Inventory Area 8, Cedar/Sammamish and Water Resource Inventory Area 9, Green/Duwamish. This participation includes working with scientists to figure out what actions are most needed. The groups are also investigating planning tools to improve water quality, conserve water and restore shorelines.

SPU is in the process of developing a master plan for utility infrastructure focused on desired infrastructure that accounts for expected growth, as well as addressing existing capacity needs and service level gaps. This planning will be both short and long-term, and will be coordinated with broader City planning efforts (Neighborhood Plans, Comprehensive Plan update). Efforts will be strategically targeted to address problem areas, areas of rapid growth, and areas with significant construction activity (e.g., Sound Transit, City of Seattle transportation projects). Utility master planning will create a more systematic understanding of current and future infrastructure needs. This analysis will better inform planning and zoning decisions, identify needed capital projects, and provide a sounder basis for responding to opportunities and challenges presented by external projects and private development.

SPU conducted and documented an evaluation of urban watershed in 2007. This document, *State of the Waters 2007*, documented the status and current conditions of hydrology and aquatic ecology resources in the major creek watersheds in Seattle. This document serves as the current baseline for watershed and basin planning efforts.

Appendix B1

City of Seattle 2009 NPDES Phase I Municipal Stormwater Permit Program Evaluation and Other Activities Narrative for the 2008 Phase I Permit Annual Report Form

Seattle Public Utilities

Restore Our Waters Urban Watershed School Programs

2009 Program Summary and Evaluation

Introduction

The Urban Watershed field trip program is an outdoor environmental education program serving nearly 2000 Seattle elementary students each year. Programs are located at Piper's Creek and Longfellow Creek and are implemented through Seattle Parks' Environmental Learning Centers with funding from Seattle Public Utilities (SPU). The field trip content was carefully designed with support from Seattle Public Schools' (SPS) Science Resource staff to reinforce curriculum. Program elements tie to SPU's core stormwater messages, stewardship values of the Parks Department and the Mayor's Restore Our Waters Strategy. The field trips are a component of the City's Stormwater Management Plan, helping meet NPDES Stormwater Permit's Outreach and Education requirement by targeting the general public with information and best management practices for the impacts of stormwater and impervious surfaces. SPU funds pay for program fees and transportation, allowing schools with underserved populations to attend the program. In 2009 program costs and transportation fees cost approximately $14,000.

Background

The program started in the early 1990s to provide context for Seattle schools raising salmon with the Washington Department of Fish and Wildlife Salmon in the Classroom Program. At Carkeek Park the salmon program is coordinated by the Carkeek Watershed Community Action Project, and Chum salmon stock are donated by the Suquamish Tribe's Grover's Creek Hatchery. The program has been implemented at various levels through a partnership between Parks ELCs (DPR), Seattle Public Utilities, and Seattle Public Schools for about 15 years, exposing thousands of children to Seattle's unique creeks and our urban drainage issues. The program provides an opportunity each year for hundreds of children to visit salmon-bearing urban streams in local parks, extend and apply classroom curriculum, and learn about water quality and drainage in a natural setting. Several years ago, at the request of Seattle Public Schools, the *Land and Water* field trip was added to tie more closely to science curriculum.

Program Demographics

- 1,951 children attended urban watershed field trips (Spring of school year '08-'09; Fall school year '09-'10).
- 37 different public, private and parochial schools participated (80 classes), 82% were Seattle public schools (SPS). SPS Home School Resource Center also brought a group of children. (Appendix 1a).
- 62% (23) of the participating schools are based north of Seattle's downtown.
- Forty-one percent of the schools attended the *Land and Water* field trip, and 49% attended the *Salmon in the Watershed* field trip.
- Public schools on the field trips averaged 37% Free and Reduced Lunch (FRL) (2009 Seattle public schools averaged 39% FRL at the elementary level). 39% of the public schools in the program had higher than 40% FRL (40% is the Title 1 eligibility level).

Description

Two program choices are available to accommodate schools, *Land and Water* and *Salmon in the Watershed*. The Land and Water Science Kit is a nationally distributed inquiry science module that has been adopted by Seattle Public Schools at the 5th grade level. The kit is approximately 15 lessons long. In it, students use a *stream table* to explore hydrology using water and a variety of

sediments. The *Land and Water* field trip is designed to reinforce the kit activities. The *Salmon in the Watershed* field trip is designed for more general audiences, schools interested in salmon and watersheds, or schools raising salmon through Washington Department of Fish and Wildlife's Salmon in the Classroom program (approx. 120 Seattle schools). In 2009 41% of the schools attended the *Land and Water* field trip, and 49% attended the *Salmon in the Watershed* field trip.

Salmon in the Watershed	
Learning Objective	**Program Activity**
Urban watershed/built environment	Intro/Build a Watershed
Salmon lifecycle	Salmon Evolution
Habitat requirements of salmon	Hooks and Ladders
Impacts of stormwater on Piper's Creek	Scavenger Hunt
Personal stewardship	Conclusion-discussion

Land and Water	
Learning Objective	**Program Activity**
urban watershed/built environment	Intro/ Build a Watershed
Impervious surfaces and stormwater	Just Passing Through
Real stream health and habitat conditions	Mapping
Impacts of stormwater on Piper's Creek	Three Things
Personal stewardship	Conclusion-discussion

Intro/ Build a Watershed - - Provides setting and context with maps of Piper's or Longfellow Creek Watershed, demonstration using crumpled paper and spray bottle.

Salmon Evolution- Each student begins as a salmon egg and attempts to progress through stages of the salmon lifecycle by defeating fellow students in rock-paper-scissors game.

Hooks and Ladders - A field game where student play the roles of salmon and make their way through an obstacle course representing the challenges salmon face during their lifecycle.

Scavenger hunt- Working in small groups students identify salmon habitat requirements and their importance on laminated activity cards.

Just Passing Through- A field game that explores imperviousness and interception where students act as stormwater running down a hillside with vegetation and then compare it to a hillside without.

Mapping - Students apply the concepts and vocabulary used with their classroom stream tables to the real stream, (*slow and fast water deposition and erosion of sediment),* then discuss how they are related and why these features occur in an urban stream.

Three things - Students fill in worksheet with guided discussion on the real stream, compares to the models of streams made in the classroom and look for the signs of positive and negative human impacts.

Conclusion/ discussion – A review activity and student pledge for new behaviors inspired by attending the field trip.

Evaluation

Teachers filled out a pre-post questionnaire to assess field trip effectiveness (Appendix 1b). They were asked to rate students understanding of three learning objectives before and after the program. Seventeen teachers filled out the survey. The surveys indicate that student understanding of the three stormwater concepts measured combined increased 32%.

Teacher rating of student's knowledge of stormwater concepts for both Land and Water and Salmon in the Watershed field trips (1=poor…5 =excellent), N=17

Stormwater Concepts	Pre-Field Trip	Post-Field Trip	Percent change
Make connections between curriculum and actual issues facing Seattle's waterways	2.81	4.06	+25%
Understand the impacts of stormwater on the health of Seattle's local waterways	2.31	4.00	+34%
Understand impervious surfaces and how they affect watershed health	1.94	3.75	+36%

The combined increase in student knowledge appears to be greater for students participating in the *Salmon in the Watershed* field trip (+38%) vs. those taking the *Land and Water* field trip (+26%). It has been shown that salmon are an effective tool for engaging people in these topics and that may explain the difference here.

2009 Teacher rating of student's knowledge of stormwater concepts for both field trips (1 =poor…5 =excellent)

Field trip program		Students make connections between curriculum and actual issues facing Seattle's waterways	Students understand the impacts of stormwater on the health of Seattle's local waterways	Students understand impervious surfaces and how they affect watershed health	Percent change (combined)
Land / Water	before	2.5	2.0	1.9	+26%
	after	**3.6**	**3.4**	**3.8**	
Salmon / watershed	before	3.1	2.6	2.1	+38%
	after	**4.5**	**4.6**	**4.4**	

Teachers in both programs have the option of extending the field trip experience with a pre-developed take-home assignment (Appendix 1c). The assignment is a two-way adult child interview which provides information back to the City on learning outcomes and general knowledge of stormwater concepts as well as disseminating program messages and BMPs into the community. After attending the field trip, children ask an adult at home a set of questions about stormwater and then adults ask the children a series of questions about the fieldtrip. The assignment was emailed

to the all of the teachers after the field trip. They were not required to return the completed questionnaires, however some chose to do so. Eight teachers assigned the interviews to their students as homework. Seven schools returned a total of 147 interviews for review.

The children's answers on the interview provide another indicator of the effectiveness of the fieldtrip. After returning home 94% of the children correctly defined a watershed and 79% demonstrated an understanding of impervious surfaces. The children's responses to suggested BMPs indicate a willingness to be active participants in watershed health. It is possible that children are not familiar with the term "stenciling storm drains", since the willingness to participate in that activity seems surprisingly low.

Children's responses to Question 5 - On your field trip to Carkeek Park and Piper's Creek you were asked to list three things you will do differently as a result of your experience there learning about watersheds and salmon. Please recall them now. Or choose ideas in the list below to help you reduce your impact on the watershed you live in.

Answers	Children's responses
Plant a tree in your neighborhood	44.5%
Volunteer at a local creek clean-up	15.8%
Pick up litter	68.8%
Take the bus, walk, or bike more	68.5%
Plant a tree at my school	25.6%
Stencil a storm drain	13.1%
Clean up after my pet, every time even in the backyard	32.0%
Learn more about watersheds	40.6%
tell a friend about watersheds	47.0%

The adult interview results indicate that approximately 17% of the adults "don't know" where their stormwater ends up. Regarding impacts from stormwater, 40% of adults indicated an understanding of water quality impacts and, 20% appeared to understand the impacts of impervious surfaces.

Adult responses to Question 3 - In many Seattle neighborhoods rainwater that goes into storm drains goes directly to a creek, river, or lake. Is this a problem? (Check more than one, if you'd like.)

Answers	Agree
"yes, rainwater can pickup and carry harmful contaminants left on streets, roads, and in yards"	39.6%
"No, rainwater coming from roadways is not really that dirty	12.3%
"Yes, even moderately heavy rains can flood and damage water bodies within a city, due to the abundance of impervious surfaces	10.8%
Answered "yes " to both	38.7%

While most adults are aware that urban runoff could have negative impacts on water quality, responses indicating a willingness to adopt new behaviors were highly variable. The percentage of respondents willing to pick up their pets waste every time ranged from 18%-60%. The percentage of respondents who were willing to take their car to a car wash ranged from 45%-91%,

Adult responses to Question 5 - Which of the following would you be willing to do to help reduce your impact on Seattle's creeks, lakes and Puget Sound? (Circle as many as you'd like.)

Answers	Adult responses
Plant a tree in your neighborhood	57.3%
Volunteer at a local creek clean-up	30.6%
Learn more about Seattle's watersheds at (ROW website link)	31.4%
Walk and/or bike more	69.6%
Use natural cleaning products like vinegar and baking soda	58.0%
Take your car to a carwash	64.3%
Clean up after your pet, every time, even in the backyard	42.6%
Care for my lawn or garden with natural products	67.1%
I am not willing to do anything	5.5%

Conclusions

Participation: The programs appear to be serving an audience that reflects Seattle's population in general. Participating schools appear to have similar demographics to the population of Seattle Public Schools. Because the Salmon in the Schools program has partnered with schools near Piper's Creek for many years, the distribution of schools attending the field trips is biased toward the north end. However by providing free programs and bus transportation, schools that would not be able to afford the cost of a field trip can attend.

Fieldtrip effectiveness: Based on the results of the teacher surveys and home extension interviews it appears that children attending both field trips are learning about the intended concepts. Teachers indicated a wide range of watershed knowledge in the students before the field trips, however it

may be the case that after attending the trips teachers include more general stormwater concepts in their classroom content, so we may see the *before* knowledge scores rise over time. In fact three of the four teachers who rated their students' knowledge highest "*before"* are veterans on the fieldtrip.

Adoption of Stormwater BMPs

The adult population surveyed is not very interested in learning more about watersheds despite fairly low understanding of stormwater, however they are generally willing to adopt stormwater BMPS. For both children and adults the most popular BMP selected was related to alternative transportation choices. Volunteering at a creek clean up was not popular among either group. There appears to be a barrier to adopting storm drain stenciling, it may be that the children surveyed in the 7 schools that returned results have not have been exposed to that program and don't understand what it is.

Appendix 1a: List of schools attending/program/site
Appendix 1b: Results from before and after survey of teachers
Appendix 1c: Take home interview extension

Appendix 1a: List of schools attending/program/site

Date	School Name	Prog	Site	FRL*
3/16/09	Home School Res.	SIW	CP	NA
3/17/09	Loyal Heights	SIW	CP	NA
3/17/09	Salmon Bay	SIW	CP	NA
3/18/09	Pacific Crest	SIW	CP	NA
3/19/09	Greenlake	SIW	CP	20.4
3/19/09	St. Alphonsus	SIW	CP	NA
3/23/09	West Woodland	SIW	CP	NA
3/24/09	Christ the King	SIW	CP	NA
3/24/09	Lawton	SIW	CP	NA
3/25/09	BF Day	SIW	CP	42.2
3/26/09	John Hay	SIW	CP	8.1
3/26/09	Whittier	SIW	CP	7.9
3/27/09	Adams	SIW	CP	NA
5/5/09	Lafayette	LW	CP	NA
5/6/09	Lafayette	LW	CP	12.3
5/12/09	John Muir	LW	CP	57.9
5/13/09	Highland Park	LW	CP	73
5/26/09	Van Asselt	LW	CP	78.0
5/26/09	West Woodland	LW	CP	8.8
10/27/09	Wing Luke	L/W	CL	NA
10/28/09	Pathfinder	SIW	CL	35.3
10/29/09	Sanislo	L/W	CL	53.5
10/30/09	Emerson	L/W	CL	82.4
10/30/09	West Seattle	L/w	CL	80.1
11/3/09	Arbor Heights	SIW	CL	38.8
11/4/09	Gatewood	L/W	CL	40.4
11/5/09	Emerson	L/W	CL	NA
11/6/09	Dunlap	L/W	CL	83.8
11/9/09	West Woodland	LW	CP	NA
11/10/09	Lawton	SIW	CP	12.1
11/10/09	Loyal Heights	LW	CP	4.4
11/12/09	St. Alphonsus	SIW	CP	NA
11/13/09	Community Schl	SIW	CP	NA
11/13/09	St. Anne School	SIW	CP	NA
11/16/09	Thurg Marshall	SIW	CP	41.8
11/17/09	Ryther	SIW	CP	NA
11/17/09	Whittier School	SIW	CP	NA
11/18/09	Graham Hill	LW	CP	51.2
11/19/09	North Beach	SIW	CP	6.5
11/20/09	AS1 School	SIW	CP	40.2
11/20/09	Daniel Bagley	BOTH	CP	13
12/1/09	TOPS School	LW	CP	27.1
12/2/09	Christ the King	SIW	CP	NA
Date	School Name	Prog	Site	FRL*

12/2/09	McGilvra	LW	CP	5.8
12/3/09	Adams	SIW	CP	33.4
12/3/09	West Woodland	SIW	CP	0
12/8/09	Salmon Bay	SIW	CP	7.6
12/9/09	Broadview Thompson	SIW	CP	53.6
12/11/09	Northgate	LW	CP	86.9
12/14/09	JSIS	SIW	CP	16.9

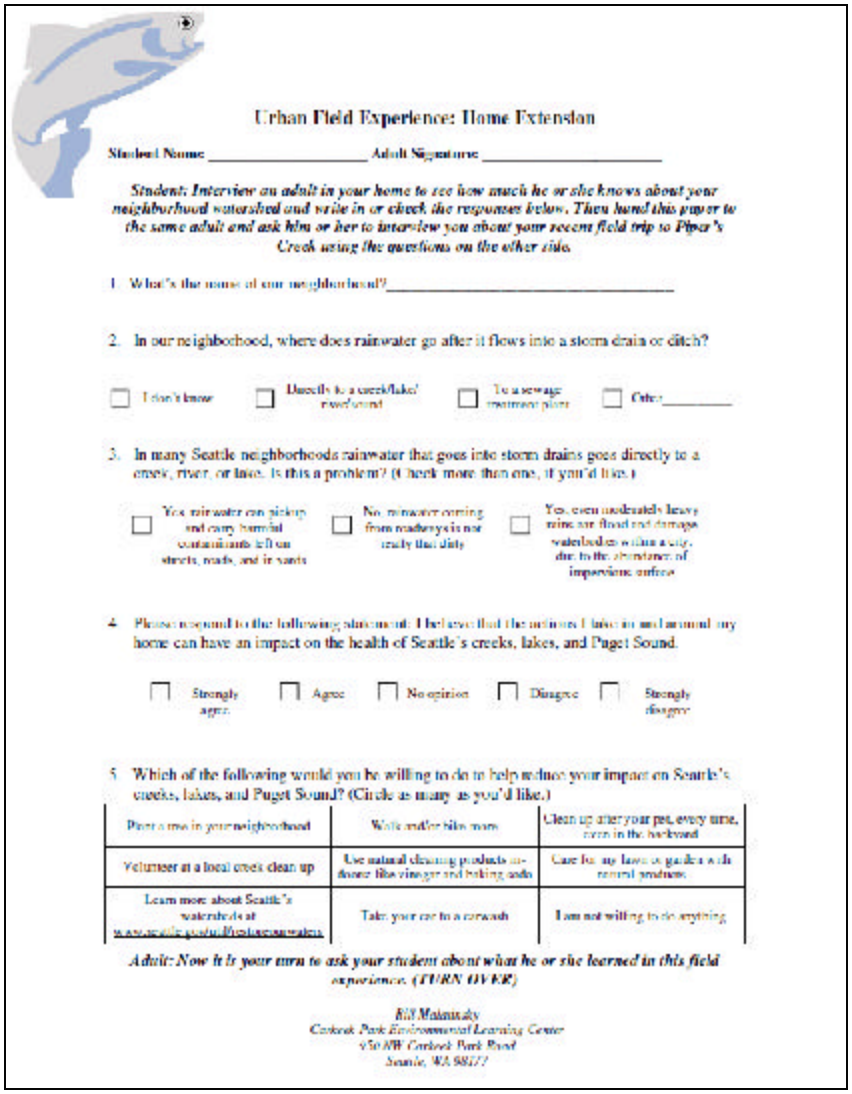
CP= Carkeek Park, Piper's Creek; CL = Camp Long, Longfellow Creek

*Free and reduced Lunch Percentages from Seattle Public Schools published demographic data

Appendix 1b: Results from before and after survey of teachers

		Question 1: Students make connections between curriculum and actual issues facing Seattle's waterways		Question 2: Students understand the impacts of stormwater on the health of Seattle's local waterways		Question 3: Students understand impervious surfaces and how they affect watershed health		
Schl	**Prog**	**Before**	**After**	**Before**	**After**	**Before**	**After**	
Lafayette	L/W	4	5	4	5	4	5	Unit 12 - Infusion
Lafayette	L/W	3	4	1	4	2	4	Complete or very near
McGilvra	L/W	2	4	2	3	2	4	#13 Steep Slope
Northgate	L/W	1	3	1	2	1	2	Skipped from rushing river to dam
TOPS	L/W	3	2	2	2	1	2	Final Lesson w/ grass
W. Seattle	L/W	3	4	3	4	1	2	#4 Basic Stream
John Muir	L/W	1	3	1	3	2	3	All the way
Adams	L/W	3	4	2	4	1	3	Land and Water #15
Lafayette	SIW	3	5	2	5	3	5	N/A
Christ the King	SIW	3	4	4	4	1	3	Land Water spring '09
Comm. Schl.	SIW	3	2	2	4	1	4	N/A
St. Alphonsus	SIW	4	5	3	5	4	4	N/A
St. Anne's	SIW	3	5	1	5	2	6	N/A
Thurgood	SIW	1	5	3	5	1	5	N/A
W.Woodland	SIW	4	5	3	5	2	4	N/A
Whittier	SIW	4	5	3	4	3	4	N/A

Appendix 1c: Take home interview extension



Urban Field Experience: Home Extension

Student Name _____ Adult Signature _____

Student: Interview an adult in your home to see how much he or she knows about your neighborhood watershed and write in or check the responses below. Then hand this paper to the same adult and ask him or her to interview you about your recent field trip to Piper's Creek using the questions on the other side.

1. What's the name of our neighborhood? _____

2. In our neighborhood, where does rainwater go after it flows into a storm drain or ditch?

☐ I don't know ☐ Directly to a creek/lake/ river/sound ☐ To a sewage treatment plant ☐ Other: _____

3. In many Seattle neighborhoods rainwater that goes into storm drains goes directly to a creek, river, or lake. Is this a problem? (Check more than one, if you'd like.)

☐ Yes, rainwater can pick up and carry harmful contaminants left on streets, roads, and in yards ☐ No, rainwater coming from roadways is not really that dirty ☐ Yes, even moderately heavy rains can flood and damage waterbodies within a city, due to the abundance of impervious surfaces

4. Please respond to the following statement: I believe that the actions I take in and around my home can have an impact on the health of Seattle's creeks, lakes, and Puget Sound.

☐ Strongly agree ☐ Agree ☐ No opinion ☐ Disagree ☐ Strongly disagree

5. Which of the following would you be willing to do to help reduce your impact on Seattle's creeks, lakes, and Puget Sound? (Circle as many as you'd like.)

Plant a tree in your neighborhood	Walk and/or bike more	Clean up after your pet, every time, even in the backyard
Volunteer at a local creek clean up	Use natural cleaning products at home like vinegar and baking soda	Care for my lawn or garden with natural products
Learn more about Seattle's watersheds at www.seattle.gov/util/EnvironmentConservation	Take your car to a car wash	I am not willing to do anything

Adult: Now it is your turn to ask your student about what he or she learned in this field experience. (TURN OVER)

Bill Malmquist
Carkeek Park Environmental Learning Center
950 NW Carkeek Park Road
Seattle, WA 98177

Adult: At Piper's Creek, students participated in a watershed game, a mapping activity or salmon scavenger hunt, and other field-based learning. Please fill in your student's responses to the following questions on this side of the sheet and then have them return it to their teacher the next day with your signature.

1. What is a watershed?

☐ A shed in which water is stored for a home ☐ Another name for an elephant's trunk ☐ Land area from which water drains to a particular waterbody

2. What are impervious surfaces?

☐ Soft surfaces like forest floors or meadows—that water can pass easily through ☐ Hard surfaces like roof tops, roads, or parking lots—that water cannot pass easily through ☐ Surfaces either hard or soft that dogs use as secret hiding places when burying their treats and bones

3. In a watershed, which of the following can harm the health of the water, and surrounding habitat, that the fish, insects, and mammals call home?

☐ Impervious surfaces ☐ A large forest ☐ A diversity of animal life

4. Please explain your answer to Question #3.

5. Now it's time to consider what you will do differently as a result of your experience at Carkeek Park learning about watersheds and salmon. In the table below, please circle the actions you pledge to take (from now on) in order to reduce your impact on the watershed you live in.

Thank you for your time…!

Plant a tree in your neighborhood	Take the bus, walk or bike more	Clean up after my pet, every time, even in the backyard
Volunteer at a local creek clean-up	Plant a tree at my school	Learn more about watersheds
Pick up litter	Stencil a storm drain	Tell a friend about watersheds!

Thank you for your time…!

Seattle Public Utilities RESTORE OUR WATERS