

# The State of the Columbia Slough

## 2011 Annual Report

### Columbia Slough Sediment Project



March 2012



ENVIRONMENTAL SERVICES  
CITY OF PORTLAND  
working for clean rivers

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# Columbia Slough Sediment Program

## 2011 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 historical and current agricultural land uses.

Routine dredging or capping actions will not be effective at 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). Actions that address the sources of contamination can, however, be effective at reducing contamination and reducing risks in the long term. Consequently, the 2005 Record of Decision (ROD) for the Columbia Slough places significant emphasis on actions that identify and control pollutant sources that impact the Slough.

The ROD identified three elements to effective clean-up of Columbia Slough sediments:

1. Identify the sources of contamination and control them,
2. Actively remediate "hot spot" areas of sediment contamination, and
3. Monitor sediment and fish tissue over time to assess the effectiveness of the above actions and natural recovery mechanisms in reducing contaminant concentrations to protective levels.

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, *Columbia Slough Sediment Program Watershed Action Plan* and *Columbia Slough Long Term Monitoring Plan* describe implementation of the tasks specified in the ROD:

**Watershed Action Plan (WAP):** Finalized in 2006. The WAP describes the actions that BES and DEQ will implement to realize this comprehensive, watershed-based approach to controlling sources and improving sediment quality in the Columbia Slough. .

**Long-Term Monitoring Plan (LTMP):** Finalized in 2007. Establishes the actions that BES will undertake to assess watershed conditions and ensure projects are meeting watershed health goals.

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>.

### **Target Areas**

“Target Areas” were developed to prioritize efforts to reduce contaminant levels in Slough sediment. Target Areas represent portions of the Slough where City outfalls with high predicted sediment yields are located near sediment samples with elevated levels of contaminants. Target Area development was intended to focus the City’s and DEQ’s efforts to control sources entering the public stormwater system and/or directly discharging to the Slough. Initial development of the Target Areas did not explicitly include consideration of private outfalls or outfalls owned by other agencies, although in many cases, the identified Target Areas span many of the priority sources with the nearby areas. The 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 17<sup>th</sup> 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 total suspended solids (TSS) in this section of the Slough.



Columbia Slough Confluence Habitat Enhancement Project Construction, Winter 2010.

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 233 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 44 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 479 acres of land. The City's stormwater system in this Target Area includes 8 City outfalls which provide drainage for approximately 209 acres of public and private land, 6 ODOT outfalls that drain approximately 98 acres, and 42 private outfalls that provide drainage for approximately 172 acres of private property in this Target Area.

Significant progress has been made in assessing both of these Target Areas. Based on the data and information gathered during these assessments, DEQ and BES have expanded program objectives in this area; combining these two Target Areas and addressing the Lower Slough between the St Johns Landfill and I-5 as the Lower Slough Target Area.

### **Buffalo Slough**

The Buffalo Slough Target Area drains to Buffalo Slough. Buffalo Slough is a one-mile side-channel of the Columbia Slough, located between NE 21<sup>st</sup> and NE 42<sup>nd</sup> streets. This channel is a priority because of the quantity of TSS and potentially elevated levels of contamination.



Great Blue Heron in Buffalo Slough

### **Buffalo Slough Target Area**

The Buffalo Slough Target Area is a portion of the Buffalo Slough drainage that stretches between NE 33<sup>rd</sup> and NE 42<sup>nd</sup> Avenues. The Buffalo Slough Target Area drains approximately 110 acres. The City's stormwater system in this Target Area includes 4 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 20 private outfalls.

The Buffalo Slough Target Area will remain the same 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. Whitaker Slough is a five mile side-channel that runs parallel and south of the main Slough channel, connecting to the main channel just west of NE 47<sup>th</sup> Avenue and ending near NE Whitaker Way. The original WAP (2006) identified elevated levels of TSS in stormwater runoff entering this slough segment and pesticides in Whitaker Slough sediment.



Whitaker Slough at NE 112<sup>th</sup> before culvert removal.



Whitaker Slough at NE 112<sup>th</sup> after culvert removal.

### **Cully Neighborhood Target Area**

The Cully Neighborhood Target Area is approximately delineated on the south by NE Emerson Street, on the west by NE 45<sup>th</sup> Avenue, on the east by NE Alderwood Road, and on the north by the main Slough channel. This Target Area drains 289 acres of land. The City's stormwater system in this Target Area

includes four outfalls which provide drainage for approximately 87 acres of public and private land. Drainage from approximately 202 acres of private property in this Target Area is provided through 32 private outfalls.

### **Marx-Whitaker Target Area**

The Marx-Whitaker Target Area includes the stretch of the Marx-Whitaker Slough between NE 109<sup>th</sup> and NE 122<sup>nd</sup> Avenues. This Target Area drains approximately 495 acres of land. The City's stormwater system in this Target Area includes 12 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 23 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 Outfall 104B of 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 Whitaker Slough was erosion from the agricultural properties.

Significant progress has been made in assessing both of these Target Areas. Based on the data and information gathered during these assessments, DEQ and BES have expanded program objectives in this area; combining these two Target Areas and addressing the entire Whitaker Slough as the Whitaker Slough Target Area.

## **2. Actions Accomplished**

### **2.1 Source Control**

#### 2.1.1 Target Areas

##### **Lower Slough Target Area**

BES began development of the *Source Investigation & Control of Contaminants in the Lower Columbia Slough I-5 to MLK Target Area Including City Outfalls 60 through 64* report. This report identifies the actions and outcome of source investigation and control actions implemented by the City and DEQ in outfall basins 60, 61, 62, 63, and 64 over the past few years. The report will identify sites that have been addressed, as well as sites that require additional work.

##### **Buffalo Slough Target Area**

DEQ and BES are reviewing available data to determine if source control is complete in the Buffalo Slough Target Area and to determine if any additional actions are warranted.

##### **Whitaker Slough Target Area**

Portland Parks and Recreation (PP&R) maintained the cover crop planted on 15 acres of land at NE 122<sup>nd</sup> and NE Shaver in 2007. This land was farmed for many years; erosion from this

property previously contributed significant quantities of sediment to Whitaker Slough via City Outfall 104B. The cover crop significantly reduced erosion from this PP&R property.

A report documenting the results of stormwater monitoring associated with agricultural properties was completed in May 2011. The monitoring consisted of collecting stormwater samples from two actively farmed properties in the Argay neighborhood during two storm events. The outfalls from the farms discharge to the City stormwater system and subsequently to Whitaker Slough via Outfall 104B. In general, sample results indicated that the farms discharge elevated concentrations of suspended solids and legacy pesticides to Whitaker Slough. These results were provided to DEQ, Multnomah County Drainage District (MCDD), and Oregon Department of Agriculture (ODA) in spring 2011. The City, DEQ, ODA, MCDD, and East Multnomah Soil and Water Conservation District (EMSWCD) will work with the property owners to implement permanent erosion control measures by Fall 2012.



Stormwater and erosion from agricultural properties in the Argay neighborhood travels through the City stormwater system to the east end of Whitaker Slough.

### 2.1.2 Cleanup Sites

#### **Lower Slough Target Area**

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.

### **Buffalo Slough Target Area**

DEQ has identified several facilities in the Buffalo Slough drainage that may have contributed contaminants to the sediment through site discovery and screening assessments completed prior to 2011. DEQ did not perform any further assessments in 2011. No parties in the Buffalo Slough entered DEQ's Cleanup Program to perform Source Control evaluations in 2011. DEQ will be reassessing contamination in Buffalo Slough sediments in 2012 in order to determine if further source control on upland sites or remediation of sediments is needed.

### **Whitaker Slough Target Area**

DEQ is actively overseeing seven cleanup projects in 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 was initiated in 2011 and will continue into 2012.

### 2.1.3 NPDES Stormwater Discharge Permits

DEQ issues NPDES permits to businesses and industries in the Slough Watershed. BES works as an agent for DEQ under an Intergovernmental 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 117 General NPDES Stormwater Discharge permit registrants within the Columbia Slough Watershed.

The 1200-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 (SWPCP) is reducing pollutant concentrations. When the benchmarks are exceeded, permittees are required to submit Action Plans which report the investigation of causes or conditions contributing to elevated pollutant concentrations and also report to changes to existing controls conducted to address the benchmark exceedance. The Action Plan includes an evaluation of whether or not the SWPCP was implemented properly.

The 1200-COLS permit that expired on 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, a new 1200-COLS permit is currently under development. Under the proposed permit, facilities with a geometric mean exceeding benchmarks will 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 conducted as 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 second year geometric mean exceedances would be subject to the same corrective action response. In addition, facilities would also be required to monitor for impairment pollutants for which a TMDL has not been developed. If the pollutant concentration exceeds criteria, the facility would be required to conduct an investigation into the cause and implement corrective measures as appropriate.

City oversight of stormwater discharges to the Columbia Slough included the following activities over the fiscal year July 1, 2010 to June 30, 2011:

- A total of 217 inspections were conducted at facilities that discharge stormwater to the Columbia Slough. Of these, 136 inspections were performed at permitted sites and 81 were at non-permitted facilities.

#### 2.1.4 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.

#### 2.1.5 Hazardous Waste

DEQ's Hazardous Waste Technical Assistance Program provided assistance visits to three facilities in the watershed between January to December 2011. The three visits included the Port of Portland Airport Facilities and SAPA Anodizing.

#### 2.1.6 Maintenance

The City of Portland Office of Transportation's Maintenance and Operations group (O&M) maintained the City's public stormwater infrastructure to support water quality by preventing sediment from reaching the Slough. This ongoing maintenance performed on City stormwater infrastructure also ensures adequate treatment capacity. The following activities took place between July 1, 2010 and June 30, 2011:

- 3 stormwater inlets were inspected and 270 inlets were cleaned in the Slough Watershed.
- 116 linear feet of culverts were cleaned and 292 feet of ditches were cleaned in the Slough Watershed.
- 11 inlets and 11 inlet leads (214 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 sediment in runoff. Major arterials were swept at least six times a year. In fiscal year 2011, 537 curb miles that drain to the City's stormwater system were swept in the Columbia Slough Watershed, keeping approximately 15,577 cubic yards of debris from entering the waterway.

- 68 public surface stormwater management facilities in the Slough Watershed were inspected twice. Of these, one was cleaned. In addition, there are 31 subsurface stormwater management facilities in the Slough Watershed that are inspected once a year. Of these, 22 were cleaned.

#### 2.1.7 Maintenance Inspection Program (Private Properties)

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. The MIP program confirms that new development and ongoing system management on private property is done in a way that reduces pollutant loads to the stormwater system and the Columbia Slough.

According to the MIP there were 46 new private stormwater management facilities planned for construction in the Slough Watershed in fiscal year 2011. 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 549 private stormwater facilities were inspected in the Columbia Slough Watershed fiscal year ending 2011.

#### 2.1.8 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 Spill Protection & Citizen Response group continued the City-wide outfall inspection program, which identifies illicit discharges to City outfalls. Illicit discharges were identified and corrected throughout the Slough Watershed.

#### 2.1.9 Construction Permits (Erosion Control)

There were 993 active private construction permits subject to erosion control inspection within the City of Portland in the Slough Watershed. These construction sites are required to maintain proper erosion control to prevent elevated levels of TSS in stormwater from reaching the Slough. A total of 873 erosion control related inspections were conducted on private sites in the Columbia Slough Watershed in FY 2011. In addition, the City maintains a 24-hour erosion control response hotline.

## **2.2 Stormwater Management**

The following accomplishments occurred during fiscal year 2011 (July 1, 2010 to June 30, 2011).

### 2.2.1 Slough-Wide

#### **Columbia Slough Stormwater Outfall Predesign**

BES began scoping a predesign effort to treat stormwater runoff from City rights-of-way that currently discharge to the Slough. This effort will focus on commercial/industrial zones, high traffic, and unimproved roadways.

#### **ODOT Stormwater Retrofit Program**

BES signed an IGA with ODOT that made four million dollars of state funding available to treat stormwater runoff from ODOT rights-of-way within the City of Portland.

### 2.2.2 Target Areas

#### **Buffalo Slough Target Area**

A project between BES and the Army Corps of Engineers to replace an undersized culvert on Buffalo Slough under NE 33rd Drive entered the construction phase in summer 2011. A pair of stormwater planters designed to treat stormwater runoff from approximately 0.4 acres of NE 33<sup>rd</sup> Drive (that previously drained untreated to Buffalo Slough via City Outfall 72) were completed this year. Construction to replace the culvert is expected to be completed in 2013.



Undersized culvert at NE 33<sup>rd</sup> Drive and Buffalo Slough to be replaced in 2013.

#### **Whitaker Slough Target Area**

Construction began on eight stormwater facilities designed to receive runoff from 2.9 acres of impervious roadway along NE 122<sup>nd</sup> Avenue between NE Fremont and NE Shaver. This area drains to Outfall 100, which flows into Whitaker Slough just west of NE 122<sup>nd</sup> Avenue, and is a

priority for the Columbia Slough Watershed. When complete, the facilities will remove sediment and pollutants from stormwater runoff before it enters the Slough.

The Portland Bureau of Transportation completed a Local Improvement District (LID) project to improve a one quarter mile section of NE 109<sup>th</sup> Avenue between NE Marx Street and Whitaker Slough. The street was previously unimproved with no sidewalks and gravel shoulders. Stormwater facilities were included to treat stormwater runoff from this section of NE 109<sup>th</sup>. Construction was completed in February 2011.



NE 109<sup>th</sup> & Marx, facing north,  
before LID construction.



NE 109<sup>th</sup> & Marx, facing north,  
during LID construction.

Portland Bureau of Transportation's Cully Boulevard Street Improvement project rebuilt a half mile stretch of NE Cully Boulevard between NE Prescott and NE Killingsworth streets. Stormwater facilities were constructed to treat runoff from this section of NE Cully Boulevard. Construction was completed in June 2011.



Cully Boulevard Street Improvement Project

### 2.2.3 Additional Opportunities

#### **NE Fremont Greenstreet Facilities**

Construction began on sixteen stormwater facilities designed to receive stormwater runoff from 3.5 acres along NE Fremont, NE 156<sup>th</sup>, NE 157<sup>th</sup>, and NE 158<sup>th</sup> Avenues. This area drains to City Outfall ABA410 which flows into Wilkes Creek, a tributary to the Slough, at NE 155<sup>th</sup> & Fremont. When complete the facilities will remove sediment and pollutants from stormwater runoff before it enters the Slough.

#### **NE 148<sup>th</sup> Water Quality Facility**

BES obtained permits for a stormwater management facility near NE 148<sup>th</sup> 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 offers Portland homeowners discounts 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 2011 was high throughout the City.



### **2.3 Sediment Sampling**

#### **Lower Slough Target Area**

In 2011, DEQ did not collect any sediment samples in the Lower Columbia Slough. Additional targeted sediment sampling will be completed in 2012 as part of a remedial investigation funded through settlement agreements with several parties in the Lower Columbia Slough.

#### **Whitaker Slough Target Area**

In January 2011, DEQ collected 3 incremental, 19 composite, and 10 bioassay sediment samples from the segment of the Slough between the mouth of Whitaker Slough to Interstate 205. 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 was released in February 2012. This data will lay the foundation for determining needed sediment cleanup in the Whitaker Slough.

## 2.4 Vegetation

The City planted over 15,859 native trees and shrubs throughout the Columbia Slough Watershed during fiscal year 2011 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 5,261 trees and 8,996 shrubs were planted at revegetation sites in the Slough Watershed. The Watershed Revegetation Program has planted and currently manages 514 acres of habitat restoration sites and 76,137 linear feet of restored stream bank in the Slough Watershed.
- Through a contract with BES, Friends of Trees planted 1,027 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, 150 native plants were planted and 1,250 pounds of invasive vegetation and 20 pounds of trash was removed from one site in the Slough Watershed.
- The City also partnered with City of Portland utility ratepayers and small organizations to maximize tree planting throughout the City, including City of Portland rights-of-way, area schools, and private yards. An additional 575 trees were planted in the Slough Watershed as a result of these efforts.

## 2.5 Education and Stewardship

### Clean River Education Programs

Environmental Services' Clean Rivers Education program offers free classroom and field science programs to kindergarten through 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 20 schools/organizations in the Columbia Slough Watershed.

This educational programming included classroom programs, through which 1,456 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 1,579 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:* 399 students. Students removed invasive species and planted native shrubs and trees at Whitaker Ponds, Kelley Point Park, and Big Four Corners Natural Area.
- *Watershed Investigations:* 760 students. Students applied concepts gained in the classroom to a field study. Students met at field sites such as Whitaker Ponds, Kelley Point Park, Big Four Corners, and the Columbia Boulevard Wastewater Treatment Plant Natural Area. Field activities included: testing water quality, sampling aquatic macroinvertebrates, exploring wildlife, and identifying native and non-native plants.
- *Stormwater Tours:* 67 students. Students visited bioswales, ecoroofs, stormwater planters, green streets, rain gardens and creative downspout disconnections. They learned how these solutions allow stormwater to soak into the ground to reduce volume, while plants and soil filter pollutants and improve water quality.
- *Columbia Slough canoe trips:* 300 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:* 77 students. This program is a community and school stewardship activity designed to increase awareness of stormwater pollution and prevent the public from disposing of household or lawn chemicals into storm drains. Volunteers 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 Regatta, Aquifer



Adventure, three 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 gatherings in which stormwater and the Columbia Slough fish advisory were topics of instruction. Approximately 1,812 attendees participated in these Council events.

- *Eyes on the Slough Program*

Two Slough clean-up events provided 62 volunteers with the opportunity to learn about the natural environment and the Slough Watershed through on the water and riparian activities. In fiscal year 2011, three tons of recyclable materials and garbage were removed from the Slough and its banks. This work was complimented by restoring 10,500 linear feet of stream bank.

- *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 tour started at Fairview Lake and ended at Whitaker Ponds Natural Area. In all, 18 individuals made the canoe trip in 2011.



2011 Corps of Rediscovery

- *Stewardship Saturdays*

BES co-sponsored 10 Columbia Slough Watershed Council Stewardship Saturday events at six sites in the Slough Watershed. The events involved about 134 individual volunteers and 643 volunteer hours. Volunteers planted native trees and shrubs, removed invasive vegetation, and removed trash from the Slough channel.

- *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 two stewardship grants, totaling \$8,654, to support watershed improvement projects in the Columbia Slough Watershed.

2011 Columbia Slough CWSP Grant Recipients:

Columbia Slough Watershed Council – Eyes on the Slough Project	\$3,254
Oregon Humane Society Natural Area Restoration	\$5,400

- *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 eighth 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 six free public events: Subs on the Slough, Aquifer Adventure, Groundwater 101, Slough 101, Cycle the Well Field, and Explorando, reaching over 811 people. Water Bureau and Council staff presented a groundwater class at the Children’s Clean Water Festival reaching 140 4<sup>th</sup> and 5<sup>th</sup> grade students. A program called Slough School delivered groundwater specific curriculum and a groundwater overview as part of the “What is a Watershed” lesson to 411 students.

- *Columbia Corridor Association*  
Through a partnership with the Columbia Corridor Association, technical assistance was provided to 29 businesses. Spill kits and prevention equipment was available to businesses upon request. The Water Bureau sponsored a business workshop on new training requirements with 26 participants. The Columbia Corridor Association conducted additional outreach to the business community via web, e-mail, publications, and local media.

**2.6 Site Cleanup**

DEQ is continuing to oversee investigation and cleanup work at over 30 sites in the Columbia Slough Watershed. Highlights of calendar year 2011 private party cleanup actions include the following:

Cleanup Agreements Signed

- A Cleanup Letter Agreement was signed for the BPA-St. John’s Substation site in N. Portland (ECSI #1858).
- A Cleanup Letter Agreement was signed for work at the Halton Voith site at NE 47<sup>th</sup> Avenue (ECSI #1503).
- A Cleanup Letter Agreement was signed for the Killingsworth Fast Disposal site at NE Killingsworth and NE 75<sup>th</sup> Avenue (ECSI #2251).
- A Cleanup Letter Agreement was signed for work at the Halton Company site at 4421 NE Columbia Blvd (ECSI #121).

### Investigations Completed

- A remedial investigation/feasibility study report for the St. Johns Landfill (ECSI #164) was completed.
- EPA Region 10 Site Assessment program completed a Site Investigation at the Hoffman Property site (ECSI #2846) in 2011. A report is expected to be sent to DEQ in spring of 2012.
- Sampling was conducted in Whitaker Slough to help evaluate potential remediation areas and source control targets.

### Source Control Actions in Progress

- Upland site cleanup, which includes source control measures, was initiated at the Pacific Meat site (ECSI #145) located at 2701 N Newark Street.

### Source Control Actions Completed

- The Airgas Norpac site (ECSI #3528) at 3591 NE Columbia Blvd was issued a No Further Action (NFA) that included a Source Control Decision.

### Cleanup Action Selected

- DEQ issued a Record of Decision for remedial actions for the Fuel Processors Inc. site (ECSI #673), located at 4150 N Suttle Road.
- A remedial action decision was selected for the Precision Equipment site (ECSI #152) located at 8440 N Kerby Avenue.

### Upland Cleanup Completed

- A Conditional NFA issued for CARCO/Varicast site located at 900 N Columbia Boulevard.
- Interstate Crossroads site (ECSI #5662), on NE Cameron east of the airport, was issued no further action based on a review of historic site land use and a soils investigation.
- Petroleum-contaminated soil was removed at the Eudaly Brothers site on NE 42<sup>nd</sup> and an NFA was issued for the site.

## **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 2011 Columbia Slough long-term monitoring efforts.

### **Sediment Monitoring**

Sediment sampling was conducted along the entire Columbia Slough by the City in 2006. DEQ performed sampling of the Lower Slough sediment between City outfalls 59 and 65 in 2009. In 2011, DEQ performed sediment sampling from the mouth of Whitaker Slough to Interstate 205.

Data from these sampling events is being combined with sediment data collected by MCDD for channel maintenance, private party cleanup site sampling, and ODOT sampling into a Slough sediment database that will be used to determine data gaps and plan remedial measures. DEQ is currently developing a work plan to collect some additional sediment samples in the Lower Slough to better define the extent of PCB contamination in that area as a basis for developing remedial action options.

DEQ also performed sediment sampling in July 2011 for three sections of the Slough using EPA grant monies to determine ‘background’ sediment concentrations for each section. The sections included the Upper Columbia Slough from NE 158<sup>th</sup> to Fairview Lake, the Middle Columbia Slough from 82<sup>nd</sup> to NE 138<sup>th</sup> and the Middle Columbia Slough\Buffalo Slough from NE 17<sup>th</sup> to NE 47<sup>th</sup>. Data from this sampling event will be available fall 2012.

### **Water Quality Monitoring**

Surface water quality monitoring samples were collected as part of two separate monitoring efforts. The first is the City’s new surface water quality monitoring program, the Portland Area Watershed Monitoring and Assessment Program (PAWMAP). PAWMAP follows sample design and field method protocols developed by the national Environmental Monitoring and Assessment Program (EMAP). PAWMAP was developed in 2009; implementation began summer of 2010.

The second monitoring effort is continuous monitoring and surface water monitoring at a number of fixed locations. The fixed location monitoring is maintained primarily for trend analysis at locations that have been monitored in the past. Once enough data for trend analysis has been gathered under PAWMAP (~2015), fixed location monitoring likely will be discontinued. Both monitoring efforts are described separately below.

### PAWMAP

The PAWMAP program includes spatially-balanced random selection of stream survey sites. Elements monitored address all four City of Portland watershed health goals (hydrology, habitat, water quality, and biological communities), and efforts include systematic monitoring of terrestrial habitat. The first four years of monitoring will establish baseline data against which future years’ results can be compared to measure changes in watershed health.



PAWMAP Crew in the Middle Slough

Sample design consists of four rotating “Panels” of 20 perennial and 12 intermittent sites, with one panel monitored during each of the first four years of the program. Monitoring starts over again with the first panel monitored in the fifth year, the second panel in the sixth year, and so on. For fiscal year 2010/2011, five perennial sites were selected in the Columbia Slough (Table 1). These sites were monitored quarterly during dry weather and once during wet weather. No intermittent sites were selected in the Slough (most intermittent sites in the City are located in Forest Park). Water quality grab samples were 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)

**Table 1 – Columbia Slough PAWMAP (Year 1) Water Quality Sample Sites**

Sampling Site	Approximate Location	Sub-Watershed
0017	9111 NE Sunderland Rd.	Peninsula Drainage Canal
0080	N of 18008 NE Airport Way	Upper Slough
0129	14912 NE Airport Way	Upper Slough
0273	6455 NE Columbia Blvd	Whitaker Slough
0329	3841 N Columbia Blvd	Lower Slough

During summer field efforts, water quality samples were collected as part of perennial stream surveys which also included physical habitat assessment, macroinvertebrate monitoring, and invertebrate population monitoring. Complete data analysis for all data collected during stream surveys, including water quality data, will be presented in a separate PAWMAP Year 1 report which is currently in progress. The PAWMAP Year 1 report will include data on the Slough individually and in comparison to other Portland area Watersheds.

Fixed Monitoring Locations

The second type of water quality monitoring conducted by the City in the Slough Watershed was conducted at fixed locations. In previous years, water quality was evaluated at nine fixed locations throughout the Columbia Slough. In fiscal year 2011, much of the fixed location monitoring was discontinued in favor of PAWMAP. However, six fixed water quality sampling locations (four continuous and two grab) were retained for trend analysis (Table 2). Continuous (15-minute) samples were taken for temperature, pH, conductivity and dissolved oxygen. Grab samples were collected every other month 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 Kjeldahl)
- pH
- Phosphorus (total and ortho phosphate)
- Secchi disc
- Temperature
- Total suspended solids
- Zinc (total and dissolved)

**Table 2 – Columbia Slough Fixed Location Water Quality Sample Sites**

Sampling Site	Location	Continuous	Grab
AWB	NE Airport Way Bridge		X
158	NE 158 <sup>th</sup> Ave. Bridge	X	
92B	NE 92 <sup>nd</sup> Ave. Bridge (main stem)	X	
21B	NE 21 <sup>st</sup> Ave Bridge (main stem)	X	
VNB*	N Vancouver St Bridge	X	
SJB	St. Johns Landfill Bridge		X

\*VNB site is not currently being monitored by BES. Multiprobe will be redeployed upon completion of the new Vancouver Avenue Bridge. Multiprobe data was provided by Metro from the St John’s Landfill Bridge as representative of conditions in the Lower Slough.

Water Quality Results

Water quality results from both PAWMAP and fixed location monitoring were compared to various regulatory standards as summarized in Table 3.

**Table 3 Water Quality Results Summary (PAWMAP and Fixed Locations)**

Analyte	Regulation	Monitoring Type	Results
Alkalinity	20 mg/l OAR 340-041 Table 20	PAWMAP	All samples exceeded the standard. Concentrations typically between 53 and 150 mg/l. Highest concentrations were measured mostly in Peninsula Drainage Canal.
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	Fixed PAWMAP	Samples at all sites met the standard.
Carbon, total organic	n/a	PAWMAP	Typically between <1.0 and 5.89 mg/l. Highest concentrations were measured mostly in Peninsula Drainage Canal.
Chlorophyll a	15µg/L (3 months average of 3 samples) OAR-340-041-150(1)(b)	PAWMAP	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. 3 out of 25 samples exceeded the standard with 2 at one location in Whitaker Slough and 1 in the Lower Slough.
Conductivity - specific	n/a	Continuous PAWMAP	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. PAWMAP data yielded results ranging from 147 to 295.

Analyte	Regulation	Monitoring Type	Results
Copper	Chronic: 12 µg/L @ 100 mg/L hardness (hardness dependent) OAR 340-041 Table 20	Fixed PAWMAP	Samples at all sites met the standard. Most were well below the standard except for one sample from Peninsula Drainage Canal which was only slightly below the standard.
Copper, dissolved	n/a	Fixed PAWMAP	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	Continuous PAWMAP	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	Fixed PAWMAP	All samples met the single sample standard except for one PAWMAP sample (420 mpn/100 ml) from Peninsula Drainage Canal collected in October 2010. Possible sources of E. coli include large avian populations in adjacent wetlands, pump stations, old cesspools/septic systems, and illicit discharge.
Hardness	n/a	Fixed PAWMAP	Typically between 70-110 mg/L
Lead	Chronic: 3.2 µg/L @ 100mg/L hardness (hardness dependent) OAR 340-041 Table 20	Fixed PAWMAP	Samples at all sites except one met the criteria though a few samples were only slightly below the fresh water chronic criterion. The December PAWMAP Peninsula Drainage canal sample was almost twice the standard.
Lead, dissolved	1.2 µg/L TMDL	Fixed PAWMAP	Samples at all sites met the standard.
Mercury	Chronic: 0.012 µg/L OAR 340-041 Table 20	PAWMAP	All samples met the standard except for one collected in Peninsula Drainage Canal
Nitrogen – ammonia	EPA-822-D-09-001 (EPA 2009)	Fixed PAWMAP	Samples at all sites met both acute and chronic criteria.
Nitrogen - nitrate	OAR 340-041 Table 20	Fixed PAWMAP	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 – nitrite	n/a	PAWMAP	Typically between <0.01 and 0.073 mg/l
Nitrogen - Kjeldahl	n/a	Fixed PAWMAP	Not yet investigated
pH	6.5-8.5 S.U. OAR 340-041-0345 TMDL	Continuous PAWMAP	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	Fixed PAWMAP	One sample in the Upper Slough was slightly above 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	Fixed PAWMAP	One fixed location sample collected in July was slightly above the standard. Three samples collected from Peninsula Drainage Canal were 2 to 3 times the standard.
Temperature	7-day average maximum: 18°C OAR 340-041-0028	Continuous	Most sites do not meet the 18 degree C standard for 7-day average of daily maximum temperature from June – August.

Analyte	Regulation	Monitoring Type	Results
Total Suspended Solids(TSS)	25 mg/L based on NPDES 1200-COLS	Fixed PAWMAP	A majority of samples collected met the standard. Exceedances were spread throughout the year and the Slough.
Zinc	Chronic: 110 µg/L @ 100mg/L hardness (hardness dependent) OAR 340-041 Table 20	Fixed PAWMAP	Samples at all sites met the standard.
Zinc, dissolved	N/A	Fixed PAWMAP	Samples at all sites met the standard.

Continuous monitoring will continue in 2012 as in past years. The Vancouver Avenue Bridge is expected to be completed during the new fiscal year and the continuous monitoring station will be redeployed at this location. Fixed location surface water quality monitoring will continue in 2012 at a reduced number of locations and frequency as in 2011.

### 3. Future Actions

Over the next five years DEQ and the City will focus on source control, stormwater management, and cleanup measures needed in the Lower Slough, Whitaker Slough, and Buffalo Slough Target Areas, such that DEQ can provide Tier 1 or Tier 2 No Further Action (NFA) determinations; as described in the 2005 *Record of Decision Remedial Action Approach for Columbia Slough Sediment*. Tier 1 and 2 NFA determinations signify 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*, the City and DEQ will focus efforts between July 2010 and June 2015 on the items listed below:

#### **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. The revised WAP is expected to be available in December 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, angler surveys. Planning for the next 10 year sediment and fish tissue monitoring events will be initiated.

#### **Source Identification and Control Plan**

Develop 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**

Develop 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 runoff 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 in City or private stormwater pipes that may contain elevated levels of contaminants and evaluate the need and feasibility of removing accumulated sediment from pipes.

## **3.1 Source Control**

### 3.1.1 Slough-Wide

#### **Source Investigation and Control Plan**

The City will work with DEQ to identify and prioritize remaining stormwater contamination sources in the Lower, Middle, and Upper Slough. This information will be used to organize source control efforts in specific areas or properties and will be the basis for the Source Investigation and Control Plan, and possibly the Sediment Cleanout Pilot Program.

### 3.1.2 Target Areas

#### **Lower Slough Target Area**

The *Source Investigation & Control of Contaminants in the Lower Columbia Slough I-5 to MLK Target Area Including City Outfalls 60 through 64* report will be completed. The report will identify priority sources in the Lower Slough and will supplement the Slough-Wide Source Investigation and Control Plan.

DEQ will guide additional remedial investigation-level 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.

The City will submit a Contaminant Loading Evaluation Workplan to assess the applicability of using the SEDCAM analytical model to evaluate the connection between City stormwater outfalls and sediment concentrations in the Slough. The City will implement the SEDCAM model as a pilot study on two City outfalls in the Lower Slough.

The City will perform stormwater and sediment sampling of at least two outfalls within the Lower Slough to support the data inputs for the SEDCAM model.

Metro will complete a feasibility study for possible sediment remedies for the St Johns Landfill.

### **Whitaker Slough Target Area**

PP&R will continue to maintain the cover crop planted on 15 acres of previously farmed land at NE 122<sup>nd</sup> & 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.

BES will continue to meet with the agricultural land owners and coordinate with DEQ, ODA, MCDD, EMSWCD, to ensure that source control measures are implemented to decrease sediments discharged through City Outfall 104b. The City will direct the landowners to implement interim stormwater/erosion controls by January 2012 and permanent controls by fall 2012.

DEQ will work with MCDD and the City to characterize contamination issues in the Marx-Whitaker subbasin.

#### **3.1.3 NPDES Stormwater and Non-Stormwater Discharge Permits**

BES will continue to inspect all permitted industries at least 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 consideration of changes to the COLS permit discussed in Section 2.2.

Construction of the Port's new treatment plant for deicing and anti-icing materials should reach 100% completion in April 2011 with full operations by April 2012. The Port designed the enhanced system to better protect water quality in the Columbia Slough.

The City will continue to implement industrial pretreatment discharge permits that regulate discharges of industrial process water to the Publicly Owned Treatment Works.

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

#### **3.1.4 DEQ Hazardous Waste**

DEQ's Hazardous Waste technical assistance outreach does not plan to specifically target the Columbia Slough in the coming year, but will plan assistance visits when requested or through referral from DEQ or BES.

#### **3.1.5 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. This work will provide the foundation for possible implementation of a pilot sediment cleanout plan (as described in Section 3.1.2).

The City will continue street sweeping throughout the watershed. Stormwater infrastructure 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.

### 3.1.6 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.

### 3.1.7 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 report spills, sewage overflows, pollution, illegal dumping, etc.

### 3.1.8 Construction Permits (Erosion Control)

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

## **3.2 Stormwater Management**

### 3.2.1 Slough-Wide

#### **Columbia Slough Stormwater Outfalls Predesign**

In 2011 – 2012 the City will begin full-scale predesign efforts to evaluate pollutant loading and stormwater treatment solutions for City-owned rights-of-way in the Slough Watershed. The predesign is expected to be completed in winter 2013.

### 3.2.2 Target Areas

#### **Whitaker Slough Target Area**

BES will complete construction of eight stormwater facilities along NE 122<sup>nd</sup> between NE Fremont and NE Shaver, in the Marx-Whitaker Target Area during the winter of 2012. The facilities will receive runoff from 2.9 acres of impervious roadway. This area drains to City Outfall 100 which flows into Whitaker Slough just west of NE 122<sup>nd</sup> Avenue, and is a priority outfall in the Slough Watershed.

### 3.2.3 Additional Opportunities

#### **NE Fremont Greenstreet Facilities**

Construction of sixteen stormwater facilities will be completed. The facilities will receive runoff from 3.5 acres of impervious roadway along NE Fremont between NE 156<sup>th</sup> and NE 158<sup>th</sup> Avenues. This area drains to City Outfall ABA410 which flows into Wilkes Creek, a tributary to the Slough, at NE 155<sup>th</sup> & Fremont.

### **ODOT Stormwater Retrofit Program**

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 Columbia Slough. BES will nominate several projects to receive funding, including the following in the Slough Watershed: I-205 at Gateway Green and Sandy Blvd from I-205 to 122<sup>nd</sup> Avenue in winter 2011 - 12.

### **NE 148<sup>th</sup> Water Quality Facility**

BES will continue design for a stormwater management facility at NE 148<sup>th</sup> 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.

## **3.3 Sediment Sampling**

### **Lower Slough Target Area**

DEQ's Columbia Slough Sediment Study Report (March 2011) for the Lower Slough identified five areas where sediment cleanup was recommended. In 2012, DEQ settlement funds will be used to better define those areas to lay the foundation for a feasibility study to assess cleanup options.

### **Whitaker Slough Target Area**

DEQ will finalize the report on the Whitaker Slough study area in 2012 and begin to assess next steps which may include some additional data collection to better characterize areas identified for sediment cleanup.

### **East Whitaker Pond**

Metro Metals has proposed sediment sampling near their historic outfall to determine extent of impact from former discharges.

## **3.4 Vegetation**

The BES Revegetation Team will continue to monitor and maintain restored lands within the Columbia 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 in fiscal year 2012.

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 2012, 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

DEQ will continue to work to close several cleanup sites over the coming year. In addition, DEQ will complete remedial investigation and feasibility study efforts for portions of the Lower Slough and make cleanup decisions that will likely be implemented in 2013. Some of the significant private sites that will likely complete cleanup actions include:

- Owens Brockway (#1311) will complete implementation of the cleanup remedy for Johnson Lake.
- Development of and final remedial and source control work will be completed at the NW Cast site (#999).
- Upland cleanup will be completed at Precision Equipment (#2437) site.

### 3.7 Long-term Monitoring

#### Stormwater Monitoring

DEQ and the City plan to develop a contaminant loading evaluation 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 I-5 to MLK Target Areas may be conducted.

#### Water Quality

Continuous water quality monitoring of at least three fixed locations in the Columbia Slough will continue as in past years, and a fourth site will be added once the Vancouver Avenue Bridge restoration is completed. Continuous monitoring measurements include temperature, pH, conductivity and dissolved oxygen. Surface water quality monitoring at two fixed locations will continue as in 2012 with one wet weather and quarterly dry weather sampling events.

Water quality monitoring will continue in 2012 as part of PAWMAP. For fiscal year 2012, five perennial sites have been selected in the Columbia Slough (Table 4). These sites will be monitored quarterly during dry weather and once during wet weather. Grab samples will continue to be collected for the analytes listed in Section 2.7.

**Table 4 – PAWMAP Year 2 Columbia Slough Water Quality Sample Sites**

Sampling Site	Approximate Location	Sub-Watershed
0513	12002 NE Inverness Dr.	Middle Slough
0529	6900 NE Cornfoot Rd.	Middle Slough
0705	4501 NE Crystal Lane	Middle Slough
0769	11632 NE Ainsworth Circle	Middle Slough
0961	2424 NE Riverside Way	Middle Slough

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 2012.

#### Physical Habitat Monitoring

PAWMAP also includes physical habitat monitoring using EMAP National Streams and Rivers Assessment protocols. 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 randomly selected sites in the Slough Watershed.

Biomonitoring is also conducted as part of PAWMAP and includes the following:

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



PAWMAP Fish Sampling on the Slough

