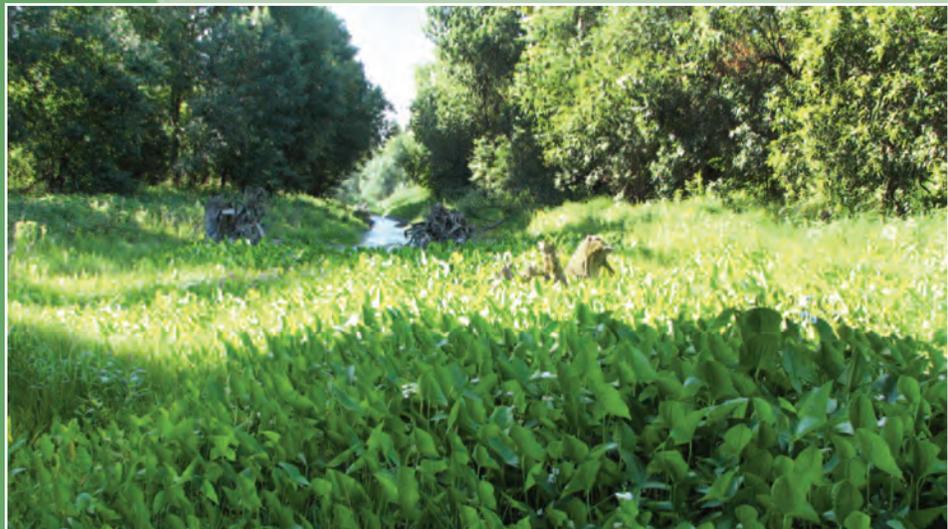


The State of the Columbia Slough

2010 Annual Report

Columbia Slough Sediment Project



January 2011



ENVIRONMENTAL SERVICES
CITY OF PORTLAND
working for clean rivers

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Columbia Slough Sediment Program

2010 Annual Report

1. Columbia Slough Sediment Program Background

Since 1993, the City of Portland, Bureau of Environmental Services (BES) and the Oregon Department of Environmental Quality (DEQ) have studied the Columbia Slough Watershed and have implemented actions to improve sediment quality. Early studies and subsequent follow-up investigations indicate widespread, low-level contamination throughout the Slough's sediments with a few isolated areas of higher contamination. Sources of contamination include contaminated sites, legacy pollutants, illegal dumping and illicit discharges, and stormwater runoff from roads and residential, commercial, industrial, and agricultural land uses. Capping and dredging actions alone are not feasible for reducing risks associated with this widespread contamination because the Slough is shallow (limits ability to cap sediments) and the contamination is ubiquitous (dredged areas are susceptible to recontamination).

An initial broad-scale sampling event was conducted in 1994/1995, the results of which were documented in the *Columbia Slough Sediment Project Screening Level Risk Assessment Report* (SLRA). Several smaller studies have been completed in the interim and provided the foundation for development of the remedial approach. A *Columbia Slough Sediment Feasibility Study* was completed in 2004.

DEQ and the City devised a cleanup approach for the Columbia Slough which was documented in a Record of Decision (ROD) issued in July 2005. The approach consists of three primary elements:

1. Source control – Implementing actions that address the sources of contamination to reduce contaminant inputs. Addressing the sources of contamination is important because it will prevent recontamination of remediated sediments and allow natural recovery processes to effectively reduce existing contamination in the Slough
2. “Hot spot” cleanup – Dredging sediments that are contaminated at levels that exceed the general pervasive level of contamination throughout the Slough
3. Long-term monitoring – Evaluate the effectiveness of the actions taken and identify areas where more focused attention is necessary

Implementation of the ROD was officially initiated in 2006; however, many aspects of the remedial approach were already in progress. These actions were pulled into the framework established in the ROD.

In 2006, BES and DEQ signed an Intergovernmental Agreement (IGA) forming a partnership to jointly implement the remedial approach for sediment contamination in the Columbia Slough. The IGA establishes a workplan for both BES and DEQ to reduce releases of contaminants to the Slough and conduct long-term monitoring of various parameters to assess progress. The 2006 IGA expired in June 2010. In September 2010, the IGA was extended to June 2015 and the

associated Scope of Work was updated to reflect program goals and to build upon work performed over the previous five years. The ultimate goal of the ROD and IGA is to reduce contaminant levels in the Slough sediment to concentrations that are protective of human health and the environment.

Two primary documents have been developed that describe implementation of the tasks specified in the ROD:

- **Watershed Action Plan (WAP):** Finalized in 2006. Describes the actions that will be implemented throughout the watershed to reduce contaminant inputs to the Slough. The WAP identifies priority areas where source control and sediment cleanup efforts are expected to provide the most value in terms of reaching environmental objectives and includes work plans and schedules for each area (watershed approach).
- **Long-Term Monitoring Plan (LTMP):** Finalized in 2007. Describes, for each media of concern, the long-term monitoring that is being conducted to measure progress and allow for re-evaluating our approach (adaptive management).

These and many of the other documents referenced in this report are available on-line at either the BES or DEQ web site:

<http://www.portlandonline.com/bes>
<http://www.deq.state.or.us/wmc/cu/NWR/ColumbiaSlough/index.htm>.

Watershed Action Plan

While general source control measures will continue to be implemented throughout the watershed, the WAP includes a prioritization of Target Areas within the Slough Watershed so that comprehensive source control can be implemented sequentially beginning with the areas of greatest concern to Slough sediment. Target Areas have been identified based on sediment contamination levels and total suspended solids (TSS) load resulting from stormwater discharge.

Source control actions and priorities described in the WAP include:

- Conducting in-depth investigations to identify and control sources of contamination and recommend remedial actions and future monitoring.
- Constructing water quality facilities, such as swales, planters, rain gardens, and eco-roofs to treat stormwater before it is discharged to the Slough.
- Ensuring best management practices (BMPs) at private businesses and industries are implemented to reduce input from widespread sources of contamination.
- Providing technical assistance to businesses that use or manage hazardous substances to help them reduce contaminant input to stormwater runoff.
- Educating students and adults who live and/or work in the Slough Watershed.
- Increasing vegetation in drainage areas to increase soil stability, stormwater absorption, and stormwater infiltration.

The WAP is currently being revised and updated to reflect new data and information, progress made to date, current program priorities, and additional source investigation and control measures. Experience gained over the past 5 years of implementation has led to discussions regarding consolidation of previously identified Target Areas and, in one case, a reassessment of objectives. The updated 2010 IGA places particular focus on the following regions and associated Target Areas:

Lower Slough

The St Johns Landfill and the I-5 to MLK Target Areas drain to the Lower Slough. The Lower Slough extends from the Peninsula Drainage Canal (approximately NE 17th Avenue) to the confluence with the Willamette River at Kelley Point Park. Some of the highest contaminant concentrations have been found in sediment in the Lower Slough and several outfalls contribute large quantities of TSS in this section of the Slough.

The City of Portland contracted with Oregon Department of Fish and Wildlife (ODFW) to conduct fish sampling in the Lower Columbia Slough. The sampling effort consisted of sample sites from the mouth to the upstream extent of the Lower Slough during spring, summer, fall, and winter 2008-2009. The report, which was finalized in September 2009, confirmed use of the entire Lower Slough by juvenile Chinook salmon and coho salmon.

St Johns Landfill Target Area

The St. Johns Landfill Target Area is at the western end of the watershed, near the Rivergate Industrial District. This Target Area drains approximately 232 acres of land. The City's stormwater system in this Target Area includes 2 outfalls which provide drainage for approximately 189 acres of public and private land. Drainage from approximately 43 acres of private property in this Target Area is provided through 1 private outfall.

I-5 to MLK Target Area

The I-5 to MLK Target Area extends along I-5 south to NE Alberta Street, west to N Chautauqua Place, east to NE Martin Luther King Jr. Boulevard, and north to Marine Drive. This Target Area drains approximately 916 acres of land. The City's stormwater system in this Target Area includes 16 outfalls which provide drainage for approximately 744 acres of public and private land. Drainage from approximately 172 acres of private property in this Target Area is provided through 42 private outfalls.

Significant progress has been made in assessing both these areas. Based on the data and information gathered during these assessments, along with private party investigation in the Lower Slough, DEQ and BES may consolidate the two priority areas and expand this focus area to encompass the entire Lower Slough.

Buffalo Slough

The Buffalo Slough is a one-mile side-channel of the Columbia Slough, located south of the main channel between NE 21st and NE 42nd avenues. This channel is a priority because of the quantity of TSS and potentially elevated levels of contamination.

Buffalo Slough Target Area

The Buffalo Slough Target Area drains approximately 110 acres between NE 33rd and NE 42nd avenues. The City's stormwater system in this Target Area includes 6 outfalls which provide drainage for approximately 38 acres of public and private land. Drainage from approximately 72 acres of private property in this Target Area is provided through 18 private outfalls.

Re-evaluation of contaminant levels in Buffalo Slough sediment suggests that associated risk may not be as high as initially thought. This area will remain a Target Area until existing data can be assessed to determine whether a minimal amount of additional data is needed to demonstrate that existing source control measures are sufficient and natural recovery processes (deposition and degradation) in the sediment should result in achievement of protective concentrations.

Whitaker Slough

The Cully Neighborhood and Marx-Whitaker Target Areas drain to Whitaker Slough, a five mile side-channel that runs parallel and south of the main Slough channel, connecting to the main channel just west of NE 47th Avenue and ending near NE Whitaker Way. The original WAP (2006) identified elevated levels of TSS in stormwater discharging from the Cully neighborhood and pesticides in Marx-Whitaker subbasin sediment.

Cully Neighborhood Target Area

The Cully Neighborhood Target Area is approximately delineated on the south by NE Emerson Street, on the west by NE 45th Avenue, on the east by NE Alderwood Road, and on the north by the main Slough channel. This Target Area drains 288 acres of land. The City's stormwater system in this Target Area includes 5 outfalls which provide drainage for approximately 86 acres of public and private land. Drainage from approximately 202 acres of private property in this Target Area is provided through 35 private outfalls.

Marx-Whitaker Target Area

The Marx-Whitaker Target Area includes the stretch of the Whitaker Slough between NE 109th and NE 122nd Avenues. This Target Area drains approximately 495 acres of land. The City's stormwater system in this Target Area includes 14 outfalls which provide drainage for approximately 416 acres of public and private land. Drainage from approximately 79 acres of private property in this Target Area is provided through 26 private outfalls. A source control investigation conducted by the City of Portland in 1997 determined that significant erosion from two small farms (41.4 acres) in the Target Area has been conveyed to the Slough via the City's stormwater system. Follow-up investigations (*Stormwater and Storm-sewer Sediment Report for the Marx-Whitaker Sub-basin of Whitaker Slough*, Ecology & Environment, 1999) have consistently determined that the

primary source of elevated pesticides in Marx-Whitaker were erosion and soil runoff from the agricultural properties

Significant progress has been made in assessing these two Target Areas. Based on the data and information gathered during these assessments, and data collected as part of clean-up site investigations, DEQ and BES may expand this focus area to encompass the entire Whitaker Slough.

2. Actions Accomplished

2.1 Target Areas

Lower Slough

Source Control

BES completed an in-depth evaluation of stormwater discharges to the Slough. The evaluation included properties that discharge to the Slough via City-owned outfalls (60 – 65) and properties that drain directly to the Slough via private outfalls. Inspections were conducted at all properties with industrial stormwater permits as were other sites that were determined to pose some level of risk for stormwater discharges. Technical assistance was provided at these sites and stormwater pollution control plans were reviewed for adequacy.

Stormwater Management

During the winter of 2009, BES and GreenWorks conducted a detailed assessment of stormwater retrofit opportunities in the St Johns Landfill and I-5 to MLK Target Areas. The assessment identified nearly 100 locations for stormwater facilities in these Target Areas. For more detail on this assessment refer to section 2.3 of this report.

BES initiated a partnership with the Oregon Department of Transportation (ODOT) to assess and prioritize stormwater management facilities designed to treat stormwater runoff from ODOT rights-of-way (I-5) that drain to the Lower Slough.

Sediment Sampling

DEQ collected 3 incremental, 22 composite, and 12 bioassay sediment samples from the segment of the Slough between City Outfalls 59 and 65 in September 2009. This sampling was conducted using money obtained from liability settlements with parties potentially responsible for release of contaminants to this section of the Slough. The analytical data was evaluated and a report will be finalized in fiscal year 2011. This data will lay the foundation for determining needed sediment cleanup in the Lower Slough.

Cleanup Sites

DEQ has identified 30 cleanup sites in the Lower Slough (for more detail refer to section 2.6 in this report). At most sites, the initial phases of investigation on the upland portions of the properties have been conducted. Nine parties have settled their liability for sediment contamination with DEQ by paying into DEQ's cleanup account. Liability release requires that these parties complete upland source control measures necessary to ensure that sediment will not be recontaminated once it is remediated. Source control has been completed at three of these sites and is expected to be completed at three more by next summer.



DEQ collecting sediment samples near the Blasen site

Buffalo Slough

Source Control

BES continued to administer the NPDES industrial stormwater permits throughout this Target Area, which involved conducting inspections of the facilities and evaluating stormwater controls for effectiveness.

DEQ is reviewing available data to determine if source control is complete and whether active sediment remediation is warranted. BES reviewed current data and sources on Buffalo Slough to evaluate the need for additional actions.

Stormwater Management

During the winter of 2009, BES and GreenWorks conducted a detailed assessment of stormwater retrofit opportunities in the Buffalo Slough Target Area. The assessment identified 11 potential stormwater facilities in the Buffalo Slough Target Area. For more detail on this assessment refer to section 2.3 of this report.

Sediment Sampling

No sediment sampling was conducted in Buffalo Slough this year.

Cleanup Sites

DEQ has identified six facilities in the Buffalo Slough drainage that may have contributed contaminants to the sediment. Further action on these sites is on hold pending evaluation of the priority of sediment cleanup needed in the Buffalo Slough.

Whitaker Slough

Source Control

BES continued to administer the NPDES industrial stormwater permits throughout this Target Area, which involved conducting inspections of the facilities and evaluating stormwater controls for effectiveness. BES began a preliminary search of additional sources that may discharge pollutants through City outfalls located in this Target Area.

Portland Parks and Recreation (PP&R) maintained the cover crop planted on 15 acres of land at NE 122nd and NE Shaver in 2007. This land was farmed for many years; erosion from this property previously contributed significant quantities of sediment to Marx-Whitaker Slough via City Outfall 104b. The cover crop significantly reduced erosion from this PP&R property.

Stormwater monitoring in Marx-Whitaker Slough was conducted during spring 2009, and the final report is in progress. The monitoring consisted of collecting grab samples from three outfalls that drain actively farmed properties during two storm events. The outfalls from the farms discharge to the City stormwater system and subsequently to the Whitaker Slough via City Outfall 104B. In general, sample results indicated that total suspended solids concentrations in stormwater from the farms were elevated. These results were provided to DEQ and ODA. The City will work with these agencies to implement additional source control actions at these sites.

Stormwater Management

During the winter of 2009, BES and GreenWorks conducted a detailed assessment of stormwater retrofit opportunities in the Cully Neighborhood Target Area. The assessment identified 27 potential stormwater facilities in the Cully Neighborhood Target Area. For more detail on this assessment refer to section 2.3 of this report. A similar assessment, in which 187 potential stormwater facilities were identified, was conducted in the Marx-Whitaker Target Area in fiscal year 2008 by BES and David Evans & Associates.

BES initiated a partnership with ODOT to assess and prioritize stormwater management facilities designed to treat stormwater runoff from ODOT rights-of-way (I-205, Hwy 30) that drain to Whitaker Slough.

Sediment Sampling

DEQ has settled with two parties in the Whitaker Slough and is using these funds to plan sediment sampling in the portion of the Slough between I-205 and its mouth. A similar strategy of incremental samples, discrete samples focused on potential sources, and bioassay samples will be applied here as was used in the Lower Slough segment. DEQ plans to implement this plan in 2011.



Whitaker Slough

Cleanup Sites

DEQ is actively overseeing seven cleanup projects in the Whitaker Slough including some in the vicinity of Johnson Lake which is connected to Whitaker Slough.

Source control including contaminated soil removal and construction of a bioswale was completed at the Owens Brockway facility on Johnson Lake. A sediment remedy for Johnson Lake is scheduled for 2011.

2.2 Source Control

BES administers General NPDES Stormwater and Non-stormwater Discharge permits throughout the Slough Watershed. Administration of these permits involves inspecting industrial sites, reviewing stormwater pollution control plans, and assessing BMP implementation at sites where industrial activities are exposed to rainfall; or the industry has industrial process water that discharges to the Slough. Additionally, BES implements a Maintenance Inspection Program for every private stormwater management facility that is installed per the City's Storm Water Management Manual. The program ensures that operations and maintenance requirements for these facilities are followed in a manner that is protective of water quality. BES also requires source control measures for new development during the permitting process and continues to implement the Illicit Discharge Elimination Program.

NPDES Stormwater Discharge Permits

DEQ issues NPDES permits to businesses and industries in the Slough watershed. BES works as an agent for DEQ under a Memorandum of Agreement to administer the 1200-COLS permits for those facilities within the City of Portland. DEQ oversees the other general and individual permits as well as the 1200-COLS permits issued to the Portland International Airport, Oregon Air National Guard, the St. Johns Landfill, the City's leaf compost facility and wastewater treatment plant, and facilities outside the City. There are currently 147 general NPDES permits within the Columbia Slough watershed:

1200-COLS	Industrial storm water discharging to the Slough	95
GEN01	Industrial wastewater discharges	3
GEN02	Industrial wastewater discharges	3
GEN03	Industrial wastewater discharges	3
GEN09	Industrial wastewater discharges	6
1200-A	Stormwater permit for gravel mining	2
1700-A	Wash water	2
1200-C	Construction storm water	17
1200-Z	Industrial stormwater	16

The COLS permit is unique to the Slough and has benchmarks, not limits, for stormwater discharges. Benchmarks are guideline concentrations designed to assist the permittee in determining whether their Stormwater Pollution Control Plan is reducing pollutant concentrations. DEQ does not take direct enforcement action on benchmarks. Instead, permittees are required to submit Action Plans which report the investigation of causes or

conditions contributing to elevated pollutant concentrations and also report the changes to existing controls conducted to address the benchmark exceedance. The Action Plan is to include an evaluation of whether or not the Stormwater Pollution Control Plan was implemented properly.

The current COLS permit, which will expire August 31, 2011, states that DEQ will revoke a facility's coverage under the general permit and require application for an individual permit if benchmarks are exceeded by the geometric mean of pollutant concentrations from the four most recent stormwater samples collected prior to June 30th of the 4th year of permit coverage. However, an alternative response to exceedances is under consideration. DEQ is evaluating requiring facilities, whose geometric mean exceeds benchmarks, to undergo a corrective action response involving an assessment of best management practices conducted by a professional engineer or a certified engineering geologist. The most appropriate BMP would be implemented within two years of coverage under the new permit.

This geometric mean evaluation and potential corrective action response would be part of the new permit application process. Those facilities without a geometric mean exceedance of benchmarks would be expected to conduct another evaluation of the geometric mean following the second year of coverage under the new permit. The pollutants undergoing this geometric mean evaluation would include those identified as 303(d) impairment pollutants for the Columbia Slough. The geometric mean of impairment pollutant concentrations would be compared against the pollutants' aquatic life criteria. The second year geometric mean exceedances would be subject to the same corrective action response. City oversight of stormwater discharges to the Columbia Slough included the following activities over the past fiscal year extending from July 1, 2009 to June 30, 2010:

- A total of 149 facilities that discharge stormwater to the MS4 were inspected. Of these, 82 were permitted and 67 were non-permitted facilities
- A total of 102 facilities that do not discharge to the MS4 were inspected. Of these, 58 facilities were issued stormwater permits and 44 were not.

NPDES Non-stormwater Permits

There are currently six individual NPDES permits that regulate non-stormwater discharges on the Columbia Slough: Lucky Farm (formerly Oregon Fresh Farm), Arclin (formerly Dynea Overlays), Portland Meadows, Portland Water Bureau Groundwater Pump Station, and two Port of Portland permits for the Airport – one for construction dewatering and one for deicing and anti-icing activities. The Port and DEQ signed a Mutual Agreement and Order which sets out a schedule for the Port to build additional infrastructure to manage the deicing and anti-icing discharge. A Columbia River outfall was completed in February 2010 which diverts some of the treated discharge directly to the Columbia River rather than the Columbia Slough. The new treatment plant for deicing and anti-icing material reached 50% construction completion in November 2010.

Hazardous Waste Technical Assistance

No technical assistance outreach efforts were conducted in the Slough watershed over the calendar past year.

Maintenance

The City of Portland Office of Transportation, Maintenance Operations (O&M) maintained the City's public stormwater infrastructure to prevent contaminated sediment from reaching the Slough. The following activities took place between July 1, 2009 and June 20, 2010:

- 36 inlets were inspected and 679 were cleaned in the Slough Watershed.
- 85 linear feet of culverts were cleaned and 487 feet of ditches were cleaned in the Slough Watershed.
- 136 public stormwater management facilities in the Slough Watershed were inspected twice. Of these, 7 were cleaned.
- 15 inlets and 22 inlet leads (1,077 linear feet) in the Slough Watershed were repaired or constructed (inlet leads are the pipe segments from the inlet to the manhole).

O&M swept streets to remove debris and reduce the amount of TSS in runoff. Major arterials were swept at least six times a year. In fiscal year 2010, 687 miles of streets that drain to the City's stormwater system were swept in the Columbia Slough Watershed, keeping 344 cubic yards of debris from entering the waterway.

Maintenance Inspection Program

The City has a Maintenance Inspection Program (MIP) to ensure that stormwater management facilities constructed on private property are operated and maintained in accordance with City requirements. The facilities are built as part of new development requirements under the City's Stormwater Management Manual. All sites are inspected at least once per five year cycle for industrial, commercial, and multi-family properties.

According to the MIP there were 69 new private stormwater management facilities planned for construction in the Slough Watershed in fiscal year 2010. Each application requires an O&M agreement, implemented by the owner, with oversight and technical assistance provided by BES. The facilities constructed include sedimentation manholes, soakage trenches, dry wells, swales, and infiltration and flow-through planters. A total of 347 private stormwater facilities were inspected in the Columbia Slough Watershed fiscal year 2010.

Spill Response and Illegal Connections

The BES Spill Response Hotline continued to operate 24-hours per day. The hotline receives calls regarding City-wide pollution complaints, spills, sanitary sewer overflows, dye tests, and seepage discharges.

BES and the Portland Water Bureau continued to implement Columbia South Shore Well Field Protection Area signage. The signs list the BES spill response hotline number and reads: "TO REPORT SPILLS CALL (503) 823-7180."

The BES Industrial Stormwater Management Program continued the City-wide outfall inspection program, which identifies illicit discharges to City outfalls. Illicit discharges were identified and corrected throughout the Slough Watershed.

Construction Permits (Erosion Control)

There were 1,129 active private construction permits subject to erosion control inspection in the Slough Watershed. These construction sites are required to maintain proper erosion control to prevent TSS from reaching the Slough. A total of 975 erosion control related inspections were conducted on private sites in the Columbia Slough Watershed. In addition, the City maintains a 24-hour erosion control response hotline.

2.3 Stormwater Management

The following accomplishments occurred during fiscal year 2010 (July 1, 2009 to June 30, 2010)

Target Area Stormwater Retrofit Opportunities Assessment

During the winter of 2009, BES and GreenWorks conducted a detailed assessment of stormwater retrofit opportunities in the St. John's Landfill, I-5 to MLK, Buffalo Slough, and Cully Target Areas. The results of the inventory were captured in a tech memo, map, and spreadsheet in which facility performance, construction feasibility, and cost information about each potential facility were ranked and prioritized. Approximately 138 potential stormwater facility locations were identified in this assessment. This data will be used to develop a predesign plan for stormwater facilities in the watershed. The goal of this project is to treat stormwater runoff from City-owned public rights-of-way.

NE 122nd Avenue Stormwater Facilities (Marx-Whitaker Target Area)

Ninety percent designs were in the process of being drafted for eight stormwater facilities designed to receive runoff from 2 acres of impervious roadway along NE 122nd Avenue between NE Fremont and NE Shaver. This area drains to Outfall 100, which flows into Whitaker Slough just west of NE 122nd Avenue, and is a priority outfall for the Columbia Slough Watershed. When complete the facilities will remove sediment and pollutants from stormwater runoff before it enters the Slough.

NE Fremont Greenstreet Facilities

Ninety percent designs were in the process of being drafted for sixteen stormwater facilities designed to receive stormwater runoff from NE Fremont, NE 156th, NE 157th, and NE 158th Avenues. This area drains to City Outfall ABA410 which flows into Wilkes Creek, a tributary to the Slough, at NE 155th & Fremont. When complete the facilities will remove sediment and pollutants from stormwater runoff before it enters the Slough.

Whitaker Ponds Rain Garden

BES supported the Columbia Slough Watershed Council in completing the design, installation, and maintenance of a new rain garden at Whitaker Ponds Natural Area. The rain garden is a visible demonstration of residential-scale stormwater retrofit options at a new education center. The rain garden manages approximately 1,200 square feet of roof runoff.

NE 33rd Drive Culvert Replacement (Buffalo Slough Target Area)

A project between BES and the Army Corps of Engineers to replace a culvert on Buffalo Slough under NE 33rd Drive entered the final design phase. The culvert will be replaced with a larger,

lower culvert for improved hydrology and water quality. As part of the project, a pair of stormwater planters will be built in the right-of-way to treat the stormwater runoff from approximately 0.4 acres of NE 33rd Drive, a high traffic freight corridor, which drains to Buffalo Slough via City Outfall 72.

NE 148th Water Quality Facility

BES distributed 90% plans for review for a stormwater management facility near NE 148th Avenue and Whitaker Way which will treat runoff from 180 acres of mixed land use (primarily residential).

Clean River Rewards

The Clean River Rewards Program allows Portland homeowners to receive a discount on their stormwater bill if they implement actions which will keep stormwater runoff on their property. During the year, education and outreach were conducted to encourage property owners to participate in the program. Participation in this program in fiscal year 2010 was high throughout the City.

2.4 Vegetation

Revegetation

The City planted more than 37,348 native trees and shrubs throughout the Columbia Slough Watershed during fiscal year 2010 and utilized four revegetation and tree planting programs:

- Through partnerships with businesses and other private landowners, the BES Watershed Revegetation Program plants native vegetation on both public and private properties. Funding comes from landowners, grants, and BES funds. A total of 21,543 trees and 15,805 shrubs were planted at revegetation sites in the Slough Watershed. The Watershed Revegetation Program has planted and currently manages 127 acres of habitat restoration sites and 8,076 linear feet of stream bank in the Slough Watershed.
- Through a contract with BES, Friends of Trees planted 1,218 trees primarily in tree-deficient areas of the Slough Watershed.
- BES supported SOLV's Team Up for Watershed Health program to engage the community in riparian area restoration. The program provided volunteer stream restoration projects during which, 315 native plants were planted and 1,050 pounds of invasive vegetation and 40 pounds of trash was removed from one site in the Slough Watershed.
- The City also partnered with ODOT and City of Portland utility ratepayers to maximize tree planting throughout the City, including City of Portland rights-of-way, ODOT rights-of-way, area schools, and private yards.

2.5 Education and Stewardship

Clean River Education Programs

Environmental Services' Clean Rivers Education program offers free classroom and field science programs to kindergarten to college-age students. Programs focus on watershed health, water quality, stormwater, riparian plants, wildlife, and related environmental issues. This fiscal year BES offered Clean Rivers Education programming to 25 schools/organizations in the Columbia Slough Watershed.

This educational programming included classroom programs, by which 1,484 students were served. The classroom programs sought to convey lessons such as:

- *Watershed Awareness.* Students learn about common non-point sources of pollution found in a watershed and how to prevent stormwater pollution.
- *Movin' on Up: Biomagnification and Bioaccumulation.* Students learn how pollutants trapped in sediments can build up in the fatty tissues of organisms, how they move through the food web, and ways to reduce health risks.
- *Soak it Up: Sustainable Stormwater.* Students calculate stormwater runoff and redesign a model neighborhood using sustainable stormwater facilities like ecoroofs, bioswales, and porous pavers.

In addition to the classroom programming, an additional 1,184 students were served by field science programs. Field programs offer watershed investigations and field assessments, such as how to measure water quality and conduct macroinvertebrate sampling as indicators of watershed health. Also included are stormwater tours, boat tours, and restoration experiences along streams and wetlands. This year's field programs included:

- *Restoration service projects:* 377 students. Students removed invasive species and planted native shrubs and trees at Whitaker Ponds and the Peninsula Crossing Trail.
- *Columbia Slough canoe trips:* 253 students. Classes that completed special classroom studies and a stewardship project were eligible for the canoe program. Tours focused on Slough history, how land use impacts waterways, combined sewer overflow history, stormwater pollution, and how personal actions can help prevent stormwater pollution.
- *Storm drain curb marker service project:* 85 students. This program is a community and school stewardship activity designed to increase awareness of stormwater pollution and help prevent the public from disposing household or lawn chemicals into the storm drain. Volunteers also distributed doorhangers containing stormwater pollution prevention messages and clean river tips to nearby residences.

Stewardship Activities and Community Events

BES provides outreach and education for adults in the Slough Watershed, including:

- *Watershed Council Community Events*
BES co-sponsored and participated in numerous community events, including Slough 101, Wetlands 101, Groundwater 101, Explorando El Columbia Slough, Canoe the Slough, Columbia Slough Small Craft Regatta, Aquifer Adventure, Corps of Rediscovery, two Soup on the Slough events, two watershed cycling events, a Great Blue Heron week event, three Wild in the City events, and five neighborhood association picnics or gatherings in which stormwater and the Columbia Slough fish advisory were topics of instruction. The City was also co-sponsor of the Columbia Slough Watershed Awards program. The total participation at these events was approximately 2,425 persons.
- *Eyes on the Slough Program*
BES participated in two training programs for 15 “Eyes on the Slough” volunteer monitors. The volunteers in this program paddle specific reaches of the Columbia Slough monthly and report on water quality and landscape conditions. Two oil spills were reported by Eyes on the Slough volunteers during the 2010 fiscal year.



2010 Corps of Rediscovery Crew

- *Corps of Rediscovery*
BES staff conducted the “Corps of Rediscovery” canoe tour of the Columbia Slough. This tour is targeted toward professionals and organizations that work on Slough-related issues. The educational/training tour started at the Multnomah County Drainage District Headquarters and ended at the Slough’s confluence with the Willamette River at Kelley Point Park. In all, 17 individuals made the canoe trip this year.

- *Stewardship Saturdays*
BES co-sponsored 10 Columbia Slough Watershed Council Stewardship Saturday events at 4 sites in the Slough Watershed. The events involved about 179 individual volunteers and 537 volunteer hours. Volunteers planted native trees and shrubs and removed invasive vegetation.
- *Community Watershed Stewardship Grants*
The BES Community Watershed Stewardship Program (CWSP) awards grants to community groups and citizens to improve the health of Portland watersheds. This year,

CWSP provided four stewardship grants, totaling \$26,179, to support watershed improvement projects in the Columbia Slough Watershed.

2010 Columbia Slough CWSP Grant Recipients:

Columbia Slough Watershed Council – Eyes on the Slough Program	\$4,607
Holy Redeemer Catholic School Stormwater Projects	\$10,000
Big Four Minority Youth Trail Building	\$4,439
Oregon Humane Society Naturescaping & Habitat Restoration	\$7,133

- *Columbia South Shore Ground Water Protection Outreach and Education*

The Portland Water Bureau administers the Columbia South Shore Well Field Wellhead Protection Program to protect the City’s secondary drinking water supply. The well field is located in the Columbia Slough Watershed. The Wellhead Protection Program also protects Slough sediments from spills, illegal dumping, and other actions that may contribute contaminants to the Slough. The Water Bureau completed the seventh year of its education and outreach program for affected residents and businesses to help them comply with requirements of the Columbia South Shore Well Field Wellhead Protection Program.



In partnership with the Columbia Slough Watershed Council, the Water Bureau conducted seven free public events: Subs on the Slough, Aquifer Adventure, Groundwater 101, Slough 101, Wetlands 101, Cycle the Well Field and Explorando, reaching over 945 people. A program called Slough School delivered groundwater specific curriculum to 213 students and a groundwater overview as part of the “What is a Watershed” lesson to 915 students.

- *Columbia Corridor Association*

Through a partnership with the Columbia Corridor Association, technical assistance was provided to 27 businesses as well as spill prevention equipment to three businesses. The Water Bureau sponsored a business workshop on the Reference Manual update with 30 participants. The Water Bureau conducted additional outreach to the business community via web, e-mail, publications, and local media.

2.6 Site Cleanup Actions

DEQ is continuing to oversee investigation and cleanup work at over 30 sites in the Columbia Slough Watershed. Highlights of calendar year 2010 private party cleanup actions include the following:

Cleanup Agreements Signed

- A source control evaluation agreement was signed for the NW Cast site at 9233 N Calvert Avenue.

Investigations Completed

- A draft remedial investigation/risk assessment report for the St. Johns Landfill was submitted to DEQ for review.
- Sampling was conducted in the slough between Johnson Lake and Whitaker Slough to help evaluate mitigation options the lake remedy.

Source Control Actions in Progress

- Blasen site located at 1601 N. Columbia Boulevard.
- Upland and bank cleanup was initiated at the Pacific Meat site located at 2701 N Newark Street.
- Upland source control remedy is pending at the Wastech site located at 701 Hunt Street.

Cleanup Action Selected

- A Feasibility Study was completed and remedial action proposed for the Fuel Processors Inc. site located at 4150 N Suttle Road.
- Upland source control remedy was selected at the Precision Equipment site located at 8440 N Kerby Avenue.
- Upland stormwater source control remedy selected for the Portland Willamette site located at 6800 NE 59th Avenue.



Sediment sampling at Portland Willamette

Upland Cleanup Completed

- Surface soil cleanup completed at the Carco site located at 900 N Columbia Boulevard.
- Metal-contaminated soil was removed at the Macadam Aluminum and Bronze site just west of I-5 and the storm drain system was cleaned and replaced.

Delisted

- Monitoring at the ICN Pharmaceuticals site located at 6060 NE 112th Avenue was completed and the site was removed from DEQ's confirmed release list and inventory.

2.7 Long-term Monitoring

The Columbia Slough Watershed Long-Term Monitoring Plan (LTMP) describes monitoring that BES will conduct in the Slough Watershed over the next ten years and more. This is a dynamic plan, and as technology and monitoring approaches change, the LTMP will also be changed to reflect those changes. The following highlights fiscal year 2010 Columbia Slough long-term monitoring efforts.

Sediment Monitoring

Sediment sampling was conducted by the City in 2006. A report documenting this sampling event is available on the City web page. Data from this sampling event is being combined with data collected in the DEQ sampling, private party cleanup site sampling, MCDD sampling for channel maintenance, and ODOT sampling for bridge construction into a Slough sediment data base that will be used to determine data gaps and plan remedial measures.

Water Quality Monitoring

Water quality samples were taken at nine sites throughout the Columbia Slough. Continuous, 15-minute, samples were taken for temperature, pH, conductivity and dissolved oxygen. Grab samples were taken bi-monthly and analyzed for the following analytes/parameters:

- Chlorophyll a
- BOD-5
- Conductivity (specific)
- Copper (total and dissolved)
- Flow Direction and velocity
- Dissolved oxygen
- E. coli
- Hardness (total)
- Lead (total and dissolved)
- Mercury
- Nickel (total and dissolved)
- Nitrogen (ammonia, nitrate and total Kjeldah)
- pH
- Phosphorus (total and ortho phosphate)
- Secchi disc
- Temperature
- Total suspended solids
- Zinc (total and dissolved)

Table 1 – Columbia Slough Water Quality Samples Sites

Sampling Site	Location	Continuous	Grab
GRF	Bridge roughly 500 ft east of Fairview Lake weir		X
AWB	NE Airport Way Bridge		X
158	NE 158 th Ave. Bridge	X	X
92B	NE 92 nd Ave. Bridge (main stem)	X	X
47S	NE 47 th Ave. Bridge (south arm)		X
21B	NE 21 st Ave Bridge (main stem)	X	X
VNB*	N Vancouver St Bridge	X	X
PED	Columbia Blvd Wastewater Treatment Plan Pedestrian Bridge		X
SJB	St. Johns Landfill Bridge		X

*VNB site is not currently being monitored. Multiprobe data was provided by Metro from the St John's landfill bridge as representative of conditions in the Lower Slough.

Table 2 Water Quality Results Summary

Analyte	Regulation	Results
BOD - 5	Maximum to meet DO = 6.5 mg/L: 16 mg/L Maximum to meet DO = 4.0 mg/L: 25 mg/L TMDL	Samples at all sites met the standard.
Chlorophyll a	15µg/L (3 months average of 3 samples) OAR-340-041-150(1)(b)	Many samples did not meet the standards. Chlorophyll a has been increasing in the lower Slough since 2003. Increases may be related to the change in sample collection method that occurred in July 2000, but this has not been verified.
Conductivity - specific	N/A	A preliminary investigation was conducted. The Willamette River has specific conductance close to 100 µS/cm; the Slough has specific conductance close to 200 µS/cm.
Copper	Chronic: 12 µg/L @ 100 mg/L hardness (hardness dependent) OAR 340-041 Table 20	Samples at all sites met the standard.
Copper, dissolved	N/A	Samples at all sites met the standard.
Dissolved oxygen	Absolute minimum: 4.0 mg/L 30-day mean minimum: 6.5 mg/L OAR 340-041-0016	Samples have shown major DO depressions during winter months. The low DO in winter may be due to de-icing agents used at the airport and discharged to the Slough. Upper Slough samples have shown DO depressions during summer months which may be due to the decomposition of algae and plants.
E. coli	406 MPN/100 mL OAR 340-041-0009	Only one sample did not meet the single sample standard, 5-sample geometric means met the 30-day mean for all sites sampled. Possible sources of E. coli include large avian populations in adjacent wetlands, pump stations, old cesspools/septic systems, and illicit discharge.
Hardness	N/A	Typically between 70-110 mg/L
Lead	Chronic: 3.2 µg/L @ 100mg/L hardness (hardness dependent) OAR 340-041 Table 20	Samples at all sites met the criteria though a few samples were only slightly below the fresh water chronic criterion
Lead, dissolved	1.2 µg/L TMDL	Samples at all sites met the standard.
Nitrogen - nitrate	OAR 340-041 Table 20	Samples at all sites met the standard for drinking water, however nitrogen is abundantly available for plants. In the upper Slough, results were higher in winter months. The lower Slough shows a downward trend.
Nitrogen – ammonia	pH and T dependent	Not yet investigated
Nitrogen - Kjeldahl	N/A	Not yet investigated
pH	6.5-8.5 S.U. OAR 340-041-0345 TMDL	Sites in the upper Slough have high pH during the spring and summer, likely due to eutrophication.
Phosphorus - ortho phosphate (dissolved)	0.1 mg/l for streams/rivers EPA 1986	Some sites in the middle and upper Slough did not meet the standard. Orthophosphates may accumulate because algal and macrophyte growth is limited due to turbidity, or due to algal decomposition and the subsequent release of orthophosphates back into the water column.
Phosphorus - total	0.1549 mg/L TMDL	Some total phosphorus samples did not meet the standard, primarily in August and September. Samples taken in the middle Slough met the standard more frequently.

Analyte	Regulation	Results
Temperature	7-day average maximum: 18°C OAR 340-041-0028	Most sites do not meet the 18 degree C standard for 7-day average of daily maximum temperature from June – August.
Total Suspended Solids(TSS)	25 mg/L based on NPDES 1200-COLS	A majority of samples collected met the standard. Exceedences were spread throughout the year and the Slough.
Zinc	Chronic: 110 µg/L @ 100mg/L hardness (hardness dependent) OAR 340-041 Table 20	Samples at all sites met the standard.
Zinc, dissolved	N/A	Samples at all sites met the standard.

Continuous water quality sampling will continue in FY2011 as in past years. However, monitoring from the nine fixed surface water quality monitoring sites (as described in Table 1) has been discontinued in favor of a status and trends monitoring program modeled after the EPA Environmental Monitoring & Assessment Program (EMAP). The Portland Area Watershed Monitoring and Assessment Program (PAWMAP) is described in section 3.6 and includes water quality monitoring, physical habitat surveys, and bio-monitoring.

3. Future Actions

Over the next five years DEQ and the City will focus on completing source control and cleanup measures needed in the Lower Slough, Whitaker Slough, and Buffalo Slough, such that the DEQ can provide Tier 1 No Further Action determinations; as described in the 2005 Record of Decision for Columbia Slough Sediment, this is the point at which sufficient action has been taken such that sediment concentrations can be expected to recover to protective levels through natural recovery mechanisms.

According to the *Voluntary Cleanup Program Columbia Slough Remedial Action Scope of Work Extension, July 2010 through June 2015*, the City will:

Watershed Action Plan

Update the Watershed Action Plan to reflect a revised priority action list, addressing stormwater management, contaminant loading, and priority areas for sediment characterization and remediation. A draft of the revised WAP is expected to be available in March 2011.

Long-term Monitoring Plan

Update the Long-term Monitoring Plan to include review of the adequacy of institutional controls; e.g., fish advisory signs. Planning for the next 10 year sediment and fish tissue monitoring events will be initiated.

Source Identification and Control Plan

Begin developing a prioritized, Slough-wide Source Investigation and Control Plan that identifies the actions and timelines needed to control the remaining significant pollutant sources (current sources and potential legacy sources).

Contaminant Loading Evaluation

Begin developing a contaminant loading evaluation in an effort to understand the effect that stormwater discharges have on sediment near stormwater outfalls and assess the adequacy of stormwater controls in the associated drainage basin.

Stormwater Treatment Predesign

Begin predesign for greenstreet facilities to treat stormwater from City-owned roadways.

Sediment Cleanout Pilot Program

Select one outfall basin or Target Area and develop a methodology and workplan to identify and sample accumulated sediment that may contain elevated levels of contaminants and evaluate the need and feasibility of removing accumulated sediment.

3.1 Target Areas

Lower Slough

- The source control evaluation report for City Outfalls 60 through 65 will be completed and action items identified.
- DEQ will finalize the report on the sediment sampling of the upper portion of the Lower Slough and identify next steps needed to define cleanup areas, identify remaining sources of concern, and complete necessary sediment cleanup actions.
- Metro will prepare a feasibility study for the St Johns Landfill.
- The City will continue to coordinate with ODOT to assess and prioritize stormwater management facilities designed to treat stormwater runoff from ODOT rights-of-way that drain to the Lower Slough.

Buffalo Slough

- DEQ and the City will evaluate data needs to determine if additional measures are needed in the Buffalo Slough.
- BES and the Army Corps of Engineers will continue to design the NE 33rd Drive culvert replacement project. The project will replace an underperforming culvert on Buffalo Slough under NE 33rd Drive. The project includes treatment of approximately 0.4 acres of runoff from NE 33rd Drive that would otherwise discharge to Buffalo Slough via City Outfall 72. The project will be constructed in fiscal year 2012.

Whitaker Slough

- DEQ will conduct sediment sampling in the portion of the Whitaker Slough between I-205 and the intersection with the main channel of the Columbia Slough.
- DEQ will work with MCDD and the City to characterize contamination issues in the Marx-Whitaker subbasin.
- Owens Brockway will implement the cleanup remedy for Johnson Lake.

- PP&R will continue to maintain the cover crop planted on 15 acres of previously farmed land at NE 122nd & Shaver. PP&R will move forward with their plan to develop a public park, Beech Park, at this site. Plans for Beech Park include stormwater swales which will reduce stormwater runoff and sediment from entering the City's storm sewer system.
- The City will continue to coordinate with ODOT to assess and prioritize stormwater management facilities designed to treat stormwater runoff from ODOT rights-of-way that drain to the Whitaker Slough.
- BES will continue to work with DEQ, the Oregon Department of Agriculture, and agricultural landowners to ensure that source control measures are implemented to decrease sediments discharged through City Outfall 104b.
- BES will construct eight stormwater facilities along NE 122nd, in the Marx-Whitaker Target Area during the spring and summer of 2011. The facilities will receive runoff from 2 acres of impervious roadway. This area drains to City Outfall 100, a priority outfall in the Slough Watershed.

3.2 Source Control

DEQ Site Discovery efforts will be coordinated with City source investigations for outfalls that appear to be sources of contamination in the Target Areas.

NPDES Stormwater Discharge Permits

BES will continue to inspect all permitted industries once per year, and conduct stormwater sampling as needed. BES will also continue inspecting non-permitted industries discharging to the MS4 and evaluating the need to permit these industries. BES will continue to locate and map non-City outfalls in the Columbia Slough and Willamette River Watersheds. DEQ will conclude evaluation of the proposed changes to the COLS permit discussed in Section 2.2 in time for the revision of the 1200-COLS which is to be adopted by August 31, 2011.

NPDES Non-stormwater Discharge Permits

Construction of the new treatment plant for deicing and anti-icing materials should reach 100% completion in April 2011 with full operations by April 2012.

The City will continue to implement NPDES Non-stormwater discharge permits that regulate discharges of industrial process water.

The permit for Lucky Farms will be discontinued as the land is scheduled to be developed as Columbia Biogas.

Hazardous Waste

DEQ is planning a technical assistance outreach to auto dismantlers for late 2011 and early 2012 which will include the wrecking facilities located along the Slough.

Maintenance

The City will evaluate the benefits of sampling and regular cleanout of City storm sewer lines to ensure that contaminated sediment is not accumulating in the lines and continuing to be a source of contaminants to the Slough. The City of Portland will continue street sweeping throughout the watershed. Stormwater facilities such as culverts, drainage ditches, water quality facilities will also be maintained. Debris will be cleaned out and any repairs to stormwater facilities will be made as needed.

Maintenance Inspection Program

The City will continue its Maintenance Inspection Program to ensure that stormwater management facilities constructed on private property are operated and maintained in accordance with City requirements.

Spill Response and Illegal Connections

BES will continue investigating and removing illicit discharges and connections to the storm sewer system as they are identified during IDEP, spill response, pretreatment, or stormwater permit inspection. BES will also continue the 24-hour complaint hotline for citizens to call when to report spills, sewage overflows, pollution, illegal dumping, etc.

Construction Permits (Erosion Control)

The City will continue to ensure the development activities do not result in erosion of soil into the Slough.

3.3 Stormwater Management

Target Area Stormwater Retrofit

Predesign/Design of innovative stormwater facilities in the each of the five Target Areas; St. Johns Landfill, I-5 to MLK, Buffalo Slough, Cully Neighborhood, and Marx-Whitaker , will commence in fiscal year 2011. This project is designed to treat stormwater runoff from City-owned public rights-of-way.

NE 122nd Avenue Stormwater Facilities (Marx-Whitaker Target Area)

Eight stormwater facilities will be constructed during the spring and summer of 2011. The facilities are designed to receive runoff from 2 acres of impervious roadway along NE 122nd Avenue between NE Fremont and NE Shaver. This area drains to Outfall 100, which flows into Whitaker Slough just west of NE 122nd Avenue, and is a priority outfall for the Columbia Slough Watershed. When complete the facilities will remove sediment and pollutants from stormwater runoff before it enters the Slough.

NE Fremont Greenstreet Facilities

Sixteen stormwater facilities will be constructed during the spring and summer of 2011. The facilities will receive runoff from NE Fremont between NE 156th and NE 158th Avenues. This area drains to City Outfall ABA410 which flows into Wilkes Creek, a tributary to the Slough, at NE 155th & Fremont.

NE 148th Water Quality Facility

BES will continue design for a stormwater management facility at NE 148th Avenue which will treat runoff from 180 acres of mixed land use (primarily residential). The design phase is expected to be completed in fiscal year 2012. Construction is scheduled for fiscal year 2014.

3.4 Vegetation

The BES Revegetation Team will continue to monitor and maintain restored lands within the Slough Watershed.

BES will contract with Friends of Trees to plant at least 585 trees along public rights-of-way and over impervious surfaces in tree deficient areas in the Slough Watershed.

BES will continue to support SOLV's Team Up for Watershed Health program.

3.5 Education and Stewardship

BES Education and Outreach

The BES educator will continue to deliver environmental science lessons to students in and near the Columbia Slough Watershed. Topics include: Watershed Awareness, Biomagnification and Bioaccumulation, Stormwater Storytelling, Riparian Plants/Riparian Restoration, Water Chemistry, Stream Bugs Tell it All, How We Can Help the Fish, and Stormwater Soak it Up. BES will lead field trips to sites in the Columbia Slough for watershed assessment and investigation and to foster a connection to local greenspaces and streams.

BES will lead tours of innovative stormwater facilities such as green streets, bioswales, stormwater planters, ecoroofs, and porous pavement throughout the watershed. BES will also lead boat tours of the Columbia Slough for student groups who have participated in Clean Rivers Education programs and who have completed a stewardship project.

BES will continue to offer Community Watershed Stewardship Program grants to community groups and citizens proposing to improve the health of Portland's watersheds.

BES will work with community partners and private landowners to remove invasive species along the Slough and vegetate riparian areas with native plants and trees.

Columbia South Shore Ground Water Protection Outreach and Education

During fiscal year 2011, the Water Bureau will continue providing technical assistance to regulated businesses and general outreach to the public under the Columbia South Shore Well Field Wellhead Protection Program with an emphasis on hazardous materials reduction.

3.6 Site Cleanup

Remedial Investigations will be completed at the following sites: Hoffman Property (9038 N. Denver Ave), Larson North property (10505 N. Portland Rd), NW Cast (9233 N Calvert Ave).

Source control evaluations will be completed at the following sites: Columbia Steel (10425 N Bloss Ave).

Source control action will be completed at the following sites: Pacific Meat (2701 N Neward St), Precision Equipment (844 N. Kerby Ave), Union Carbide (11020 N. Byrgard St), Wastech (701 Hunt St).

Cleanup evaluations will be completed at the following sites: Harbor Oil (Force Lake), Pacific Carbide and Alloys (9901 N. Hurst Ave), St Johns Landfill.

Cleanup actions will be completed at the following sites: Hanson Pipe and Products, Inc (755 N Columbia Blvd), Larson South property (10145 N Portland Rd), PC Development (955 N. Columbia Blvd), Johnson Lake.

3.7 Long-term Monitoring

Stormwater Monitoring

DEQ and the City plan to develop a contaminant loading model that will estimate the type and concentration of pollutants associated with stormwater runoff. The results of this study will be used to identify outfalls where source control measures appear to be warranted and to determine when adequate source control measures have been completed.

Sediment Sampling

No slough-wide sediment sampling is planned for the next year. In-line sediment sampling in the MS4 in the Marx-Whitaker and/or I-5 to MLK Target Areas may be conducted.

Water Quality

Continuous water quality monitoring of at least three Columbia Slough sites will continue as in past years, and a fourth site will be added again once the Vancouver Avenue bridge restoration is completed. Continuous monitoring measurements include temperature, pH, conductivity and dissolved oxygen.

A water quality report summarizing sample results over the past five years is under development by the City and will be submitted to DEQ in 2011.

The City of Portland is updating its watershed monitoring approach. The City's new surface water quality monitoring program, Portland Area Watershed Monitoring and Assessment Program (PAWMAP), incorporates the best available science and protocols developed by the national Environmental Monitoring and Assessment Program (EMAP). The PAWMAP program includes spatially-balanced random selection of stream survey sites. Elements to be monitored

address all four watershed health goals (hydrology, habitat, water quality, and biological communities), and the effort will be expanded to include systematic monitoring of terrestrial habitat. In addition, the new approach will increase the rigor, accuracy and cost-efficiency by streamlining efforts and coordinating to fulfill many of the City's compliance monitoring requirements. The new monitoring program was designed in 2009 and began implementation in the summer of 2010. The first year of monitoring will establish baseline data against which future years' results can be compared to measure changes in watershed health.

For fiscal year 2011, five perennial sites have been selected in the Columbia Slough. These sites will be monitored quarterly during dry weather and once during wet weather. Grab samples will be collected for the following analytes:

- Alkalinity
- Chlorophyll a
- BOD-5
- Carbon, dissolved organic (summer only)
- Carbon, total organic
- Conductivity (specific)
- Copper (total and dissolved)
- Dissolved oxygen
- E. coli
- Hardness (total)
- Lead (total and dissolved)
- Mercury, total
- Nitrogen (ammonia, nitrate, nitrite, and total Kjeldahl)
- pH
- Phosphorus (total and ortho-phosphate)
- Temperature
- Turbidity
- Total suspended solids
- Zinc (total and dissolved)

Physical Habitat Monitoring

PAWMAP also includes physical habitat monitoring using EMAP National Streams and Rivers Assessment protocols. Each of the five perennial Slough sites will be surveyed each year. The surveys will be conducted July through September during dry weather. Physical habitat indicators evaluated through stream surveys include the following:

- Large wood
- Depth refugia
- Substrate composition
- Amount of off-channel habitat
- Bank condition
- Stream connectivity
- Width and composition of vegetated riparian zone
- Breaks and barriers
- Plant community composition
- Floodplain condition
- Canopy cover

Bio-Monitoring

BES will continue monitoring a variety of species of concern. Some of the species are on the federal Threatened and Endangered list and some are on the State of Oregon list of sensitive species. BES will conduct quarterly fish monitoring at the Slough's confluence with the Willamette River. BES will also monitor birds, amphibians, turtles, and macrophytes at various sites in the Slough Watershed.

Bio-monitoring is also conducted as part of PAWMAP and includes the following:

- Aquatic communities: fish, conducted quarterly.
- Aquatic communities: benthic macroinvertebrates, conducted annually.

