King County
Department of Natural Resources and Parks
Wastewater Treatment Division
King Street Center, KSC-NR-0500
201 South Jackson Street
Seattle, WA 98104-3855

July 26, 2013

Alison Evans, Permit Manager
Washington State Department of Ecology
3190 160th Avenue SE
Bellevue, WA 98008-5442

Dear Ms. Evans:

Enclosed is the King County Wastewater Treatment Division Annual Combined Sewer Overflow Report prepared in accordance with the requirements established in the National Pollutant Discharge Elimination System (NPDES) Permit WA-002918-1 and WAC 173-245-090. The report contains an overview and status of King County's Combined Sewer Overflow (CSO) Control Program, and 2012 overflow and frequency information.

The annual rainfall for 2012, as an average over local rain gauges, was 42.79 inches, which is higher than the long-term Sea-Tac annual average of 37 inches. The wettest months were November (8.5 inches) and December (7.2 inches). Hydraulic modeling predicts that King County CSOs will discharge 800 million gallons (MG) of untreated CSO in an average year of rainfall. Conditions in 2012 resulted in 324 untreated events discharging 1,405 MG and treated CSOs totaled 54 events discharging 864 MG.

The report also includes event-based data for the year (Appendices A and B) which is also being provided electronically by email. Appendices C through F are the annual reports for the four CSO treatment facilities.

King County is committed to ensuring that its CSO treatment facilities run properly and are in compliance with the NPDES permit. If you have any questions, please contact me at 206-263-3825, or Karen Huber, Wastewater Engineer IV, at 206-684-1246.

Sincerely,

Dan Grenet, Manager, West Section
King County, Wastewater Treatment Division

Enclosure

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Combined Sewer Overflow Control Program
2012 Annual Report

July 2013

King County
Department of Natural Resources and Parks
Wastewater Treatment Division

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Section 1

Introduction

King County's Wastewater Treatment Division (WTD)—responsible to manage the regional wastewater system—prepares annual reports on its combined sewer overflow (CSO) control program and submits them to the Washington State Department of Ecology (Ecology). The annual reports are completed to fulfill requirements under the National Pollutant Discharge Elimination (NPDES) permit for the County's West Point Treatment Plant in Seattle and requirements in WAC 173-245-090.[1] This report documents CSO control program activities for 2012.

The annual rainfall for 2012, as an average over local rain gauges, was 42.79 inches, which is higher than the long-term Sea-Tac annual average of 37.07 inches. The wettest months were November (8.5 inches) and December (7.2 inches). Hydraulic modeling predicts that King County CSOs will discharge 800 million gallons (MG) of untreated CSO in an average year of rainfall. Conditions in 2012 resulted in 324 untreated events discharging 1,405 MG and treated CSOs totaled 54 events discharging 864 MG.

The following sections provide background on King County's wastewater system and its CSO control program and describe new requirements for the program in the most recent NPDES permit renewal, with particular emphasis on changes to reporting requirements.

1.1 King County CSO Locations

King County provides wholesale wastewater conveyance and treatment of flows from 17 cities, 16 local sewer utilities, and one tribal government.

The City of Seattle's local wastewater collection system contains combined sewers that collect both wastewater and stormwater. Other newer local systems use separate sewers to convey wastewater and stormwater. Seattle's combined sewers convey flows to county trunks and interceptors, which convey flows to the West Point Treatment Plant in Seattle's Discovery Park. A small portion of flows from the combined system is treated at the South Treatment Plant in Renton.

When large storms occur and flows exceed the capacity of county conveyance system facilities, CSOs may occur at any of the 38 county CSO locations that discharge to Lake Washington, Lake Union, the Lake Washington Ship Canal, the Duwamish River, Elliott Bay, and Puget Sound (Figure 1). CSOs also may occur at the City of Seattle's 90 CSO locations in their local sewer system. The city is responsible for managing and reporting on these locations. CSOs are a recognized source of water pollution that can result in temporary increases in bacterial counts and aesthetic degradation of shorelines, in long-term adverse effects on sediment quality at discharge points, and in raised public health concerns in areas where there is potential for public contact.

[1] WAC = Washington Administrative Code.

1.2 CSO Control Plans, Amendments and Updates

Since the 1970s when the basic regional wastewater system infrastructure was in place, the Municipality of Metropolitan Seattle (Metro), and its successor, King County WTD, have been implementing CSO control projects to improve water quality in the Seattle area. King County does this through a CSO Control Plan that is amended or updated with each renewal of the West Point Treatment Plant's NPDES permit. Ahead of each CSO Control Plan update, the County reviews the plan, progress toward CSO control, and its program in general against conditions that may have changed since the last review—conditions such as flow patterns, scientific developments, changed regulations, new technologies, and public priorities. Significant change may require adjustment of the CSO Control Plan.

1.2.1 CSO Control Plans, 1979-2008

Metro first formalized CSO control with the development of the *1979 CSO Control Program* (1979 Program). The 1979 Program identified nine projects to reduce the number of CSO events into fresh water (Lake Washington, Lake Union, and the Lake Washington Ship Canal). In 1985, the Washington State Water Pollution Control Act (Chapter 90.48 RCW) introduced new regulations that required all municipalities with CSOs to develop plans for "the greatest reasonable reduction at the earliest possible date." Metro prepared the *1986 Final Supplemental Plan for Secondary Treatment Facilities and Combined Sewer Overflow Control* (1986 Plan) to meet this requirement.

Before the 1986 Plan could be implemented, Ecology promulgated new regulations (WAC 173-245-020) that defined "greatest reasonable reduction" to mean "control of each CSO such that an average of one untreated discharge may occur per year." Metro worked with Ecology to develop an interim goal of 75 percent reduction of CSO volumes systemwide by the end of 2005. Metro's *Final 1988 Combined Sewer Overflow Control Plan* (1988 Plan) identified 11 CSO control projects designed to meet this interim goal.

King County took over responsibility for operating and maintaining the regional wastewater system in 1994. As part of the 1995 NPDES permit renewal for the West Point Treatment Plant, King County prepared an update and amendment to the 1988 Plan. The *1995 CSO Control Plan Update* (1995 Plan Update) assessed the effectiveness of CSO reduction efforts to date, reevaluated priorities for control of CSO sites, and identified three control projects for completion in 1995–2000.

Figure 1. King County CSO Locations

In the late 1990s, King County developed a major update to its comprehensive sewerage plan called the *1999 Regional Wastewater Services Plan* (RWSP). During that period Ecology agreed to discontinue the 75% volume reduction interim target for County CSO control to allow prioritization of control projects according to public health and environmental benefit rather than volume. The final RWSP adopted by the King County Council in 1999 included a revision to the CSO Control Plan that consisted of 21 control projects to complete system control by 2030. It was included in an amendment to the CSO Control Plan—*Year 2000 CSO Control Plan Update* (2000 Plan Update)—with the June 2000 submission of the West Point Treatment Plant NPDES permit renewal application. The 2000 Plan Update described King County's progress in CSO control, documented its compliance with CSO control requirements, and identified two large control projects—Denny Way/Lake Union and Henderson/Martin Luther King (MLK)/Norfolk CSO control projects—for completion in the next five-year NPDES permit cycle. The resulting Mercer/Elliott West and Henderson/Norfolk CSO control systems came online in spring 2005.

In the RWSP, the King County Council called for a review of the County's CSO control program ahead of the NPDES renewal application and 2000 Plan Update that was expected to be due in 2005. Issuance of the NPDES permit took longer than expected, pushing back the due date for the next application to 2008. King County completed the review in 2006 as the basis for the CSO Control Plan Update (2008 Plan Update) which was then submitted as a part of the NPDES permit renewal application in 2008. The 2008 Plan Update described the County's wastewater system and the control status of its CSOs and overall progress, indicated how the County meets the U.S. Environmental Protection Agency's (EPA's) Nine Minimum Controls, and summarized the scientific studies that have shaped the control program over time. The 2008 Plan Update also described completed, in progress, and planned CSO control projects. No changes to the RWSP CSO Control Plan were recommended and King County committed to implementing the first four of the RWSP projects—Barton, Murray, South Magnolia, and North Beach—together known as the Puget Sound beach projects (described in Section 3 of this report).

The West Point Treatment Plant NPDES permit was renewed July 1, 2009. The renewed permit contained new requirements for the CSO control program. These changes led King County to redesign and simplify its annual CSO Control Program reports.

1.2.2 The 2012 Plan Review and Long-term CSO Control Plan Amendment

The County's current cycle of review began in 2010 and resulted in King County Executive Dow Constantine submitting his recommended CSO Control Plan to the King County Council for review and approval in June 2012.

In September 2012, the King County Council unanimously approved an amendment to the CSO Control Plan describing nine projects to control 14 CSOs by 2030 for $711 million dollars (2010 dollars). The adopted amendment to the plan was submitted to Ecology November 20, 2012, ahead of the June 2013 application date for the NPDES permit renewal.

The adopted projects emerged from a three-year comprehensive review of the CSO control program. During the review King County evaluated new conditions, opportunities, new science and regulations and community input since the last major CSO plan update in 1999. Project alternatives were developed for all 14 uncontrolled CSOs to determine which ones were the most

cost effective and cost efficient. The adopted projects reflect community priorities heard during the public review process:

- Completing most projects in the Lower Duwamish River area first to support ongoing regional efforts to clean up the river. Later projects will control CSOs in the Lake Washington Ship Canal.
- Conducting more detailed evaluation of the use of green stormwater infrastructure (GSI) on four projects to complement traditional CSO control techniques.
- Collaborating with the City of Seattle on projects when it is cost effective to do so.

The adopted plan amendment contains nine projects to control 14 CSOs by end of 2030. Two projects are to construct CSO high rate sedimentation wet weather treatment facilities in the Lower Duwamish and East Waterway area. Seven projects will control CSOs by building storage tanks or conveyance pipes. Four projects will be built in the Lake Washington Ship Canal/Montlake Cut area, and five in the Duwamish River/Elliot Bay area. King County and the City of Seattle will continue to collaborate on three of the seven storage tank projects. GSI will be conducted early ahead of traditional CSO control methods in four basins to hopefully reduce the size of the gray infrastructure needed to control the CSO.

The Council also adopted a plan to complete a water quality assessment and monitoring study early in the plan schedule to confirm or possibly adjust some of the future projects or schedules. The recommendation for this study emerged through conversations with stakeholders and the public asking that CSO control be evaluated more fully along with other programs that improve water quality in the region.

Detailed project information, including an interactive map, can be found at http://www.kingcounty.gov/environment/wastewater/CSO/ProgramReview.aspx

Figure 2 shows the adopted schedule of projects.

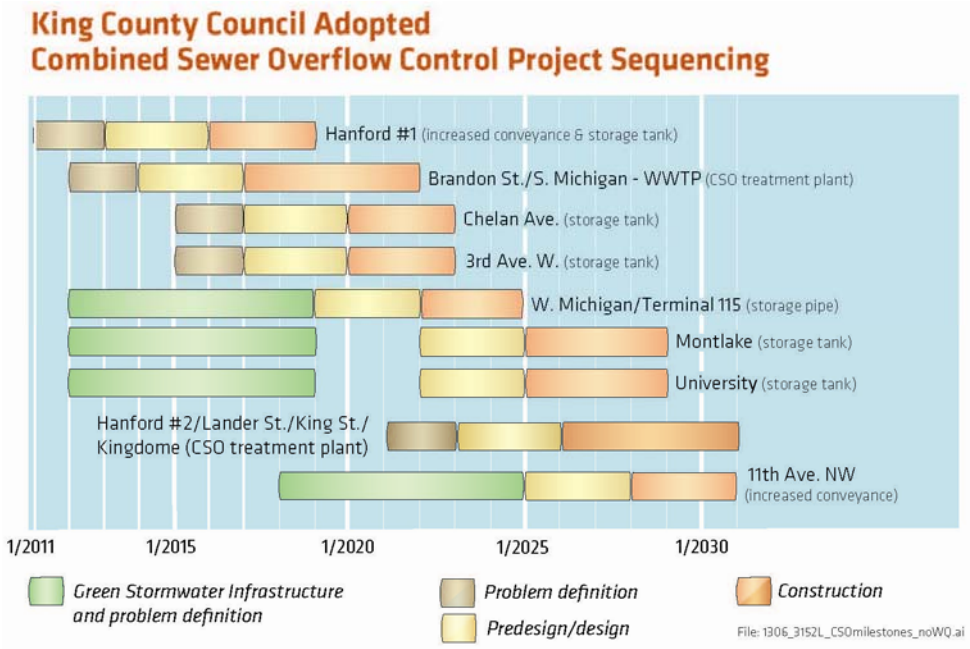


Figure 2. Adopted Project Schedule to Complete Program by end of 2030

1.3 EPA Compliance Review and Consent Decree Development

In January 2008, EPA began a compliance review of the County's wet-weather management programs in relation to the federal CSO control policy. Such reviews are occurring across the country under a strategy set by EPA's Office of Enforcement and Compliance Assurance (OECA). Agencies that manage combined systems are selected to be reviewed based on their size, population served, and system complexity. The City of Seattle's program began a similar review at the same time. OECA and EPA Region 10 staff, accompanied by Ecology staff, performed an intensive inspection over five days. Since that time, King County has met with EPA many times and has provided additional information on programs and activities.

EPA and Ecology concluded its review of the King County's CSO Control Plan and King County's Amended 2012 Long-term CSO Control Plan (LTCP) in the fall of 2012, and EPA approved the County's LTCP as meeting federal requirements on March 7, 2013. In parallel with the plan development and to establish enforceable milestones for implementation of King County's CSO Control Plan, the terms of a consent decree (CD) were drafted. The draft CD was submitted to the King County Council in November 2012 for their consideration and was approved. After Council approval, it was approved in early 2013 by the King County Executive and was subsequently lodged with the federal court on April 16, 2013. The Department of Justice filed a motion to enter the CD with the court. The CD was approved and became effective on July 3, 2013. The requirements of the consent decree are now being implemented.

1.3.1 Consent Decree Implementation

The consent decree requires several plans that are progressing well. These include the following:

- Supplemental Compliance Plans for Dexter Regulator CSO, Denny Regulator CSO, and Harbor Regulator CSO, due August 2, 2013.
- Sewer System Operational Plan, due October 1, 2013.
- Joint Operations and System Optimization Plan with the City of Seattle, due March 1, 2016.
    - Progress Reports due December 31, 2013 and December 31, 2014.

All are on track to meet their milestone submittal dates. Progress will be reported in the first annual consent decree report that will be submitted by the end of the first full quarter after July 3, 2013.

1.4 Ecology Agreed Order

In 2011, King County and Ecology entered into an Agreed Order establishing compliance milestones for King County to forward a CSO control plan to the King County Council by September 2012 (completed) and control all CSOs by 2030. The consent decree also addresses the control of all CSOs and establishes the enforcement mechanism envisioned in the Agreed Order for meeting the CSO plan. Ecology was a party to the Federal consent decree. With the consent decree and Agreed Order addressing the same issue, it creates the potential for conflicting requirements. In light of the potential conflict, King County has requested the Agreed Order be rescinded by Ecology.

1.5 Sediment Sampling and Analysis

King County prepared a sediment management plan in 1999 for addressing contaminated sediment at county CSO locations. The County is in the process of updating that plan. As a part of the update process, a predictive sediment contamination model for CSO discharges has been developed. Sediment sampling will be used to calibrate and verify model performance. This additional sediment sampling to calibrate and verify model performance, agreed to with Ecology, was incorporated into the sediment sampling and analysis plan required in the 2009 NPDES permit.

The schedule for the sediment management plan update calls for two rounds of sampling at CSO locations. Sediment sampling results of the first round were provided to Ecology at the end of 2012. The second set of sampling occurred in 2012.

In 2011, King County delivered the report on the development and calibration of a near-field discharge model for contaminated sediments in the vicinity of CSOs. The work was partially conducted under Model Toxics Control Act (MTCA) grants G0800508, G0600259 and G0200213. The County requested Ecology to review this model to assess the utility of the model for sediment cleanup decisions for CSOs. King County's goal is for Ecology to formally approve the use of this modeling approach for evaluation of recovery and recontamination potential under WAC 172-204-560.

1.6 Organization of this Report

Subsequent sections and appendices in this report present the following information:

- Section 2—a report on implementation of the Nine Minimum Controls, as defined in the renewed NPDES permit.
- Section 3—status of CSO control projects in progress.
- Section 4—discussion of 2012 rainfall and CSO events.
- Section 5—a table showing the 20-year average frequency of untreated CSO events for each site.
- Appendix A—detailed event-based tables for untreated CSOs in 2012.
- Appendix B—detailed event-based tables for treated CSOs in 2012.
- Appendices C through F—annual reports for the four satellite CSO treatments facilities—Alki, Carkeek, Mercer/Elliott West, and Henderson/Norfolk.

Section 2

Programs to Meet EPA's Nine Minimum Controls

King County has implemented a number of programs to satisfy the requirements of the Nine Minimum Controls, which are a part of EPA's codified CSO Control Policy. Nine Minimum Controls are actions that can be taken more quickly to minimize CSO impacts while long-term capital projects are under way. The following sections describe King County's programs and activities in regard to each of the Nine Minimum Controls, with emphasis on activities undertaken in 2012.

2.1 Control 1—Reducing CSOs Through Operation and Maintenance

Implement proper operation and maintenance programs for the sewer system and all CSO outfalls to reduce the magnitude, frequency, and duration of CSOs. The program must consider regular sewer inspections; sewer, catch basin, and regulator cleaning; equipment and sewer collection system repair or replacement, where necessary; and disconnection of illegal connections.

Proper facility operation is managed by West Point Treatment Plant staff using SCADA.[2] Asset management programs implemented by West Point Treatment Plant, South Treatment Plant, and collection system staff maintain CSO outfalls, regulator stations, and pump stations. Collection system staff inspect sewers on a specified schedule and perform corrective actions when deficiencies are found. Maintenance schedules and records of visits are available for inspection on request.

Salt water and sand that enter the system can cause corrosion and occupy capacity. In 2007−2009, meters were installed to better identify the areas of intrusion during high tide cycles in dry-weather months, to assess the extent of the problem, and to develop a plan to address it. Data were analyzed in 2010, and a report was completed in early 2011.

A review done by King County WTD several years ago indicated that installing permanent backup generators in pump stations that lack reliable dual power feeds could help to prevent overflows. The installation process is nearly complete. The last two generators will be installed at the Barton and Murray pump stations by December 31, 2016 as part of a pump station upgrade project (Barton) and CSO control projects (Murray). Until then a portable generator is available.

WTD's Asset Management Program expanded its use of asset management tools, including a more robust standardized inventory system and condition rating systems, and is developing long-range asset replacement and renewal forecasts, including action plans, to avoid failure of critical assets. An update to WTD's 2005 Strategic Asset Management Plan was completed in 2010.

[2] SCADA = Supervisory Control and Data Acquisition system, which provides monitoring and control capabilities for the treatment plant collection systems.

2.2 Control 2—Storing CSOs in Collection System

Implement procedures that will maximize use of the collection system for wastewater storage that can be accommodated by the storage capacity of the collection system in order to reduce the magnitude, frequency, and duration of CSOs.

Under normal and expected conditions the SCADA system automatically operates the wastewater system based on programmed level setpoints and action sequences. Levels in pump station wet wells and at key points in the conveyance system trigger changes in pump speeds and adjustments of gate positions at pump, regulator and outfall stations. These adjustments can change the rate and direction of flow through conveyance pipes and optimize storage of flows in the conveyance system. The setpoints are reviewed when the hydraulic model is recalibrated and when operational experience suggests that more efficient use of the collection system may be possible.

King County WTD periodically modifies the collection system control strategies to take into account advances in computer modeling, to incorporate more recent field data, and to reflect modifications to the wastewater system. For example, in 1992, storage levels behind regulator stations were raised to improve the capture of CSOs. Currently SCADA system hardware and software at the West Point Treatment Plant is being upgraded to bolster the reliability of monitoring and control of offsite regulator and pump stations.

In 2003, WTD embarked on a division-wide effort to improve its operations by developing instrumentation and control standards that would be applied to all of its existing facilities. After developing the standards, Ovation™ by Emerson Process Management was selected as the control system. The control system was designed to enable regional monitoring of pump stations feeding King County's treatment plants and to control processes at each of the treatment plants. The South Treatment Plant upgrade is essentially complete and work continues at the West Point Treatment Plant. It is anticipated that the Ovation control system upgrades will be completed systemwide by the end of 2015.

Each treatment plant has offsite conveyance and pump stations that feed flows to the plant. Programmable Logic Control (PLC) based systems at these offsite facilities are connected to the Ovation control system to monitor and, in some cases, control the flow and so optimize conveyance to the plant for treatment and the use of system storage capacity.

A previous project completed in 2005—the Denny/Lake Union CSO control project—intended to store flows from Seattle's East Lake Union CSOs and the County's Denny Regulator and Dexter Regulator in the constructed Mercer Tunnel. Stored flows would then drain to West Point for treatment. When the capacity of the tunnel is exceeded, settled flows from the tunnel would be further treated at the Elliott West Facility and discharged to Elliott Bay. Though significant CSO capture has been achieved, the project did not fully control Denny Regulator or Dexter Regulator. Work has continued to adjust those facilities. This year's data suggests that Denny Regulator may now be controlled, but more work at Dexter is needed. What has been done to date, and what is planned, is described in supplemental compliance plans being submitted to EPA and Ecology by August 2, 2013.

The newly amended 2012 King County Long-term CSO Control Plan includes seven collection system upgrade and storage projects for CSO control that will increase collection system storage.

2.3 Control 3—Optimizing Pretreatment Program

Review and modify, as appropriate, its existing pretreatment program to minimize CSO impacts from the discharges from nondomestic users.

King County's Industrial Waste Program (IWP) issues approvals that set limits on the chemical contents of industrial discharges. The program includes monitoring and permit enforcement, education, and technical assistance to businesses on appropriate waste pretreatment and disposal techniques. Local discharge limits are reviewed on a regular basis according to Ecology requirements. The County submits an annual pretreatment report to Ecology detailing permitting, monitoring and inspections, and enforcement actions taken during the year as well as an evaluation of influent, effluent and biosolids focusing on loading and removal rates.

King County also administers and helps fund the Local Hazardous Waste Management Program.

Influent and effluent quality at the West Point Treatment Plant is assessed for trends that would suggest concurrent changes in CSO discharges. In addition, biosolids quality data from the West Point Treatment Plant are tracked as an indicator of changed loading to the system that could influence CSO quality. The only trends seen are the slow decrease or stability in pollutant concentrations.

The County completed the Source Tracking Characterization study to more fully characterize industrial discharges as required in the current NPDES permit. This wastewater characterization study of selected industrial users did not identify any new sources of chemical inputs that have the potential to impact the King County sanitary sewer system. In addition, the study confirmed the appropriateness of the current mechanisms in effect to regulate the discharges of industrial wastewater to the sanitary sewer including the numerical local discharge limits, the federal categorical discharge limits and the authority from King County Code (Title 28) and local discharge limits public rule to establish discharge limits for organic chemicals on a case-by-case basis. The results of the King County Source Tracking Characterization will be submitted during the application process for the renewal of the West Point NPDES Permit.

2.4 Control 4—Maximizing Flow to Treatment Plant

Operate the POTW treatment plant at maximum treatable flow during all wet weather flow conditions to reduce the magnitude, frequency, and duration of CSOs. The Permittee must deliver all flows to the treatment plant within the constraints of the treatment capacity of the POTW.[3]

SCADA is used to maximize flow to the secondary treatment plants, while protecting the biological treatment system, via operation of regulators and pump stations. The West Point Treatment Plant provides secondary treatment for all base flows (defined by Ecology as 2.25 times the average wet-weather flow) and CSO/primary treatment for flows between 300 million gallons per day (mgd) and the peak hydraulic capacity of 440 mgd.[4] (The parallel Fort Lawton Tunnel was built in 1992 to convey up to 440 mgd to the plant.) CSO/primary treated flows are mixed with secondary effluent for disinfection, dechlorination, and discharge from the deep marine outfall. The resulting effluent must meet secondary effluent quality limits, with a small

[3] POTW = publicly owned treatment works.
[4] mgd = million gallons per day.

reduction—80 percent instead of 85 percent removal during the wet season months of November through April—in total suspended solids (TSS) percent removal requirements.

Up to 24 mgd of combined flows are conveyed to South Treatment Plant from southeast Seattle to receive full secondary treatment. This conveyance minimizes CSOs to the Duwamish River along the Elliott Bay Interceptor.

Treatment process stability is monitored and optimized to manage flows based on information from automatic sensors and a battery of analytical tests. Process control laboratories at each plant conduct the testing and analysis and then recommend adjustments to the processes if necessary.

All analyses for CSO control project alternatives include storage and transfer to the secondary and CSO treatment plants.

As stated above under Control 2, it is anticipated that the South Treatment Plant will be on the Ovation control system by the end of 2013, and the West Point Treatment Plant by the end of 2015. Currently both systems are running in parallel to fine-tune Ovation. Each treatment plant has offsite conveyance and pump stations that feed flows to the plant. PLC based control systems at these offsite facilities are connected to the Ovation control system to monitor and, in some cases, control the flow and so optimize conveyance to the plant for treatment and the use of system storage capacity. In the West Point system this will minimize CSOs. Critical alarms and process data are communicated to the plant operators using monitoring systems that report data in independent communication pathways from the control system. WTD installed the OSI PI™ process data historian for long-term trending of all key WTD process, operational, and monitoring data (treatment plants, conveyance facilities, CSO control facilities, and offsite pump stations). The system has been in service since 2005.

2.5 Control 5—Preventing Dry-Weather Overflows

Dry weather overflows from CSO outfalls are prohibited. The Permittee must report each dry weather overflow to the permitting authority as soon as it becomes aware of the overflow. When it detects a dry weather overflow, the Permittee must begin corrective action immediately and inspect the dry weather overflow each subsequent day until it has eliminated the overflow.

The County provides enough capacity in the combined sewer system to transfer 2.25 times the average wet-weather flow to secondary treatment, as negotiated with Ecology. As a result, overflows during the dry season are not the result of a lack of capacity. During dry weather, the County only experiences overflows in the combined system when problems such as power outages, mechanical failures, or human error occur. While these events are rare and are immediately corrected and reported to Ecology, WTD's ongoing Asset Management Program will reduce the likelihood of these kinds of failures.

To minimize the risk of a dry-weather overflow due to power loss at a pump station, a capital program was initiated to install new backup generators and replace old generators that had reached the end of their useful life. This program will be completed with the installations at Murray and Barton pump stations by December 31, 2016. By installing generators at pump stations throughout the system, the program greatly reduces the risk of overflows associated with a loss of power.

To minimize the risk of mechanical failure, the WTD Asset Management Program includes an assessment to determine the criticality of pump station equipment. This assessment identifies

assets essential to pumping sewage, and inspection and maintenance routines have been developed to increase service time and reduce failures for these critical assets. These efforts contribute to reducing overflows by decreasing the probability of mechanical failures.

Operation and maintenance programs, as described for Control 1, focus on preventing dry-weather overflows and exacerbated CSOs.[5] The conveyance system is monitored through SCADA and direct inspection; corrective action is taken immediately if a problem occurs. Equipment problems are immediately reviewed, and repair or replacement is undertaken in a timely manner.

2.6 Control 6—Controlling Solids and Floatables

Implement measures to control solid and floatable materials in CSOs.

The majority of floatables in the King County system are captured in the large volume of wastewater transferred to the treatment plants before overflows occur.

The County routinely engages in the following practices to control floatables:

- Capturing the "first flush" (maximizing flow to treatment plants) so that most solids and floatables that do enter the sewer are conveyed to the plant for removal and disposal before pipelines reach overflow conditions.
- Constructing facilities with gates and weirs that retain and minimize the release of solid and floatable materials. Gates are set to maximize flow containment. Baffles are used in front of weirs to help hold back all but the smallest items in the flow that passes over them.
- Coordinating with the City of Seattle on measures to reduce the washing of street solids and trash into sewers via stormwater and to promote proper disposal of trash so that it is not flushed down toilets.
  - The City of Seattle's catch basin maintenance program limits the introduction of floatable materials to sewers.
  - King County developed an information campaign with brochures, TV spots, and a webpage to educate the public that trash should not be flushed to the sewers. The brochure and webpage are offered in English and five other languages (http://www.kingcounty.gov/environment/wtd/Education/ThingsYouCanDo/TalkTrash.aspx.).
- Encouraging less water use to reduce unnecessary flows in the sewer that contribute to overflows (http://www.kingcounty.gov/environment/wtd/Education/ThingsYouCanDo.aspx).
- Monitoring the development of new floatables control technologies.

Observations of the quantity of floatables are noted in logs at each facility and are available for inspection on request. These observations have indicated that additional floatables and solids

[5] Exacerbated CSOs occur during precipitation but are worsened by mechanical failures, power outages, and human error.

controls are not needed at this time. Under the July 2009 EPA ordered floatables study, this was confirmed with a three-year project to observe for floatables in water bodies near nine CSOs within four hours of an overflow. During the study overflow observations were compared to photos of each area during summer non-overflow periods. Before and after photos showed no accumulation of sewage-related solids or floatables around the discharge points. The third and final floatables report was submitted to Ecology and EPA concurrent with the 2011 CSO annual report.

2.7 Control 7—Preventing Pollution

Implement a pollution prevention program focused on reducing the impact of CSOs on receiving waters.

King County implements the IWP and is a major participant in the Local Hazardous Waste Management Program. Both programs serve to reduce discharge to sewers of chemicals and other substances that adversely impact the environment and the wastewater treatment process.

IWP limits the discharge of fats, oil, and grease (FOG) from a petroleum or mineral origin (nonpolar FOG) to 100 milligrams per liter. Industries must use oil/water separators to pretreat oily wastewater to prevent harm to the biological phase of wastewater treatment and must submit plans for the separators to the local sewer utility or to IWP for review and approval before installing the separators. FOG from an animal or a vegetable origin (polar FOG) can block sewer lines. Although polar FOG has no numerical limit, dischargers are required to minimize free-floating polar FOG and may be required to complete a FOG control plan for IWP's review and approval.

King County also prohibits discharge to the sewer of materials such as ashes, sand, grass, and gravel. Industrial wastewater must contain less than 7 milliliters per liter of solids capable of settling. Food waste, including food-grinder waste, must be capable of passing through a 0.25-inch sieve. Discharge rates and maximum volumes are also set for construction dewatering projects with strict restrictions during the wet season.

Educational materials on controlling trash disposal to sewers are a part of the larger public information program.

King County manages a small grant program to help residents and small businesses implement small-scale projects to improve water quality and support the success of King County's combined sewer overflow projects through controlling new and ongoing sources of pollution that could harm the environment or recontaminate cleaned up areas in the waterway. The grants will also help promote partnerships around source control, develop local expertise in water quality protection, and enhance small-scale environmental and economic opportunities in the community. The grants help King County residents protect their long-term investment in CSO projects.

In 2012, King County awarded $96,678 to four community groups in the Duwamish Valley. The projects and recipients include the following:

- Sustainable West Seattle to deliver the Tox-Ick campaign messages to raise awareness in the Duwamish Basin about the impact of combined sewer overflows and stormwater runoff on local waterways.

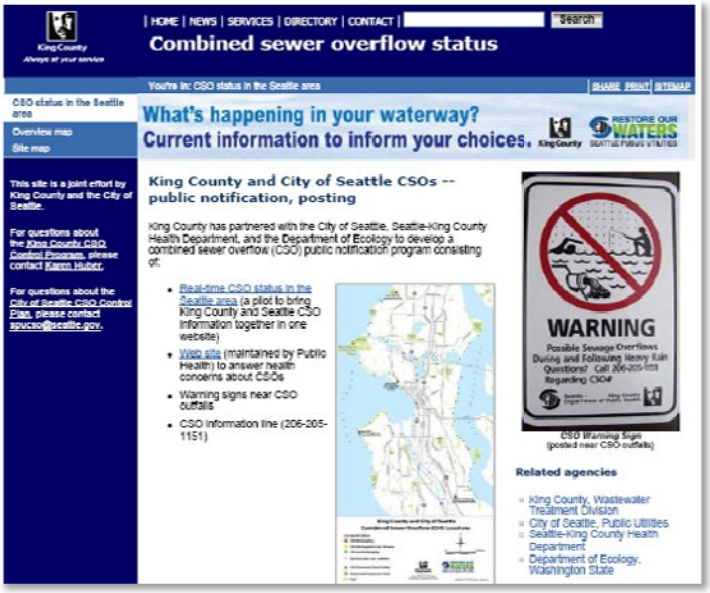
- Sustainable Seattle to work with the Highlands Park Improvement Club to install rain gardens, rainwater cisterns, and other forms of green infrastructure on the Club's property.
- Garden Cycles to work with the community to provide hands-on opportunities for students and volunteers to learn how improved forest health can reduce the impacts of stormwater on Puget Sound.
- Environmental Coalition of South Seattle to build upon the work from last year and engage South Park and Highland Park residents to become part of the polluted runoff solution by putting in rain garden and rainwater cistern demonstration projects at key community meeting places.

Under a settlement with the Puget Sound Clean Air Authority, King County will continue funding small scale air and water quality grants in the Lower Duwamish Valley for up to three more years.

In 2012, King County funded a three-year Source Control Inspector position within the Department of Ecology to conduct stormwater inspections in combined basins. The County will evaluate the findings from the inspections to assess trends that would suggest changes in current County procedures that could influence CSO quality.

2.8 Control 8—Notifying the Public

Implement a public notification process to inform the citizens of when and where CSOs occur. The process must include (a) mechanism to alert persons of the occurrence of CSOs and (b) a system to determine the nature and duration of conditions that are potentially harmful for users of receiving waters due to CSOs.



King County operates a CSO Notification and Posting Program as a joint project with the City of Seattle and Public Health–Seattle & King County. This program includes the posting of signs at publicly accessible CSO locations, an information phone line, websites, a brochure, and other public outreach activities.

A website providing real-time notification of recent and current CSO discharges went live in December 2007.[6] In April 2011, King County completed the process to incorporate City of Seattle real-time overflow information on this website. The website presents overflow status for the majority of city and County CSOs with links to and from each agency's independent website. The community now has access to consolidated information to assist in making choices about use of

[6] http://www.kingcounty.gov/environment/wastewater/CSOstatus.aspx.

local waters. Outreach for the joint notification site, led by the City of Seattle, began in summer of 2011. An automated email notification system for county CSOs continues to be tested.

From January-December 2012, the **CSO Control Program** *and* the **CSO Status** sites had over 41,000 page views (representing 28,692 unique page views). The most page views, 1,261, was logged on November 19, 2012, corresponding to a large rain event of 2.13 inches.

From January-December 2012, the **CSO Status** site had over 9,900 page views (representing 6,646 unique page views). The most page views, 1,053, was logged on November 19, 2012, corresponding to a large rain event of 2.13 inches.

King County continued ongoing community involvement efforts on the individual project level and the program-wide level to help keep the public informed of the CSO Control Plan under consideration by the Executive and King County Council in 2012. CSO related activities and opportunities to participate strengthened public acceptance of the County's CSO control approaches and the facilities planned in the drainage basins of the four Puget Sound beach projects: Barton, Murray, North Beach and South Magnolia. King County continues to develop partnerships throughout the County. WTD uses resources and skills throughout the division to support community based education partnerships, providing resources that will in turn be further disseminated throughout the region. For example, a training focused on the basics of water systems, CSO's, and trash/chemical flushing issues was held for 200 Seattle Aquarium Beach Naturalists who facilitate family environmental education at 10 sites around the Puget Sound.

The King County Executive's Recommended CSO Control Plan was shared with the community in many ways including via websites, community group briefings, email notifications to interested parties, a flyer on the plan that was translated into four languages, and document repositories in numerous libraries. These efforts helped to ensure that interested community members were aware of the plan's content and of the opportunities community members had to offer their comments to the Executive and County Councilmembers. The County Council approved the CSO Control Plan in September 2012. The Public and Regulatory Agency Participation Plan, updated in 2012, is available at: http://your.kingcounty.gov/dnrp/library/wastewater/cso/docs/ProgramReview/2012/WTDRec/TechMemos/PublicInvolvementPlan,June2012.pdf

Extensive outreach was also conducted to answer questions and build public support for facility design and implementation of the four Puget Sound beach projects. Community input generated from these efforts influenced project design decisions including facility location, landscaping, and architecture for all four projects. Community support in the Barton basin for the RainWise program was factored into the County's decision to incorporate the program into its control plan. Recommendations from the Murray CSO Control Facility Design Advisory Group were integrated into the facility's architectural features and art. Landscape and architecture designs for the North Beach and South Magnolia facilities were developed and refined with community input from meetings, workshops and briefings held from 2009-2012.

2.9 Control 9—Monitoring CSO Outfalls

Monitor CSO outfalls to characterize CSO impacts and the efficacy of CSO controls. This must include collection of data that it will use to document the existing baseline conditions, evaluate the efficacy of the technology-based controls, and determine the baseline conditions upon which it will base the long-term control plan. This data must include:

a. Characteristics of the combined sewer system including the population served by the combined portion of the system and locations of all CSO outfalls in the CSS.

b. Total number of CSO events and the frequency and duration of CSOs for a representative number of events.

c. Locations and designated uses of receiving water bodies.

d. Water quality data for receiving water bodies.

e. Water quality impacts directly related to CSO (for example, beach closing, floatables, wash-up episodes, fish kills).

In 1986, WTD's predecessor, Metro, began a sampling program to characterize each CSO and identify high priority sites for early control. The program included collecting overflow quality data for five CSO sites per year and collecting sediment samples at each site. In the 1990s, sampling was expanded to assess compliance with state Sediment Management Standards. The County's extensive monitoring for its 1999 CSO Water Quality Assessment of the Duwamish River and Elliott Bay found that the majority of risks to people, wildlife, and aquatic life would not be reduced by removal of CSOs because most risk-related chemicals come from sources other than CSOs.

Under the renewed NPDES permit for the West Point Treatment Plant, King County developed a comprehensive sediment quality summary report for all CSO discharge locations (submitted December 2009) and a draft CSO post-construction monitoring plan (PCMP) submitted July 2010.[7] Ecology reviewed this document and provided comments on the PCMP. Ecology approved the final PCMP on September 28, 2012. It can be found at: http://your.kingcounty.gov/dnrp/library/wastewater/cso/docs/ProgramReview/2012/AppH_CSO_PostConstructionMonitoringPlan,Sept2012.pdf

Also, the County will submit ambient monitoring data near CSO plant outfalls, required by Section S.18.I of the NPDES permit by June 30, 2013, and will implement additional sediment sampling if required by Ecology.

[7] The sediment report is available at http://www.kingcounty.gov/environment/wastewater/CSO/Library/SedQualSum.aspx.

Section 3

Status of Current CSO Control Projects

This section describes the progress made on implementing current CSO control projects and projects that affect CSO control.

3.1 Puget Sound Beach Projects

Four CSO control projects are in the final design process: South Magnolia, North Beach, Barton, and Murray. These four projects are referred to as the Puget Sound Beach projects. The 2009 renewal of the NPDES permit for the West Point Treatment Plant set the following compliance schedule for these projects:

- Submit for approval a Facilities Plan by December 31, 2010.
- Submit final plans and specifications by December 31, 2012.
- Begin construction by December 31, 2013.
- Construction completion by December 31, 2015 (South Magnolia and North Beach) and December 31, 2016 (Barton and Murray).

The selected alternative for each project is as follows:

- Construction of a 1.5 MG storage tank outside the South Magnolia basin near the Magnolia Bridge. During predesign, the tank volume was revised from 1.8 to 1.5 million gallons.
- Construction of a 0.33 MG storage pipeline in a public right-of-way in the North Beach basin. During predesign, the tank volume was revised from 0.23 to .33 million gallons.
- A pump station upgrade and installation of approximately 77,000 square feet of bioretention swales in the public right-of-way in the Sunrise Heights and Westwood neighborhoods (for the Barton CSO).
- Construction of a 1 MG storage tank across from Lowman Beach Park in the Murray basin.

The proposed alternatives and the alternatives development processes are documented in the Facilities Plans submitted in December 2010 and approved by Ecology in 2011. These alternatives continue to be refined through the design process. Cost estimate increases prompted WTD to undertake a value engineering process to find efficiencies and cost savings in the design during the spring of 2012. Efficiencies and cost savings were realized and all projects achieved approval of baseline schedules and budgets in summer 2012.

Other accomplishments in 2012 for all projects includes: progress through 60 and 90% design; extensive community engagement; initiation of land acquisitions with the Port of Seattle, Seattle City Parks, and local utilities and easements; and continued permitting activities with City of Seattle. All projects are on schedule to begin construction in 2013.

Information on each Puget Sound beach project is available at

Barton:
http://www.kingcounty.gov/environment/wtd/Construction/Seattle/BartonCSO-GSI.aspx

Murray:
http://www.kingcounty.gov/environment/wtd/Construction/Seattle/MurrayCSOStorage.aspx

North Beach:
http://www.kingcounty.gov/environment/wtd/Construction/Seattle/NBeachCSOStorage.aspx

South Magnolia:
http://www.kingcounty.gov/environment/wtd/Construction/Seattle/SMagnoliaCSOStorage.aspx

3.2 Ballard Siphon Replacement

The Ballard Siphon Replacement project is an asset management project with a CSO control element. The project includes two major components: (1) slip-lining the existing wood-stave siphon barrels to extend their useful life, and (2) tunneling an 84-inch diameter pipe below the canal. Completion of the new siphon will eliminate CSO events at the Ballard Regulator Station earlier than planned. Completion of slip-lining of the original siphon will provide capacity for future control of overflows at the 11th Avenue NW CSO site and will reduce overflows in the interim. Design was completed in May 2009. Notice to Proceed for construction was issued in May 2011, and completion of the Ballard CSO control component is scheduled for December 2013.

The retrieval and launch shafts have both been completed and more than 1000 linear feet, slightly more than 50 percent of the total length, of the tunnel has been mined. The connection to the North Interceptor has been completed and the contractor has made significant progress toward completing modifications to the existing regulator station. Poor weather limited construction slightly such that the slip-lining of the existing siphon may not be completed until early in January 2014; however, the new siphon providing Ballard CSO control is on track to go in service by the end of 2013.

More information is available at
http://www.kingcounty.gov/environment/wtd/Construction/Seattle/BallardSiphon.aspx

3.3 Hanford at Rainier / Bayview North CSO Control Project

The primary objective of this project is to control the Hanford at Rainier and Bayview North CSOs. To control the Bayview North CSO, peak flow up to the one-year event would be diverted to the Bayview Tunnel, where there is extra capacity to transfer flow to the Elliott Bay Interceptor near the Hanford #2 CSO. To control the Hanford at Rainier CSO, 0.34 MG of off-line storage near the CSO discharge location will be constructed. The property for this storage tank has been identified and property purchase is anticipated to be completed by July 2013.

The consent decree compliance dates for this project are as follows:

- Submit Facility Plan December 31, 2014.
- Completion of bidding December 31, 2016.
- Construction completion December 31, 2019.

Accomplishments in 2012: The project was transferred to a capital project team and the team was formed. The project will be designed by WTD in-house engineering and was formally approved to move into pre-design.

3.4 Brandon / South Michigan Wet Weather Treatment Plant

The primary objective of this project is to control the Brandon Street and South Michigan Street CSOs in compliance with the Washington State standards.

This objective will be met by building a 66 mgd high rate clarification wet weather treatment facility (WWTF) as adopted by the King County Council and approved by the US EPA in the 2012 King County Long-term Combined Sewer Overflow Plan Amendment. Success will be measured through post construction monitoring of each CSO under a plan approved by Ecology.

In April 2013, the findings of enhanced monitoring, modeling and facility inspection were incorporated into a preliminary project charter including project requirements, constraints and risks, which was transferred to the Capital project team responsible for the design and construction of the project. This is ahead of the planned start in January 2014.

The consent decree milestones for this project are as follows:

- Submission of Facilities Plan by December 31, 2015.
- Completion of bidding by December 31, 2017.
- Construction completion by December 31, 2022.

Section 4

Summary of Rainfall and CSO Events

WTD measures rainfall in the Seattle area at several of its regulator and pump stations and at the West Point Treatment Plant. It also monitors the frequencies and volumes of both untreated and treated CSOs at all its CSO discharge sites.

This section describes rainfall data, reports on unpermitted overflows, and summarizes frequency and volume for all untreated and treated CSO discharges in 2012. More information can be found in the appendices.

4.1 Annual Rainfall

The 2009 renewed NPDES permit requires that rainfall data be reported for each CSO event as measured by the nearest King County owned rain gauge. Rainfall data for 2012 are included in Appendices A and B of this annual report.

The annual rainfall for 2012, as an average over local rain gauges, was 42.79 inches, which is greater than the long-term Sea-Tac annual average of 37.07 inches.

4.2 Unpermitted Overflows

Overflows can occur from CSO structures, broken pipelines, and manholes. Overflows that are not caused by rainfall are called dry-weather overflows (DWOs). In King County's system, DWOs usually result from mechanical failures, power outages, or human error. Under EPA's Nine Minimum Controls, DWOs are to be prevented. Overflows that occur during precipitation, but are worsened by mechanical failures, power outages, or human error, are referred to as "exacerbated CSOs."

One DWO and one exacerbated overflow occurred in the county system in 2012.

Table 1. One Dry-Weather Overflow and One Exacerbated CSO Event, 2012

Date	Location	Estimated Volume (gallons)	Estimated Duration (minutes)	Receiving Water	Cause and Resolution
June 3	Barton Street Pump Station	44,600	60	Puget Sound	Power outage (dry-weather overflow)
December 17	Murray Street Pump Station	1,950,370	79	Puget Sound	See letter to Ecology dated 12/18/12 (exacerbated CSO)

4.3 Annual Untreated CSO Events

West Point's SCADA system monitors the volume and frequency of CSOs at regulator and pump stations. Portable flow meters are deployed at ten CSO locations not currently monitored by SCADA: 11th Avenue NW, SW Alaska Street, Bayview North and South, East and West Duwamish, Hanford at Rainier, South Magnolia, North Beach Pump Station inlet, and Terminal 115. Portable meters also supplement SCADA in a few locations.

With higher than normal rainfall, King County CSOs discharged a total of 1,405 MG over 324 events during 2012. This represents a 40 percent reduction from the 1981-1983 baseline volume of 2,339 MG, but does not reflect the long-term trend of reduction. The most storm events and the highest precipitation occurred in November and December, resulting in a discharge of 1,017 MG, or 72 percent of the annual total. The largest overflow was 152 MG at the Lander CSO during a storm lasting over 142 hours.

The renewed NPDES permit now requires "event-based" data reporting by CSO site. Appendix A of this report lists the untreated events from County CSOs during 2012. These data are also provided in electronic form to Ecology along with this report.

The permit also requires reporting against the performance standard of no more than one untreated event per year by site as a 20-year moving average. Section 5 of this report presents performance against this 20-year standard.

4.4 CSO Treatment

King County provides CSO treatment, defined in Chapter 173-245 WAC as "equivalent to primary" treatment, at the West Point Treatment Plant and at four satellite facilities: Alki, Carkeek, Mercer/Elliott West, and Henderson/Norfolk.

The following sections summarize performance and compliance at each facility during 2012. Appendix B of this report provides more detail on volumes and events. Appendices C–F contain the annual reports for each satellite CSO treatment facility.

4.4.1 West Point Treatment Plant

In addition to secondary treatment of up to 300 mgd of base wastewater flows (defined as 2.25 times the average wet-weather flow of 133 mgd), the West Point Treatment Plant provides CSO/primary treatment for flows above 300 mgd and up to a peak of 440 mgd. Combined sewer flows that would otherwise overflow to the Lake Washington Ship Canal are transferred to the West Point Treatment Plant. After receiving CSO treatment, these flows are blended with secondary effluent prior to disinfection, dechlorination, and discharge from the deep marine outfall. The resulting effluent must meet secondary effluent quality limits, with a small reduction—80 percent instead of 85 percent—in the monthly removal requirements during the typical wet season months of November through April. WTD submitted a report documenting that there are no feasible alternatives to this practice as it is a fundamental component to King County's CSO control strategy and was documented in a No Feasible Alternatives Analysis as part of the 2008 NPDES permit renewal. Ecology accepted the report.

During 2012, 551.9 MG received CSO/primary treatment at West Point over 21 events. All final plant secondary treatment effluent limits were met during the year. These occurrences are listed in Appendix B.

4.4.2 Alki CSO Treatment Plant

The transfer of Alki area base flows to the West Point Treatment Plant was completed in 1998, and conversion from a continuously operating primary plant to a CSO treatment plant was completed in 2001. There were seven filling events and seven discharge events at the Alki CSO

Treatment Plant during 2012. The plant received a total inflow of 108.39 MG and discharged 81.45 MG.

All performance permit limits were met except for the monthly geometric mean limit for fecal coliforms during January. Overall TSS removal was 57.25 percent which met the annual 50 percent TSS removal limit.

To reduce the possibility of higher effluent fecal coliforms, efforts to correct challenges with sodium hypochlorite dosing and to modify fecal coliform sampling are described in the Alki CSO Treatment Plant annual report in Appendix C.

4.4.3 Carkeek CSO Treatment Plant

The transfer of Carkeek area base flows to the West Point Treatment Plant and the conversion from a continuously operating primary plant to a CSO treatment plant was completed in 1994. In 2012, the Carkeek CSO Treatment Plant operated 17 times with a total inflow volume of 31.2 MG, and discharged six times with a total discharge volume of 26.8 MG.

The monthly average and event-based limits for settleable solids were met. The annual 50 percent TSS removal limit was also met; TSS removal averaged 50.1 percent. Fecal coliform levels met the effluent limits. The daily average effluent chlorine residual did exceed the permit limit of 490 µg/L during one event in November when sodium bisulfite solution (SBS) feed had to be shut off to repair a leaking SBS feed line.

Maintenance activities included installing a valve and a water hose connection to enable back-flushing capabilities, replacing sodium hypochlorite with fresh hypochlorite, and implementing a flow monitoring improvement project.

More detail is available in the Carkeek CSO Treatment Plant annual report in Appendix D.

4.4.4 Mercer/Elliott West CSO Treatment and Storage Facilities

The Mercer/Elliott West tunnel storage and treatment system was brought online in May 2005 as a joint project with Seattle's East Lake Union CSO control projects. In 2012, the system's seventh full year of operation, there were 46 filling events totaling 511.9 MG and 12 discharge events with a total volume of 198.9 MG. Elliott West continues in the commissioning phase as needed corrections are identified and implemented across intermittent operations.

The 50 percent annual average TSS removal limit was met; TSS removal was 64.5 percent compared to 62.4 percent in 2011. The system did not continuously meet four permit limits during the year: (1) the annual average and (2) the event maximum settleable solids limits; (3) the total residual chlorine limit; and (4) the instantaneous minimum pH.

Meeting the settleable solids permit limits continues to be a challenge at the Elliot West CSO Facility (EWCSO). In response, WTD installed a portable sequential auto-sampler at EWCSO in order to compare solids in the samples collected by the effluent auto-sampler at the Denny Regulator, and tunnel flushing has been implemented more frequently to evaluate its impact on settleable solids compliance. In addition, a Chlorination-Dechlorination Improvements project

that became operational in November 2011 assists in addressing problems that may be contributing to chlorine residual, pH, and fecal coliform limits not being met. The project created four operational modes—modes one and two are flow paced hypo feed controls and modes three and four are feedback controls based on chlorine residual. The first two modes have been tested, but testing of the remaining two await more storm flow events. Since the project was implemented, dosing levels have been reduced for both hypochlorite and sodium bisulfate.

More detail can be found in the Mercer/Elliott West annual report in Appendix E of this report.

The associated Denny Regulator CSO has not met the control standard since the Elliott West facility came online in May 2005.

Investigation suggested that two of the inputs—Denny Local and Denny Lake Union—were overflowing more than intended. The investigation recommended removal of the lower Denny Local weir and modification of the Elliott West pump ramp up strategy to drop the lead pump start setpoint by 2.25' and improve flow into the Elliott West facility. The weir modifications were completed in July 2011 and pumping strategy modifications were completed November 17, 2011. These improvements appear to be having a benefit—in 2011 only two overflows, one 14 minutes and another two minutes long, occurred. In 2012, a single two minute overflow occurred, and through May of 2013 no overflows have occurred. Performance of these improvements will continue to be monitored. Further detail is provided in the supplemental compliance plan being submitted to Ecology and EPA shortly after this report.

The other associated County CSO is Dexter Regulator. Despite significant capture of CSO volume, it also continues to have frequent, but much smaller, overflows since the Elliott West/Mercer facilities came online. In 2012, 13 fairly small overflows occurred. Control system refinements at Dexter CSO have been implemented to maximize use of upstream storage and transfer to the Mercer tunnel and downstream conveyance while minimizing overflows. At this time these have not brought Dexter fully into control. A construction project to make physical modifications to the drop structure to Mercer tunnel is now being designed.

Detail on both regulator improvements is provided in the supplemental compliance plans being submitted to Ecology and EPA shortly after this report.

4.4.5 Henderson/Norfolk CSO Treatment and Storage Facilities

The Henderson/Norfolk tunnel storage and treatment system was brought online in May 2005, and 2012 marked its seventh full year of operation. As is typical of intermittently operated facilities, adjustments to systems and operations to achieve intended performance continued during the first few years. The Henderson/Norfolk system had five filling events in 2012, totaling 14.1 MG and one discharge event.

The TSS removal limit was achieved at an average of 63.6 percent by capture and transfer for treatment at South Plant, meeting the 50 percent removal limit. All other permit limits were met except for the maximum daily chlorine residual limit in November.

For several years King County and City of Seattle have been discussing their potential to transfer captured CSO from several of their Lake Washington facilities to the County's Henderson and Henderson/MLK conveyance and treatment tunnel system for more cost-effective control. Early information on peak flow rates suggested there would be no impact on downstream County facilities, and a letter was sent to Ecology that an MOA was in development. However, recent

information on the duration and total volume of these transfers has raised concerns that impacts on the Henderson treatment tunnel process and the volume of the treated discharge to the Lower Duwamish Waterway Superfund site may have greater impacts than anticipated. King County and City of Seattle are working together to verify information. Once impacts can be identified and quantified by both utilities, King County and Seattle will discuss potential alternatives, including potentially managing transferred flows where it can be done so within our regulatory requirements.

The annual report for Henderson/Norfolk system is provided in Appendix F of this report.

Section 5

Twenty-Year Moving Average of Event Frequencies

The renewed NPDES permit for the West Point Treatment Plant, effective July 1, 2009, implements a new interpretation of the performance standard for CSO control, which is derived from the state regulatory requirements for "greatest reasonable reduction" as specified in WAC 173-245-022(22).

The standard of "not more than one untreated discharge event per year per outfall on average" is now based on a 20-year moving average. Previous permits identified the average as five years. The number of untreated discharges that occurred over each of the previous 20 years is reported for each CSO site and then averaged (Table 2). This average is used each year to assess compliance with the performance standard for CSOs identified as controlled. However, a full 20 years of data are not available for all sites because the upgraded SCADA system was brought online and began to report data for all sites over time. Locations lacking the full 20 years of measured data are noted. For sites where new control facilities have been built and which lack the 20 years of measured data, modeled data of how the new facilities would have performed over those years of rainfall have been substituted for the early missing data. For sites not identified as controlled, only available measured data are reported. Ecology has directed that treated discharges from the CSO treatment facilities that are categorized as the "one untreated event per year" for permit limit compliance purposes should be considered as treated and should not be counted in the 20-year data.

The following 16 sites were identified as controlled through the monitoring and modeling data:

30th Avenue NE Pump Station
53rd Avenue SW Pump Station
63rd Avenue SW Pump Station
8th Ave S Regulator[8]
SW Alaska Street
Belvoir Pump Station
Canal Street
East Duwamish Pump Station and Siphon
West Duwamish Siphon
Henderson Pump Station
East Marginal Pump Station
Matthews Park Pump Station
Martin Luther King Way (MLK)
Norfolk
E Pine Street Pump Station
Rainier Avenue Pump Station.

Projects previously completed at three CSO sites—Denny Regulator, Dexter Regulator, and Harbor Regulator—have not fully achieved control to the state standard. Work to complete control that has been implemented and is planned is described in supplemental compliance plans being submitted by August 2, 2013.

[8] Modeled and monitored data at 8th Ave. S. do not agree on control status. Additional monitors have been placed to update data for the next recalibration of the model. The control status of the 8th Avenue South Regulator Station will be confirmed at that time.

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Table 2. Untreated CSO Events, Averages, and Baselines, 1993–2012

CSO Site	Discharge Serial Number (DSN)	1993	1994	1995	1996[b]	1997[c]	1998	1999	2000[d]	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	20-Year Average	20-Year Average for Compliance	1983 Baseline (24-hr interevent)
11th Ave. NW[e]	004	7	20	30	18	21	10	12	14	14	8	8	6	11	22	10	7	16	19	16	20	14.5		16
30th Ave. NE[f]	049	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0	<1
3rd Ave. W[g]	008	0	4	10	15	9	8	4	1	11	4	6	4	5	13	6	3	9	8	7	13	7.0		17
53rd Ave. SW[h]	053	NM	NM	NM	NM	NM	NM	NM	0	0	0	0	0	0	2	1	0	0	0	0	1	0.3	0.3	<1
63rd Ave[h]	054	NM	NM	NM	NM	NM	NM	NM	0	0	0	2	0	1	0	0	0	0	1	1	3	0.6	0.6	2
8th Ave./ W Marginal Way	040	1	2	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0.4	0.4	6
Alaska St. SW[e,f]	055	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1[t]	0	1	1	1	0.3	0.3	1
Ballard	003	4	11	12	11	8	3	5	2	2	0	4	2	1	5	2	1	8	6	7	13	5.4		13
Barton[h]	057	NM	NM	NM	NM	NM	NM	NM	0	0	0	3	4	5	11	3	1	2	4	1	4	2.9		9
Belvoir	012	1	0	0	1	1	0	1	0	0	0	2	2	0	1	1	0	0	1	0	1	0.6	0.6	<1
Brandon St.[k]	041	133	37	53	55	40	31	32	30	30	21	28	21	27	11	NM	3[t]	16	11	7	12	31.5		36
Canal St.	007	0	0	0	3	1	2	0	1	0	0	0	0	0	0	1	0	1	1	0	1	0.6	0.6	<1
Chelan	036	5	15	8	15	8	5	5	2	7	2	3	1	2	5	2	0	0	3	4	13	5.3		7
Denny Way	027a	38	33	49	54	37	23	23	25	26	15	25	20	11	9	1	2	4	2	2	1	20.0		32
Dexter	009	4	10	23	22	21	13	10	10	12	9	15	8	12	20	9	3	11	13	8	13	12.3		15
Duwamish E[e]	034	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	1	0	0	0.2	0.2	<1
Duwamish W[e,o]	035	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	1	0	1	0	0	1	0	0	0.4	0.4	<1
Hanford #1																								30
Hanford @ Rainier[e, j]	031a	0	0	0	20[i]	14	17	5	0	0	3	6	8	NM	16	4	6	14	13	13	18	8.3		NA
Bayview South[e]	031b	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM [s]	0	1	0.5		NA
Bayview North[e]	031c	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	5 [r]	2	7	4.7		NA
Hanford #2	032	10	17	32	20	17	17	18	17	13	10	12	16	15	26	12	8	17	17	15	23	16.6		28
Harbor Ave.[l]	037	39	13	47	39	1	1	0	0	2	0	2	0	3	5	2	0	0	1	1	3	8.0		30
Henderson[q]	045	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	0	0	0	0	0	0	0	0.0	0.0	12
King Street	028	20	19	27	17	18	11	14	10	14	12	16	15	20	27	7	3	15	18	15	13	15.6		16
Kingdome (formerly Connecticut)	029	15	8	15	14	11	3	0	1	0	0	0	2	5	4	5	1	8	6	2	11	5.6		29
Lander St.	030	0	7	26	16	12	10	15	11	10	10	12	9	8	28	8	6	19	17	15	25	13.2		26
Magnolia S[e]	006	20	28	39	48	34	19	5	0	0	5	18	17	26	30	21	26	25	38	22	36	22.9		25
Marginal E	043	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0	<1
Matthews Park	018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0	<1
Michigan St.	039	9	13	0	0	0	0	10	8	12	8	9	6	5	13	5	3	10	12	14	16	7.7		34
Michigan W	042	12	2	5	6	6	3	3	2	7	5	4	1	3	8	4	0	8	9	3	5	4.8		5
MLK Jr. Way[q]	013	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	0	0	0	0	0	0	0	0.0	0.0	16
Montlake	014	3	4	11	7	2	7	0	2	0	5	11	5	6	NM	0	1	3	10	8	18	5.4		6
Murray[h]	056	NM	NM	NM	NM	NM	NM	NM	0	0	0	3	5	10	10	3	1	11	8	3	5	4.5		5
Norfolk St.[q]	044a	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	0	0	0	0	0	0	0	0.0	0.0	20
North Beach Inlet[e]	048b	5	13	19	22	20	13	9	11	10	1	6	6	10	13	4	3	13	6	15	13	10.6		18
North Beach Wet Well[m]	048a	w/inlet	w/inlet	w/inlet	w/inlet	w/inlet	w/inlet	w/inlet	w/inlet	w/inlet	w/inlet	w/inlet	w/inlet	3	15	6	3	14	10	8	20	9.9		18
Pine St. E	011	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0	<1
Rainier Ave.	033	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0	<1
Terminal 115[e,n]	038	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	2	0	2	7	4	0	3	3	0	1	2.2		4
University	015	2	10	15	13	9	10	4	3	5	4	4	4	3	12	5	3	9	8	6	13	7.1		13
Rainfall (inches)		24.91	32.37	39.34	42.28	35.23	41.32	33.81	29.82	35.99	27.39	34.46	27.79	31.32	42.82	31.11	24.90	31.46	40.30	32.2	42.57	34.1		37.00

Notes for Table 2:

[b] The West Point Treatment Plant computers (SCADA) were down from 10/17/1996 to 11/17/1996.

[c] CSO "event" definition changed to be based on a 48-hour dry period.

[d] CSO “event” definition changed to be based on a 24-hour dry period.
[e] Portable monitors are used at 11th Avenue NW, Alaska Street SW, Bayview North and South, East and West Duwamish, Hanford South Magnolia, North Beach Inlet, and Terminal 115. The Bayview North monitor was installed in 2010; the Bayview South monitor was installed in 2011.
[f] Monitoring began in June 1992 at Belvoir, 30th Avenue NE, Alaska Street SW, South Magnolia, East Marginal, Matthews Park, MLK Jr. Way, East Pine, Rainier avenue, Henderson, and North Beach.
[g] The 3rd Avenue West monitor was down 6/2006 through 11/2006.
[h] Monitoring began in June 2000 at 53rd Avenue, 63rd Avenue, Barton, and Murray.
[l] Monitoring began at Hanford #1 (Hanford @ Rainier) in January 1996.
[j] The monitor at Hanford #1 was down June 2000 through May 2001 and was not operating properly 6/1/2007 to 12/17/2007.
[k] The monitor at Brandon was down June 2006 to March 2008. A portable monitor was installed in March 2008. Monitoring by SCADA was restored beginning with the 2009 period
[l] No data were recorded at Harbor Avenue April and May 2004.
[m] Reporting of the North Beach wet well began in June 2005.
[n] Monitoring began in June 2003 at Terminal 115.
[o] Monitoring began at West Duwamish in June 2005.
[q] Henderson, MLK Jr. Way, and Norfolk Street were controlled as of 2006. Modeled data through 2005 (in italics) have been substituted to simulate how current facilities would have performed under rain patterns during that time.
[r] Hanford #1 (Bayview N) began monitoring in 2010
[s] Hanford #1 (Bayview S) began monitoring in 2011
[t] Corrected data from 2010 report

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Appendices

Appendix A. Untreated CSO Events, January–December 2012

Appendix B. Treated CSO Events, January–December 2012

Appendix C. Alki CSO Treatment Plant 2012 Annual Report

Appendix D. Carkeek CSO Treatment Plant 2012 Annual Report

Appendix E. Mercer/Elliott West CSO Control Facilities 2012 Annual Report

Appendix F. Henderson/Norfolk CSO Control Facilities 2012 Annual Report

Appendix A
Untreated CSO Events
January–December 2012

Outfall DSN #	CSO Name	Receiving Water	Event Starting Date/Time	Event Ending Date/Time	Event Duration (hours)	Volume (gallons)	Precipitation (inches)	Storm Duration (hours)	Note if DWO/ Exacerbated
003	Ballard Siphon Regulator via Seattle Storm Drain	Lake Washington Ship Canal	1/4/12 1:01 PM	1/4/12 1:35 PM	0.57	86,490	0.46	22.78	
003	Ballard Siphon Regulator via Seattle Storm Drain	Lake Washington Ship Canal	3/15/12 10:10 AM	3/15/12 10:31 AM	0.35	35,889	1.68	74.15	
003	Ballard Siphon Regulator via Seattle Storm Drain	Lake Washington Ship Canal	7/3/12 4:40 AM	7/3/12 3:29 PM	10.82	50,244	0.56	19.30	
003	Ballard Siphon Regulator via Seattle Storm Drain	Lake Washington Ship Canal	7/20/12 9:46 AM	7/20/12 10:15 AM	0.48	61,850	0.56	6.03	
003	Ballard Siphon Regulator via Seattle Storm Drain	Lake Washington Ship Canal	10/18/12 8:43 PM	10/18/12 8:47 PM	0.07	643	0.37	1.82	
003	Ballard Siphon Regulator via Seattle Storm Drain	Lake Washington Ship Canal	10/30/12 4:07 PM	10/31/12 6:21 AM	14.23	162,074	2.18	28.72	
003	Ballard Siphon Regulator via Seattle Storm Drain	Lake Washington Ship Canal	11/19/12 6:13 AM	11/21/12 6:16 AM	48.05	505,128	4.35	111.05	
003	Ballard Siphon Regulator via Seattle Storm Drain	Lake Washington Ship Canal	11/23/12 2:10 PM	11/23/12 2:57 PM	0.78	42,668	0.63	13.78	
003	Ballard Siphon Regulator via Seattle Storm Drain	Lake Washington Ship Canal	11/30/12 8:32 PM	12/1/12 4:23 AM	7.85	349,680	1.78	62.57	
003	Ballard Siphon Regulator via Seattle Storm Drain	Lake Washington Ship Canal	12/3/12 2:28 AM	12/4/12 2:49 AM	24.35	79,985	3.35	133.00	
003	Ballard Siphon Regulator via Seattle Storm Drain	Lake Washington Ship Canal	12/16/12 4:46 PM	12/16/12 8:42 PM	3.93	95,200	0.82	33.97	
003	Ballard Siphon Regulator via Seattle Storm Drain	Lake Washington Ship Canal	12/19/12 5:04 PM	12/20/12 11:01 AM	17.95	86,153	1.75	31.40	

Outfall DSN #	CSO Name	Receiving Water	Event Starting Date/Time	Event Ending Date/Time	Event Duration (hours)	Volume (gallons)	Precipitation (inches)	Storm Duration (hours)	Note if DWO/ Exacerbated
003	Ballard Siphon Regulator via Seattle Storm Drain	Lake Washington Ship Canal	12/25/12 11:42 AM	12/25/12 1:18 PM	1.60	112,114	0.50	4.60	
004	East Ballard (AKA 11th Ave NW)	Lake Washington Ship Canal	1/2/12 5:07 PM	1/2/12 6:02 PM	0.92	54,472	0.37	2.70	
004	East Ballard (AKA 11th Ave NW)	Lake Washington Ship Canal	1/4/12 12:37 PM	1/4/12 8:27 PM	7.83	320,319	0.74	29.32	
004	East Ballard (AKA 11th Ave NW)	Lake Washington Ship Canal	1/26/12 5:32 AM	1/26/12 5:42 AM	0.17	1,788	0.65	46.95	
004	East Ballard (AKA 11th Ave NW)	Lake Washington Ship Canal	2/1/12 6:17 AM	2/1/12 6:57 AM	0.67	116,072	0.41	7.43	
004	East Ballard (AKA 11th Ave NW)	Lake Washington Ship Canal	2/17/12 3:37 PM	2/17/12 3:47 PM	0.17	8,737	0.22	30.92	
004	East Ballard (AKA 11th Ave NW)	Lake Washington Ship Canal	3/15/12 10:17 AM	3/15/12 10:57 AM	0.67	611,870	1.68	74.15	
004	East Ballard (AKA 11th Ave NW)	Lake Washington Ship Canal	3/29/12 3:42 PM	3/29/12 5:02 PM	1.33	55,287	1.01	62.55	
004	East Ballard (AKA 11th Ave NW)	Lake Washington Ship Canal	7/3/12 4:42 AM	7/3/12 3:57 PM	11.25	963,240	0.57	20.00	
004	East Ballard (AKA 11th Ave NW)	Lake Washington Ship Canal	7/13/12 11:00 AM	7/13/12 11:15 AM	0.25	4,441	0.22	0.98	
004	East Ballard (AKA 11th Ave NW)	Lake Washington Ship Canal	7/20/12 9:45 AM	7/20/12 10:35 AM	0.83	225,944	0.56	6.03	
004	East Ballard (AKA 11th Ave NW)	Lake Washington Ship Canal	10/18/12 8:45 PM	10/18/12 9:15 PM	0.50	205,089	0.40	2.27	
004	East Ballard (AKA 11th Ave NW)	Lake Washington Ship Canal	10/29/12 2:00 AM	10/29/12 2:10 AM	0.17	34,528	0.40	7.53	
004	East Ballard (AKA 11th Ave NW)	Lake Washington Ship Canal	10/30/12 4:00 PM	10/31/12 6:30 AM	14.50	1,781,723	2.19	28.87	
004	East Ballard (AKA 11th Ave NW)	Lake Washington Ship Canal	11/1/12 9:00 AM	11/1/12 9:10 AM	0.17	1,739	2.76	55.17	
004	East Ballard (AKA 11th Ave NW)	Lake Washington Ship Canal	11/19/12 7:08 AM	11/21/12 7:37 AM	48.48	9,328,594	4.36	111.60	
004	East Ballard (AKA 11th Ave NW)	Lake Washington Ship Canal	11/23/12 3:07 PM	11/23/12 7:56 PM	4.82	215,586	0.85	18.72	
004	East Ballard (AKA 11th Ave NW)	Lake Washington Ship Canal	11/30/12 5:40 PM	12/4/12 7:16 PM	97.60	2,815,692	3.47	148.90	
004	East Ballard (AKA 11th Ave NW)	Lake Washington Ship Canal	12/16/12 4:36 PM	12/17/12 2:07 AM	9.52	535,455	1.04	39.70	

Outfall DSN #	CSO Name	Receiving Water	Event Starting Date/Time	Event Ending Date/Time	Event Duration (hours)	Volume (gallons)	Precipitation (inches)	Storm Duration (hours)	Note if DWO/ Exacerbated
004	East Ballard (AKA 11th Ave NW)	Lake Washington Ship Canal	12/19/12 9:09 AM	12/20/12 11:32 AM	26.38	1,011,591	1.76	31.93	
004	East Ballard (AKA 11th Ave NW)	Lake Washington Ship Canal	12/25/12 10:23 AM	12/25/12 1:32 PM	3.15	194,045	0.51	4.88	
006	Magnolia Overflow	Elliot Bay/Puget Sound	1/2/12 4:17 PM	1/2/12 6:52 PM	2.58	174,302	0.39	3.69	
006	Magnolia Overflow	Elliot Bay/Puget Sound	1/4/12 12:17 PM	1/4/12 8:17 PM	8.00	261,973	0.53	29.12	
006	Magnolia Overflow	Elliot Bay/Puget Sound	1/20/12 1:27 PM	1/21/12 5:37 AM	16.17	326,112	1.27	21.10	
006	Magnolia Overflow	Elliot Bay/Puget Sound	1/22/12 2:27 PM	1/22/12 2:47 PM	0.33	5,071	1.45	56.06	
006	Magnolia Overflow	Elliot Bay/Puget Sound	1/26/12 12:12 AM	1/26/12 6:07 AM	5.92	22,987	0.58	47.97	
006	Magnolia Overflow	Elliot Bay/Puget Sound	1/29/12 3:42 AM	1/29/12 3:57 AM	0.25	14,528	0.13	0.93	
006	Magnolia Overflow	Elliot Bay/Puget Sound	2/1/12 6:17 AM	2/1/12 7:12 AM	0.92	165,899	0.38	6.02	
006	Magnolia Overflow	Elliot Bay/Puget Sound	2/17/12 3:07 PM	2/17/12 4:22 PM	1.25	49,754	0.24	4.87	
006	Magnolia Overflow	Elliot Bay/Puget Sound	2/24/12 4:17 PM	2/24/12 4:37 PM	0.33	3,882	0.15	1.56	
006	Magnolia Overflow	Elliot Bay/Puget Sound	2/28/12 11:42 PM	2/29/12 12:02 AM	0.33	5,718	0.14	5.46	
006	Magnolia Overflow	Elliot Bay/Puget Sound	3/11/12 12:17 AM	3/11/12 12:32 AM	0.25	3,470	0.46	31.39	
006	Magnolia Overflow	Elliot Bay/Puget Sound	3/12/12 5:07 PM	3/12/12 5:37 PM	0.50	4,250	0.27	8.34	
006	Magnolia Overflow	Elliot Bay/Puget Sound	3/15/12 5:02 AM	3/15/12 11:12 AM	6.17	307,441	1.27	73.25	
006	Magnolia Overflow	Elliot Bay/Puget Sound	3/17/12 7:42 AM	3/17/12 8:07 AM	0.42	2,146	1.85	118.70	
006	Magnolia Overflow	Elliot Bay/Puget Sound	3/29/12 4:07 AM	3/31/12 9:22 AM	53.25	78,007	1.50	103.12	
006	Magnolia Overflow	Elliot Bay/Puget Sound	4/25/12 6:42 PM	4/25/12 7:07 PM	0.42	38,620	0.23	22.06	
006	Magnolia Overflow	Elliot Bay/Puget Sound	5/3/12 9:17 PM	5/4/12 5:12 PM	19.92	108,621	1.33	70.45	

Outfall DSN #	CSO Name	Receiving Water	Event Starting Date/Time	Event Ending Date/Time	Event Duration (hours)	Volume (gallons)	Precipitation (inches)	Storm Duration (hours)	Note if DWO/ Exacerbated
006	Magnolia Overflow	Elliot Bay/Puget Sound	5/21/12 4:57 PM	5/21/12 5:12 PM	0.25	12,036	0.63	30.23	
006	Magnolia Overflow	Elliot Bay/Puget Sound	6/5/12 4:42 AM	6/5/12 5:02 AM	0.33	503	0.19	2.11	
006	Magnolia Overflow	Elliot Bay/Puget Sound	6/7/12 7:02 AM	6/7/12 2:32 PM	7.50	30,829	0.52	9.16	
006	Magnolia Overflow	Elliot Bay/Puget Sound	6/22/12 1:32 PM	6/23/12 1:02 AM	11.50	5,317	0.73	14.72	
006	Magnolia Overflow	Elliot Bay/Puget Sound	7/3/12 4:37 AM	7/3/12 5:32 AM	0.92	208,122	0.35	9.23	
006	Magnolia Overflow	Elliot Bay/Puget Sound	7/13/12 11:32 AM	7/13/12 11:47 AM	0.25	59,182	0.13	0.19	
006	Magnolia Overflow	Elliot Bay/Puget Sound	7/20/12 7:27 AM	7/20/12 10:52 AM	3.42	255,013	0.63	7.17	
006	Magnolia Overflow	Elliot Bay/Puget Sound	10/14/12 9:43 PM	10/14/12 10:03 PM	0.33	1,864	0.45	49.08	
006	Magnolia Overflow	Elliot Bay/Puget Sound	10/18/12 7:48 PM	10/18/12 9:13 PM	1.42	182,724	0.3	2.22	
006	Magnolia Overflow	Elliot Bay/Puget Sound	10/27/12 10:23 AM	10/27/12 10:28 AM	0.08	76	0.42	22.53	
006	Magnolia Overflow	Elliot Bay/Puget Sound	10/29/12 1:38 AM	10/29/12 2:13 AM	0.58	92,224	0.47	7.36	
006	Magnolia Overflow	Elliot Bay/Puget Sound	10/30/12 5:58 AM	11/1/12 9:03 AM	51.08	1,210,488	3.01	86.36	
006	Magnolia Overflow	Elliot Bay/Puget Sound	11/4/12 10:13 PM	11/4/12 10:33 PM	0.33	6,065	0.17	19.15	
006	Magnolia Overflow	Elliot Bay/Puget Sound	11/18/12 6:33 PM	11/21/12 11:23 AM	64.83	4,022,800	4.04	116.17	
006	Magnolia Overflow	Elliot Bay/Puget Sound	11/23/12 8:28 AM	11/23/12 3:13 PM	6.75	215,159	0.77	14.62	
006	Magnolia Overflow	Elliot Bay/Puget Sound	11/30/12 1:53 AM	12/4/12 3:03 AM	97.17	1,393,106	3.10	133.40	
006	Magnolia Overflow	Elliot Bay/Puget Sound	12/16/12 4:18 PM	12/17/12 1:58 AM	9.67	273,673	0.81	14.15	
006	Magnolia Overflow	Elliot Bay/Puget Sound	12/19/12 7:43 AM	12/20/12 11:03 AM	27.33	126,337	1.50	31.32	
006	Magnolia Overflow	Elliot Bay/Puget Sound	12/25/12 9:33 AM	12/25/12 1:18 PM	3.75	86,798	0.98	98.82	

Outfall DSN #	CSO Name	Receiving Water	Event Starting Date/Time	Event Ending Date/Time	Event Duration (hours)	Volume (gallons)	Precipitation (inches)	Storm Duration (hours)	Note if DWO/ Exacerbated
007	Canal Street Overflow	Lake Washington Ship Canal	11/19/12 12:12 PM	11/19/12 12:39 PM	0.45	18,819	3.05	69.78	
008	3rd Ave W and Ewing St	Lake Washington Ship Canal	1/4/12 1:12 PM	1/4/12 2:26 PM	1.23	179,473	0.51	23.67	
008	3rd Ave W and Ewing St	Lake Washington Ship Canal	3/29/12 4:15 PM	3/29/12 5:06 PM	0.85	51,544	1.01	62.55	
008	3rd Ave W and Ewing St	Lake Washington Ship Canal	7/3/12 4:36 AM	7/3/12 5:04 AM	0.47	72,330	0.38	8.92	
008	3rd Ave W and Ewing St	Lake Washington Ship Canal	7/20/12 9:34 AM	7/20/12 10:27 AM	0.88	26,048	0.56	6.03	
008	3rd Ave W and Ewing St	Lake Washington Ship Canal	10/18/12 8:36 PM	10/18/12 8:49 PM	0.22	9,952	0.38	1.92	
008	3rd Ave W and Ewing St	Lake Washington Ship Canal	10/30/12 3:31 PM	10/31/12 6:30 AM	14.98	353,029	2.19	28.87	
008	3rd Ave W and Ewing St	Lake Washington Ship Canal	11/19/12 6:20 AM	11/19/12 7:24 PM	13.07	2,969,850	3.44	75.23	
008	3rd Ave W and Ewing St	Lake Washington Ship Canal	11/21/12 5:52 AM	11/21/12 6:48 AM	0.93	38,452	4.36	111.60	
008	3rd Ave W and Ewing St	Lake Washington Ship Canal	11/30/12 6:30 PM	12/2/12 3:51 AM	33.35	453,760	2.22	85.87	
008	3rd Ave W and Ewing St	Lake Washington Ship Canal	12/4/12 1:54 AM	12/4/12 3:10 AM	1.27	99,116	3.35	133.00	
008	3rd Ave W and Ewing St	Lake Washington Ship Canal	12/16/12 7:22 PM	12/16/12 8:57 PM	1.58	85,805	0.82	33.97	
008	3rd Ave W and Ewing St	Lake Washington Ship Canal	12/19/12 4:54 PM	12/20/12 6:49 PM	25.92	27,095	1.77	32.65	
008	3rd Ave W and Ewing St	Lake Washington Ship Canal	12/25/12 11:57 AM	12/25/12 1:24 PM	1.45	15,019	0.51	4.88	
009	Dexter Ave Regulator	Lake Union	2/1/12 6:29 AM	2/1/12 6:53 AM	0.40	15,605	0.46	10.90	
009	Dexter Ave Regulator	Lake Union	3/15/12 10:22 AM	3/15/12 10:53 AM	0.52	10,445	1.84	78.87	
009	Dexter Ave Regulator	Lake Union	5/3/12 10:26 PM	5/4/12 3:18 PM	16.87	145,083	1.25	68.42	
009	Dexter Ave Regulator	Lake Union	5/21/12 5:00 PM	5/21/12 5:22 PM	0.37	338,479	0.75	30.25	
009	Dexter Ave Regulator	Lake Union	7/3/12 4:33 AM	7/3/12 5:03 AM	0.50	291,395	0.39	9.62	
009	Dexter Ave Regulator	Lake Union	7/20/12 9:23 AM	7/20/12 10:25 AM	1.03	370,791	0.62	6.70	
009	Dexter Ave Regulator	Lake Union	10/18/12 8:52 PM	10/18/12 9:02 PM	0.17	1,000	0.37	2.02	
009	Dexter Ave Regulator	Lake Union	10/29/12 1:46 AM	10/29/12 2:28 AM	0.70	447,643	0.47	7.55	

Outfall DSN #	CSO Name	Receiving Water	Event Starting Date/Time	Event Ending Date/Time	Event Duration (hours)	Volume (gallons)	Precipitation (inches)	Storm Duration (hours)	Note if DWO/ Exacerbated
009	Dexter Ave Regulator	Lake Union	10/30/12 3:28 PM	10/31/12 2:03 AM	10.58	101,491	2.13	55.30	
009	Dexter Ave Regulator	Lake Union	11/19/12 6:11 AM	11/21/12 6:27 AM	48.27	7,088,628	4.29	111.17	
009	Dexter Ave Regulator	Lake Union	11/23/12 2:19 PM	11/23/12 2:26 PM	0.12	712	0.74	14.30	
009	Dexter Ave Regulator	Lake Union	11/30/12 9:11 PM	11/30/12 11:50 PM	2.65	323,371	1.56	57.75	
009	Dexter Ave Regulator	Lake Union	12/4/12 2:05 AM	12/4/12 2:27 AM	0.37	11,373	3.38	132.75	
011	E Pine St. Pump Station Emergency Overflow	Lake Washington			0.00	0			
012	Belvoir Pump Station Emergency Overflow	Lake Washington	11/19/12 8:34 AM	11/19/12 7:37 PM	11.05	864,797	3.90	75.97	
013	Martin Luther King Way Trunkline Overflow	Lake Washington via storm drain			0.00	0			
014	Montlake Overflow	Lake Washington Ship Canal	1/4/12 1:23 PM	1/4/12 1:56 PM	0.55	632,006	0.52	23.45	
014	Montlake Overflow	Lake Washington Ship Canal	2/1/12 6:38 AM	2/1/12 7:09 AM	0.52	471,847	0.43	10.43	
014	Montlake Overflow	Lake Washington Ship Canal	3/15/12 10:26 AM	3/15/12 11:25 AM	0.98	1,993,098	1.94	74.07	
014	Montlake Overflow	Lake Washington Ship Canal	3/29/12 4:16 PM	3/29/12 5:15 PM	0.98	709,230	1.28	62.95	
014	Montlake Overflow	Lake Washington Ship Canal	5/3/12 10:12 PM	5/4/12 3:21 PM	17.15	1,854,564	0.99	67.70	
014	Montlake Overflow	Lake Washington Ship Canal	7/3/12 4:41 AM	7/3/12 5:17 AM	0.60	813,229	0.42	9.07	
014	Montlake Overflow	Lake Washington Ship Canal	7/13/12 11:07 AM	7/13/12 11:18 AM	0.18	256,772	0.13	0.53	
014	Montlake Overflow	Lake Washington Ship Canal	7/20/12 9:32 AM	7/20/12 10:32 AM	1.00	994,821	0.59	6.98	
014	Montlake Overflow	Lake Washington Ship Canal	10/29/12 2:05 AM	10/29/12 2:17 AM	0.20	225,118	0.50	7.48	
014	Montlake Overflow	Lake Washington Ship Canal	10/30/12 4:07 PM	10/31/12 5:30 AM	13.38	1,470,626	2.75	58.87	
014	Montlake Overflow	Lake Washington Ship Canal	11/19/12 5:56 AM	11/20/12 12:09 AM	18.22	31,420,139	3.92	80.83	

Outfall DSN #	CSO Name	Receiving Water	Event Starting Date/Time	Event Ending Date/Time	Event Duration (hours)	Volume (gallons)	Precipitation (inches)	Storm Duration (hours)	Note if DWO/ Exacerbated
014	Montlake Overflow	Lake Washington Ship Canal	11/21/12 5:56 AM	11/21/12 6:31 AM	0.58	1,009,136	4.82	111.45	
014	Montlake Overflow	Lake Washington Ship Canal	11/23/12 2:06 PM	11/23/12 3:21 PM	1.25	1,726,089	0.84	14.80	
014	Montlake Overflow	Lake Washington Ship Canal	11/30/12 5:41 PM	12/1/12 4:10 AM	10.48	5,627,392	1.93	62.42	
014	Montlake Overflow	Lake Washington Ship Canal	12/2/12 6:37 PM	12/2/12 7:09 PM	0.53	344,052	2.80	101.27	
014	Montlake Overflow	Lake Washington Ship Canal	12/4/12 2:00 AM	12/4/12 2:54 AM	0.90	1,428,959	3.55	133.08	
014	Montlake Overflow	Lake Washington Ship Canal	12/16/12 7:54 PM	12/16/12 8:23 PM	0.48	690,876	0.93	33.90	
014	Montlake Overflow	Lake Washington Ship Canal	12/20/12 10:36 AM	12/20/12 10:49 AM	0.22	175,605	1.89	30.92	
015	University Regulator	Lake Washington Ship Canal	1/4/12 1:43 PM	1/4/12 2:14 PM	0.52	701,181	0.54	23.80	
015	University Regulator	Lake Washington Ship Canal	3/12/12 6:07 PM	3/12/12 6:07 PM	0.01	4,697	0.52	9.57	
015	University Regulator	Lake Washington Ship Canal	3/15/12 10:43 AM	3/15/12 11:07 AM	0.40	1,226,655	1.94	74.07	
015	University Regulator	Lake Washington Ship Canal	7/3/12 4:56 AM	7/3/12 5:27 AM	0.52	1,443,781	0.42	9.07	
015	University Regulator	Lake Washington Ship Canal	10/18/12 9:00 PM	10/18/12 9:21 PM	0.35	926,662	0.46	2.32	
015	University Regulator	Lake Washington Ship Canal	10/30/12 5:08 PM	10/31/12 6:36 AM	13.47	4,954,658	2.80	59.87	
015	University Regulator	Lake Washington Ship Canal	11/19/12 6:34 AM	11/19/12 8:12 PM	13.63	73,259,292	3.90	75.97	
015	University Regulator	Lake Washington Ship Canal	11/21/12 6:03 AM	11/21/12 6:49 AM	0.77	1,690,720	4.82	111.45	
015	University Regulator	Lake Washington Ship Canal	11/23/12 2:45 PM	11/23/12 3:31 PM	0.77	1,664,641	0.84	14.80	
015	University Regulator	Lake Washington Ship Canal	11/30/12 9:15 PM	12/1/12 12:34 AM	3.32	10,100,826	1.69	58.25	
015	University Regulator	Lake Washington Ship Canal	12/4/12 2:21 AM	12/4/12 3:18 AM	0.95	2,013,513	3.55	133.08	
015	University Regulator	Lake Washington Ship Canal	12/16/12 8:21 PM	12/16/12 9:09 PM	0.80	1,143,586	0.94	34.13	

Outfall DSN #	CSO Name	Receiving Water	Event Starting Date/Time	Event Ending Date/Time	Event Duration (hours)	Volume (gallons)	Precipitation (inches)	Storm Duration (hours)	Note if DWO/ Exacerbated
015	University Regulator	Lake Washington Ship Canal	12/20/12 8:58 AM	12/20/12 12:37 PM	3.65	5,928,176	1.97	32.72	
018	Matthews Park Pump Station Emergency Overflows	Lake Washington			0.00	0			
027a	Denny Way Regulator	Elliott Bay	1/20/12 9:10 PM	1/20/12 9:12 PM	0.04	580	1.15	14.53	
028	King Street Regulator	Elliott Bay	1/2/12 6:44 PM	1/2/12 8:24 PM	1.67	255,912	0.40	4.25	
028	King Street Regulator	Elliott Bay	1/4/12 1:20 PM	1/4/12 4:32 PM	3.20	698,180	0.51	25.88	
028	King Street Regulator	Elliott Bay	1/20/12 9:04 PM	1/21/12 9:40 AM	12.60	1,514,574	1.04	16.90	
028	King Street Regulator	Elliott Bay	2/1/12 6:31 AM	2/1/12 7:37 AM	1.10	255,932	0.41	9.33	
028	King Street Regulator	Elliott Bay	3/11/12 6:09 AM	3/11/12 6:15 AM	0.09	13,317	0.63	36.32	
028	King Street Regulator	Elliott Bay	3/12/12 6:12 PM	3/12/12 10:36 PM	4.40	589,599	0.52	12.53	
028	King Street Regulator	Elliott Bay	3/14/12 2:22 PM	3/15/12 5:04 PM	26.70	1,709,226	1.83	78.13	
028	King Street Regulator	Elliott Bay	3/29/12 3:06 PM	3/29/12 8:03 PM	4.96	1,125,269	1.25	65.48	
028	King Street Regulator	Elliott Bay	5/3/12 9:13 PM	5/3/12 11:36 PM	2.39	1,455,505	1.02	51.75	
028	King Street Regulator	Elliott Bay	5/21/12 4:57 PM	5/21/12 5:05 PM	0.13	33,088	0.49	29.60	
028	King Street Regulator	Elliott Bay	7/3/12 4:29 AM	7/3/12 4:36 AM	0.12	13,562	0.32	8.77	
028	King Street Regulator	Elliott Bay	11/19/12 8:03 AM	11/19/12 5:20 PM	9.29	199,894	3.08	74.52	
028	King Street Regulator	Elliott Bay	11/21/12 5:36 AM	11/21/12 5:41 AM	0.09	1,874	3.87	110.88	
029	Connecticut St. Regulator (AKA Kingdome)	Elliott Bay	3/15/12 10:16 AM	3/15/12 10:50 AM	0.57	536,686	1.69	72.70	
029	Connecticut St. Regulator (AKA Kingdome)	Elliott Bay	5/3/12 9:42 PM	5/3/12 10:35 PM	0.88	418,587	1.01	51.60	
029	Connecticut St. Regulator (AKA Kingdome)	Elliott Bay	10/30/12 4:30 PM	10/31/12 6:11 AM	13.68	2,544,013	2.23	63.68	
029	Connecticut St. Regulator (AKA Kingdome)	Elliott Bay	11/19/12 6:20 AM	11/19/12 7:44 PM	13.40	26,242,313	3.10	75.87	
029	Connecticut St. Regulator (AKA Kingdome)	Elliott Bay	11/21/12 6:12 AM	11/21/12 6:32 AM	0.35	55,872	3.94	111.72	

Outfall DSN #	CSO Name	Receiving Water	Event Starting Date/Time	Event Ending Date/Time	Event Duration (hours)	Volume (gallons)	Precipitation (inches)	Storm Duration (hours)	Note if DWO/ Exacerbated
029	Connecticut St. Regulator (AKA Kingdome)	Elliott Bay	11/23/12 2:11 PM	11/23/12 4:39 PM	2.47	1,156,429	0.71	15.27	
029	Connecticut St. Regulator (AKA Kingdome)	Elliott Bay	11/30/12 6:18 PM	12/1/12 4:51 AM	10.55	5,709,119	1.53	63.17	
029	Connecticut St. Regulator (AKA Kingdome)	Elliott Bay	12/2/12 4:02 PM	12/2/12 8:28 PM	4.43	1,673,894	2.31	101.87	
029	Connecticut St. Regulator (AKA Kingdome)	Elliott Bay	12/4/12 1:49 AM	12/4/12 5:00 AM	3.18	1,599,439	2.94	135.48	
029	Connecticut St. Regulator (AKA Kingdome)	Elliott Bay	12/16/12 5:09 PM	12/17/12 9:21 AM	16.20	2,205,437	0.84	14.37	
029	Connecticut St. Regulator (AKA Kingdome)	Elliott Bay	12/19/12 5:18 PM	12/20/12 1:12 PM	19.90	5,287,629	1.36	32.93	
030	Lander St Regulator	Elliott Bay	1/2/12 6:34 PM	1/2/12 9:03 PM	2.48	5,053,356	0.55	4.68	
030	Lander St Regulator	Elliott Bay	1/4/12 1:49 PM	1/4/12 5:19 PM	3.50	2,718,809	0.60	26.77	
030	Lander St Regulator	Elliott Bay	1/20/12 4:31 PM	1/21/12 4:07 PM	23.60	71,074,077	1.45	16.20	
030	Lander St Regulator	Elliott Bay	1/26/12 7:53 AM	1/26/12 9:22 AM	1.48	2,779,622	0.79	50.83	
030	Lander St Regulator	Elliott Bay	2/1/12 6:51 AM	2/1/12 8:03 AM	1.20	1,496,947	0.42	11.22	
030	Lander St Regulator	Elliott Bay	2/17/12 6:24 PM	2/17/12 6:40 PM	0.27	45,087	0.33	6.27	
030	Lander St Regulator	Elliott Bay	3/12/12 6:38 PM	3/12/12 6:51 PM	0.22	20,756	1.22	76.35	
030	Lander St Regulator	Elliott Bay	3/15/12 9:35 AM	3/16/12 7:17 AM	21.70	17,126,635	3.19	160.77	
030	Lander St Regulator	Elliott Bay	3/17/12 11:06 AM	3/17/12 12:42 PM	1.60	1,414,922	3.63	188.97	
030	Lander St Regulator	Elliott Bay	3/29/12 10:02 AM	3/29/12 8:28 PM	10.43	15,018,474	1.31	65.17	
030	Lander St Regulator	Elliott Bay	3/31/12 9:58 AM	3/31/12 10:25 AM	0.45	166,449	1.65	104.33	
030	Lander St Regulator	Elliott Bay	5/3/12 9:13 PM	5/3/12 11:56 PM	2.72	5,432,410	0.79	33.70	
030	Lander St Regulator	Elliott Bay	7/20/12 9:28 AM	7/20/12 12:28 PM	3.00	6,349,394	0.66	5.38	
030	Lander St Regulator	Elliott Bay	10/18/12 10:59 PM	10/19/12 12:51 AM	1.87	2,633,956	0.59	5.60	
030	Lander St Regulator	Elliott Bay	10/27/12 11:22 AM	10/27/12 11:44 AM	0.37	161,285	0.50	23.02	
030	Lander St Regulator	Elliott Bay	10/29/12 5:27 AM	10/29/12 6:54 AM	1.45	1,607,684	1.38	66.63	
030	Lander St Regulator	Elliott Bay	10/30/12 8:54 AM	10/31/12 9:02 AM	24.13	28,760,948	3.46	115.88	

Outfall DSN #	CSO Name	Receiving Water	Event Starting Date/Time	Event Ending Date/Time	Event Duration (hours)	Volume (gallons)	Precipitation (inches)	Storm Duration (hours)	Note if DWO/ Exacerbated
030	Lander St Regulator	Elliott Bay	11/1/12 9:43 AM	11/1/12 9:58 AM	0.25	46,105	3.98	141.12	
030	Lander St Regulator	Elliott Bay	11/19/12 6:30 AM	11/21/12 7:19 AM	48.82	84,996,758	4.15	112.20	
030	Lander St Regulator	Elliott Bay	11/23/12 10:30 AM	11/23/12 10:45 PM	12.25	20,501,844	0.85	22.22	
030	Lander St Regulator	Elliott Bay	11/30/12 6:15 PM	12/4/12 11:56 AM	89.68	151,509,374	3.33	142.37	
030	Lander St Regulator	Elliott Bay	12/16/12 5:03 PM	12/17/12 11:01 AM	17.97	34,734,944	1.08	41.78	
030	Lander St Regulator	Elliott Bay	12/19/12 4:18 PM	12/20/12 4:05 PM	23.78	65,573,316	1.66	33.65	
030	Lander St Regulator	Elliott Bay	12/23/12 10:10 PM	12/23/12 10:56 PM	0.77	271,759	0.55	61.03	
030	Lander St Regulator	Elliott Bay	12/25/12 11:42 AM	12/25/12 3:00 PM	3.30	4,940,528	0.38	21.12	
031a	Hanford #1 (Hanford @ Rainier)	Duwamish River via Diagonal Storm Drain	1/2/12 7:10 PM	1/2/12 7:35 PM	0.42	157,778	0.54	4.25	
031a	Hanford #1 (Hanford @ Rainier)	Duwamish River via Diagonal Storm Drain	1/4/12 1:20 PM	1/4/12 2:05 PM	0.75	504,393	0.46	23.65	
031a	Hanford #1 (Hanford @ Rainier)	Duwamish River via Diagonal Storm Drain	1/20/12 11:15 PM	1/21/12 6:10 AM	6.92	814,178	1.45	16.20	
031a	Hanford #1 (Hanford @ Rainier)	Duwamish River via Diagonal Storm Drain	1/26/12 6:10 AM	1/26/12 6:50 AM	0.67	402,007	0.78	48.62	
031a	Hanford #1 (Hanford @ Rainier)	Duwamish River via Diagonal Storm Drain	1/29/12 4:05 AM	1/29/12 4:15 AM	0.17	52,769	0.14	0.87	
031a	Hanford #1 (Hanford @ Rainier)	Duwamish River via Diagonal Storm Drain	2/1/12 6:35 AM	2/1/12 7:20 AM	0.75	578,260	0.42	11.22	
031a	Hanford #1 (Hanford @ Rainier)	Duwamish River via Diagonal Storm Drain	3/15/12 10:25 AM	3/15/12 5:00 PM	6.58	2,473,709	2.87	145.62	
031a	Hanford #1 (Hanford @ Rainier)	Duwamish River via Diagonal Storm Drain	3/29/12 3:55 PM	3/29/12 6:05 PM	2.17	958,136	1.27	63.90	
031a	Hanford #1 (Hanford @ Rainier)	Duwamish River via Diagonal Storm Drain	5/3/12 8:55 PM	5/3/12 11:05 PM	2.17	3,479,852	0.79	33.70	
031a	Hanford #1 (Hanford @ Rainier)	Duwamish River via Diagonal Storm Drain	7/3/12 4:35 AM	7/3/12 5:10 AM	0.58	462,247	0.34	6.87	

Outfall DSN #	CSO Name	Receiving Water	Event Starting Date/Time	Event Ending Date/Time	Event Duration (hours)	Volume (gallons)	Precipitation (inches)	Storm Duration (hours)	Note if DWO/ Exacerbated
031a	Hanford #1 (Hanford @ Rainier)	Duwamish River via Diagonal Storm Drain	7/20/12 9:10 AM	7/20/12 10:15 AM	1.08	1,014,494	0.61	4.57	
031a	Hanford #1 (Hanford @ Rainier)	Duwamish River via Diagonal Storm Drain	10/29/12 1:45 AM	10/29/12 2:20 AM	0.58	472,103	1.19	61.88	
031a	Hanford #1 (Hanford @ Rainier)	Duwamish River via Diagonal Storm Drain	10/30/12 3:05 PM	10/31/12 5:35 AM	14.50	2,348,472	3.41	113.43	
031a	Hanford #1 (Hanford @ Rainier)	Duwamish River via Diagonal Storm Drain	11/19/12 5:33 AM	11/21/12 6:25 AM	48.87	55,894,566	4.14	111.15	
031a	Hanford #1 (Hanford @ Rainier)	Duwamish River via Diagonal Storm Drain	11/23/12 9:00 AM	11/23/12 3:51 PM	6.85	2,397,526	0.74	15.73	
031a	Hanford #1 (Hanford @ Rainier)	Duwamish River via Diagonal Storm Drain	11/30/12 5:14 PM	12/4/12 3:19 AM	82.08	14,040,737	3.27	133.58	
031a	Hanford #1 (Hanford @ Rainier)	Duwamish River via Diagonal Storm Drain	12/16/12 4:38 PM	12/17/12 1:00 AM	8.37	2,713,061	1.02	38.52	
031a	Hanford #1 (Hanford @ Rainier)	Duwamish River via Diagonal Storm Drain	12/19/12 11:10 PM	12/20/12 11:29 AM	12.32	1,176,731	1.61	32.03	
031b	Hanford #1 (Bayview S.)	Duwamish River via Diagonal Storm Drain	11/19/12 6:55 AM	11/19/12 6:05 PM	11.17	667,100	3.35	74.70	
031c	Hanford #1 (Bayview N.)	Duwamish River via Diagonal Storm Drain	3/15/12 10:20 AM	3/15/12 10:50 AM	0.50	499,937	2.27	135.08	
031c	Hanford #1 (Bayview N.)	Duwamish River via Diagonal Storm Drain	5/3/12 9:50 PM	5/3/12 10:30 PM	0.67	85,522	0.78	33.23	
031c	Hanford #1 (Bayview N.)	Duwamish River via Diagonal Storm Drain	7/20/12 9:05 AM	7/20/12 9:25 AM	0.33	33,945	0.53	3.75	
031c	Hanford #1 (Bayview N.)	Duwamish River via Diagonal Storm Drain	10/29/12 1:45 AM	10/29/12 1:50 AM	0.08	8,845	1.16	61.60	
031c	Hanford #1 (Bayview N.)	Duwamish River via Diagonal Storm Drain	11/19/12 6:10 AM	11/19/12 11:45 PM	17.58	3,885,604	3.49	80.77	

Outfall DSN #	CSO Name	Receiving Water	Event Starting Date/Time	Event Ending Date/Time	Event Duration (hours)	Volume (gallons)	Precipitation (inches)	Storm Duration (hours)	Note if DWO/ Exacerbated
031c	Hanford #1 (Bayview N.)	Duwamish River via Diagonal Storm Drain	11/30/12 11:00 PM	11/30/12 11:30 PM	0.50	72,040	1.36	58.07	
031c	Hanford #1 (Bayview N.)	Duwamish River via Diagonal Storm Drain	12/4/12 2:05 AM	12/4/12 2:10 AM	0.08	301	3.22	132.78	
032	Hanford #2 Regulator	Duwamish River - East Waterway	1/2/12 6:34 PM	1/2/12 9:24 PM	2.83	1,002,116	0.55	4.68	
032	Hanford #2 Regulator	Duwamish River - East Waterway	1/4/12 1:49 PM	1/4/12 6:44 PM	4.92	10,215,779	0.60	26.77	
032	Hanford #2 Regulator	Duwamish River - East Waterway	1/20/12 4:31 PM	1/21/12 6:59 PM	26.47	27,064,872	1.45	16.20	
032	Hanford #2 Regulator	Duwamish River - East Waterway	1/26/12 8:41 AM	1/26/12 9:53 AM	1.20	609,825	0.80	51.68	
032	Hanford #2 Regulator	Duwamish River - East Waterway	1/30/12 2:12 AM	1/30/12 3:15 AM	1.05	251,799	0.49	21.78	
032	Hanford #2 Regulator	Duwamish River - East Waterway	2/1/12 6:54 AM	2/1/12 10:52 AM	3.97	5,125,653	0.42	11.22	
032	Hanford #2 Regulator	Duwamish River - East Waterway	2/17/12 6:22 PM	2/17/12 7:15 PM	0.88	209,590	0.34	7.62	
032	Hanford #2 Regulator	Duwamish River - East Waterway	3/12/12 6:32 PM	3/12/12 10:57 PM	4.42	2,464,038	1.38	80.30	
032	Hanford #2 Regulator	Duwamish River - East Waterway	3/15/12 7:12 AM	3/17/12 3:12 PM	56.00	34,878,797	3.63	188.97	
032	Hanford #2 Regulator	Duwamish River - East Waterway	3/29/12 10:01 AM	3/29/12 9:40 PM	11.65	20,186,326	1.31	65.17	
032	Hanford #2 Regulator	Duwamish River - East Waterway	3/31/12 9:57 AM	3/31/12 11:52 AM	1.92	2,123,943	1.66	105.28	
032	Hanford #2 Regulator	Duwamish River - East Waterway	5/3/12 9:05 PM	5/4/12 12:30 AM	3.42	4,726,960	0.79	33.70	
032	Hanford #2 Regulator	Duwamish River - East Waterway	10/18/12 10:58 PM	10/19/12 1:35 AM	2.62	6,128,531	0.59	5.60	
032	Hanford #2 Regulator	Duwamish River - East Waterway	10/27/12 11:21 AM	10/27/12 12:26 PM	1.08	1,592,045	0.51	23.68	
032	Hanford #2 Regulator	Duwamish River - East Waterway	10/29/12 3:15 AM	10/29/12 8:20 AM	5.08	1,748,917	1.40	67.47	
032	Hanford #2 Regulator	Duwamish River - East Waterway	10/30/12 8:53 AM	11/1/12 10:34 AM	49.68	32,015,506	3.99	141.92	

Outfall DSN #	CSO Name	Receiving Water	Event Starting Date/Time	Event Ending Date/Time	Event Duration (hours)	Volume (gallons)	Precipitation (inches)	Storm Duration (hours)	Note if DWO/ Exacerbated
032	Hanford #2 Regulator	Duwamish River - East Waterway	11/19/12 6:31 AM	11/21/12 8:18 AM	49.78	54,536,401	4.15	112.20	
032	Hanford #2 Regulator	Duwamish River - East Waterway	11/23/12 10:27 AM	11/23/12 11:22 PM	12.92	15,055,746	0.85	22.22	
032	Hanford #2 Regulator	Duwamish River - East Waterway	11/30/12 6:16 PM	12/4/12 12:46 PM	90.50	55,983,273	3.33	142.37	
032	Hanford #2 Regulator	Duwamish River - East Waterway	12/16/12 5:06 PM	12/17/12 11:45 AM	18.65	14,709,094	1.08	41.78	
032	Hanford #2 Regulator	Duwamish River - East Waterway	12/19/12 4:20 PM	12/20/12 7:08 PM	26.80	37,539,577	1.66	33.65	
032	Hanford #2 Regulator	Duwamish River - East Waterway	12/23/12 10:09 PM	12/23/12 11:07 PM	0.97	792,615	0.55	61.03	
032	Hanford #2 Regulator	Duwamish River - East Waterway	12/25/12 11:43 AM	12/25/12 4:02 PM	4.32	4,451,848	0.39	22.68	
033	Rainier Ave. Pump Station	Lake Washington			0.00	0			
034	E. Duwamish Pump Station	Duwamish River			0.00	0			
035	W. Duwamish Pump Station	Duwamish River			0.00	0			
036	Chelan Ave. Regulator	West Waterway of Duwamish River	1/20/12 11:37 PM	1/21/12 2:53 PM	15.27	450,079	1.45	16.20	
036	Chelan Ave. Regulator	West Waterway of Duwamish River	3/15/12 10:08 AM	3/15/12 6:18 PM	8.17	899,522	2.87	145.62	
036	Chelan Ave. Regulator	West Waterway of Duwamish River	3/17/12 12:06 PM	3/17/12 12:08 PM	0.03	646	3.63	188.97	
036	Chelan Ave. Regulator	West Waterway of Duwamish River	3/29/12 3:09 PM	3/29/12 7:36 PM	4.45	513,317	1.31	65.17	
036	Chelan Ave. Regulator	West Waterway of Duwamish River	10/30/12 5:02 PM	10/31/12 6:54 AM	13.87	125,738	3.45	114.57	
036	Chelan Ave. Regulator	West Waterway of Duwamish River	11/19/12 6:22 AM	11/20/12 1:41 AM	19.32	7,074,032	3.51	81.37	
036	Chelan Ave. Regulator	West Waterway of Duwamish River	11/23/12 1:48 PM	11/23/12 5:22 PM	3.57	311,399	0.75	17.45	

Outfall DSN #	CSO Name	Receiving Water	Event Starting Date/Time	Event Ending Date/Time	Event Duration (hours)	Volume (gallons)	Precipitation (inches)	Storm Duration (hours)	Note if DWO/ Exacerbated
036	Chelan Ave. Regulator	West Waterway of Duwamish River	11/30/12 6:48 PM	12/1/12 7:44 AM	12.93	1,616,715	1.66	64.17	
036	Chelan Ave. Regulator	West Waterway of Duwamish River	12/2/12 4:05 PM	12/2/12 9:31 PM	5.43	78,565	2.53	103.03	
036	Chelan Ave. Regulator	West Waterway of Duwamish River	12/4/12 2:18 AM	12/4/12 4:42 AM	2.40	91,355	3.30	134.68	
036	Chelan Ave. Regulator	West Waterway of Duwamish River	12/16/12 7:32 PM	12/17/12 2:16 AM	6.73	77,260	1.07	39.82	
036	Chelan Ave. Regulator	West Waterway of Duwamish River	12/19/12 10:56 PM	12/20/12 2:51 PM	15.92	769,567	1.66	33.65	
036	Chelan Ave. Regulator	West Waterway of Duwamish River	12/25/12 12:01 PM	12/25/12 1:15 PM	1.23	8,691	0.36	19.93	
037	Harbor Avenue Regulator	Duwamish River into Elliott Bay	10/31/12 4:29 AM	10/31/12 7:16 AM	2.78	1,274,147	3.45	114.57	
037	Harbor Avenue Regulator	Duwamish River into Elliott Bay	11/19/12 8:06 AM	11/20/12 12:52 AM	16.77	12,363,682	3.51	81.37	
037	Harbor Avenue Regulator	Duwamish River into Elliott Bay	11/30/12 11:04 PM	12/1/12 6:27 AM	7.38	3,040,714	1.66	64.17	
038	Terminal 115 Overflow	Duwamish River	11/19/12 7:40 AM	11/19/12 8:50 PM	13.17	1,937,500	3.43	75.40	
039	Michigan Regulator (AKA S. Michigan Regulator)	Duwamish River	1/2/12 6:19 PM	1/2/12 7:33 PM	1.23	468,645	0.53	4.42	
039	Michigan Regulator (AKA S. Michigan Regulator)	Duwamish River	1/4/12 1:10 PM	1/4/12 2:57 PM	1.78	667,549	1.12	47.87	
039	Michigan Regulator (AKA S. Michigan Regulator)	Duwamish River	2/1/12 6:30 AM	2/1/12 7:32 AM	1.03	783,962	0.55	12.47	
039	Michigan Regulator (AKA S. Michigan Regulator)	Duwamish River	3/12/12 6:13 PM	3/12/12 6:55 PM	0.70	22,414	1.48	74.63	

Outfall DSN #	CSO Name	Receiving Water	Event Starting Date/Time	Event Ending Date/Time	Event Duration (hours)	Volume (gallons)	Precipitation (inches)	Storm Duration (hours)	Note if DWO/ Exacerbated
039	Michigan Regulator (AKA S. Michigan Regulator)	Duwamish River	3/15/12 10:26 AM	3/15/12 4:56 PM	6.50	2,729,400	3.30	144.07	
039	Michigan Regulator (AKA S. Michigan Regulator)	Duwamish River	3/29/12 3:32 PM	3/29/12 6:07 PM	2.58	375,895	1.54	63.97	
039	Michigan Regulator (AKA S. Michigan Regulator)	Duwamish River	7/3/12 4:52 AM	7/3/12 5:13 AM	0.35	12,573	0.28	4.33	
039	Michigan Regulator (AKA S. Michigan Regulator)	Duwamish River	7/20/12 8:26 AM	7/20/12 10:21 AM	1.92	720,261	0.64	6.70	
039	Michigan Regulator (AKA S. Michigan Regulator)	Duwamish River	10/18/12 9:06 PM	10/18/12 10:12 PM	1.10	40,982	0.43	2.72	
039	Michigan Regulator (AKA S. Michigan Regulator)	Duwamish River	10/29/12 1:51 AM	10/29/12 2:34 AM	0.72	352,451	1.19	62.17	
039	Michigan Regulator (AKA S. Michigan Regulator)	Duwamish River	10/30/12 7:03 AM	10/31/12 5:25 AM	22.37	1,152,399	3.39	113.18	
039	Michigan Regulator (AKA S. Michigan Regulator)	Duwamish River	11/19/12 5:19 AM	11/19/12 7:49 PM	14.50	56,149,513	3.43	75.40	
039	Michigan Regulator (AKA S. Michigan Regulator)	Duwamish River	11/23/12 9:31 AM	11/23/12 4:15 PM	6.73	3,316,829	0.96	15.93	
039	Michigan Regulator (AKA S. Michigan Regulator)	Duwamish River	11/30/12 5:20 PM	12/4/12 3:21 AM	82.02	7,831,828	3.71	134.40	
039	Michigan Regulator (AKA S. Michigan Regulator)	Duwamish River	12/16/12 4:37 PM	12/17/12 12:59 AM	8.37	1,306,068	1.19	40.30	

Outfall DSN #	CSO Name	Receiving Water	Event Starting Date/Time	Event Ending Date/Time	Event Duration (hours)	Volume (gallons)	Precipitation (inches)	Storm Duration (hours)	Note if DWO/ Exacerbated
039	Michigan Regulator (AKA S. Michigan Regulator)	Duwamish River	12/19/12 7:04 PM	12/19/12 11:35 PM	4.52	51,373	1.00	20.03	
040	8th Ave South Regulator (AKA W. Marginal Way Pump Station)	Duwamish River			0.00	0			
041	Brandon Street Regulator	Duwamish River	1/21/12 4:38 AM	1/21/12 6:48 AM	2.17	4,365,092	1.45	16.20	
041	Brandon Street Regulator	Duwamish River	3/15/12 10:30 AM	3/15/12 11:09 AM	0.65	709,338	2.70	140.58	
041	Brandon Street Regulator	Duwamish River	3/29/12 4:37 PM	3/29/12 6:41 PM	2.07	671,626	1.27	63.90	
041	Brandon Street Regulator	Duwamish River	7/20/12 11:03 AM	7/20/12 11:32 AM	0.48	208,889	0.66	5.38	
041	Brandon Street Regulator	Duwamish River	10/30/12 3:07 PM	10/30/12 7:28 PM	4.35	1,492,684	2.57	103.08	
041	Brandon Street Regulator	Duwamish River	11/19/12 5:44 AM	11/19/12 9:00 PM	15.27	25,915,569	3.36	75.90	
041	Brandon Street Regulator	Duwamish River	11/23/12 1:56 PM	11/23/12 5:13 PM	3.28	1,580,179	0.74	15.73	
041	Brandon Street Regulator	Duwamish River	11/30/12 5:52 PM	12/1/12 4:05 AM	10.22	5,829,217	1.63	62.65	
041	Brandon Street Regulator	Duwamish River	12/2/12 5:41 PM	12/2/12 7:46 PM	2.08	112,123	2.52	101.93	
041	Brandon Street Regulator	Duwamish River	12/4/12 2:01 AM	12/4/12 4:47 AM	2.77	425,431	3.30	134.68	
041	Brandon Street Regulator	Duwamish River	12/16/12 7:41 PM	12/16/12 8:18 PM	0.62	414,662	0.86	33.87	
041	Brandon Street Regulator	Duwamish River	12/20/12 10:16 AM	12/20/12 1:44 PM	3.47	6,025,568	1.66	33.65	
042	West Michigan (AKA SW Michigan St regulator)	Duwamish River	3/15/12 10:32 AM	3/15/12 12:31 PM	1.98	143,510	3.12	140.28	
042	West Michigan (AKA SW Michigan St regulator)	Duwamish River	11/19/12 6:17 AM	11/19/12 9:49 PM	15.53	2,618,678	3.43	75.40	
042	West Michigan (AKA SW Michigan St regulator)	Duwamish River	11/23/12 2:13 PM	11/23/12 4:04 PM	1.85	185,342	0.96	15.93	
042	West Michigan (AKA SW Michigan St regulator)	Duwamish River	11/30/12 9:30 PM	12/1/12 12:48 AM	3.30	358,007	1.70	60.07	
042	West Michigan (AKA SW Michigan St regulator)	Duwamish River	12/4/12 2:21 AM	12/4/12 3:15 AM	0.90	85,327	1.75	51.32	
043	East Marginal Pump Station	Duwamish River			0.00	0			
044a	Norfolk local drainage	Duwamish River			0.00	0			

Outfall DSN #	CSO Name	Receiving Water	Event Starting Date/Time	Event Ending Date/Time	Event Duration (hours)	Volume (gallons)	Precipitation (inches)	Storm Duration (hours)	Note if DWO/ Exacerbated
045	Henderson Pump Station	Lake Washington			0.00	0			
048a	North Beach Pump Station (wet well)	Puget Sound	1/2/12 4:54 PM	1/2/12 5:44 PM	0.83	17,372	0.33	2.37	
048a	North Beach Pump Station (wet well)	Puget Sound	1/4/12 12:36 PM	1/4/12 8:17 PM	7.69	52,426	0.74	29.32	
048a	North Beach Pump Station (wet well)	Puget Sound	1/20/12 2:16 PM	1/21/12 2:20 AM	12.07	11,990	1.11	17.19	
048a	North Beach Pump Station (wet well)	Puget Sound	2/1/12 6:02 AM	2/1/12 6:20 AM	0.29	8,727	0.38	7.06	
048a	North Beach Pump Station (wet well)	Puget Sound	3/15/12 9:52 AM	3/15/12 10:43 AM	0.85	43,645	1.68	74.14	
048a	North Beach Pump Station (wet well)	Puget Sound	3/29/12 3:23 PM	3/30/12 1:38 PM	22.26	20,055	1.22	83.27	
048a	North Beach Pump Station (wet well)	Puget Sound	4/25/12 6:37 PM	4/25/12 6:41 PM	0.08	819	0.21	22.82	
048a	North Beach Pump Station (wet well)	Puget Sound	7/3/12 4:20 AM	7/3/12 3:42 PM	11.37	79,893	0.56	19.30	
048a	North Beach Pump Station (wet well)	Puget Sound	7/13/12 10:36 AM	7/13/12 11:03 AM	0.44	18,260	0.22	0.97	
048a	North Beach Pump Station (wet well)	Puget Sound	7/20/12 9:34 AM	7/20/12 10:22 AM	0.80	29,023	0.56	6.03	
048a	North Beach Pump Station (wet well)	Puget Sound	10/18/12 8:26 PM	10/18/12 9:02 PM	0.59	74,973	0.39	2.06	
048a	North Beach Pump Station (wet well)	Puget Sound	10/29/12 1:38 AM	10/29/12 1:57 AM	0.33	12,283	0.39	7.23	
048a	North Beach Pump Station (wet well)	Puget Sound	10/30/12 3:49 PM	10/31/12 7:04 AM	15.24	318,688	2.19	28.87	
048a	North Beach Pump Station (wet well)	Puget Sound	11/19/12 5:53 AM	11/21/12 6:34 AM	48.68	1,279,988	4.36	111.61	
048a	North Beach Pump Station (wet well)	Puget Sound	11/23/12 1:58 PM	11/23/12 3:00 PM	1.05	38,625	0.63	13.79	
048a	North Beach Pump Station (wet well)	Puget Sound	11/30/12 5:39 PM	12/4/12 7:09 PM	97.50	5,087,079	3.47	148.90	
048a	North Beach Pump Station (wet well)	Puget Sound	12/12/12 4:27 AM	12/12/12 5:21 AM	0.89	310,548	0.29	15.50	
048a	North Beach Pump Station (wet well)	Puget Sound	12/16/12 4:18 PM	12/17/12 2:57 AM	10.64	3,067,457	1.04	39.70	

Outfall DSN #	CSO Name	Receiving Water	Event Starting Date/Time	Event Ending Date/Time	Event Duration (hours)	Volume (gallons)	Precipitation (inches)	Storm Duration (hours)	Note if DWO/ Exacerbated
048a	North Beach Pump Station (wet well)	Puget Sound	12/19/12 9:02 AM	12/20/12 1:42 PM	28.67	674,363	1.77	32.66	
048a	North Beach Pump Station (wet well)	Puget Sound	12/25/12 10:05 AM	12/25/12 1:22 PM	3.28	62,134	0.51	4.88	
048b	North Beach Pump Station (inlet structure)	Puget Sound	1/4/12 7:55 PM	1/4/12 8:00 PM	0.08	12,148	0.73	29.18	
048b	North Beach Pump Station (inlet structure)	Puget Sound	3/15/12 9:10 AM	3/15/12 9:45 AM	0.58	114,764	1.42	73.47	
048b	North Beach Pump Station (inlet structure)	Puget Sound	7/3/12 4:40 AM	7/3/12 3:35 PM	10.92	86,685	0.56	19.30	
048b	North Beach Pump Station (inlet structure)	Puget Sound	7/13/12 10:54 AM	7/13/12 11:00 AM	0.10	3,201	0.21	0.95	
048b	North Beach Pump Station (inlet structure)	Puget Sound	7/20/12 9:36 AM	7/20/12 10:00 AM	0.40	42,682	0.53	5.77	
048b	North Beach Pump Station (inlet structure)	Puget Sound	10/18/12 8:45 PM	10/18/12 8:50 PM	0.08	1,648	0.38	1.92	
048b	North Beach Pump Station (inlet structure)	Puget Sound	10/30/12 4:05 PM	10/31/12 6:25 AM	14.33	375,947	2.18	28.72	
048b	North Beach Pump Station (inlet structure)	Puget Sound	11/19/12 6:10 AM	11/19/12 6:40 PM	12.50	2,999,668	3.44	75.23	
048b	North Beach Pump Station (inlet structure)	Puget Sound	11/21/12 5:15 AM	11/21/12 6:10 AM	0.92	61,545	4.36	111.60	
048b	North Beach Pump Station (inlet structure)	Puget Sound	11/30/12 9:00 PM	12/1/12 8:00 AM	11.00	345,886	1.83	65.93	
048b	North Beach Pump Station (inlet structure)	Puget Sound	12/3/12 2:15 AM	12/4/12 2:40 AM	24.42	60,537	3.34	132.63	
048b	North Beach Pump Station (inlet structure)	Puget Sound	12/16/12 7:25 PM	12/17/12 2:00 AM	6.58	38,374	1.03	39.37	
048b	North Beach Pump Station (inlet structure)	Puget Sound	12/19/12 2:45 PM	12/20/12 11:20 AM	20.58	194,948	1.75	31.40	
049	30th Avenue NE Pump Station	Lake Washington			0.00	0			
052	53rd Avenue SW Pump Station	Puget Sound	11/19/12 7:28 AM	11/19/12 11:19 AM	3.85	558,004	2.58	68.58	
054	63rd Avenue SW Pump Station	Puget Sound	10/31/12 1:35 AM	10/31/12 6:22 AM	4.78	794,898	3.44	114.12	
054	63rd Avenue SW Pump Station	Puget Sound	11/19/12 7:58 AM	11/19/12 6:45 PM	10.78	9,072,175	3.10	75.87	

Outfall DSN #	CSO Name	Receiving Water	Event Starting Date/Time	Event Ending Date/Time	Event Duration (hours)	Volume (gallons)	Precipitation (inches)	Storm Duration (hours)	Note if DWO/ Exacerbated
054	63rd Avenue SW Pump Station	Puget Sound	11/30/12 11:01 PM	12/1/12 4:27 AM	5.43	1,151,303	1.52	62.50	
055	SW Alaska Street Overflow	Puget Sound	11/19/12 8:03 AM	11/19/12 5:21 PM	9.30	8,063	3.34	74.57	
056	Murray Street Pump Station	Puget Sound	3/15/12 10:11 AM	3/15/12 10:51 AM	0.67	671,357	2.68	140.15	
056	Murray Street Pump Station	Puget Sound	11/19/12 6:08 AM	11/19/12 5:48 PM	11.67	5,815,974	3.09	74.65	
056	Murray Street Pump Station	Puget Sound	11/30/12 11:03 PM	11/30/12 11:25 PM	0.37	160,531	1.30	57.78	
056	Murray Street Pump Station	Puget Sound	12/4/12 1:47 AM	12/4/12 1:51 AM	0.07	14,779	3.18	132.53	
056	Murray Street Pump Station	Puget Sound	12/17/12 7:32 AM	12/17/12 8:51 AM	1.32	1,950,370	1.08	41.78	Exacerbated
057	Barton Street Pump Station	Puget Sound	3/15/12 10:20 AM	3/15/12 10:39 AM	0.32	97,418	1.37	64.23	
057	Barton Street Pump Station	Puget Sound	6/3/12 4:35 PM	6/3/12 5:35 PM	1.00	44,600	N/A	N/A	DWO
057	Barton Street Pump Station	Puget Sound	11/19/12 6:20 AM	11/19/12 5:52 PM	11.53	1,817,030	3.77	77.92	
057	Barton Street Pump Station	Puget Sound	11/30/12 11:04 PM	11/30/12 11:21 PM	6:43	26,580	1.52	58.12	
				Total volume		**1,405,047,188**			

Appendix B
Treated CSO Events
January–December 2012

Outfall DSN #	CSO Name	Receiving Water	Event Starting Date/Time	Event Ending Date/Time	Event Duration (hours)	Volume (gallons)	Precipitation (inches)	Storm Duration (hours)	Note if DWO/ Exacerbated
001	West Point Wastewater Treatment Plant	Puget Sound	1/2/12 5:53 PM	1/2/12 9:21 PM	3.32	10,170,000	0.47	4.20	
001	West Point Wastewater Treatment Plant	Puget Sound	1/4/12 1:12 PM	1/4/12 5:38 PM	4.39	16,300,000	0.60	26.20	
001	West Point Wastewater Treatment Plant	Puget Sound	1/20/12 3:49 PM	1/21/12 8:13 AM	16.40	30,740,000	1.12	20.40	
001	West Point Wastewater Treatment Plant	Puget Sound	2/1/12 6:44 AM	2/1/12 9:45 AM	2.87	5,680,000	0.43	8.87	
001	West Point Wastewater Treatment Plant	Puget Sound	2/17/12 4:58 PM	2/17/12 6:56 PM	1.81	4,020,000	0.30	33.67	
001	West Point Wastewater Treatment Plant	Puget Sound	3/12/12 5:38 PM	3/12/12 8:59 PM	3.22	8,090,000	0.47	12.50	
001	West Point Wastewater Treatment Plant	Puget Sound	3/15/12 6:19 AM	3/15/12 1:54 PM	4.89	15,950,000	1.68	74.15	
001	West Point Wastewater Treatment Plant	Puget Sound	3/29/12 2:45 PM	3/29/12 8:39 PM	5.74	16,670,000	1.11	65.62	
001	West Point Wastewater Treatment Plant	Puget Sound	3/31/12 9:19 AM	3/31/12 11:07 AM	1.76	2,320,000	1.52	104.43	
001	West Point Wastewater Treatment Plant	Puget Sound	5/3/12 11:11 PM	5/4/12 12:38 AM	1.45	1,810,000	0.59	21.33	
001	West Point Wastewater Treatment Plant	Puget Sound	6/22/12 6:18 PM	6/22/12 6:43 PM	0.23	670,000	0.47	7.83	
001	West Point Wastewater Treatment Plant	Puget Sound	7/3/12 5:35 AM	7/3/12 7:32 AM	1.90	2,270,000	0.38	8.92	
001	West Point Wastewater Treatment Plant	Puget Sound	7/20/12 9:39 AM	7/20/12 12:50 PM	3.14	3,620,000	0.59	8.13	
001	West Point Wastewater Treatment Plant	Puget Sound	10/18/12 9:37 PM	10/19/12 12:46 AM	3.15	4,980,000	0.54	4.92	
001	West Point Wastewater Treatment Plant	Puget Sound	10/30/12 7:35 AM	11/1/12 10:51 AM	51.27	63,290,000	2.79	56.18	
001	West Point Wastewater Treatment Plant	Puget Sound	11/19/12 6:24 AM	11/21/12 9:36 AM	51.20	101,280,000	4.36	111.60	

Outfall DSN #	CSO Name	Receiving Water	Event Starting Date/Time	Event Ending Date/Time	Event Duration (hours)	Volume (gallons)	Precipitation (inches)	Storm Duration (hours)	Note if DWO/ Exacerbated
001	West Point Wastewater Treatment Plant	Puget Sound	11/23/12 10:08 AM	11/23/12 9:45 PM	11.26	29,270,000	0.86	19.15	
001	West Point Wastewater Treatment Plant	Puget Sound	11/30/12 6:01 PM	12/4/12 6:29 AM	84.47	98,870,000	3.40	135.42	
001	West Point Wastewater Treatment Plant	Puget Sound	12/16/12 5:00 PM	12/17/12 4:14 AM	11.23	34,700,000	1.05	41.52	
001	West Point Wastewater Treatment Plant	Puget Sound	12/19/12 3:27 PM	12/20/12 4:32 PM	25.08	85,780,000	1.77	32.65	
001	West Point Wastewater Treatment Plant	Puget Sound	12/25/12 11:34 AM	12/25/12 4:01 PM	4.24	15,410,000	0.56	7.13	
027b	Elliott West CSO Treatment Facility	Puget Sound	1/4/12 4:14 PM	1/4/12 6:23 PM	2.20	1,330,000	0.51	26.48	
027b	Elliott West CSO Treatment Facility	Puget Sound	1/20/12 9:12 PM	1/21/12 6:23 PM	19.40	29,010,000	1.27	21.11	
027b	Elliott West CSO Treatment Facility	Puget Sound	3/15/12 10:49 AM	3/16/12 9:51 AM	9.10	8,220,000	1.15	25.0	
027b	Elliott West CSO Treatment Facility	Puget Sound	3/29/12 3:41 PM	3/29/12 10:23 PM	6.50	9,730,000	1.46	12.70	
027b	Elliott West CSO Treatment Facility	Puget Sound	7/20/12 10:35 AM	7/20/12 3:09 PM	4.60	7,790,000	0.66	7.6	
027b	Elliott West CSO Treatment Facility	Puget Sound	10/30/12 5:55 PM	10/31/12 12:51 PM	16.43	26,900,000	2.57	65.99	
027b	Elliott West CSO Treatment Facility	Puget Sound	11/19/12 7:17 AM	11/20/12 3:57 PM	16.80	73,730,000	3.53	95.2	
027b	Elliott West CSO Treatment Facility	Puget Sound	11/23/12 3:06 PM	11/23/12 9:05 PM	4.60	3,710,000	0.93	20.5	
027b	Elliott West CSO Treatment Facility	Puget Sound	11/30/12 12:00 AM	12/1/12 12:00 AM	11.13	19,980,000	2.08	70.23	
027b	Elliott West CSO Treatment Facility	Puget Sound	12/2/12 6:17 PM	12/4/12 6:45 AM	8.42	9,000,000	1.47	70.7	
027b	Elliott West CSO Treatment Facility	Puget Sound	12/16/12 8:11 PM	12/17/12 2:38 AM	1.77	2,730,000	0.81	14.2	
027b	Elliott West CSO Treatment Facility	Puget Sound	12/19/12 11:57 PM	12/20/12 1:00 PM	7.60	6,700,000	1.52	32.3	
046b	Carkeek CSO Treatment Facility Outfall	Puget Sound	10/31/12 5:55 AM	10/31/12 11:32 AM	5.60	200,000	2.3	33.87	
046b	Carkeek CSO Treatment Facility Outfall	Puget Sound	11/19/12 7:18 AM	11/21/12 2:45 PM	45.20	13,490,000	45.2	117.05	

Outfall DSN #	CSO Name	Receiving Water	Event Starting Date/Time	Event Ending Date/Time	Event Duration (hours)	Volume (gallons)	Precipitation (inches)	Storm Duration (hours)	Note if DWO/ Exacerbated
046b	Carkeek CSO Treatment Facility Outfall	Puget Sound	11/30/12 10:14 PM	12/2/12 11:14 AM	28.10	3,930,000	2.25	93.15	
046b	Carkeek CSO Treatment Facility Outfall	Puget Sound	12/4/12 4:16 AM	12/4/12 9:17 AM	2.05	40,000	0.61	25.12	
046b	Carkeek CSO Treatment Facility Outfall	Puget Sound	12/16/12 10:06 PM	12/17/12 6:54 AM	8.20	500,000	1.05	41.51	
046b	Carkeek CSO Treatment Facility Outfall	Puget Sound	12/19/12 3:55 PM	12/21/12 6:59 AM	34.45	8,660,000	1.76	31.93	
044b	Henderson/ MLK CSO Treatment Facility	Duwamish River	11/19/12 11:35	11/19/12 22:30	10.92	5,200,000	2.57	75.95	
051b	Alki CSO Treatment Facility Outfall	Puget Sound	1/21/12 1:08 AM	1/21/12 7:00 AM	5.86	8,240,000	1.35	12.92	
051b	Alki CSO Treatment Facility Outfall	Puget Sound	1/21/12 7:00 AM	1/21/12 2:40 PM	7.67	4,470,000	0.11	3.28	
051b	Alki CSO Treatment Facility Outfall	Puget Sound	10/31/12 2:15 AM	10/31/12 7:00 AM	4.75	5,310,000	1.35	24.00	
051b	Alki CSO Treatment Facility Outfall	Puget Sound	10/31/12 7:00 AM	10/31/12 9:07 AM	2.12	1,430,000	0.86	8.03	
051b	Alki CSO Treatment Facility Outfall	Puget Sound	11/19/12 9:07 AM	11/20/12 7:00 AM	21.88	27,660,000	2.43	24.00	
051b	Alki CSO Treatment Facility Outfall	Puget Sound	11/20/12 7:00 AM	11/20/12 3:28 PM	8.47	3,820,000	0.32	13.92	
051b	Alki CSO Treatment Facility Outfall	Puget Sound	11/30/12 11:37 PM	12/1/12 7:00 AM	7.38	8,050,000	1.19	24.00	
051b	Alki CSO Treatment Facility Outfall	Puget Sound	12/1/12 7:00 AM	12/1/12 1:20 PM	6.33	2,100,000	0.31	5.47	
051b	Alki CSO Treatment Facility Outfall	Puget Sound	12/2/12 4:32 PM	12/2/12 10:04 PM	5.53	7,120,000	0.50	24.00	
051b	Alki CSO Treatment Facility Outfall	Puget Sound	12/4/12 3:22 AM	12/4/12 6:41 AM	3.33	2,710,000	0.55	21.92	
051b	Alki CSO Treatment Facility Outfall	Puget Sound	12/4/12 10:59 AM	12/4/12 11:01 AM	0.03	20,000	0.06		
051b	Alki CSO Treatment Facility Outfall	Puget Sound	12/17/12 12:40 AM	12/17/12 4:24 AM	3.73	3,500,000	0.81	21.15	
051b	Alki CSO Treatment Facility Outfall	Puget Sound	12/17/12 8:04 AM	12/17/12 10:10 AM	2.10	3,680,000	0.03		
051b	Alki CSO Treatment Facility Outfall	Puget Sound	12/20/12 11:09 AM	12/20/12 2:56 PM	3.78	3,340,000	0.28	5.98	
				Total volume		**864,190,000**			

Appendix C
Alki CSO Treatment Plant
Annual Report
January–December 2012

This 2012 annual report summarizes performance of King County's Alki CSO Treatment Plant. The plant came online for CSO treatment in 1998. Alki operates under the NPDES permit for the West Point Treatment Plant (WA-0029181-1).

There were seven filling events and seven discharge events during calendar year 2012. The Alki CSO Treatment Plant received 108.39 MG and discharged 81.45 MG. All performance permit limits were met except for the monthly geometric mean limit for fecal coliforms during January.

Weather Conditions

A total of 42.37 inches of rain fell in calendar year 2012 as measured at the King County Chelan Avenue gauge.

Table C-1. Alki CSO Permit Compliance Summary

Compliance Summary	Value/Outcome
Number of Inflow Events:	7
Total Inflow Volume (MG):	108.39
Number of Discharge Events:	7
Total Discharge Volume (MG):	81.45
Total Influent TSS (lbs):	58,739
Total Discharge TSS from Alki + WP (lbs):	24,721
Overall TSS Removal (%):	57.25%
Annual rainfall (inches):	42.37
Annual Average TSS Removal Limit Compliance:	**Met**
Monthly Event Max Settleable Solids Limit Compliance:	**Met**
Annual Average Settleable Solids Limit Compliance:	**Met**
Max Daily Residual Chlorine Limit Compliance:	**Met**
Monthly Fecal Coliform Limit Compliance:	**Not Met – Jan. 2012**

Operational Challenges (see monthly reports for more details)

All performance permit limits were met except for the monthly geometric mean limit for fecal coliforms during January. The reasons are as follows:

- Under-dosed sodium hypochlorite to the force main (0.7 mg/L average chlorine dose at bar screen analyzer).

- High suspended solid in the influent during the beginning of event (88 mg/L) comprised of inorganic material had a shielding effect, limiting the effectiveness of the chlorine disinfection at the beginning.
- The fecal coliform sample may have been contaminated by scum.

Several corrective actions have been put in place to reduce the possibility of a similar result:

- Maintain a chlorine residual of 2.0mg/L at bar screen chlorine analyzer or 1.0 mg/L at pre-dechlorination analyzer (whichever is higher). The concentration at the hypochlorite batch tank was lowered to 2% from 4% to allow for finer control, minimizing the risk of overdosing.
- Operations received refresher training on fecal coliforms sampling techniques.
- Effluent from the chlorine basin will be used in addition to the city water in the scum spraying system to minimize the chance of scum getting into the effluent basin.
- A fecal sample port was created by making a slip stream off of the final chlorine analyzer feed line. This helps eliminate contamination by not having to break through the water surface of the chlorine contact channel.

Facility Improvements

The aging breaker at the 63rd Avenue SW Pump Station that tripped when the control system called for a second pump to operate was replaced in late December 2012. The replacement breaker worked well for subsequent events, minimizing the overflows caused by the tripping of the breaker.

The project to install a larger capacity sodium bisulfite (SBS) dechlorination system to increase dosing capacity is in progress and anticipated to be completed in the fall of 2013. The new system, with higher capacity gear pumps and new storage tanks with new piping, electrical and controls, will replace the existing dechlorination system with LMI diaphragm pumps.

Routine Operation and Maintenance (see monthly reports for more details)

Routine operation and maintenance (O&M) activities not directly associated with an event included weekly operator inspections, checklists, equipment and sampler testing, and alarm checks, weekly analyzer preventive maintenance (PM) and calibration, quarterly lubrication and PM of mechanical equipment, annual training and preparation for winter wet weather operation, post-event cleaning of the CSO facilities, and post-event debriefs and corrective work orders as appropriate. The concentrations of the sodium hypochlorite and sodium bisulfate chemicals were checked quarterly.

WTD's East Section offsite facilities began transferring primary responsibility for operations and maintenance of the Alki CSO Treatment Plant to West in November 2012. In April 2013 the handover was complete, and Alki and 63rd Avenue SW Pump Station are now operated and maintained by West Section offsite facilities.

Table C-2. Alki CSO Plant Annual Event Data Summary

									Alki Effl. Settleable Solids				Alki Effl. Residual Chlorine			Alki Effl. Fecal Coliforms		pH	
Month	# of Inflow Events @ Alki	# of Discharge Events @Alki	Inflow Vol. (MG)	Discharge Vol. (MG)	ALKI Influent TSS (lbs)	ALKI +WP Effluent TSS (lbs)	%TSS Removal monthly average (report)	Permit Limit for Annual Avg TSS %Rem	Daily (ml/l/hr)	Permit Limit for Annual Avg (%Rem)	Max. of all events in a month (ml/l/hr)	Permit Max. of all events in a month (ml/l/hr)	Daily (µg/l)	Max. of Daily Averages (µg/l)	Permit Limit for Max of Daily Avg (µg/l)	Monthly Geomean (#/100 ml)	Permit Limit (#/100 ml)	Alki Effluent Min. and Max pH	Permit Limit for pH Min/Max
January	**1**	**1**	**16.1**	**12.7**	**4120**	**2863**	**30.5%**		**0.1**		**0.1**	**1.9**	**28**	**158**	**234**	**2157**	**400**	**7.4/7.4**	**6.0/9.0**
20	1a	1a	10.56	8.24	2466	1834	25.6%		0.1				28			2157			**6.0/9.0**
21	1b	1b	5.51	4.47	1654	1029	37.8%		0.1										**6.0/9.0**
February												**1.9**			**234**		**400**		**6.0/9.0**
March												**1.9**			**234**		**400**		**6.0/9.0**
April												**1.9**			**234**		**400**		**6.0/9.0**
May												**1.9**			**234**		**400**		**6.0/9.0**
June												**1.9**			**234**		**400**		**6.0/9.0**
July												**1.9**			**234**		**400**		**6.0/9.0**
August												**1.9**			**234**		**400**		**6.0/9.0**
September												**1.9**			**234**		**400**		**6.0/9.0**
October	**1**	**1**	**9.3**	**6.7**	**4188**	**1451**	**65.4%**		**0.15**		**0.2**	**1.9**	**34**	**34**	**234**	**56**	**400**	**6.2/6.2**	**6.0/9.0**
30	1a	1a	7.53	5.31	3391	1069	68.5%		0.2				34			56			
31	1b	1b	1.77	1.43	797	382	52.1%		0.1										
November	**2**	**2**	**50.7**	**41.6**	**25,669**	**10,358**	**59.6%**		**0.22**		**0.6**	**1.9**	**66**	**87**	**234**	**35**	**400**	**6.3/6.3**	**6.0/9.0**
19	1a	1a	31.92	27.66	7986	4271	46.5%		<0.1				87			16			
20	1b	1b	5.04	3.82	7902	2684	66.0%		0.60										
30	2a	2a	10.58	8.05	8471	2925	65.5%		<0.1				46			77			
December 1	2b	2b	3.14	2.1	1309	478	63.5%		<0.1										
December	**3**	**3**	**32.34**	**20.37**	**24,763**	**10,049**	**59.4%**		**0.2**		**0.4**	**1.9**	**17**	**49**	**234**	**313**	**400**	**6.0/6.7**	**6.0/9.0**
2	1a	1a	9.9	7.12	3963	1568	60.4%						9			500			
3	1b	1b	4.73	2.71	1894	552	70.9%		0.1				11			600			
4	1c	1c	1.08	0.02	937	183	80.5%						1			40			
16	2a	2a	6.23	3.5	5144	2667	48.2%		0.1				11			1			

									Alki Effl. Settleable Solids				Alki Effl. Residual Chlorine			Alki Effl. Fecal Coliforms		pH	
Month	# of Inflow Events @ Alki	# of Discharge Events @Alki	Inflow Vol. (MG)	Discharge Vol. (MG)	ALKI Influent TSS (lbs)	ALKI +WP Effluent TSS (lbs)	%TSS Removal monthly average (report)	Permit Limit for Annual Avg TSS %Rem	Daily (ml/l/hr)	Permit Limit for Annual Avg (%Rem)	Max. of all events in a month (ml/l/hr)	Permit Max. of all events in a month (ml/l/hr)	Daily (µg/l)	Max. of Daily Averages (µg/l)	Permit Limit for Max of Daily Avg (µg/l)	Monthly Geomean (#/100 ml)	Permit Limit (#/100 ml)	Alki Effluent Min. and Max pH	Permit Limit for pH Min/Max
17	2b	2b	4.62	3.68	8246	2775	66.3%						49						
20	3	3	5.78	3.34	4579	2304	49.7%		0.4				20			800			
Total	**7**	**7**	**108.39**	**81.45**	**58739**	**24721**													
Ann Ave./Geomean All Events							**57.25%**	**50%**	**0.2125**	**0.3**			**29.6**			**104.043115**			
Min/Max																			

Appendix D
Carkeek CSO Treatment Plant
Annual Report
January–December 2012

Executive Summary

This report is the nineteenth annual report summarizing the performance of Carkeek CSO Treatment plant. The plant began to operate as a CSO treatment facility on November 1, 1994. The facility operates under the NPDES permit for the West Point Treatment Plant, Washington State Department of Ecology permit number WA-0029181-1, in effect from July 1, 2009, through June 30, 2014.

2012 was a very wet year. The total rainfall for the reporting period was 40.41 inches, as measured by the Ballard Station rain gauge.

Performance in 2012

In 2012, there were 17 inflow events into the Carkeek CSO plant and six resulted in discharges to Puget Sound out of the Carkeek CSO outfall. The total inflow and discharge volumes for the reporting period were 31.2 MG and 26.8 MG, respectively.

The performance of the plant for the year 2012 is summarized below in Table D-1.

Table D-1. Carkeek CSO Permit Performance in 2012

Parameter	Performance	Permit Conditions
Number of Discharge Events	6	10 [a]
Discharge Volume (MGD)	26.8	46 [a]
Annual Average Settleable Solids (ml/l/hr)	0.1	0.3
Event Maximum Settleable Solids (ml/l/hr)	0.1	1.9
Annual Average %Total Suspended Solids Removal, data excludes the one untreated event per year	50.1%	50%
Fecal Coliform, Maximum Monthly Geomean (MPN#/100 ml)	4.5	400
Instantaneous Minimum/Maximum Effluent pH	5.1/7.9	≥6.0 / ≤9.0
Total Residual Chlorine, Maximum of Daily (µg/l)	723	490

[a] Compliance assessed over a 5-year average.

Suspended and Settleable Solids

Total Suspended Solids (TSS) removal averaged 50.1 percent, thereby meeting the annual TSS removal permit limit of 50 percent. The annual settleable solids (SS) for the year averaged 0.1 ml/l/hr and the event maximum settleable Solids was 0.1 ml/l/hr thereby meeting both the annual average SS and event maximum (maximum of the event average SS concentration).

Fecal Coliform Bacteria

The maximum monthly geomean during the 2012 reporting period was 4.5 counts/100 ml that occurred in December, thereby meeting the permit limit of 400 counts/100mL.

Total Residual Chlorine

Maximum of daily average effluent total residual chlorine (TRC) during the 2012 reporting period was 723 µg/L, which occurred on November 19. The daily average effluent chlorine residual did exceed the permit limit of 490 µg/L. During the November 19 CSO treatment and discharge event, King County staff noticed high Cl2 residual at the final effluent analyzer as a result of lack of sodium bisulfite solution (SBS) feed. The SBS line was broken at two different fittings. It appears that SBS crystals caused blockage in the feed line and that resulted in high back pressure and stress on the line. The leaks were quickly repaired; however, it was necessary to shut off the SBS feed during the work. This resulted in no dechlorination during that time. To minimize a reoccurrence, a water flushing valve was installed in order to facilitate regular flushing of the feed line. In addition, in early 2013 the SBS feed line was modified to include a manifold and a bypass so staff can switch feed pumps and allow continuous chemical feed without disruption during any repair or pump replacement work.

Operation and Maintenance

WTD staff included back-flushing capabilities to the final effluent sample line by installing a valve and a water hose connection. This is now part of routine station readiness tasks. Sodium hypochlorite was replaced with fresh hypochlorite in September. Annual CSO refresher training for the off-site operations staff was provided in October 2012.

Near Future Operation

During Carkeek facility's 19 years of operation, opportunities to operate and then to optimize have been very limited. Challenges may be identified during an event in the wet season, but any major projects to address the challenge would likely have to occur during the following dry season. Then, after the completion of these projects, the opportunities to test the improvements would likely occur in the following wet season. Given the complexity of this facility's design and operation and the "normal" challenges of an intermittently operated facility, WTD has essentially had to make improvements continuously.

Future projects to improve Carkeek's performance include replacement of the hypochlorite feed pumps with newer and more reliable pumps, a hypochlorite feed flow meter, and more accurate and reliable inflow and effluent flow measurements. The hypochlorite feed pump replacement project, including the addition of a hypochlorite feed flow meter, is scheduled to be completed in fall of 2013. The project to automate the pump-down of stored CSO volumes back to the pump station and return to West Point Treatment Plant was completed in early 2013. This project was initiated during 2010-2011. The automation allows WTD to minimize the CSO discharge at Carkeek Treatment Plant when the Carkeek Pump Station has the capacity to return flows to West Point.

Because the current means to measure the influent and discharge flows are limited to 34 and 23 mgd respectively, a project to evaluate alternatives to improve flow monitoring also is under way. The alternative analysis and design phases of the flow monitoring improvement project began during 2011-2012. The project is expected to be completed in 2013.

Table D-2. Carkeek Annual Plant Performance 2012

Month	Day	Carkeek Inflow Event Number	Carkeek Inflow Volume (MGD)	Carkeek Discharge Event Number	Carkeek Discharge Volume (MGD)	Total Influent TSS (lbs)	Total Effluent TSS Discharged @ Carkeek + WP (lbs)	% removal	Carkeek Effl. Settleable Solids (ml/l/hr)	Carkeek Effl. Settleable Solids Event Avg (ml/l/hr)	Carkeek Effl. Avg pH	Carkeek Avg Effl. Fecal Coliforms (#/100 ml)	Carkeek Effl. Residual Chlorine (µg/l)	Min/Max pH
January	2	1	0.01	# ND	#ND	12	1		ND	ND	ND	ND	ND	
	4	2	0.06	ND	ND	61	7		ND	ND	ND	ND	ND	
	20	3	0.16	ND	ND	55	4		ND	ND	ND	ND	ND	
	Inst. Min/Max pH													
	Event/Daily Max									**ND**			**ND**	
	Mon. Total/Avg/Geomean	**3**	**0.23**	**ND**	**0.00**	**127**	**13**	**90.1%**	**ND**			**ND**		
February	No Inflow or Discharges			ND	ND				ND	ND	ND	ND	ND	
	Inst. Min/Max pH													
	Event/Daily Max													
	Mon. Total/Avg/Geomean	0	**0**	**ND**	**ND**	**0.0**	**0.0**							
March	14	1a	0.01	ND	ND	2	0		ND	ND	ND	ND	ND	
	15	1b	0.31	ND	ND	1042	627		ND	ND	ND	ND	ND	
	29	2	0.15	ND	ND	689	358		ND	ND	ND	ND	ND	
	Inst. Min/Max pH													
	Event/Daily Max									**ND**			**ND**	
	Mon. Total/Avg/Geomean	**2**	**0.47**	**ND**	**0.0**	**1733**	**986**	**43.1%**	**ND**			**ND**		
April	No Inflow or Discharges			ND	ND									
	Inst. Min/Max pH													
	Event/Daily Max													
	Mon. Total/Avg/Geomean	**0**		**ND**	**ND**									
May	No Inflow or Discharges			ND	ND				ND	ND	ND	ND	ND	
	Inst. Min/Max pH													
	Event/Daily Max													
	Mon. Total/Avg/Geomean	**0**	**0**	**ND**	**ND**	**0**	**0**							

Month	Day	Carkeek Inflow Event Number	Carkeek Inflow Volume (MGD)	Carkeek Discharge Event Number	Carkeek Discharge Volume (MGD)	Total Influent TSS (lbs)	Total Effluent TSS Discharged @ Carkeek + WP (lbs)	% removal	Carkeek Effl. Settleable Solids (ml/l/hr)	Carkeek Effl. Settleable Solids Event Avg (ml/l/hr)	Carkeek Effl. Avg pH	Carkeek Avg Effl. Fecal Coliforms (#/100 ml)	Carkeek Effl. Residual Chlorine (µg/l)	Min/Max pH
June	No Inflow or Discharges			ND	ND				**ND**	**ND**	**ND**	**ND**	**ND**	
	Inst. Min/Max pH													
	Event/Daily Max													
	Mon. Total/Avg/Geomean	**0**		**ND**	**ND**									
July	3	1	0.03	ND	ND	38	2.3		ND	ND	ND	ND	ND	
	20	2	0.02	ND	ND	25	1.9		ND	ND	ND	ND	ND	
	Inst. Min/Max pH													
	Event/Daily Max													
	Mon. Total/Avg/Geomean	2	**0.05**	**ND**	**ND**	**62.7**	**4.1**	**93.4%**						
August	No Inflow or Discharges			ND	ND				**ND**	**ND**	**ND**	**ND**	**ND**	
	Inst. Min/Max pH													
	Event/Daily Max													
	Mon. Total/Avg/Geomean	**0**	**0**	**ND**	**ND**	**0**	**0**							
September	No Inflow or Discharges			ND	ND				ND	ND	ND	ND	ND	
	Inst. Min/Max pH													
	Event/Daily Max													
	Mon. Total/Avg/Geomean	0	**0**	**ND**	**ND**	**0**	**0**							
October	18	1	0.02	ND	ND	29	2		ND	ND	ND	ND	ND	
	30	2a	0.91	ND	ND	675	103		ND	ND	ND	ND	ND	
	31	2b	0.04	1	0.20	60	43		0.1	0.1	6.3	1	94	
	Inst. Min/Max pH													6.3/7.1
	Event/Daily Max												**94**	
	Mon. Total/Avg/Geomean	2	**0.97**	**1**	**0.2**	**765**	**147**	**80.8%**	**0.1**			**1**		

Month	Day	Carkeek Inflow Event Number	Carkeek Inflow Volume (MGD)	Carkeek Discharge Event Number	Carkeek Discharge Volume (MGD)	Total Influent TSS (lbs)	Total Effluent TSS Discharged @ Carkeek + WP (lbs)	% removal	Carkeek Effl. Settleable Solids (ml/l/hr)	Carkeek Effl. Settleable Solids Event Avg (ml/l/hr)	Carkeek Effl. Avg pH	Carkeek Avg Effl. Fecal Coliforms (#/100 ml)	Carkeek Effl. Residual Chlorine (µg/l)	Min/Max pH
November	1	1	0.01	ND	ND	15	2		ND	ND	ND	ND	ND	
	19	2a	11.89	1a	11.89	10015	6143		0.10		6.5	1	723	6.4/7.9
	20	2b	1.12	1b	1.11	374	193		0.10		6.7	1	89	6.1/7.8
	21	2c	0.49	1c	0.49	221	98		0.10	0.1	6.6	1	6	6.5/7.2
	23	3	0.32	ND	ND	240	31		ND	ND	ND	ND	ND	ND
	30	4a	2.72	2a	2.34	1225	534		0.10		6.6	1	30	6.4/7.9
	1-Dec	4b	1.73	2b	1.53	765	248		0.10		6.9	1	216	6.6/7.8
	2-Dec	4c	0.23	2c	0.06	159	37		0.10	0.1	7.1	1	6	6.2/7.7
	Inst. Min/Max pH													**6.1/7.9**
	Event/Daily Max									**0.1**			723	
	Mon. Total/Avg/Geomean	**4**	**18.51**	**2**	**17.42**	**13014**	**7287**	**44.0%**	**0.1**			**1**		
December	3	1a	0.51	1a	0.01	362	50		*NR		6.4	1	7	6.4/6.5
	4	1b	0.23	1b	0.03	163	36		NR	NR	7.0	1	60	6.6/7.5
	16	2	0.93	2	0.50	766	167		0.1	0.1	6.7	20	7	6.4/6.8
	19	3a	4.20	3a	3.60	1058	483		0.1		6.9	20	474	6.5/7.9
	20	3b	4.95	3b	5.06	3905	1808		0.0	0.1	6.8	^ED	247	5.1/7.0
	25	4	0.13	ND	ND	34	4		ND	ND	ND	ND	ND	
	Inst. Min/Max pH													**5.1/7.9**
	Event/Daily Max									**0.1**			**474**	
	Mon. Total/Avg/Geomean	**4**	**10.95**	**3**	**9.20**	**6288**	**2547**	**59.5%**	**0.1**			**4.5**		

Month	Day	Carkeek Inflow Event Number	Carkeek Inflow Volume (MGD)	Carkeek Discharge Event Number	Carkeek Discharge Volume (MGD)	Total Influent TSS (lbs)	Total Effluent TSS Discharged @ Carkeek + WP (lbs)	% removal	Carkeek Effl. Settleable Solids (ml/l/hr)	Carkeek Effl. Settleable Solids Event Avg (ml/l/hr)	Carkeek Effl. Avg pH	Carkeek Avg Effl. Fecal Coliforms (#/100 ml)	Carkeek Effl. Residual Chlorine (µg/l)	Min/Max pH
January – December 2012	Total	17	31.18	6	26.82	21990	10984							
	Inst. pH Min/Max													5.1/7.9
	Max (GEM, SS, TRC)								0.1			4.5	723	
	Annual Average all events							50.1%	0.1					

Notes:

 # ND= No Discharge.

^ED= End of discharge; fecal coliform grab samples were collected as required but then discharge ended before next grab sample was required.

*** NR= Not Reported due to lab error.**

Appendix E
Mercer/Elliott West CSO Treatment Plant
Annual Report
January–December 2012

Executive Summary

This document constitutes the seventh annual report of the Mercer/Elliott West CSO Treatment Facility (EWCSO). It summarizes the performance and operation of the facility during January−December 2012.

EWCSO began operating in July 2005. The facility operates under the permit for the West Point Treatment Plant, Washington State Department of Ecology permit number WA-0029181-1. The current permit went into effect on July 1, 2009 and expires June 30, 2014. Effective June 2011, a new fecal coliform limit was implemented by Ecology as a monthly geomean of 154 counts/ 100 mL with no more than 10% of the discharge days to exceed 473 counts/ 100 mL. In calculating the geomean, Ecology directed that a value of "one" for non-discharge days be used.

2012 marks the eighth year of operation of EWCSO by WTD. There were 46 inflow events and 12 discharge events in 2012. EWCSO received a total of 511.9 million gallons (MG) of CSO flow out of which 198.9 MG was treated and discharged through the EWCSO outfall at the Denny Regulator Station located in Myrtle Edwards Park. Nearly 50 percent of the total discharged CSO flow volume occurred in November 2012. The average total suspended solids (TSS) removal for all discharge events during the year was 64.5 percent.

The eighth year was characterized by higher rainfall and subsequent inflow and discharge volumes. Total rainfall recorded in 2012 was 51.1 inches as measured at the Denny Way rain gauge station which is located at 3165 Alaskan Way in Seattle. This is higher than the reported Sea-Tac total of 48.26 inches in 2012.

Performance in 2012

Table E-1 summarizes permit performance in 2012.

Table E-1. Mercer/Elliott West CSO Permit Performance in 2012

Parameter	Performance	Permit Conditions
Number of Discharge Events	12	NA
Discharge Volume (mgd)	198.9	NA
Annual Average Settleable Solids (mL/L/hr)	1.4	0.3
Monthly Event Maximum Settleable Solids (mL/L/hr)	5.5	1.9
Annual Average percent Total Suspended Solids Removal including all discharge events	64.5%	50%
Fecal Coliform, Maximum Monthly Geomean (MPN#/100 ml)	3	400
Instantaneous Minimum/Maximum Effluent pH	4.6/8.4	>6.0/<9.0
Total Residual Chlorine, Maximum of Daily (µg/l)	407	104

Suspended and Settleable Solids:

Including all the discharge events in 2012, the annual TSS removal was calculated to be 64.5 percent, compared to 62.4 percent removal for 2011.

WTD used the tunnel flushing system at the East Portal Structure to flush the solids left in the tunnel after a discharge event in order to improve solids capture. WTD is also reviewing strategies for an automated flushing program. In addition, the dewatering pumps located in the wet well at Elliott West facility are programmed to run throughout a discharge to improve the amount of solids removed during a discharge. This strategy was based on the observation that the solids are re-suspended in the wet well when the large main pumps are pumping. Operating the smaller dewatering pumps, whose intakes are lower than those of the main pumps, allows the EWCSO to pump flows with higher solids concentration back to West Point via the Elliott Bay Interceptor. This approach appeared to improve the amount of TSS removed by returning additional higher solids flows to West Point. Solids recovery continues to improve over the past few years, for example, annual solids removal of 42 percent in 2009, a 53.3 percent removal in 2010, 62.4 percent in 2011, and 64.5 percent in 2012.

Meeting the settleable solids (SS) permit limits continues to be a challenge at EWCSO. The annual SS concentration for the 2012 discharge events averaged 1.4 mL/L/hr., and the monthly event maximum was 5.5 mL/L/hr. In response, WTD installed a portable sequential auto-sampler at EWCSO to sample from the pump discharge channel during discharge events at discrete flow signals in order to compare the solids (both settleable and suspended solids) in the samples collected by the effluent auto-sampler at Denny. The initial findings indicate that the high SS concentrations reported from samples taken by effluent sampler at Denny are also being observed from the samples taken from the pump discharge channel. The main pumps at EWCSO are pumping high TSS and SS levels from the wet well/Mercer tunnel, indicating that the effluent samples from the Denny sampler are representative of the solids during a discharge. It was not, as previously speculated, that the high SS is from either tidal inputs/marine influenced effluent samples or scouring of the solids that have accumulated in the effluent pipeline from previous events. WTD staff will continue to sample at both locations—the discharge channel using the sequential sampler and the final effluent sampler—to further study the TSS and SS removal at Elliott West.

Fecal Coliform Bacteria

In 2012, the maximum monthly geomean for fecal coliform bacteria was calculated as 3 counts/100 mL. This occurred in two months, January and July. Effective June 2011 (and through the end of the current permit cycle in June 2014), the fecal coliform permit limit and calculation methodology changed for Elliott West CSO discharges. The new monthly geometric mean for fecal coliform limit is 154 counts/ 100 mL, and no more than 10 percent of discharge days can exceed 473 counts/ 100 mL. Non-discharge days are assigned a value of "one" for the calculation. If discharges occur on fewer than 10 days in the month, then 1 day may exceed 473 counts/ 100 mL. The new chlorination system, part of the Chlorination–Dechlorination Improvement Project, is currently in use. Since the chlorination system became operational in November 2011, WTD has continued to evaluate and fine-tune the chlorination and dechlorination controls at each discharge event. WTD continues to monitor the performance of the new system and has made several improvements.

Total Residual Chlorine

During 2012, there were three discharge days that exceeded the maximum daily average effluent total residual chlorine (TRC) permit level of 104 µg/L. These events occurred on January 20 (231 µg/L), December 19 (297 µg/L), and December 20 (407 µg/L). The TRC exceedance on January 20 was caused by hypochlorite over feeding, and the hypochlorite feed control setpoints have been adjusted in response to the over feeding. The other two discharge days with TRC exceedances were the result of continual adjustments to the sodium bisulfite (SBS) feed in direct

response to the minimum pH excursions (see below). The SBS feed was lowered below what was necessary for proper dechlorination. WTD staff is continuing to fine-tune the chemical feed controls as well as monitor the online chlorine analyzers and pH meter.

Instantaneous Minimum and Maximum Effluent pH

Instantaneous minimum and maximum effluent pH in 2012 was measured as 4.6 and 8.4, respectively. There were a total of 19 discharge days in 2012, and 10 discharge days in which the instantaneous minimum effluent pH was measured below the permit level of 6.0, while there were no events exceeding the maximum pH limit of 9.0. Typically, a drop in the effluent pH during discharge and treatment indicates a potential overdosing of SBS. In response to these incidents of depressed effluent pH values, WTD staff has been fine-tuning the SBS feed control program and reducing SBS feed; however, these actions did not prevent exceedances of the instantaneous minimum pH limit of 6.0 in subsequent discharges.

Additional follow up by WTD staff included using a portable pH meter as an independent measurement throughout the treatment process, starting with the flows entering the wet well at EW, then pump discharge flows, pre-dechlorination, and final effluent. The inflows have a pH measurement around 7.0. The alkalinities of the inflow and final effluents have been determined to be in the range 18-32 mg/L as $CaCO_3$. These very low alkalinity values are contributing to the pH challenges at Elliott West. While the cause for the final effluent pH dropping below 6.0 has not yet been determined, significant time and effort has been and continues to be spent investigating the possible causes. WTD staff will continue to respond to EW discharges in order to fine-tune the chlorination and dechlorination controls in an effort to prevent permit limit violations. Additional troubleshooting and the implementation of system improvements will occur when the cause is determined.

Operation and Maintenance

Highlights of Operation and Maintenance activities at EWCSO during 2012 include the following:

- Conducted annual CSO refresher training for the operators in September 2012.
- Implemented a response team comprised of an Instrumentation Technician, Operations staff and a Process Analyst to troubleshoot and fine-tune the new chlorination-dechlorination feed controls that were completed and transferred to operations staff in November 2011.
- Continued using the East Portal flushing gate in an attempt to flush and capture the solids settled in the Mercer Tunnel. Overall, the flushing procedure contributed to better solids capture during this reporting period.
- Continued to run the dewatering pumps during discharges in order to remove additional solids, which takes advantage of the turbulence and re-suspension of solids in the wet well caused by the larger main pumps and increases the amount of solids in the return flows to West Point Treatment Plant. This operational strategy has helped EWCSO achieve greater TSS removal and thereby meet the annual percent TSS removal permit level of 50 percent.
- Continued to conduct debriefings with operations and maintenance staff after discharge events to review and discuss the discharge and treatment performance and make any needed operational adjustments for subsequent events.
- Continued to exercise the chemical feed pumps on a monthly basis as a preventive maintenance measure.

Chlorination-Dechlorination System Improvements Project

2012 marked the first full year of operation for the new chlorination-dechlorination system controls, part of the Chlorination-Dechlorination System Improvement Project. This project was completed in November 2011. WTD's response team was tasked with troubleshooting and fine-tuning the feed controls, and they responded to each treatment and discharge event when the wet well was filling and prior to the start of the main discharge pumps. While fine-tuning the new system had its challenges, WTD evaluated station performance during the operations debriefing held after each discharge event.

Final Effluent Sampling Improvements Project

The Final Effluent Sampling Improvements project was completed in early 2013. This project will improve effluent sampling by minimizing the potential for sea water intrusion into the effluent sample stream. The project relocated the effluent sample intake from the Outfall Transition Structure to the effluent pipe between the Dechlorination and Transition structures, upstream of the flap gate between the two structures. The project included a newly designed sample intake screen with a debris deflector designed to minimize debris that can clog the sample pump and line. WTD will evaluate the effectiveness of the new effluent sampling system during each treatment and discharge event. Also, a new manual sampling location was established so that if the automatic sampler is not available, a manual sample can be obtained.

Near Future Operation

During Elliott West facility's seven years of operation, opportunities to operate and then to optimize have been very limited. Challenges may be identified during an event in the wet season, but any major projects to address the challenge would likely have to occur during the following dry season. Then, after the completion of these projects, the opportunities to test the improvements would likely occur in the following wet season. Given the complexity of this facility's design and operation and the "normal" challenges of an intermittently operated facility, WTD has essentially had to make improvements continuously, and a number of improvements have been identified to be addressed during subsequent dry seasons. WTD staff will continue to fine-tune the chlorination-dechlorination controls and assess and improve the facility performance using these additional tools. In addition, the Elliott West CSO Treatment Plant will

- continue to investigate and correct the cause of the instantaneous minimum pH limit exceedances.
- continue to implement the response team to EW as the wet well fills and in anticipation of a discharge.
- continue evaluation and fine-tuning of the new chlorination and dechlorination controls.
- switch to "mode 3" of hypochlorite feed control, which is a feedback loop using the immediate chlorine residual (analyzer sampling from the pump discharge channel) as part of the control logic for the feed program.
- evaluate the newly completed Final Effluent Improvement Project.
- repair and replace the broken marine flap gate located in outfall Transition, expected to be completed by fall 2013.
- complete the new city water service connection to the Denny Regulator and Pre-dechlorination station of EW scheduled by fall 2013.
- complete the automation of the Mercer Tunnel flushing and begin monitoring the program's effectiveness upon completion.
- complete repair of the effluent tunnel flushing gate in the fall of 2013.

Table E-2 Elliott West Annual Plant Performance 2012

Month	Day	EWCSO Inflow Event Number	EWCSO Inflow Volume (MGD)	EWCSO Discharge Event Number	EWCSO Discharge Volume (MGD)	Total Influent TSS (lbs)	Total Effluent TSS Discharged @ Denny + WP (lbs)	% removal	EWCSO Effl. Settl Solids Daily Avg (ml/l/hr)	EWCSO Effl. Settl Solids Event Avg (ml/l/hr)	Avg EWCSO Effl. pH	EWCSO Avg Effl. Fecal Coliforms (#/100 ml)	EWCSO Effl. Residual Chlorine Daily Average (µg/l)	Daily Min/Max pH
January	2	1a	6.3	# ND	ND	1672	169		ND	ND	ND	1	ND	
	3	1b	1.2	ND	ND	271	18		ND	ND	ND	1	ND	
	4	1c	9.2	1	1.33	13297	2138		0.10	0.10	6.60	30000	0.0	6.3/6.8
	5	1d	1.3	ND	ND	281	25		ND	ND	ND	1	ND	
	9	2	0.3	ND	ND	204	7		ND	ND	ND	1	ND	
	16	3	0.2	ND	ND	67	2		ND	ND	ND	1	ND	
	20	4a	23.3	2a	21.21	11360	10011		0.90		6.70	1	231	6.3/8.4
	21	4b	16.5	2b	7.80	4665	2276		0.10	0.5	6.57	270	0.0	6.5/6.7
	22	4c	3.5	ND	ND	951	79		ND	ND	ND	1	ND	
	25	5a	0.7	ND	ND	366	19		ND	ND	ND	1	ND	
	26	5b	4.0	ND	ND	3789	231		ND	ND	ND	1	ND	
	27	5c	0.6	ND	ND	2951	115		ND	ND	ND	1	ND	
	28	5d	0.3	ND	ND	512	23		ND	ND	ND	1	ND	
	29	5e	1.4	ND	ND	420	35		ND	ND	ND	1	ND	
	31	6	0.1	ND	ND	887	35		ND	ND	ND	1	ND	
Instant. Min/Max pH														**6.3/8.4**
Event/Daily Max										**0.1**			**231**	
Monthly Total/Avg/Geomean		**6**	**68.9**	**2**	**30.3**	**41693**	**15184**	**63.6%**	**0.4**			**3**		
February	1	1	4.6	ND	ND	19954	1397		ND	ND	ND	ND	ND	
	7	2	0.2	ND	ND	1426	57		ND	ND	ND	ND	ND	
	13	3	0.2	ND	ND	83	6		ND	ND	ND	ND	ND	
	17	4a	3.1	ND	ND	6782	746		ND	ND	ND	ND	ND	
	18	4b	0.7	ND	ND	1123	135		ND	ND	ND	ND	ND	
	22	5	0.2	ND	ND	168	10		ND	ND	ND	ND	ND	
	24	6	0.7	ND	ND	379	27		ND	ND	ND	ND	ND	
	28	7	0.2	ND	ND	997	30		ND	ND	ND	ND	ND	
Instant. Min/Max pH														
Event/Daily Max										**ND**			**ND**	
Monthly Total/Avg/Geomean		**7**	**9.7**	**ND**	**ND**	**30913**	**2407**	**92.2%**	**ND**			**ND**		

Month	Day	EWCSO Inflow Event Number	EWCSO Inflow Volume (MGD)	EWCSO Discharge Event Number	EWCSO Discharge Volume (MGD)	Total Influent TSS (lbs)	Total Effluent TSS Discharged @ Denny + WP (lbs)	% removal	EWCSO Effl. Settl Solids Daily Avg (ml/l/hr)	EWCSO Effl. Settl Solids Event Avg (ml/l/hr)	Avg EWCSO Effl. pH	EWCSO Avg Effl. Fecal Coliforms (#/100 ml)	EWCSO Effl. Residual Chlorine Daily Average (µg/l)	Daily Min/Max pH
March	5	1	0.61	ND	ND	605	27		ND	ND	ND	1	ND	
	12	2a	3.36	ND	ND	3079	354		ND	ND	ND	1	ND	
	13	2b	4.69	ND	ND	1835	211		ND	ND	ND	1	ND	
	14	2c	3.10	ND	ND	1456	312		ND	ND	ND	1	ND	
	15	2d	9.76	1a	7.06	23230	16562		1.40		6.8	1100	22	6.6/7.6
	16	2e	8.77	1b	1.16	8166	1860		1.40	1.40	6.6	1	1	6.5/6.8
	17	2f	6.87	ND	ND	2650	501		ND	ND	ND	1	ND	
	18	2g	1.03	ND	ND	361	49		ND	ND	ND	1	ND	
	20	3	0.63	ND	ND	16067	2185		ND	ND	ND	1	ND	
	28	4a	0.14	ND	ND	96	4		ND	ND	ND	1	ND	
	29	4b	17.61	2	9.73	10737	8734		0.70	0.70	6.5	1	76	6.1/7.0
	30	4c	2.88	ND	ND	304	18		ND	ND	ND	1	ND	
	31	4d	4.40	ND	ND	1153	107		ND	ND	ND	1	ND	
Instant. Min/Max pH														**6.1/7.6**
Event/Daily Max										**1.40**			**76**	
Monthly Total/Avg/Geomean		**4**	**63.9**	**2**	**18.0**	**69739**	**30924**	**55.7%**	**1.17**			**2**		
April	11	1	0.19	ND	ND	551	16		ND	ND	ND	ND	ND	
	18	2	0.19	ND	ND	349	10		ND	ND	ND	ND	ND	
	20	3	0.74	ND	ND	506	19		ND	ND	ND	ND	ND	
	25	4	0.44	ND	ND	393	14		ND	ND	ND	ND	ND	
Instant. Min/Max pH														
Event/Daily Max										**ND**			**ND**	
Monthly Total/Avg/Geomean		**4**	**1.6**	**ND**	**ND**	**1799**	**60**	**96.7%**	**ND**			**ND**		

Month	Day	EWCSO Inflow Event Number	EWCSO Inflow Volume (MGD)	EWCSO Discharge Event Number	EWCSO Discharge Volume (MGD)	Total Influent TSS (lbs)	Total Effluent TSS Discharged @ Denny + WP (lbs)	% removal	EWCSO Effl. Settl Solids Daily Avg (ml/l/hr)	EWCSO Effl. Settl Solids Event Avg (ml/l/hr)	Avg EWCSO Effl. pH	EWCSO Avg Effl. Fecal Coliforms (#/100 ml)	EWCSO Effl. Residual Chlorine Daily Average (µg/l)	Daily Min/Max pH
May	3	1a	5.31	ND	ND	2613	68		ND	ND	ND	ND	ND	
	4	1b	6.47	ND	ND	1327	78		ND	ND	ND	ND	ND	
	5	1c	0.94	ND	ND	706	25		ND	ND	ND	ND	ND	
	21	2a	2.81	ND	ND	6130	288		ND	ND	ND	ND	ND	
	22	2b	0.39	ND	ND	335	12		ND	ND	ND	ND	ND	
Instant. Min/Max pH														
Event/Daily Max										**ND**			**ND**	
Monthly Total/Avg/Geomean		**2**	**15.9**	**ND**	**ND**	**11110**	**471**	**95.8%**	**ND**			**ND**		
June	5	1	1.58	ND	ND	1542	145		ND	ND	ND	ND	ND	
	7	2a	6.06	ND	ND	8558	770		ND	ND	ND	ND	ND	
	8	2b	0.38	ND	ND	371	25		ND	ND	ND	ND	ND	
	22	3a	1.97	ND	ND	591	40		ND	ND	ND	ND	ND	
	23	3b	1.88	ND	ND	549	41		ND	ND	ND	ND	ND	
Instant. Min/Max pH														
Event/Daily Max										**ND**			**ND**	
Monthly Total/Avg/Geomean		**3**	11.9	**ND**	**ND**	**11611**	**1021**	**91.2%**	**ND**			**ND**		
July	3	1	2.87	ND	ND	12812	833		ND	ND	ND	1	ND	
	13	2	1.15	ND	ND	806	20		ND	ND	ND	1	ND	
	20	3	16.52	1	7.79	36807	21691		5.50	5.50	6.5	40	59	6.3/7.6
Instant. Min/Max pH														**6.3/7.6**
Event/Daily Max										**5.5**			**59**	
Monthly Total/Avg/Geomean		**3**	**20.5**	**1**	**7.8**	**50424**	**22544**	**55.3%**	**5.5**			**3**		
August	No Inflow/No Disch.			ND	ND				ND	ND	ND	ND	ND	
Instant. Min/Max pH														
Event/Daily Max										**ND**			**ND**	
Monthly Total/Avg/Geomean		**0**	**0**	**ND**	**ND**	**0**	**0**		**ND**			**ND**		

Month	Day	EWCSO Inflow Event Number	EWCSO Inflow Volume (MGD)	EWCSO Discharge Event Number	EWCSO Discharge Volume (MGD)	Total Influent TSS (lbs)	Total Effluent TSS Discharged @ Denny + WP (lbs)	% removal	EWCSO Effl. Settl Solids Daily Avg (ml/l/hr)	EWCSO Effl. Settl Solids Event Avg (ml/l/hr)	Avg EWCSO Effl. pH	EWCSO Avg Effl. Fecal Coliforms (#/100 ml)	EWCSO Effl. Residual Chlorine Daily Average (µg/l)	Daily Min/Max pH
September	No Inflow/No Disch.			ND	ND				ND	ND	ND	ND	ND	
Instant. Min/Max pH														
Event/Daily Max										**ND**			**ND**	
Monthly Total/Avg/Geomean		**0**	**0.0**	**ND**	**ND**	**0**	**0**		**ND**			**ND**		
October	14	1a	0.72	ND	ND	823	35		ND	ND	ND	1	ND	
	15	1b	0.92	ND	ND	568	20		ND	ND	ND	1	ND	
	18	2a	4.74	ND	ND	1563	103		ND	ND	ND	1	ND	
	19	2b	1.56	ND	ND	546	47		ND	ND	ND	1	ND	
	21	3a	0.21	ND	ND	74	3		ND	ND	ND	1	ND	
	22	3b	0.23	ND	ND	107	5		ND	ND	ND	1	ND	
	23	3c	0.15	ND	ND	116	4		ND	ND	ND	1	ND	
	25	4a	0.23	ND	ND	65	2		ND	ND	ND	1	ND	
	26	4b	0.21	ND	ND	158	5		ND	ND	ND	1	ND	
	27	4c	2.65	ND	ND	4139	252		ND	ND	ND	1	ND	
	28	4d	0.88	ND	ND	308	15		ND	ND	ND	1	ND	
	29	4e	4.36	ND	ND	651	53		ND	ND	ND	1	ND	
	30	4f	26.44	1a	24.2	18194	10137		0.15		6.1	1	103	5.2/7.5
	31	4g	11.36	1b	2.7	5205	1658		0.10	0.13	5.7	^ED	34	4.6/6.2
Instant. Min/Max pH														**4.6/7.5**
Event/Daily Max										**0.1**			**103**	
Monthly Total/Avg/Geomean		**4**	**54.7**	**1**	**27.0**	**32517**	**12341**	**62.0%**	**0.1**			**1**		
November	1	1a	2.75	ND	ND	1041	112		ND	ND	ND	1	ND	
	2	1b	0.72	ND	ND	1705	77		ND	ND	ND	1	ND	
	4	2a	0.49	ND	ND	106	5		ND	ND	ND	1	ND	
	5	2b	0.65	ND	ND	585	30		ND	ND	ND	1	ND	
	11	3a	2.17	ND	ND	1413	45		ND	ND	ND	1	ND	
	12	3b	1.33	ND	ND	244	12		ND	ND	ND	1	ND	
	13	3c	0.22	ND	ND	538	18		ND	ND	ND	1	ND	
	15	4	2.03	ND	ND	2895	78		ND	ND	ND	1	ND	
	18	5a	1.48	ND	ND	14750	1637		ND	ND	ND	1	ND	

Month	Day	EWCSO Inflow Event Number	EWCSO Inflow Volume (MGD)	EWCSO Discharge Event Number	EWCSO Discharge Volume (MGD)	Total Influent TSS (lbs)	Total Effluent TSS Discharged @ Denny + WP (lbs)	% removal	EWCSO Effl. Settl Solids Daily Avg (ml/l/hr)	EWCSO Effl. Settl Solids Event Avg (ml/l/hr)	Avg EWCSO Effl. pH	EWCSO Avg Effl. Fecal Coliforms (#/100 ml)	EWCSO Effl. Residual Chlorine Daily Average (µg/l)	Daily Min/Max pH
	19	5b	73.93	1a	71.04	76211	73142		0.3		6.1	335	16	5.9/7.3
	20	5c	11.94	1b	2.69	13424	2924		0.1	0.2	6.0	40	67	5.8/6.6
	21	5d	5.88	ND	ND	7012	989		ND	ND	ND	1	ND	
	22	5e	0.79	ND	ND	125	5		ND	ND	ND	1	ND	
	23	5f	11.92	2	3.71	40881	10814		*NR	*NR	6.1	125	13	5.5/6.3
	24	5g	29.21	ND	ND	93690	8620		ND	ND	ND	1	ND	
	25	5h	22.89	ND	ND	45978	8184		ND	ND	ND	1	ND	
	30	6a	22.28	3a	19.68	4924	3927		0.1		6.3	10	102	5.7/7.2
	1-Dec	6b	7.59	3b	0.30	583	173		0.1	0.1	5.7	^ED	0	5.6/5.7
	Instant. Min/Max pH													**5.5/7.2**
	Event/Daily Max									**0.2**			**102**	
	Monthly Total/Avg/Geomean	**6**	**198.3**	**3**	**97.4**	**306106**	**110791**	**63.8%**	**0.2**			**3**		
December	2	1a	7.78	1a	4.10	1757	1507		NR		6.10	40	40	5.95/7.3
	3	1b	9.79	1b	4.90	3218	1908		0.20	0.20	6.30		13	5.8/6.8
	4	1c	7.37	ND	ND	926	180		ND	ND	ND	1	ND	
	5	1d	0.87	ND	ND	762	50		ND	ND	ND	1	ND	
	6	1e	0.24	ND	ND	102	3		ND	ND	ND	1	ND	
	9	2	0.23	ND	ND	104	4		ND	ND	ND	1	ND	
	11	3	2.69	ND	ND	%NS	%NS		ND	ND	ND	1	ND	
	14	4a	1.04	ND	ND	130	7		ND	ND	ND	1	ND	
	15	4b	1.04	ND	ND	1188	52		ND	ND	ND	1	ND	
	16	4c	6.20	2	2.73	5584	3036		3.70	3.70	6.50	50	69	5.8/7.3
	17	4d	5.65	ND	ND	1256	168		ND	ND	ND	1	ND	
	19	5a	5.09	3a	2.55	2915	1247		NR		6.80	1	297	6.5/7.6
	20	5b	11.69	3b	4.15	5799	2599		0.10	0.10	6.40		407	6.05/7.2
	25	6a	5.62	ND	ND	1052	108		ND	ND	ND	1	ND	
	26	6b	0.57	ND	ND	233	15		ND	ND	ND	1	ND	
	27	6c	0.54	ND	ND	68	3		ND	ND	ND	1	ND	
	31	7	0.19	ND	ND	326	8		ND	ND	ND	1	ND	

Month	Day	EWCSO Inflow Event Number	EWCSO Inflow Volume (MGD)	EWCSO Discharge Event Number	EWCSO Discharge Volume (MGD)	Total Influent TSS (lbs)	Total Effluent TSS Discharged @ Denny + WP (lbs)	% removal	EWCSO Effl. Settl Solids Daily Avg (ml/l/hr)	EWCSO Effl. Settl Solids Event Avg (ml/l/hr)	Avg EWCSO Effl. pH	EWCSO Avg Effl. Fecal Coliforms (#/100 ml)	EWCSO Effl. Residual Chlorine Daily Average (µg/l)	Daily Min/Max pH
Instant. Min/Max pH														5.8/7.6
Event/Daily Max										3.7			407	
Monthly Total/Avg/Geomean		7	66.60	3	18.4	25420	10894	57.1%	1.3			2		
Total		46	511.9	12	198.9	581333	206637							
Inst. pH Min/Max														4.6/8.4
Max (GEM, SS, TRC)										5.5		3	407	
Annual Average								64.5%	1.4					

Notes:

 # ND= No Discharge.

*** NR= Not Reported due to lab error.**

%NS= No sample collected

^ED= End of discharge; fecal coliform samples were collected for 0-3 and 4-8 hour grabs then discharge ended before next grab sample was required.

	Inflow Volume (MGD)	Discharge Volume (MGD)	Total EWCSO TSS lbs-in	Total EWCSO TSS lbs Discharged	Annual Average EWCSO %TSS Recovery	Annual Average EWCSO Settleable Solids (ml/l/hr)	Monthly Event Max Settleable Solids Concentration (ml/l/hr)	Maximum Monthly Geomean EWCSO Effl. Fecal Coliforms (#/100 ml)	Maximum of Daily Averages of EWCSO Effl. Res. Cl2 (µg/l)	Instant. Min/Max pH	Comments
Including all Discharge Events	357.3	170.1	378404	142231	62.4%	0.8	4.5	400000	259	4.9/8.5	

Appendix F
Henderson/Norfolk CSO Control System Annual Report
January–December 2012

This 2012 annual report summarizes the performance of King County's Henderson/Norfolk CSO treatment facilities. These CSO facilities came online in 2005. They operate under the NPDES permit for the West Point Treatment Plant (WA-0029181-1).

There were five filling events and one discharge event during calendar year 2012. The Henderson/Norfolk CSO Treatment Plant received a total inflow of 14.07 million gallons (MG) and discharged 5.2 MG as treated CSO. The annual 50 percent total suspended solids (TSS) removal limit was achieved, averaging 63.6 percent. All performance permit limits were met except for the maximum daily residual chlorine limit in November.

Season's Weather Conditions

A total of 47.85 inches of rain fell in calendar year 2012 as measured at Henderson Pump Station. The historic average is 37.07 inches as measured at Sea-Tac Airport.

Table F-1 Henderson/Norfolk CSO Permit Compliance Summary

Compliance Summary	Value/Outcome
Number of Inflow Events:	5
Total Inflow Volume (MG):	14.07
Number of Discharge Events:	1
Total Discharge Volume (MG):	5.2
Total Influent TSS (lbs):	6778
Total Discharge TSS from MLK + WP (lbs):	2467
Overall TSS Removal (%):	63.6%
Annual rainfall (inches):	47.85
Annual Average TSS Removal Limit Compliance:	**Met**
Monthly Event Max Settleable Solids Limit Compliance:	**Met**
Annual Average Settleable Solids Limit Compliance:	**Met**
Max Daily Residual Chlorine Limit Compliance:	**Not Met – Nov. 2012**
Monthly Fecal Coliform Limit Compliance:	**Met**

Operational Challenges

The Henderson/Norfolk facilities operated well in 2012. All performance permit limits were met except for the maximum daily residual chlorine limit in November. To correct this, the sodium bisulfite (SBS) flow-paced dose will be increased, the hypochlorite flow-paced dose will remain at a lower setting, and the effluent Cl_2 residual prior to SBS addition will continue to be monitored during future events.

Routine Operation and Maintenance Activities

The equipment and facilities of the Henderson/Norfolk CSO treatment system were fully functioning and available during 2012. Preventive maintenance was performed routinely. Routine O&M activities not directly associated with an event included weekly operator inspections, checklists, equipment and sampler testing, alarm checks, weekly analyzer preventive maintenance and calibrations, quarterly lubrication and preventive maintenance of mechanical equipment, annual training and preparation for winter wet weather operation, post-event cleaning of the CSO facilities, and post-event debriefs and corrective work orders as appropriate. More details are available in the monthly discharge monitoring reports.

The annual and/or first four events sampling required in the NPDES permit was completed during the November 19, 2012 event. Flow-composited effluent samples for trace organics and metals were collected during the event. Effluent grab samples for phenols, cyanides and oil and grease were also collected for the 0-3 hour and 4-8 hour sampling intervals. Results were reported in the November and December 2012 monthly reports.

Table F-2 Henderson/Norfolk Annual Plant Performance 2012

									Effluent Settleable Solids			Effluent Chlorine		Effluent Fecal Coliforms		Effluent Max/Min pH	
Month	# of Inflow Events @ MLK	# of Discharge Events @ MLK	Inflow Vol. (MG)	Discharge Vol. (MG)	MLK Influent TSS (lbs)	MLK Effluent TSS+WP (lbs)	%TSS Removal (Monthly Ave Report)	Permit Limit for Annual Average %TSS Removal	Max. of all events in a month (ml/l/hr)	Permit Max. of all events in a month (ml/l/hr)	Permit Limit for Annual Avg (ml/l/hr)	Max. of Daily Averages (µg/l)	Permit Limit for Max of Daily Avg (µg/l)	Monthly Geomean (#/100 ml)	Permit Limit (#/100 ml)	Instant. Min/Max	Permit Limit for pH Min/Max
January	1	0	0.50	0.00	124	31	75.0%			1.9			39		400	NA	**6.0/9.0**
February	0	0	0	0						1.9			39		400	NA	**6.0/9.0**
March	1	0	1.55	0.00	1086	122	88.8%			1.9			39		400	NA	**6.0/9.0**
April	0	0	0	0						1.9			39		400	NA	**6.0/9.0**
May	0	0	0	0						1.9			39		400	NA	**6.0/9.0**
June	0	0	0	0						1.9			39		400	NA	**6.0/9.0**
July	0	0	0	0						1.9			39		400	NA	**6.0/9.0**
August	0	0	0	0						1.9			39		400	NA	**6.0/9.0**
September	0	0	0	0						1.9			39		400	NA	**6.0/9.0**
October	0	0	0	0						1.9			39		400	NA	**6.0/9.0**
November	3	1	12.02	5.20	5568	2314	58.5%		0.1	1.9	0.1	218	39	2	400	**6.8/6.8**	**6.0/9.0**
December	0	0	0	0						1.9			39		400	NA	**6.0/9.0**
Annual Total All Events	**5**	**1**	**14.07**	**5.20**	**6778**	**2467**	**63.6%**	50%			-						