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

July 31, 2009

Mark Henley
Washington State Department of Ecology
3190 160th Avenue SE
Bellevue, WA 98008-5442

Dear Mr. Henley:

Enclosed is the King County Wastewater Treatment Division's Annual Combined Sewer Overflow Report for 2008. The report contains an overview and status of King County's Combined Sewer Overflow (CSO) Control Program, overflow data, and information on implementation of the Nine Minimum Controls.

This report was prepared in accordance with WAC 173-245-090 and with the requirements for annual CSO reports as established in the new National Pollutant Discharge Elimination System Permit WA-002918-1 for the West Point Treatment Plant (effective July 1, 2009). The changes in reporting requirements, listed below, have resulted in a different report structure and content from previous years:

- Submittal deadline of July 31 each year
- Reporting of information by calendar year
- "Event-based" data reporting by CSO site
  - Include duration of each CSO event. The duration represents the period from the start until the end of the overflow, as defined by a subsequent 24-hour non-overflow period. The overflow itself may be intermittent within this duration period.
  - Include rainfall data for each CSO event as measured by the nearest King County rain gauge. This event-based rainfall reporting will begin with the August 2009 monthly report and will be compiled in next year's 2009 annual report.
  - Provide event-based data in electronic form along with the report
- Reporting of the average of the overflow frequency at each CSO site over the last 20 years. Because 20 years of data are not available for all sites, Ecology has specified that missing data from the early years or pre-control project years will be reported from the hydraulic model for those sites identified as having achieved control to the state standard. These modeled data will be provided in the 2009 report.
- Identification of CSOs considered controlled in both the annual reports and the control plan amendments.

In 2008, 27.29 inches of rain was measured as an average over local rain gauges compared to the typical average of 37 inches. The rainfall pattern during the year exhibited lower, steadier precipitation without the intense storms seen in recent years. This type of rainfall is more easily assimilated by the combined sewer system. As a result, King County CSO locations discharged 106 million gallons (MG) over a total of 89 untreated events—the lowest total discharge volume recorded since system monitoring and reporting began in 1991. The 1981–1983 baseline is 2,339 MG, which was set at the start of the current control effort.

Continued progress is being made toward meeting performance goals at the Mercer/Elliott West treatment and storage facilities. Improvements in sampling are now demonstrating higher solids capture than previously identified. In 2008, 72.1 percent of total suspended solids (TSS) was removed, and the permit limit of 50 percent TSS removal was met. Modifications to improve hydraulics and improvements to the disinfection and dechlorination systems were also made during the year. These activities are described in detail in the Mercer/Elliott West annual report in Appendix E.

The first four CSO projects called for in the Regional Wastewater Services Plan are moving through predesign and alternatives development phases. Issuance of Facility Plans is expected by the end of 2010, with construction scheduled to begin the end of 2013. If you have any questions, please contact me at 206-684-1236, or Karen Huber, Wastewater Engineer IV, at 206-684-1246.

Sincerely,

Christie True
Division Director

Enclosure

cc: Shirley Marroquin, Planning and Asset Management Unit Manager (PAM), Project Planning and Delivery Section (PPD), Wastewater Treatment Division (WTD), Department of Natural Resources and Parks (DNRP)
Laura Wharton, Supervisor, Comprehensive Planning for Assets and Sewer Services Group (CPASS), PAM, PPD, WTD, DNRP

Combined Sewer Overflow Control Program

2008 Annual Report

July 2009

King County
Department of Natural Resources and Parks
Wastewater Treatment Division

For comments or questions, contact:
Karen Huber
King County Wastewater Treatment Division
CSO Control Program
201 S. Jackson St.
KSC-NR-0512
Seattle, WA 98104-3855
206-684-1246
karen.huber@kingcounty.gov

Alternative Formats Available
206-684-1280 TTY Relay: 711

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Section 1

Introduction

King County prepares annual reports on its combined sewer overflow (CSO) control program and submits them to the Washington State Department of Ecology (Ecology) 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 calendar-year 2008.

The annual rainfall for 2008 was 27.29 inches as an average over local rain gauges. This is significantly lower than the average of 37 inches. The rainfall pattern exhibited lower, steadier precipitation without the intense storms seen in recent years. This type of rainfall is more easily assimilated by the combined sewer system. As a result, King County CSOs discharged 106 million gallons (MG) over a total of 89 untreated events—the lowest total discharge volume recorded since system monitoring and reporting began in 1991.

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

1.1 Background

The King County Wastewater Treatment Division (WTD) provides wholesale wastewater conveyance and treatment for flows from 17 cities, 16 local sewer utilities, and 1 Indian tribe.

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 then convey flows to the West Point Treatment Plant located in 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 pipes, CSOs occur at some 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 occur in 88 CSO locations in the City of Seattle's local sewer system. The city is responsible for 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.

Figure 1. King County CSO Locations

Since the 1970s when the basic regional wastewater system infrastructure was in place, King County has been implementing CSO control projects to improve water quality in the Seattle area.

The county 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 freshwater (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." The county prepared the *1986 Plan for Secondary Treatment Facilities and Combined Sewer Overflow Control* (1986 Plan) to meet this requirement.

Before the 1986 Plan was 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." The county worked with Ecology to develop an interim goal of 75 percent reduction of CSO volumes systemwide by the end of 2005. The county's *Final 1988 Combined Sewer Overflow Control Plan* (1988 Plan) identified 11 CSO control projects designed to meet this interim goal.

As part of the 1995 National Pollutant Discharge Elimination System (NPDES) permit renewal for the West Point Treatment Plant, King County prepared an update and amendment to the 1988 Plan. The *1995 CSO 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.[2]

In November 1999, the King County Council approved the *Regional Wastewater Services Plan* (RWSP). The RWSP identifies wastewater projects to be built through 2030 to protect human health and the environment, serve population growth, and meet regulatory requirements. The RWSP includes a CSO control plan that consists of the amended 1988 Plan, a goal for achieving control at each CSO location by 2030,[3] and identification of 21 CSO control projects at a total cost of $378 million (2005 dollars) to meet this goal.

An update of the RWSP's CSO control plan—*Year 2000 CSO Control Plan Update* (2000 Plan Update)—was included in the June 2000 submission of the West Point Treatment Plant NPDES permit renewal application. The 2000 Plan Update describes King County's progress in implementing its CSO control program, documents its compliance with state and federal CSO control requirements, and identifies 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.

[2] Ecology's CSO regulation (Chapter 173-245 WAC) requires that CSO plan updates be submitted with each NPDES permit renewal for the West Point Treatment Plant. Updates are intended to document progress on implementing the county's CSO control program, identify its program for the next five years, and provide a vehicle for making changes in the overall long-term program.

[3] Prior to King County's adoption of the RWSP, Ecology had withdrawn the 1988 Plan's interim goal of 75 percent reduction of CSO volumes by 2005 in favor of allowing the county to prioritize control projects in terms of protection of human health rather than reduction of volumes.

King County completed the *2008 CSO Control Plan Update* (2008 Plan Update) in April 2008. The 2008 Plan Update describes the county's wastewater system and the control status of its CSOs, indicates how the county is meeting the U.S. Environmental Protection Agency's (EPA's) Nine Minimum Controls, and summarizes the scientific studies that have shaped the control program over time. The update also describes completed, in progress, and planned CSO control projects, available CSO control strategies, and how these strategies apply to county projects.

In early January 2008, EPA conducted an audit of the county's wet-weather management programs. Such audits are occurring across the country under a strategy set by EPA's Office of Enforcement and Compliance Assurance (OECA). Agencies are selected to be audited based on their size, population served, and system complexity. City of Seattle programs underwent a similar audit at the same time. OECA and EPA Region X 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 has not yet made its findings public. The county is committed to working with regulatory agencies to ensure that its programs comply with regulations.

1.2 Changes in NPDES Permit Requirements Affecting CSO Control Program

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

The sections below describe the new program requirements and then specific requirements for annual reports. The information in parentheses following each requirement refers to the section of the permit where the requirement can be found.

1.2.1 CSO Program Requirements

New requirements for King County's CSO control program that became effective July 1, 2009,[7] include the following:

- Submittal of the next CSO control plan amendment/update as part of the NPDES permit renewal application by June 30, 2013
- Interim and final fecal coliform effluent limits at the Mercer/Elliott West CSO treatment facility (S.1.D)
- Monitoring requirements for all treated CSOs (S.2.A.2−5)
- Monitoring requirements for all untreated CSOs (S.2.A.6)
- Priority pollutant monitoring of the Henderson/Norfolk treated CSO discharge (S.18.F)
- More specific definition of the CSO–related bypass, monitoring, and reporting requirements at the West Point Treatment Plant (S.17)
- New reporting requirements:

- Monthly CSO reports (S18.B.1)
- Changes to the annual CSO report (S.18.B.2), described below
- A new interpretation of the control performance standard of "one untreated event per year per outfall" as a 20-year moving average (S.18.B.2, S.18.C, and S.18.K.1)
- A compliance schedule for the four Puget Sound Beach CSO control projects (S.18.E)
- Slightly changed Nine Minimum Control descriptions (S.18.H.)
- Submittal of a receiving water characterization study for the CSO treatment facilities by June 30, 2013 (S.18.I), preceded by a receiving water sampling quality assurance plan for any newly required monitoring by June 30, 2010
- Submittal of a sediment quality summary report for all CSOs and CSO treatment facilities by December 31, 2009 (S.18.J)—preceded by an annotated outline by September 1, 2009; also a sediment sampling and analysis plan for any newly required monitoring by December 31, 2010, and a sediment data report for any required sampling by January 1, 2013
- Submittal of a CSO post-construction monitoring plan by July 1, 2010 (S.18.K.3), followed by a post-construction monitoring data report by August 31, 2012

1.2.2 Annual Reporting Requirements

The renewed NPDES permit includes several requirements for annual CSO control program reports. Because this 2008 report was due shortly after the requirements took effect, a couple of the requirements (noted below) will be implemented starting with the 2009 report. The requirements and how they are being implemented are as follows:

- Submittal deadline of July 31 each year.
- Reporting of information by calendar year.[4]
- "Event-based" data reporting by CSO site:[5]
  - Include duration of each CSO event. The duration represents the period from the start until the end of the overflow, as defined by a subsequent 24-hour non-overflow period. The overflow itself may be intermittent within this duration period.
  - Include rainfall data for each CSO event as measured by the nearest King County rain gauge. This will begin with the August 2009 monthly report and will be compiled in next year's 2009 annual report.[6]
  - Provide event-based data in electronic form along with the report.
- Reporting of the average of the overflow frequency at each CSO site over the last 20 years. Because 20 years of data are not available for all sites, Ecology has specified that

[4] The previous June–May reporting over a wet season is being discontinued. The information for January–May in this report was also reported in the 2007–2008 annual report submitted in October 2008.
[5] Reports no longer contain tables providing summary data for CSOs across the system and over the wet season.
[6] The table summarizing all rain gauge data over the wet season (Table 1 in this report) will be discontinued for the 2009 report.

missing data from the early years or pre-control project years will be reported from the hydraulic model for those sites identified as having achieved control to the state standard. These modeled data will be provided in the 2009 report.

- Identification of CSOs considered controlled in both the annual reports and the control plan amendments (S.18.K.2).

1.3 Organization of this Report

Subsequent chapters in this report present the following information:

- Chapter 2—a report on implementation of the Nine Minimum Controls, as defined in the renewed NPDES permit. These differ slightly from EPA's Nine Minimum Controls.
- Chapter 3—status of CSO control project in progress. Four RWSP CSO control projects are in predesign—the four Puget Sound Beach projects (South Magnolia, North Beach, Barton Street, and Murray Avenue CSO projects). The Ballard Siphon Replacement project, also in design, is expected to reduce CSOs at two sites once it is completed.
- Chapter 4—summary of 2008 rainfall and CSO events. Detailed event-based tables for untreated and treated CSOs are located in Appendices A and B.
- Chapter 5—a table showing the 20-year average event frequency for each CSO site.

Appendices C–F contain annual reports for the four satellite CSO treatments facilities—Alki, Carkeek, Henderson/Norfolk, and Mercer/Elliott West.

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. The new NPDES permit for the West Point Treatment Plant defined the controls slightly differently from EPA's definitions. 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 2008.

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.[7] Asset management programs implemented by the West Point Treatment Plant, South Treatment Plant, and collection system maintenance division 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.

Saltwater and sand that leak into the system can cause corrosion and occupy capacity. In 2007, meters were installed at suspected saltwater intrusion points to better identify the areas of intrusion during high tide cycles in dry-weather months. Monitoring results prompted initiation of a new study in February 2008 to assess the extent of leaks and to develop a plan to address the problem. The plan should be completed by 2010.

A review done 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 nearing completion.

King County'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.

[7] SCADA = Supervisory Control and Date Acquisition system, which controls 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 the pipes and optimize storage of flows in the conveyance system. The setpoints are reviewed when the hydraulic model is recalibrated and when other information suggests that more efficient use of the collection system might be possible.

The RWSP CSO control plan also emphasizes collection system storage projects for CSO control.

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 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 education, permitting, monitoring and inspections, and enforcement actions taken during the year.

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

The county assesses influent quality at the West Point Treatment Plant for trends that would suggest concurrent changes in CSO discharges. In addition, it tracks biosolids quality data from the West Point Treatment Plant as an indicator of changed loading to the system that could influence CSO quality. Manhole monitoring may also be used to identify system character changes. The only trends seen are the slow decrease or stability in pollutant concentrations.

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.[8]

SCADA is used to maximize flow to the secondary treatment plants via operation of regulator and pump stations. The West Point Treatment Plant provides secondary treatment for all base

[8] POTW = publicly owned treatment works.

flows (defined by Ecology as 2.25 times the average wet-weather flow) and CSO/primary treatment for flows between 300 mgd and the peak hydraulic capacity of 440 mgd.[9] (The parallel Fort Lawton Tunnel was built in 1992 to convey up to 440 mgd to the plant.) After receiving CSO/primary treatment, 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 reduction—80 percent instead of 85 percent removal—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.

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.

King County CSOs do not occur as a result of inadequate dry-weather flow capacity. 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. The only overflows seen in the combined system during dry weather result from problems such as power outages, mechanical failures, or human error. These events are rare and are immediately reported to Ecology.

Operation and maintenance programs, as described for Control 1, focus on preventing dry-weather overflows and exacerbated CSOs.[10] The conveyance system is monitored through SCADA and direct observation; 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.

[9] mgd = million gallons per day.

[10] Exacerbated overflows occur during precipitation but are worsened by mechanical failures, power outages, and occasional human error.

The county 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 and open from the top down (to hold back solids). Weirs help to 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.
- Building CSO control projects so that floatables and solids are retained in the sewer.
- Encouraging wise water use to reduce unnecessary flows in the sewer that contribute to overflows.
- Monitoring development of new floatables control technologies.

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 and TV spots to educate the public that trash should not be flushed to the sewers. Information is available at http://www.kingcounty.gov/environment/wastewater/CSO/Library/ResourcesLinks.aspx.

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 controls are not needed at this time. To supplement this effort, King County will begin a three-year project in 2009 to observe the floatables in water bodies near 15 CSOs within four hours of an overflow. Observations will be compared to photos of each area during summer non-overflow periods. If additional floatables control is found to be needed in the future, the needs will be addressed in the CSO control projects implemented under the county's long-term control plan.

2.7 Control 7—Preventing Pollution

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

King County has implemented the Industrial Waste Program (IWP) and has been 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.

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

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, a Web site, a brochure, and other public outreach activities. A Web site providing real-time notification of recent and current CSO discharges went live December 2007 (http://www.kingcounty.gov/environment/wastewater/CSO/RealTime/SeattleOverview.aspx). In 2009, King County will start to incorporate City of Seattle overflow information on this site. An automated e-mail notification system is also being tested and is looking promising.

Ongoing community involvement programs help to keep the public informed of CSO-related conditions. Specific efforts are being implemented to involve the communities near the Puget Sound Beach projects in the decisions for those projects. Efforts to scope the level of public involvement efforts for the next CSO control plan update are under way.

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, King County 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 will submit ambient monitoring data near CSO plant outfalls by June 30, 2013, will develop a comprehensive sediment quality summary report for all CSO discharge locations by December 31, 2009, will implement additional sampling if required by Ecology, and will submit a CSO post-construction monitoring plan by July 1, 2010.

Section 3

Status of Current CSO Control Projects

This chapter describes the progress made on implementing five CSO control projects—the four Puget Sound Beach projects and the Ballard Siphon Replacement project.

3.1 Puget Sound Beach Projects

Four CSO control projects are currently in predesign: South Magnolia, North Beach, Barton Street, and Murray Avenue. These four projects are referred to as the Puget Sound Beach projects. The recently renewed 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 for review and approval final plans and specifications by December 31, 2012
- Begin construction by December 31, 2013

Storage was identified in the RWSP as the method of control for these projects. An initial assessment, however, indicated that reducing upstream sources may be a cost-effective solution. Flow meters were installed in the project basins in December 2007, and data were collected in 2008. Detailed sub-basin models were created and calibrated to the flow data. Approaches for each basin were identified using this information. Four approaches were chosen for further evaluation:

- Conveyance/treatment—sending flows from the basin to a secondary treatment plant
- Storage—retaining flows during storms to prevent CSOs
- On-site treatment—providing primary treatment for flows exceeding system capacity during large storms
- Demand management (stormwater flow reduction)—implementing one or more methods of limiting stormwater flow into the sewer system; green stormwater infrastructure (GSI) may be considered to manage the stormwater

Up to nine alternatives, representing a combination of approaches and potential sites, will be developed for each basin. In autumn 2009, the project team will begin evaluating the alternatives for each basin using basin-specific criteria. The use of GSI will be explored as an alternative in at least one of the basins. The most suitable basins will be identified in cooperation with the City of Seattle, and the feasibility and costs of the strategy will be assessed. The most promising alternatives will be brought forward for further evaluation. A final alternative for each basin will be selected in spring 2010. The preferred alternative and alternative development process will be documented in the Facilities Plan that is due to Ecology by the end of 2010.

The public will have opportunities to comment throughout the alternatives selection process through public meetings, community group meetings, e-mail, and letters. Information on the county's CSO control program and progress on the Puget Sound Beach projects is available at http://www.kingcounty.gov/environment/wtd/Construction/Seattle/BeachCSO.aspx.

3.2 Ballard Siphon Replacement

The Ballard Siphon, built in 1935, consists of two woodstave siphon barrels that rest on the bottom of the Lake Washington Ship Canal. The siphon carries flows collected from Seattle's north end near Carkeek Park and from the Ballard area across the Ship Canal. From there, the flows are conveyed to the West Point Treatment Plant.

In November 2005, King County conducted a sonar inspection of the Ballard Siphon. The inspection showed spots of abnormalities in the integrity of the pipe. Because sonar inspections are a new technology, it is unclear how long the abnormalities had been present and how high the risk of failure. Subsequent analyses and inspections indicated that the anomalies were not threatening; however, replacing the siphon is continuing forward as a high priority project in order to maintain siphon integrity and function and because the project will yield CSO control benefits. The completed project will eliminate CSO events at the Ballard Regulator Station earlier than planned. It will also reduce overflows at the 11th Avenue CSO site, likely reducing the scope of a future control project at this site.

The Ballard Siphon Replacement project includes two major components: (1) slip-lining the existing woodstave siphon barrels to extend their useful life, and (2) tunneling an 84-inch-diameter pipe below the canal. Design will be completed in early 2009; construction is expected to begin in third quarter 2009 and be substantially complete in 2012.

Section 4

Summary of Rainfall and CSO Events

King County measures rainfall at several of its regulator and pump stations and at the West Point Treatment Plant in the Seattle area. It also monitors the frequencies and volumes of both untreated and treated CSOs at all its CSO sites. The annual rainfall for 2008 was 27.29 inches as an average over local rain gauges. This is significantly lower than the average of 37 inches. The rainfall pattern exhibited lower, steadier precipitation without the intense storms seen in recent years. This type of rainfall is more easily assimilated by the combined sewer system. As a result, King County CSOs discharged 106 MG over a total of 89 untreated events—the lowest total discharge volume recorded since system monitoring and reporting began in 1991.

This chapter presents the rainfall data for each facility, reports on unpermitted overflows, and summarizes frequency and volume for all untreated and treated CSO discharges in 2008. More information can be found in the appendices.

4.1 Annual Rainfall

Table 1. shows the monthly and yearly rainfall measured at each facility in 2008 and the total monthly and yearly averages for all facilities. This table will be replaced with event-based rainfall reporting beginning with the 2009 annual CSO control program report.

Table 1. Rainfall Measured at Pump Stations, Regulator Stations, and Treatment Facilities in 2008 (inches)

Station	Jan.	Feb.	March	April	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Ballard	3.36	0.75	2.27	1.68	0.42	1.33	0.46	2.03	0.36	1.23	4.61	3.26	21.76
Chelan Avenue	4.74	1.61	4.87	1.99	0.9	1.54	0.63	2.76	0.47	2.4	5.91	3.83	31.65
Denny Way/ Lake Union	3.45	0.9	3.64	1.64	0.42	1.57	0.49	1.7	0.47	1.48	3.63	2.29	21.68
Dexter	4.61	1.33	3.98	2.15	0.69	2.16	0.55	2.47	0.65	1.96	4.88	3.89	29.32
King Street	2.52	0.69	3.59	1.49	0.62	1.59	0.4	2.29	0.5	1.65	3.98	3.01	22.33
Marginal Way, E.[a]	4.13	1.18	3.85	1.58	0.93	—	—	—	—	0.33	5.55	3.6	21.15
Matthews Park	4.34	1.55	3.68	2.95	1.04	2.21	0.74	2.84	0.92	2.45	5.29	4.48	32.49
Pine Street, E.	3.64	1.46	3.94	1.8	0.66	1.88	0.42	2.83	0.57	2.28	4.9	3.51	27.89
Rainier Avenue	3.75	1.22	4.34	1.5	0.88	1.38	0.45	2.66	0.63	2.19	5.31	3.9	28.21
University[b]	4.77	1.41	4.13	2.03	0.72	1.73	0.57	2.9	0.75	2.43	—	—	22.85
West Point	7.12	1.36	4.08	2.14	0.44	1.56	0.86	2.09	0.5	1.97	3.67	2.97	28.76

Station	Jan.	Feb.	March	April	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Average	**4.22**	**1.22**	**3.85**	**1.90**	**0.70**	**1.70**	**0.56**	**2.46**	**0.53**	**1.85**	**4.77**	**3.47**	**27.29**

[a] The Marginal Way, E., rain gauge was out of service June 3 through October 30, 2008, during roof repair.

[b] The University rain gauge was out of service from November 4, 2008, through the end of the year.

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 occasional 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 occasional human error, are referred to as "exacerbated CSOs." No dry-weather overflows occurred from the county system in 2008. Two exacerbated overflows occurred during the year (Table 2).

Table 2. Exacerbated CSO Events, 2008

Date	Location	Estimated Volume	Estimated Duration	Receiving Water	Cause and Resolution
May 13–23	Ravenna Drop Structure	6.4 MG	10 days	Ravenna Creek/University Slough	Lake City Tunnel flows were diverted to the Laurelhurst Trunk to facilitate repair of a flow sensor in the tunnel. An overflow weir and open gate allowed diverted flow to enter an unknown connection to a storm sewer. Major creek remediation was done, and plugs were inserted to prevent future flows to the creek.
August 24	Ravenna Drop Structure	100,000 gallons	1 hour	Ravenna Creek/University Slough	The plugs were removed temporarily to respond to a Washington State Department of Fish and Wildlife directive, which has since been rescinded.

Note: The Ravenna Drop Structure is not a CSO site.

On May 13, 2008, King County diverted sewer flows at the Ravenna Drop Structure in order to facilitate repair of a bubbler downstream in the Lake City Tunnel. WTD records indicated that this diversion would send wastewater flows to the Laurelhurst Trunk. Seattle Public Utilities notified the county on May 23 that it had noticed unusual flows in Ravenna Creek for about 10 days. Inspection determined that wastewater had been inadvertently sent into Ravenna Creek, which discharges into University Slough and Union Bay. King County crews redirected the flows back to the Laurelhurst Trunk, initiated overflow reporting to notify appropriate agencies, posted warning signs, and took water quality samples. For the next several days, the county cleaned up debris from the creek and used absorbent materials to take up oils and residue. The immediate response was followed by a remediation effort in coordination with the Washington State Department of Fish and Wildlife (WDFW) and the University of Washington.

Review of this incident identified that a project in 2004 to daylight Ravenna Creek and remove its flows from the combined sewer inadvertently created an overflow point to the creek. Overflows may have been occurring during extreme storms since 2004. The county began working with Ecology, Seattle Public Utilities, Seattle Parks, and WDFW to identify near-term and permanent solutions. While permanent solutions were being developed, the county proposed to temporarily plug the stream diversion to prevent further overflows. Negotiations were complicated by concerns about impacts on aquatic resources of suspending the creek diversion, but WDFW agreed to the temporary plug when another overflow occurred August 24.

The proposed permanent correction will extend the existing 18-inch-diameter stream transfer pipe, connect it directly to the existing Ravenna Creek intake structure, and eliminate the overflow point. In addition, the inlet capacity to the Lake City Tunnel at the 24th Avenue NE Diversion Structure will be increased, improving system hydraulics. The design is scheduled to be completed in 2009, and construction will occur in 2010.

In further review of the incident, the county determined that documents (manuals, drawings, and as-builts) used to locate wastewater pipes had not been updated at the completion of the creek diversion project. To prevent such overflows in the future, the county has accelerated an existing project to update these documents and has developed a new standard operating procedure to confirm diversions.

4.3 Annual Untreated CSO Events

Appendix A lists the untreated events from county CSOs during 2008. The listing follows the event-based approach required under the renewed NPDES permit for the West Point Treatment Plant.

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

The total volume of untreated CSOs for 2008 was 106 MG over a total of 89 untreated events. This is the lowest total discharge volume recorded since system monitoring and reporting began in 1991 and represents a 95 percent reduction over the 1981–1983 baseline of 2,339 MG.

The bubbler at the Brandon CSO was damaged during a project to upsize the regulator return pipeline. Repair was completed in March. A portable bubbler, installed by King County's Environmental Lab, will be used until calibration on the repair is complete. King County has developed a computer program that automatically reviews overflow data for anomalies and is also using its new real-time reporting system to identify monitoring problems immediately so that repair can occur more quickly and data loss can be minimized.

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, Elliott West/Mercer, and Henderson/Norfolk.

The following sections summarize performance and compliance at each facility during 2008. Appendix B provides more detail on volumes and events for each facility. 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 between 300 mgd and the peak of 440 mgd. Combined sewer flows that would otherwise overflow at points around the combined system are transferred to the West Point Treatment Plant. After receiving CSO treatment, these 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 reduction—80 percent instead of 85 percent—in total suspended solids (TSS) percent removal requirements.

During 2008, 81.6 MG received CSO/primary treatment at West Point during parts of 13 days.

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. Alki had only one filling event in 2008. The event occurred in November. A volume of 13.8 MG entered the plant, and 11.6 MG was discharged. The annual average total settleable solids removal was 69.9 percent, meeting the 50 percent limit. The maximum daily chlorine limit was exceeded during the November treatment event because of bisulfate crystallization problems. None of the hydraulic surge or short-circuiting problems that occurred in the past were encountered.

4.4.3 Carkeek CSO Treatment Plant

The transfer of Carkeek area base flows to the West Point Treatment Plant was completed in 1994, and the conversion from a continuously operating primary plant to a CSO treatment plant was completed around 1997. In 2008, the Carkeek CSO Treatment Plant stored 0.32 MG of CSO over eight filling events with no discharges. The plant transferred these flows to West Point for secondary treatment. The system TSS removal was 95.4 percent, meeting the 50 percent removal

limit. The system operated well. Only routine maintenance activities were required, including rebuilding Raw Sewage Pumps 3 and 5 and the seal water pumps, replacing programmable logic controllers at the pump station and plant, modifying the odor control scrubber, and installing a new dechlorination system control panel.

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. There were 27 filling events and four discharge events in 2008, the third full year of operation. The discharge volume was 53.1 MG.

As is typical of intermittently operated facilities, adjustments to the systems and operations to achieve full performance are still under way. Numerous improvements to the instrumentation, sampling equipment and methodology, and hydraulics (including the removal of the duck-bill valve on the outfall and construction of an aboveground structure at the dechlorination structure) have been made to resolve performance challenges faced in the first years of operation of the facility and to improve permit compliance. One of the most significant changes was installation of stop logs to raise the weir at the Valley Street connection. This installation appears to have controlled the unexpected high strength/high floatables dry-weather flows previously entering the Mercer Tunnel from Seattle's Lake Union system. Clogging of the screens has significantly diminished. This improvement will be monitored during treatment events before determining if more modifications are needed. Interim sampling improvements were made in February, and some permanent modifications to the samplers were completed in October 2008. As a result, sampling from the sump pumps has improved considerably, revealing much better solids capture (71.2 percent TSS removal) than previously identified and meeting the 50 percent removal requirement.

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 2008 marked its third full year of operation. As is typical of intermittently operated facilities, adjustments to the systems and operations to achieve intended performance have continued during the first few years. Because of the low precipitation in 2008, Henderson/Norfolk did not operate in 2008. Routine preventive maintenance and a pre wet-season tune-up were done.

Section 5

20-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 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. The number of untreated discharges that occurred over each of the previous 20 years is reported for each CSO site and then averaged (Table 3). This average will be used each year to assess compliance with the performance standard for CSOs identified as controlled. However, 20 years of data are not available because the upgraded SCADA system was brought online and began to report data for an increasing number of sites in 1991. For sites that are identified as controlled, modeled data will be substituted for the early missing data. These modeled data will be available for the 2009 annual report. For sites not identified as controlled, only available measured data will be reported.

Ecology has directed that discharges from the CSO treatment facilities that are designated as the "one untreated event" for permit limit compliance purposes are still considered as treated and should not be counted in the 20-year data.

Table 3. 1988-2008 Untreated CSO Events, Averages and Baselines

Station	Discharge Serial Number (DNS)	1989[11,12]	1990[11]	1991	1992	1993	1994	1995	1996[13]	1997[14]	1998	1999	2000[15]	2001	2002	2003	2004	2005	2006	2007	2008	Up to 20-Y Ave	Controlled CSO: 20-Y Average for Compliance	1983 Baseline (24 hr inter-event)
11th Ave. NW	004			7	16	7	20	30	18	21	10	12	14	14	8	8	6	11	22	10	7	**13.4**		16
30th Ave. NE[16]	049			NM	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.	008			6	5	0	4	10	15[17]	9	8	4	1	11	4	6	4	5	13	6	3	**6.3**		17
53rd Ave. SW	053			NM	NM	NM	NM	NM	NM	NM	NM	NM	0[18]	0	0	0	0	0	2	1	0	**0.3**	**0.3**	<1
63rd Ave. PS	054			NM	NM	NM	NM	NM	NM	NM	NM	NM	0[17]	0	0	2	0	1	0	0	0	**0.3**	**0.3**	2
8th Ave./W. Marginal Way	040			5	3	1	2	0	3	0	0	0	0	0	0	0	0	0	0	0	0	**0.8**	**0.8**	6
Alaska St. SW[15]	055			NM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	**0.1**	**0.1**	1
Ballard	003			5	0	4	11	12	11	8	3	5	2	2	0	4	2	1	5	2	1	**4.3**		13
Barton	057			NM	NM	NM	NM	NM	NM	NM	NM	NM	0[17]	0	0	3	4	5	11	3	1	**3.0**		9
Belvoir[15]	012			NM	0	1	0	0	1	1	0	1	0	0	0	2	2	0	1	1	0	**0.6**	**0.6**	<1
Brandon St.	041			36	41	133	37	53	55	40	31	32	30	30	21	28	21	27	11[19]	NM[18]	0[18]	**36.8**		36
Canal St.	007			5	3	0	0	0	3	1	2	0	1	0	0	0	0	0	0	1	0	**0.9**	**0.9**	<1
Chelan	036			5	5	5	15	8	15	8	5	5	2	7	2	3	1	2	5	2	0	**5.3**		7
Denny Way	027a			42	39	38	33	49	54	37	23	23	25	26	15	25	20	11	9	1	2	**26.2**		32
Dexter	009			8	9	4	10	23	22	21	13	10	10	12	9	15	8	12	20	9	3	**12.1**		15
Duwamish P.S., W.	035			NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	1[20]	0	1	0	**0.5**	**0.5**	<1
Duwamish P.S., E.	034			0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	**0.1**	**0.1**	<1
Hanford #1 (Hanford @ Rainier)	031			0	0	0	0	0	20[21]	14	17	5	0[22]	0	3	6	8	NM	16	4[23]	6	**5.8**		30
Hanford #2	032			11	10	10	17	32	20	17	17	18	17	13	10	12	16	15	26	12	8	**15.6**		28
Harbor Ave.	037			51	58	39	13	47	39	1	1	0	0	2	0	2	0[24]	3	5	2	0	**14.6**		30
Henderson[15]	045			0	2	19	11	27	20	8	5	23	24	15	7	13	1	0	0	0	0	**9.7**		12
Kingdome (formerly Connecticut)	029			31	28	15	8	15	14	11	3	0	1	0	0	0	2	5	4	5	1	**7.9**		29
King Street	028			23	30	20	19	27	17	18	11	14	10	14	12	16	15	20	27	7	3	**16.8**		16
Lander II St.	030			8	0	0	7	26	16	12	10	15	11	10	10	12	9	8	28	8	6	**10.9**		26
Magnolia, S.[15]	006			0	4	20	28	39	48	34	19	5	0	0	5	18	17	26	30	21	26	**18.9**		25
Marginal, E.[15]	043			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[15]	018			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			6	15	9	13	0	0	0	0	10	8	12	8	9	6	5	13	5	3	**6.8**		34
Michigan, W.	042			7	8	12	2	5	6	6	3	3	2	7	5	4	1	3	8	4	0	**4.8**		5
MLK Jr. Way[15]	013			0	1	6	10	18	25	18	18	4	2	0	0	2	4	3	0	0	0	**6.2**		16

[11] CSO "Event" defined as being followed by at least a three hour dry period
[12] SCADA off-line for upgrades
[13] The West Point computers (SCADA) were down from 10/17/96-11/17/96
[14] CSO "Event" definition changed to be based on a 48 hour dry period
[15] CSO "Event" definition changed to be based on a 24 hour dry period
[16] Belvoir, 30th, Alaska, Magnolia, E. Marginal, Matthews, MLK, Pine, Rainier, Henderson, North Beach monitored beginning 6/92
[17] 3rd Ave. W. monitor down 6-11/06
[18] Barton, Murray, 63rd & 53rd began monitoring 6/2000 so only have 6 mos of data in 2000
[19] Brandon meter out 6/06-3/08; Portable meter installed at Brandon 3/08
[20] W. Duwamish started monitoring 6/05 so only have 6 mos of data
[21] Hanford #1 began monitoring 1/96
[22] Hanford @ Rainier meter out 6/00-5/01 - only 6 mos of data in 2000
[23] Hanford @ Rainier meter was not operating properly from 6/1/2007-12/17/2007, so only 6 mos of data
[24] Harbor missing data 4-5/04

Station	Discharge Serial Number (DNS)	1989[11,12]	1990[11]	1991	1992	1993	1994	1995	1996[13]	1997[14]	1998	1999	2000[15]	2001	2002	2003	2004	2005	2006	2007	2008	Up to 20-Y Ave	Controlled CSO: 20-Y Average for Compliance	1983 Baseline (24 hr inter-event)
Montlake	014			11	13	3	4	11	7	2	7	0	2	0	5	11	5	6	NM	0	1	**5.2**		6
Murray	056			NM	NM	NM	NM	NM	NM	NM	NM	NM	0[8]	0	0	3	5	10	10	3	1	**3.6**		5
Norfolk St.	044a			*12*	*13*	*19*	*19*	*32*	*22*	*13*	*5*	*0*	*1*	*4*	*1*	*2*	*0*	*0*	0	0	0	**0.0**[24]	**0.0**[25]	20
North Beach Inlet[15]	048a			0	1	5	13	19	22	20	13	9	11	10	1	6	6	10	13	4	3	**8.8**		18
North Beach Wet Well	048b			w/ inlet	w/ inlet	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[26]	15	6	3	**2.3**		18
Pine, E St.[15]	011			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.[15]	033			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	038			NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	2[27]	0	2	7	4	0	**1.3**		4
University	015			7	6	2	10	15	13	9	10	4	3	5	4	4	4	3	12	5	3	**5.5**		13
Rainfall (inch)				8.19[28]	27.45	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	**24.5**		**37.00**

[25] CSO was controlled beginning 2006. Pre-control data is not included in the reported average and will be replaced with modeled data for the 2009 report.
[26] N. Beach wet well reported separately beginning 6/05 so only 6 mos data
[27] Terminal 115 monitoring began 6/03 so only 6 mos of data
[28] Rainfall data not reported first 6 months

Appendices

Appendix A. Untreated CSO Events, January–December 2008

Appendix B. Treated CSO Events, January–December 2008

Appendix C. Alki CSO Treatment Plant Annual Report

Appendix D. Carkeek CSO Treatment Plant Annual Report

Appendix E. Elliott West CSO Control Facilities Annual Report

Appendix F. Henderson/Norfolk CSO Control Facilities Annual Report

Appendix A

Untreated CSO Events, January–December 2008

Outfall DSN No.	Station Name	Receiving Water	Event Starting Date	Duration (hours)	Volume (gallons)	Identified As Controlled
003	Ballard	Lake Washington Ship Canal	6/3/2008	0.47	32,518	
004	11th Avenue NW	Lake Washington Ship Canal	1/9/2008	0.25	37,437	
004	11th Avenue NW	Lake Washington Ship Canal	3/26/2008	0.83	56,112	
004	11th Avenue NW	Lake Washington Ship Canal	4/4/2008	0.17	24,454	
004	11th Avenue NW	Lake Washington Ship Canal	6/3/2008	0.92	511,827	
004	11th Avenue NW	Lake Washington Ship Canal	8/20/2008	0.17	6,646	
004	11th Avenue NW	Lake Washington Ship Canal	8/24/2008	0.67	197,103	
004	11th Avenue NW	Lake Washington Ship Canal	11/4/2008	0.25	69,476	
006	Magnolia, S.	Elliott Bay	1/2/2008	2.5	703	
006	Magnolia, S.	Elliott Bay	1/9/2008	1.17	463,838	
006	Magnolia, S.	Elliott Bay	1/12/2008	0.42	171,485	
006	Magnolia, S.	Elliott Bay	1/14/2008	3.5	1,331,865	
006	Magnolia, S.	Elliott Bay	1/19/2008	0.92	537,123	
006	Magnolia, S.	Elliott Bay	3/15/2008	23.5	831,413	
006	Magnolia, S.	Elliott Bay	3/23/2008	7.67	994,573	
006	Magnolia, S.	Elliott Bay	3/25/2008	20.17	298,743	
006	Magnolia, S.	Elliott Bay	3/29/2008	0.25	1,690	
006	Magnolia, S.	Elliott Bay	6/3/2008	14.33	3,315,229	
006	Magnolia, S.	Elliott Bay	6/9/2008	0.33	124,813	
006	Magnolia, S.	Elliott Bay	7/3/2008	0.42	340,723	
006	Magnolia, S.	Elliott Bay	7/31/2008	1.33	796,554	
006	Magnolia, S.	Elliott Bay	8/19/2008	17.67	1,458,035	
006	Magnolia, S.	Elliott Bay	8/24/2008	1.33	819,929	
006	Magnolia, S.	Elliott Bay	8/25/2008	0.17	2,729	
006	Magnolia, S.	Elliott Bay	10/3/2008	2.92	101,827	
006	Magnolia, S.	Elliott Bay	10/13/2008	3.92	384,393	
006	Magnolia, S.	Elliott Bay	11/4/2008	5.33	1,465,298	
006	Magnolia, S.	Elliott Bay	11/6/2008	21	3,287,753	
006	Magnolia, S.	Elliott Bay	11/8/2008	0.83	338,790	
006	Magnolia, S.	Elliott Bay	11/21/2008	0.25	39,346	
006	Magnolia, S.	Elliott Bay	12/8/2008	0.42	177,344	

Outfall DSN No.	Station Name	Receiving Water	Event Starting Date	Duration (hours)	Volume (gallons)	Identified As Controlled
006	Magnolia, S.	Elliott Bay	12/12/2008	0.83	84,780	
006	Magnolia, S.	Elliott Bay	12/24/2008	23.67	28,172	
006	Magnolia, S.	Elliott Bay	12/29/2008	0.25	38,644	
007	Canal Street	Lake Washington Ship Canal	none		0	Controlled
008	3rd Avenue West	Lake Washington Ship Canal	6/3/2008	1.77	1,493,538	
008	3rd Avenue West	Lake Washington Ship Canal	8/24/2008	1.03	188,570	
008	3rd Avenue West	Lake Washington Ship Canal	11/4/2008	0.6	61,475	
009	Dexter	Lake Union	3/23/2008	0.07	1,034	
009	Dexter	Lake Union	6/3/2008	1.7	3,526,793	
009	Dexter	Lake Union	8/24/2008	0.77	70,437	
011	Pine, E.	Lake Washington	none		0	Controlled
012	Belvoir	Lake Washington	none		0	Controlled
013	MLK Jr. Way	Lake Washington	none		0	
014	Montlake	Lake Washington Ship Canal	8/24/2008	0.92	407,251	
015	University	Lake Washington Ship Canal	6/3/2008	1.07	3,959,649	
015	University	Lake Washington Ship Canal	8/24/2008	0.28	285,432	
015	University	Lake Washington Ship Canal	11/4/2008	1.07	2,300,159	
018	Matthews Park	Lake Washington	none		0	Controlled
027a	Denny Way	Elliott Bay	6/3/2008	0.38	43,210	
027a	Denny Way	Elliott Bay	11/4/2008	1.23	38,285	
028	King	Elliott Bay	3/23/2008	1.57	382,157	
028	King	Elliott Bay	3/29/2008	0.55	103,352	
028	King	Elliott Bay	6/3/2008	0.6	330,144	
029	Kingdome	Elliott Bay	11/6/2008	0.88	229,293	
030	Lander	Duwamish River	1/10/2008	1.98	1,431,729	
030	Lander	Duwamish River	3/23/2008	2.68	8,909,291	
030	Lander	Duwamish River	3/29/2008	0.98	734,914	
030	Lander	Duwamish River	11/4/2008	3.82	9,551,936	
030	Lander	Duwamish River	11/6/2008	12.77	12,995,740	
030	Lander	Duwamish River	12/28/2008	0.01	86	
031	Hanford #1	Duwamish River	1/3/2008	0.08	69	
031	Hanford #1	Duwamish River	3/23/2008	1	774,895	
031	Hanford #1	Duwamish River	3/29/2008	0.67	336,504	
031	Hanford #1	Duwamish River	6/3/2008	0.5	164,436	
031	Hanford #1	Duwamish River	8/24/2008	0.75	287,513	

Outfall DSN No.	Station Name	Receiving Water	Event Starting Date	Duration (hours)	Volume (gallons)	Identified As Controlled
031	Hanford #1	Duwamish River	11/6/2008	5.58	1,690,813	
032	Hanford #2	Duwamish River	1/10/2008	3.2	730,759	
032	Hanford #2	Duwamish River	3/23/2008	3.23	345,823	
032	Hanford #2	Duwamish River	3/29/2008	1.85	1,446,582	
032	Hanford #2	Duwamish River	8/20/2008	1.02	246,601	
032	Hanford #2	Duwamish River	8/24/2008	1.97	1,370,873	
032	Hanford #2	Duwamish River	11/4/2008	4.17	683,001	
032	Hanford #2	Duwamish River	11/6/2008	18.1	16,833,311	
032	Hanford #2	Duwamish River	12/27/2008	6.42	2,283,042	
033	Rainier Avenue	Lake Washington	none		0	Controlled
034	Duwamish PS, E.	Duwamish River	none		0	Controlled
035	Duwamish PS, W	Duwamish River	none		0	Controlled
036	Chelan	Duwamish River	none		0	
037	Harbor	Duwamish River	none		0	
038	Terminal 115	Duwamish River	none		0	
039	Michigan	Duwamish River	3/23/2008	0.35	9,181	
039	Michigan	Duwamish River	6/6/2008	0.5	38,912	
039	Michigan	Duwamish River	11/6/2008	0.85	57,133	
040	8th Ave./W. Marginal Way	Duwamish River	none		0	Controlled
041	Brandon[a]	Duwamish River	6/6/09	1.28	338,000	
041	Brandon[a]	Duwamish River	8/9/09	0.68	270,600	
041	Brandon[a]	Duwamish River	11/6/09	8.53	1,290,100	
042	Michigan, W.	Duwamish River	none		0	
043	Marginal, E.	Duwamish River	none		0	Controlled
044b	Norfolk	Duwamish River	none		0	Controlled
045	Henderson	Lake Washington	none		0	
048a	North Beach Wet Well	Puget Sound	4/4/2008	0.1	3	
048a	North Beach Wet Well	Puget Sound	6/3/2008	0.43	1,757	
048a	North Beach Wet Well	Puget Sound	7/3/2008	0.11	883	
048a	North Beach Wet Well	Puget Sound	8/24/2008	0.82	3,887	
048b	North Beach Inlet	Puget Sound	6/3/2008	0.5	61,280	
048b	North Beach Inlet	Puget Sound	7/3/2008	0.25	29,390	
048b	North Beach Inlet	Puget Sound	8/24/2008	0.25	21,408	
049	30th Avenue NE	Lake Washington	none		0	Controlled
052	53rd Avenue PS	Puget Sound	11/4/2008	0.07	99,965	Controlled
054	63rd Avenue PS	Puget Sound	none		0	Controlled
055	Alaska Street	Puget Sound	none		0	Controlled

Outfall DSN No.	Station Name	Receiving Water	Event Starting Date	Duration (hours)	Volume (gallons)	Identified As Controlled
	SW[b]					
056	Murray	Puget Sound	6/6/2008	1.27	5,545,877	
056	Murray	Puget Sound	8/25/2008	0.5	1,834,732	
056	Murray	Puget Sound	11/6/2008	0.9	2,931,330	
057	Barton	Puget Sound	6/6/2008	0.6	422,301	
057	Barton	Puget Sound	8/25/2008	0.35	357,191	
Total Volume Over System			**105,923,993 gallons**			
Total Events per Outfall Over System			**89 events**			

[a] An application of field portable monitors was devised for Outfall 3041, Brandon, while construction and calibration of permanent bubbler replacement is completed; data into March is missing.
[b] Data gaps at Outfall #055, Alaska St. SW, for 10/15/08–11/13/08; 11/18/08–11/20/08; and 12/26/08–12/31/08.

Appendix B

Treated CSO Events, January–December 2008

Treated CSO Volume Summary, January–December 2008

Outfall DSN No.	Station Name	Receiving Water	Event Starting Date	Duration (hours)	Volume (gallons)	Identified As Controlled
001	West Point CSO-Related Bypass	Puget Sound	1/9/2008	3.20	5,230,000	Controlled
001	West Point CSO-Related Bypass	Puget Sound	1/14/2008	4.40	7,390,000	Controlled
001	West Point CSO-Related Bypass	Puget Sound	2/8/2008	1.17	530,000	Controlled
001	West Point CSO-Related Bypass	Puget Sound	3/23/2008	2.78	6,180,000	Controlled
001	West Point CSO-Related Bypass	Puget Sound	6/3/2008	0.634	16,100,000	Controlled
001	West Point CSO-Related Bypass	Puget Sound	8/19/2008	0.049	980,000	Controlled
001	West Point CSO-Related Bypass	Puget Sound	8/20/2008	0.01	10,000	Controlled
001	West Point CSO-Related Bypass	Puget Sound	8/24/2008	0.13	3,640,000	Controlled
001	West Point CSO-Related Bypass	Puget Sound	11/3/2008	3.45	7,240,000	Controlled
001	West Point CSO-Related Bypass	Puget Sound	11/4/2008	1.92	2,780,000	Controlled
001	West Point CSO-Related Bypass	Puget Sound	11/6/2008	15.63	31,330,000	Controlled
001	West Point CSO-Related Bypass	Puget Sound	11/7/2008	0.18	40,000	Controlled
001	West Point CSO-Related Bypass	Puget Sound	12/12/2008	0.59	100,000	Controlled
051	Alki CSO Plant	Puget Sound	11/6/2008	15.03	11,600,000	Controlled
046	Carkeek CSO Plant	Puget Sound	None			Controlled
027b	Elliott West/Mercer CSO Facilities	Elliott Bay	3/23/2008	3.93	2,960,000	Controlled
027b	Elliott West/Mercer CSO Facilities	Elliott Bay	6/3/2008	5.42	9,930,000	Controlled
027b	Elliott West/Mercer CSO Facilities	Elliott Bay	11/3/2008	5.52	7,490,000	Controlled
027b	Elliott West/Mercer CSO Facilities	Elliott Bay	11/6/2008	17.67	35,740,000	Controlled
044b	Henderson/Norfolk CSO Facilities	Duwamish River	None			Controlled

Appendix C

Alki CSO Treatment Plant Annual Report

January–December 2008

This 2008 annual report summarizes performance of King County's Alki CSO treatment facilities. These facilities came on-line for CSO treatment in 1998. Alki operates under the NPDES permit for the West Point Treatment Plant (WA-0029181-1).

There was one event during calendar year 2008. It occurred November 6-7, 2008, when 13.8 MG CSO entered the facility in response to 3.14 inches of rain. A total of 11.6-MG of treated CSO was discharged over 14 hours. All the permit conditions for settleable solids, fecal coliforms and suspended solids removal were met. The facility did not meet the monthly and daily limits for chlorine residual; dechlorination continued to be a challenge. (see Tables C-1 and C-2.)

Season's Weather Conditions

In calendar year 2008, 30.73 inches of rain was recorded at the SeaTac Weather Station. This is significantly less than the historic average of 37.1 inches. The largest storm of the year occurred November 6-7, 2009, when 3.05 inches fell in 34 hours.

Operational Challenges (see November 2008 report for more details)

Though most of the tanks, equipment and instrumentation at Alki and the 63rd Pump Station operated appropriately, there were some notable operational challenges.

The unusually cold temperatures of early November crystallized the 38 percent sodium bisulfite solution in the smaller diameter piping, valves, etc. of the dechlorination system. This led to the high Cl_2 residuals during the November 6-7, 2008, event. Subsequently, the bisulfite facility was modified to provide space heating as well as equipment freeze protection. The 38 percent solution was replaced with 25 percent solution due to its lower freezing temperature. Two new 12-gpm bisulfite dechlorination pumps were also installed in 2008.

The chlorine analyzers and composite samplers were another notable operational challenge. The sample pumps that deliver flow to these analyzers/samplers became clogged or did not work during the November 6-7 event. Heavy debris is often associated with the first major storm of the year. The chlorine analyzers are used by operators to monitor disinfection and dechlorination processes so manual adjustments can be made. The composite samplers are designed to automatically collect flow-proportioned influent and effluent samples. Staff reviewed operation and maintenance practices and options to reduce the potential for such clogging in the future.

A project to refurbish the Alki Regulator gate and structure was started in 2008. The gate was installed to maximize performance of the Alki CSO system by regulating flow to the West Seattle Tunnel and thus, the Alki CSO plant. However, the gate actuator and drive shaft have failed several times since their installation. Staff are reviewing how best to proceed considering the difficulties of the site and possible time frames. The gate, which can manually be adjusted, has been set at 70 percent open for the time being.

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

Operations, Maintenance and Process staff will continue to debrief after each event providing information and feedback on performance, operational and maintenance issues.

Table C-1 Alki CSO Plant Annual Event Data Summary

Month	Day	Alki Inflow Event Number	Alki Inflow Volume (MGD)	Alki Discharge Event Number	Alki Discharge Volume (MGD)	Total Influent TSS (lbs)	Total Effluent TSS Discharged @ Alki + WP (lbs)	TSS% removal	Alki Effluent Settleable Solids (ml/l/hr)	Alki Effluent pH	Alki Average Effluent Fecal Coliforms (#/100 ml)	Alki Effluent Residual Chlorine (ug/l)
January												
	Event/Daily Max											
	Mon. Total/Avg											
February												
	Event/Daily Max											
	Mon. Total/Avg											
March												
	Event/Daily Max											
	Mon. Total/Avg											
April												
	Event/Daily Max											
	Mon. Total/Avg											
May												
	Event/Daily Max											
	Mon. Total/Avg											
June												
	Event/Daily Max											
	Mon. Total/Avg											
July												
	Event/Daily Max											
	Mon. Total/Avg											
August												
	Event/Daily Max											
	Mon. Total/Avg											

Month	Day	Alki Inflow Event Number	Alki Inflow Volume (MGD)	Alki Discharge Event Number	Alki Discharge Volume (MGD)	Total Influent TSS (lbs)	Total Effluent TSS Discharged @ Alki + WP (lbs)	TSS% removal	Alki Effluent Settleable Solids (ml/l/hr)	Alki Effluent pH	Alki Average Effluent Fecal Coliforms (#/100 ml)	Alki Effluent Residual Chlorine (ug/l)
September												
	Event/Daily Max											
	Mon. Total/Avg											
October												
	Event/Daily Max											
	Mon. Total/Avg											
November	6-7,	1	13.75	1	11.57	7235	2180	69.9%	0.3	7.1	6	1900
	Event/Daily Max											
	Mon. Total/Avg	1	13.75	1	11.57	7235	2180	69.9%	0.3	7.1	6	1900
December												
	Event/Daily Max											
	Mon. Total/Avg											
Total		1	13.75	1	11.57	7235	2180					
Annual Avg/GEM								69.9%	0.30	7.1	6	1900
Min/Max or Max									0.30	7.1	6	1900

Table C-2 Alki Annual Summary

	No. of Discharge Events	Inflow Volume (MGD)	Discharge Volume (MGD)	Total Alki TSS lbs-in	Total Alki TSS lbs Discharged	Annual Average Alki %TSS Recovery	Annual Average Alki Settleable Solids (ml/l/lhr)	Event Maximum Alki Settleable Solids (ml/l/lhr)	Maximum Monthly Geomean Alki Effl. Fecal Coliforms (#/100 ml)	Maximum of Daily Averages of Alki Effl. Res. Cl2 (ug/l)	Comments
Including all Discharge Events	1	13.75	11.6	7235	2180	69.9%	0.30	0.3	6	1900	

Table C-3 Alki Performance Summary

Parameter	Performance	Permit Conditions
No. of Discharge Events	1	NA
Discharge Volume (MGD)	11.57	NA
Annual Average Settleable Solids (ml/l/lhr)	0.30	0.3
Event Maximum Settleable Solids (ml/l/lhr)	0.3	1.9
Annual Average %TSS Removal	69.9%	50%
Maximum Monthly Geomean Effl. Fecal Coliforms (#/100 ml)	6	1700
Maximum of Daily Averages Effl. Res. Cl2 (ug/l)	1900	290

Appendix D

Carkeek CSO Plant Annual Report

January–December, 2008

This report is the fifteenth 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 West Point Treatment Plant, Washington State Department of Ecology permit number WA-0029181-1, in effect from January 1, 2004, through December 31, 2008. Effective January 1, 2006, new permit limits for fecal coliform and residual chlorine went into effect.

In 2005, a dechlorination system was designed and installed at Carkeek to meet the new residual chlorine limits and the hypochlorite dosage controls were modified to meet the new fecal coliform limits. The 2008 CSO year is the fourth year of operating the improved disinfection system and the newly installed dechlorination system and both the systems demonstrated that the plant is capable of meeting the effluent fecal coliform and the effluent residual chlorine limits based on the performance from past years. The temporary sodium bisulfite storage tank was replaced with a permanent storage tank in May 2007.

Season's Weather Conditions

The total rainfall for the 2008 reporting period added up to 28.8 inches which is significantly lower than the average of 37 inches.

Performance

During the January 1 - December 31, 2008, period, there were eight inflow events into the Carkeek CSO plant, none of which resulted in discharges to Puget Sound out of the Carkeek CSO outfall. The total inflow volume for the reporting period was 0.32 MG, respectively. All of the flow was transferred to West Point where it received secondary treatment. The performance of the plant for the year 2008 is summarized in Tables D-1 and D-2. The first five months of the performance data were included in the data reported under the last year's annual CSO report (June 2007 - May 2008). Since the new permit calls for the switch to a calendar year based reporting, this data is being repeated.

Table D-1 Carkeek CSO Permit Performance in 2008

Parameter	Performance	Permit Conditions
Number of Discharge Events	0	10 [a]
Discharge Volume (MGD)	0.32	46 [a]
Annual Average Settleable Solids (ml/l/lhr)	No Discharge	0.3
Event Maximum Settleable Solids (ml/l/lhr)	No Discharge	1.9
Annual Average %TSS Removal	95.4%[b]	50%
Fecal Coliform, Maximum Monthly Geomean (MPN#/100 ml)	No Discharge	2800
Total Residual Chlorine, Maximum of Daily (ug/l)	No Discharge	490

Operation and Maintenance

Raw sewage pumps #3 and #5 were rebuilt in 2008. Seal water pumps were rebuilt. Carkeek Pump Station and CSO plant programmable logic controller replacement was completed in 2008. Odor control scrubber modifications were completed in 2008. A new control panel for the dechlorination system was installed and tested in 2008. Hypochlorite was replaced with fresh hypochlorite early fall of 2008.

Carkeek Annual Plant Performance 2007-2008

Table D-2 Carkeek CSO Plant Annual Event Data Summary

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)	TSS% removal	Carkeek Effluent Settleable Solids (ml/l/hr)	Carkeek Effluent pH	Carkeek Average Effluent Fecal Coliforms (#/100 ml)	Carkeek Effluent Residual Chlorine (ug/l)
January	9	1	0.01	ND	ND	5	0.3					
	Event/ Daily Max											
	Mon. Total/Avg	1	0.0	ND	ND	5	0.3	95.0%				
February												
	Event/ Daily Max											
	Mon. Total/Avg											
March	23	1	0.03	ND	ND	42	2					
	26	2	0.02			22	1					
	Event/ Daily Max											
	Mon. Total/Avg	2	0.05	ND	ND	64	3	96.0%				
April	4	1	<0.01	ND	ND	0.0						
	7	2	0.058	ND	ND	96	3					
	Event/ Daily Max											
	Mon. Total/Avg	2	0.058	ND	ND	96	3	96.5%				
May												
	Event/ Daily Max											
	Mon. Total/Avg											

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)	TSS% removal	Carkeek Effluent Settleable Solids (ml/l/hr)	Carkeek Effluent pH	Carkeek Average Effluent Fecal Coliforms (#/100 ml)	Carkeek Effluent Residual Chlorine (ug/l)
June	3	1	0.10	ND	ND	81	5					
	Event/ Daily Max											
	Mon. Total/Avg	1	0.10			81	5	94.4%				
July												
	Event/ Daily Max											
	Mon. Total/Avg											
August	24	1	0.10	ND	ND	159	8					
	Event/ Daily Max											
	Mon. Total/Avg	1	0.10	ND	ND	159	8	94.9%				
September												
	Event/ Daily Max											
	Mon. Total/Avg											
October												
	Event/ Daily Max											
	Mon. Total/Avg											
November	6	1	0.001	ND	ND	0.19	0.00					
	Event/ Daily Max											
	Mon. Total/Avg	1	0.00	ND	ND	0.19	0.00	97.4%				

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)	TSS% removal	Carkeek Effluent Settleable Solids (ml/l/hr)	Carkeek Effluent pH	Carkeek Average Effluent Fecal Coliforms (#/100 ml)	Carkeek Effluent Residual Chlorine (ug/l)
December												
	Event/ Daily Max											
	Mon. Total/Avg											
Total		8	0.32	0	0.0	406.21	18.86					
Annual Avg/ GEM								95.4%	ND			
Min/Max or Max									ND	ND	ND	ND

Table D-3 Carkeek Annual Summary

	No.of Discharge Events	**Inflow Volume (MGD)**	**Discharge Volume (MGD)**	**Total Carkeek TSS lbs-in**	**Total Carkeek TSS lbs Discharged**	**Annual Average Carkeek %TSS Recovery**	**Annual Average Carkeek Settleable Solids (ml/l/lhr)**	**Event Maximum Carkeek Settleable Solids (ml/l/lhr)**	**Maximum Monthly Geomean Carkeek** Effluent **Fecal Coliforms (#/100 ml)**	**Maximum of Daily Averages of Carkeek** Effluent **Residual Cl_2 (ug/l)**	**Comments**
Including all Discharge Events	0	0.32	0.0	406	19	95.4%	ND	ND	ND	ND	

Appendix E

Elliott West/Mercer CSO Plant Annual Report

January–December, 2008

This document constitutes the fourth annual report of the Elliott West/Mercer CSO treatment and storage facilities (EWCSO). EWCSO began to operate in May of 2005. During 2008, the facility operated under the permit for West Point Treatment Plant, Washington State Department of Ecology permit number WA-0029181-1, in effect from January 1, 2004, through December 31, 2009. The renewed permit went into effect July 1, 2008. The new permit calls for reporting CSO data by calendar year, instead of wet season. As a result data reported for January to May 2008 in the 2007-08 CSO Annual Report is repeated here.

Performance

The 2008 calendar year marked the fourth year of operation of EWCSO facilities. Lower than average rainfall resulted in significantly less volume entering the Elliott West/Mercer facilities and much lower discharges occurred. There were 27 inflow events totaling 165.7 MG and 4 discharge events totaling 53.1 MG during 2008. The total suspended solids (TSS) removal for the reporting period was 72.1 percent, meeting the 50 percent removal permit requirement.

The annual average settleable solids concentration for the discharge events of 0.13 ml/l/hr met the permit limit of 0.3 ml/l/hr, and the daily maximum settleable solids event limit of 1.9 ml/l/hr was met.

Effluent fecal coliform count limit of 400#/100 ml, as a monthly geometric mean, was met, but the maximum of the daily average effluent residual chlorine limit of 44 µg/l was exceeded during the November 6-7 discharge event.

Sampling problems during the November 3-4 discharge event resulted in the loss of some data.

See Tables E-1 and E-2.

Operations and Maintenance

During the first years of operation unexpected dry weather flows entered the Mercer tunnel from the City of Seattle East Lake Union connection at Valley Street. This high strength waste with its elevated floatables caused significant problems for the facility, including repeated clogging of the screens. Subsequent sewer cleaning operations by the City and the raising of the valley weir with stop logs appear to have eliminated the dry weather flows and the screen problems, but additional operation will be needed to determine if any additional screening improvements will be needed.

As is common for complex, intermittently operated facilities, several rounds of operation and modifications are being needed to achieve the intended facility performance. Ongoing efforts included the following improvements in 2008:

- King County collected discrete samples manually from dewatering sump pump from February through August 2008 and demonstrated better solids recovery than assumed previously.
- Modifications to the dewatering sump pump CSO flow composite auto-sampler were made to improve reliability - the modified sampler was commissioned in October 2008 and been collecting the dewatering sump pump CSO flow composite sample reliably.
- Modifications to the disinfection and dechlorination systems to improve the treatment effectiveness, equipment reliability and storage capacity issues have been made. The Gas Mastrr induction motors were re-installed in a horizontal position to improve mixing efficiency. Construction of a 5-foot-high bulk head in the dechlorination structure was completed by October 2008. The pre-dechlorination analyzer sample pump was also replaced and its intake was moved 30 feet upstream of the bisulfite injection point.
- To increase EWCSO treatment facility's dechlorination capacity, King County began stocking 38 percent sodium bisulfite in the storage tanks (as opposed to the design concentration of 25 percent sodium bisulfite) at the end of 2007. This change increased the available disinfection capacity by 50 percent; 38 percent SBS is more available and easier to obtain on short notice. A disadvantage to 38 percent sodium bisulfite, however, is that it may crystallize when the temperature is below 42ºF. As a precautionary measure, the county increased the thermostat settings to maintain the storage room temperature above 60ºF. During an unusually long and extremely cold weather in mid December crystallization of the SBS in the transfer line did occur. The county initiated a long and difficult process to clear the frozen SBS line. Fortunately, there were no discharge events in December.
- The following schedule of additional improvements are planned, with the completion date dependent on weather and opportunities to test solutions:
    - By end of 2009
        - Resolve 38 percent sodium bisulfite freezing
    - By end of 2010
        - Install flowmeters on chemical lines (hypochlorite and bisulfite) to monitor the chemical dosing,
        - Modify sodium bisulfite dosage control algorithm
    - By end of 2011
        - Provide for operator adjustment of sodium hypochlorite dosing to account for chemical decomposition
        - Modify sodium hypochlorite dosing pump control system to resolve auto start failure
    - By end of 2012

  - Install a chlorine analyzer to measure immediate chlorine demand and modify dosing program
  - Modify sodium hypochlorite diffuser system size and increase injection velocity to improve mixing

- Structural modifications to the dechorination structure have been made, including construction of an above ground structure to allow for dampening of hydraulic surges and air release to minimize the over-pressurization of EWCSO effluent pipeline resulting during periods of extreme flows were completed in October of 2008. No further surface discharges out of the dechlorination structure occurred.

Elliott West/Mercer Annual Plant Performance 2007-2008

Table E-1 Elliott West/Mercer CSO Facilities Annual Event Data Summary

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)	TSS % removal	EWCSO Effluent Settleable Solids (ml/l/hr)	EWCSO Effluent pH	EWCSO Average Effluent Fecal Coliforms (#/100 ml)	EWCSO Effluent Residual Chlorine (ug/l)
January	2	1a	2.43	ND	ND	1257	70					
	3	1b	1.62	ND	ND	230	13					
	4	1c	0.55	ND	ND	78	4					
	5	1d	0.42	ND	ND	74	4					
	6	1e	0.64	ND	ND	133	7					
	7	1f	0.6	ND	ND	248	14					
	8	1g	1.36	ND	ND	839	47					
	9	1h	0.68	ND	ND	147	8					
	10	1i	6.16	ND	ND	1485	83					
	11	1j	0.37	ND	ND	164	9					
	12	1k	0.78	ND	ND	286	16					
	14	1l	5.7	ND	ND	2054	115					
	15	1m	1.36	ND	ND	647	36					
	19	2	1.16	ND	ND	4721	263					
	28	3a	0.62	ND	ND	486	27					
	29	3b	0.67	ND	ND	525	29					
	30	3c	0.53	ND	ND	365	20					
	31	3d	0.43	ND	ND	255	14					
	Event/Daily Max											
	Monthly Total/Avg/GeoMean	3	26.1	ND	ND	13992	781	94.4%				
February	5	1a	0.39	ND	ND	3974	112					
	6	1b	0.78	ND	ND	10571	298					
	7	1c	0.52	ND	ND	1041	29					

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)	TSS % removal	EWCSO Effluent Settleable Solids (ml/l/hr)	EWCSO Effluent pH	EWCSO Average Effluent Fecal Coliforms (#/100 ml)	EWCSO Effluent Residual Chlorine (ug/l)
	8	1d	0.70	ND	ND	1238	35					
	9	1e	1.80	ND	ND	1231	35					
	10	1f	0.40	ND	ND	614	17					
	16	2	0.40	ND	ND	504	14					
	28	3	0.26	ND	ND	334	9					
	Event/Daily Max											
	Monthly Total/Avg/GeoMean	3	5.25	ND	ND	19506	550	97.2%				
March	1	1	0.34	ND	ND	1100	44					
	3	2	0.30	ND	ND	525	21					
	11	3a	0.80	ND	ND	1334	54					
	13	3b	1.23	ND	ND	954	38					
	14	3c	0.38	ND	ND	906	36					
	15	3d	0.61	ND	ND	1252	50					
	16	3e	1.02	ND	ND	1506	61					
	23	4a	10.85	1	2.96	4483	1578		0.10	6.1	230	27
	24	4b	1.21	ND	ND	666	27					
	26	4c	1.47	ND	ND	479	19					
	28	4d	1.79	ND	ND	584	23					
	29	4e	3.54	ND	ND	1122	45					
	Event/Daily Max								0.10	6.1	230	27
	Monthly Total/Avg/GeoMean	4	23.54	1	2.96	14912	1997	86.6%	0.10	6.1	230	27
April	1	1a	0.96	ND	ND	849	29					
	2	1b	0.81	ND	ND	5593	194					
	8	2a	0.51	ND	ND	3173	110					

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)	TSS % removal	EWCSO Effluent Settleable Solids (ml/l/hr)	EWCSO Effluent pH	EWCSO Average Effluent Fecal Coliforms (#/100 ml)	EWCSO Effluent Residual Chlorine (ug/l)
	9	2b	0.87	ND	ND	167	6					
	10	2c	0.66	ND	ND	4833	168					
	14	3	0.63	ND	ND	5123	178					
	18	4	0.26	ND	ND	1132	39					
	28	5a	0.84	ND	ND	2053	71					
	29	5b	0.34	ND	ND	539	19					
	Event/Daily Max											
	Monthly Total/Avg/GeoMean	5	5.88	ND	ND	23461	814	96.5%				
May												
	Event/Daily Max											
	Monthly Total/Avg/GeoMean											
June	2	1a	0.01	ND	ND	4	0					
	3	1b	18.82	1	9.93	11083	6952	9.93	<0.1	6.6	460	10
	4	1c	2.80	ND	ND	1634	91					
	Event/Daily Max								<0.1	6.6	460	10
	Monthly Total/Avg/GeoMean	1	21.6	1	9.93	12720	7044	44.6%	<0.1	6.6	134	10
July												
	Event/Daily Max											
	Monthly Total/Avg/GeoMean											

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)	TSS % removal	EWCSO Effluent Settleable Solids (ml/l/hr)	EWCSO Effluent pH	EWCSO Average Effluent Fecal Coliforms (#/100 ml)	EWCSO Effluent Residual Chlorine (ug/l)
August	1	1	0.62	ND	ND	408	21					
	19	2a	3.49	ND	ND	1207	62					
	20	2b	1.92	ND	ND	802	41					
	21	2c	0.95	ND	ND	602	31					
	24	3a	4.95	ND	ND	1321	68					
	25	3b	3.17	ND	ND	867	44					
	26	3c	1.19	ND	ND	2740	140					
	27	3d	0.28	ND	ND	580	30					
	Event/Daily Max											
	Monthly Total/Avg/GeoMean	3	16.56	ND	ND	8528	437	94.9%				
September												
	Event/Daily Max											
	Monthly Total/Avg/GeoMean											
October	3	1a	0.02	ND	ND	42	4					
	4	1b	0.13	ND	ND	1069	101					
	6	2a	1.62	ND	ND	772	73					
	7	2b	0.30	ND	ND	58	5					
	Event/Daily Max											
	Monthly Total/Avg/GeoMean	2	2.07	ND	ND	1939	182	90.6%				
November	1	1	0.35	ND	ND	349	6					
	3	2a	3.33	1a	3.33	2472	2472		NS	NS	NS	NS
	4	2b	12.80	1b	4.16	2386	1686		NS	6.6	1	0.0

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)	TSS % removal	EWCSO Effluent Settleable Solids (ml/l/hr)	EWCSO Effluent pH	EWCSO Average Effluent Fecal Coliforms (#/100 ml)	EWCSO Effluent Residual Chlorine (ug/l)
	5	2c	0.13	ND	ND	178	5					
	6	2d	27.25	2a	26.96	19589	19344		0.4	6.3	305	54
	7	2e	14.24	2b	5.78	2211	1047		<0.1	5.8	30	76
	8	2f	1.17	ND	ND	769	22					
	11	3a	0.39	ND	ND	104	3					
	12	3b	0.21	ND	ND	3469	101					
	21	4	0.41	ND	ND	1304	38					
	Event/Daily Max								0.4	5.8/6.6	305	76
	Monthly Total/Avg/GeoMean	4	60.26	2	40.23	32831	24724	24.7%	0.2		20	43
December	13	1	0.94	ND	ND	393	12					
	29	2	3.53	ND	ND	3255	103					
	Event/Daily Max											
	Monthly Total/Avg/GeoMean	2	4.48	ND	ND	3648	116	96.8%				
	2008 Total	27	165.74	4	53.1	131538	36645					76
	Annual Avg							72.1%	0.13			
	Min/Max/MonthlyGEM$_{max}$								0.40	5.8/6.6	230	

Table E-2 Elliott West/Mercer Annual Summary

	No. of Discharge Events	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/lhr)	Maximum Monthly Geomean EWCSO Effluent Fecal Coliforms (#/100 ml)	Maximum of Daily Averages of EWCSO Effluent Residual Cl_2 (ug/l)	Comments
Including all Discharge Events	4	165.7	53.1	131538	36645	72.1%	0.13	230	76	

Appendix F

Henderson/Norfolk CSO Treatment Facilities Annual Report

January–December 2008

This 2008 annual report summarizes the performance of King County's Henderson/Norfolk CSO treatment facilities. These CSO facilities came on-line in 2005. They operate under the NPDES permit for the West Point Treatment Plant (WA-0029181-1). There were no filling or discharge events in 2008.

Season's Weather Conditions

In calendar year 2008, 30.73 inches of rain were recorded at the SeaTac Weather Station. This is notably less than the historic average of 37.1 inches. The largest storm of the year occurred November 6-7, 2009, when 3.05 inches fell in 34 hours.

Operational Challenges

The Henderson/Norfolk CSO system did not operate in 2008.

Routine Operation and Maintenance Activities

The equipment and facilities of the Henderson/Norfolk CSO treatment system were fully functioning and available during 2008. Preventive maintenance was performed routinely. More details are available in the monthly discharge monitoring reports.

No data tables are provided because the facilities did not operate in 2008.