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 31, 2019

Laura Fricke
Municipal Unit Supervisor
Washington State Department of Ecology
Northwest Regional Office
3190 160th Avenue, SE
Bellevue, WA 98008

Thomas Mariani
Chief, Environmental Enforcement Section
Environmental and Natural Resources Division
U.S. Department of Justice
P.O. Box 7611
Washington, D.C. 20044

Robert Grandinetti
NPDES Compliance
U.S. Environmental Protection Agency, Region 10
Office of Compliance and Enforcement
309 Bradley Blvd., Suite 115
Richland, WA 99352

Ronald Lavigne
Assistant Attorney General, Ecology Division
Office of the Attorney General of Washington
P.O. Box 40117
Olympia, WA 98504

Edward Kowalski
Director, Office of Compliance and Enforcement
U.S. Environmental Protection Agency, Region 10
1200 Sixth Ave., Suite 900
Seattle, WA 98101

Kevin Wright
Chief of the Civil Division
King County Prosecuting Attorney's Office
King County Courthouse
516 Third Avenue, Room W400
Seattle, WA 98104

Mark Pollins
Director, Water Enforcement Division
Office of Civil Enforcement
U.S. Environmental Protection Agency
1200 Pennsylvania Avenue NW
Mail Code: 2243-A
Washington, D.C. 20460

Shawn McKone
NPDES Permit Manager
Washington State Department of Ecology
Northwest Regional Office
3190 160th Avenue SE
Bellevue, WA 98008

RE: King County 2018 Combined Sewer Overflow (CSO) Control Program Consolidated Annual Consent Decree and NPDES Report

Dear Sir/Madam:

In accordance with the reporting requirements in Section VIII of the Consent Decree, Civil Action No. 2:13-cv-677, enclosed is King County's CSO Control Program Consent Decree Annual Report, dated July 2019. The report addresses the County's CSO control project and compliance activities from January through December 2018.

Under King County's National Pollutant Elimination Discharge System (NPDES) permit WA-002918-1 S18.B.2. and Washington Administrative Code (WAC) 173-245-090(1)(a)-(c), the County also submits a CSO control program annual report to the Washington State Department of Ecology. This report documents CSO control program activities for calendar year 2018.

Previous reports are available on the County's CSO control program website at:
http://www.kingcounty.gov/services/environment/wastewater/cso/library/annual-reports.aspx

With agreement of the U.S. Environmental Protection Agency and Washington State Department of Ecology, this report responds to the reporting requirements of the Consent Decree (§ VIII, paragraph 43), WAC, and NPDES permit in a single document.

King County is committed to meeting all the milestones and actions outlined in the Consent Decree, WAC, and NPDES permit. Compliance with the Consent Decree and regulations is a top priority for the County's Wastewater Treatment Division (WTD).

Thank you for your review of the King County 2018 Annual CSO and Consent Decree Report. If you have any questions or would like additional information, please contact me at 206-477-4601 or Mark.Isaacson@kingcounty.gov.

Certification

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

Bruce Kessler, Deputy Division Director for

Mark Isaacson, Division Director
Wastewater Treatment Division
King County Department of Natural Resources and Parks

7/31/19
Date

cc: Verna Bromley, Senior Deputy Prosecuting Attorney, King County Prosecuting Attorney's Office
Jeff Lafer, Wastewater Planner/Project Manager IV, Wastewater Treatment Division (WTD), Department of Natural Resources and Parks (DNRP)
Susan Kaufman-Una, Project Resources Unit Manager, WTD, DNRP
Eric Mandel, CSO Program Coordinator/Capital Project Manager IV, WTD, DNRP

Combined Sewer Overflow Control Program

2018 Annual CSO and Consent Decree Report

July 2019

For comments or questions, contact:
Jim Simmonds
King County Wastewater Treatment Division
201 S Jackson St.
KSC-NR-0503
Seattle, WA 98104-3855
206-477-4825
jim.simmonds@kingcounty.gov

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

Table of Contents

Tables

Figures

List of Abbreviations and Acronyms

BMPs	best management practices
CD	consent decree
Seattle	City of Seattle
County	King County
CSO	combined sewer overflow
DOJ	Department of Justice
DSN	discharge serial number
DWO	dry weather overflow
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
ERTS	Environmental Report Tracking System
FOG	fats, oil, and grease
GSI	green stormwater infrastructure
HLKK	Hanford/Lander/King/Kingdome
hr	hour
JOIST	Joint Operations Information Sharing Team
JPA	joint project agreement
L	liter
LHWMP	Local Hazardous Waste Management Program
LTCP	long-term control plan
Metro	Municipality of Metropolitan Seattle
µg/L	micrograms per liter
MG	million gallons
MGD	million gallons per day
ml	milliliter

MLK	Martin Luther King
MOA	memorandum of agreement
WQA/MS	water quality assessment/monitoring study
NPDES	National Pollutant Discharge Elimination System
NTP	notice to proceed
O&M	operation and maintenance
PCMP	Post-construction Monitoring Plan
RWSP	Regional Wastewater Services Plan
SBS	sodium bisulfite
SCADA	supervisory control and data acquisition
SEPA	State Environmental Policy Act
SPU	Seattle Public Utilities
SS	settleable solids
SSO	sewer overflow
SSOP	Sewer System Operations Plan
SCIP	Source Control Implementation Plan
TRC	total residual chlorine
TSS	total suspended solids
TEPS	tunnel effluent pump station
UIC	underground injection control
WAC	Washington Administrative Code
WTD	Wastewater Treatment Division
WWTS	wet weather treatment station
VFD	variable frequency drive

1 Introduction

King County's (County) Wastewater Treatment Division (WTD) is responsible for managing the County's regional wastewater system, which consists of both separate and combined systems. WTD prepares annual reports for the combined portion of its system, which includes its combined sewer overflow (CSO) control program. This annual report fulfills requirements under the National Pollutant Discharge Elimination System (NPDES) permit for the County's West Point Treatment Plant (WA0029181) in Seattle and requirements in Washington Administrative Code (WAC) 173-245-090. King County submits these reports to the Washington State Department of Ecology (Ecology). The NPDES permit for West Point Treatment Plant (West Point) was renewed on December 19, 2014 and became effective on February 1, 2015.

On July 3, 2013, a consent decree (CD), Civil Action No. 2:13-cv-677, between the U.S. Department of Justice (DOJ), U.S. Environmental Protection Agency (EPA), Ecology, and King County was finalized. Section VIII of the CD requires submittal of an annual report detailing implementation of the CD. With agreement from EPA and Ecology, beginning with the 2014 annual report, the CSO and CD annual reports were consolidated into one report. This annual report meets the CD, WAC, and NPDES requirements.

CSO control is important to King County because CSOs are a recognized source of water pollution that can result in temporary increases in bacterial counts, aesthetic degradation of shorelines, long-term adverse impacts on sediment quality at discharge points, and raised public health concerns in areas where there is potential for human contact. Protection of water quality and compliance with environmental regulations are top priorities for King County.

In addition, the County is committed to meeting all the milestones and actions outlined in the CD. WTD staff are provided with ongoing trainings and briefings to ensure they are able to fully meet the required milestones and actions of the CD. WTD has a dedicated staff position to provide division-wide communication on the CD to ensure everyone works together to achieve these priorities.

This report documents King County CSO Control Program and CD implementation activities and information for the 2018 calendar year on the following topics:

- Implementation of early action and long-term CSO control plan measures
- CSO volumes and frequency of overflows (including overflow durations and associated rainfall data)
- Information on any CSO-related bypasses at West Point

- Information on any dry weather overflows (DWOs)
- Updates on the implementation of the CD
- Sewer System Operations Plan (SSOP) implementation
- Revision of the Joint Operations and System Optimization Plan between WTD and Seattle Public Utilities (SPU) based on comments from Ecology
- Implementation of the Joint Operations and System Optimization Plan between WTD and SPU
- Coordination between WTD and SPU on CSO control programs and projects
- NPDES permit compliance for the King County wet weather treatment stations (WWTSs)
- Coordination with SPU on implementation of source control BMPs in King County CSO basins

The following sections provide background on King County's wastewater system, its CSO Control Program, and NPDES and CD requirements.

1.1 King County CSO System

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 (Seattle) local wastewater collection system contains combined sewers that collect both wastewater and stormwater. The newer local systems in the other 33 agencies served by WTD use separated sewers to convey wastewater and stormwater within different pipelines. Seattle's combined sewers convey flows to King County trunks and interceptors, which convey the majority of flows to West Point in Seattle's Discovery Park. A small portion of flows from the combined system are treated at the County's South Treatment Plant (South Plant) in Renton. King County's responsibility for sewerage facilities begins at the point where 1,000 acres of drainage come together.

When large storms occur, and flows exceed the capacity of the County conveyance system, CSOs may occur at any of the 39 County CSO locations that discharge to Lake Washington, Lake Union, the Lake Washington Ship Canal (Ship Canal), the Duwamish River, Elliott Bay, and Puget Sound (Figure 1). CSOs may also occur at Seattle's 85 CSO locations in their local sewer system. SPU is responsible for separately managing and reporting on those locations.

Figure 1. King County CSO Locations

1.2 CSO Control Plans, Amendments, and Updates

Since the 1970s, the Municipality of Metropolitan Seattle (Metro) and its successor, King County, have been implementing CSO control projects to improve water quality in the Seattle area. King County does this under a CSO Control Plan that is amended or updated with each renewal of West Point's NPDES permit. Prior to each CSO Control Plan update, the County reviews the plan and progress toward CSO control and compares its existing program against conditions that may have changed since the last update (e.g., flow patterns, scientific developments, changed regulations, new technologies, and public priorities). Significant changes may require adjustment of the CSO Control Plan and, potentially, the CD.

1.2.1 CSO Control Plans, 1979–2012

Metro first formalized CSO control with the development of the 1979 CSO Control Program, which was developed in cooperation with EPA and Seattle. The 1979 program identified nine Metro projects to reduce the number of CSO events into fresh water (Lake Washington, Lake Union, and the 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 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 system-wide by the end of 2005. Metro's Final 1988 Combined Sewer Overflow Control 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 from Metro in 1994. As part of the 1995 NPDES permit renewal for West Point, King County prepared an update and amendment to the 1988 Plan. The 1995 CSO Control 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 between 1995 and 2000.

In the late 1990s, King County developed a major update to its comprehensive sewerage plan, including both the combined and separated systems, called the 1999 Regional Wastewater Services Plan (RWSP). During that period, Ecology agreed to discontinue the 75 percent 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 1995 Plan Update that consisted of 21 control projects to complete system control by 2030. The revision was included with the June 2000 submission of the West Point Treatment Plant NPDES permit renewal application as the Year 2000 CSO Control Plan Update. 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 Elliott West Wet Weather Treatment Station (Elliott West WWTS)/Mercer Street Treatment Tunnel (Mercer St. Treatment Tunnel) and Henderson/Martin Luther King Jr. Way Wet Weather Treatment Station (Henderson/MLK Jr. Way WWTS) 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 permit renewal application and update to the 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 2008 CSO Control 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, control status of its CSOs, and overall progress toward CSO control; how the County met EPA's Nine Minimum Controls; and summarized the scientific studies that have shaped the control program over time. The 2008 Plan Update also described planned, in-progress, and completed CSO control projects. No changes to the 1999 RWSP CSO Control Plan were recommended and King County committed to implementing the first four of the RWSP CSO projects: Barton Street, Murray Street, South Magnolia, and North Beach, collectively known as the "Puget Sound Beach Projects."

In 2012, the County completed a three-year review of the CSO Control Program. The 2012 Long-term Control Plan Amendment (LTCP) was approved by the King County Council in September 2012. The 2012 LTCP was submitted to Ecology and EPA on November 20, 2012, ahead of the June 2013 application date for the NPDES permit renewal and as part of the CD negotiations. The approved projects in the 2012 LTCP emerged from an evaluation of new conditions, opportunities, science, regulations, and community input since the last major CSO plan update in 1999. Project alternatives were developed for all uncontrolled CSOs to determine which were the most cost effective.

The approved 2012 LTCP is the County's current plan to construct nine projects to control 14 CSOs by the end of 2030. The approved plan includes conducting green stormwater infrastructure (GSI) early, ahead of traditional CSO control projects, for four projects, to reduce the size of the gray infrastructure needed to control CSOs.

The King County Council also approved a plan to complete a water quality assessment and monitoring study (WQA/MS) ahead of the next update of the LTCP. The purpose of the study was to ensure that future CSO projects to control pollution are well planned and timed to improve water quality in Elliott Bay, the Duwamish River, and the Ship Canal. The study was intended to confirm or identify possible adjustments in the sequence and schedule of future CSO projects, look at other planned water quality projects, and consider findings as part of a potential Integrated Plan proposal. The recommendation for this study emerged through conversations with stakeholders and the public asking that CSO control be evaluated more fully, along with other water quality improvement programs in the region. The WQA/MS, completed in 2017, is discussed further in Section 1.2.3 Water Quality Assessment/Monitoring Study.

1.2.2 2018 CSO Control Program Update

In 2015, King County began a comprehensive review and update of the CSO Control Program including the 2012 LTCP approved in 2013. Every five years, updates are required by the WAC 173-245-090, West Point's NPDES permit, and King County Code 28.86.080. The resulting 2018 CSO Program Update was submitted to Ecology and EPA with the West Point NPDES permit renewal application in January 2019.

In the 2018 CSO Program Update, WTD conducted analyses of the remaining uncontrolled CSO locations (Figure 1) where projects are not already being implemented, including an evaluation of the CSO control projects identified in the 2012 LTCP. The analysis considered recent monitoring of control techniques, updated modeling information, and opportunities for collaboration with other agencies.

The purpose of re-evaluating the approved 2012 LTCP alternatives was to identify any changes in conditions that could impact the type, size, and location of the alternatives since 2012. The results of this risk-based value analysis were similar to the triple bottom line results in the approved 2012 LTCP. Based on this review of the CSO program, WTD did not recommend any changes or amendment to the LTCP at this time.

In its next phase of LTCP implementation, WTD will identify opportunities for project refinement, facility optimization, and new water quality projects. WTD will quantify the potential water quality benefits and costs of these opportunities and evaluate their merits in providing benefits that align with regional values, countywide initiatives, and planning efforts.

Concurrent with LTCP implementation, WTD has initiated the Clean Water Plan, a planning process to update its comprehensive wastewater system plan. The purpose of this planning effort is to assess all the demands on the regional wastewater utility, including CSOs, and plan a future direction for the regional system that makes the right investments at the right time. Since CSO investments are among the demands

considered in the planning effort, the CSO Control Program will continue its evaluation of CSO control alternatives and additional water quality improvement opportunities to inform the Clean Water Plan. WTD will continue to work with Ecology and EPA, along with many other community members and interested parties, as these planning processes unfold.

1.2.3 Water Quality Assessment/Monitoring Study

The WQA/MS, requested by King County Council, was completed in October 2017. The WQA/MS informed the 2018 CSO Program Update and will also inform future activities undertaken by King County and other entities to improve water quality in the region. The study assessed past and present water quality conditions in the waterbodies where the County's remaining uncontrolled CSOs discharge more than an average of once per year: Lake Union/Ship Canal, Elliott Bay, and the Duwamish Estuary. The study also estimated annual contaminant loadings to these study areas from different pollutant pathways, reviewed planned projects to understand how contaminant loadings may change, and identified potential water quality impairments that may remain in 2030. Twelve reports describe different aspects of water quality in the study areas and include summary reports and a report from the peer review team that reviewed the science. The information from the WQA/MS was used to assess the timing and sequence of the remaining CSO control projects.

The findings indicate that actions over the past 50 years have improved water quality; nutrient and bacteria levels have decreased in surface waters and sediment cleanups have improved sediment quality. Despite improvements, some water quality is still impaired in the three study areas. Pathways contributing to impairments to receiving water bodies include CSO discharges, stormwater discharges, leaching from boat-bottom vessel paint, and leaching from creosote-treated wood pilings. Planned actions in the region will reduce some contaminant loadings by 2030. Reduction in frequency of untreated CSO discharges will reduce bacteria loadings. Stormwater management and treatment will reduce loadings from stormwater. Laws limiting copper content in antifouling vessel bottom paint and automobile brake pads will reduce copper. Creosote-treated wood piling removal will reduce organic chemical loading, and contaminated sediment cleanup will reduce sediment contamination levels. However, water quality challenges will remain in 2030 and beyond. Recommended next steps for the region include the following: reduce the frequency of untreated CSO discharges, implement planned water quality improvement projects and programs, monitor changes, and add to the body of knowledge over time.

Links to the 12 reports are available at:
https://www.kingcounty.gov/services/environment/wastewater/cso/projects/water-quality-study.aspx

1.3 Consent Decree

After King County Council approval of the 2012 LTCP, King County submitted the LTCP to Ecology and EPA for approval. EPA and Ecology approved the County's LTCP as meeting federal requirements on March 7, 2013. This approved version became the basis for settlement of ongoing negotiations with EPA, Ecology, and DOJ to finalize a negotiated CD between King County, EPA, DOJ and Ecology. The CD was formally filed in U.S. District Court on July 3, 2013.

The CD commits King County to implement the LTCP CSO capital projects specified in the 2012 LTCP within the timelines specified in the CD, as well as to complete several related plans (including the SSOP and Joint Operations and System Optimization Plan, described in this report in Sections 3.2.1 and 3.2.2, respectively). Meeting all CD milestones is a high priority for the County. To date, the County has met all milestones, with two exceptions, and is currently on schedule to meet all future milestones. The exceptions are:

1) The South Magnolia CSO Beach Project (or South Magnolia Wet Weather Storage Project, CSO Outfall 006), which had completed construction and was operating correctly until an unexpected conveyance pipe break prevented flows from reaching the new facility. Details on this occurrence are provided in the South Magnolia project summary under Section 3. In summary, the pipe was replaced, and the project was again operating as designed by year-end 2018.
2) The Barton Street CSO Beach project (CSO Outfall 057), which met its construction completion CD date, did not achieve its required performance standard by year-end 2017. Consequently, a Supplemental Compliance Plan was submitted April 23, 2018. Progress is to be documented in this and subsequent Annual Reports. Details for this project are also found under Section 3 below. In summary, adjustments to the related pump station controls have been made and the performance and modeling data are being collected and analyzed to determine if compliance will be achieved moving forward.

Further, the original CD mandated the completion of plans and implementation for achieving control at three CSO outfalls that had not achieved controlled status when the CD was signed. Supplemental Compliance Plans were submitted in August 2013 for Dexter Avenue Regulator Station Overflow (Dexter Ave. RS Overflow), Denny Way Regulator Station Overflow (Denny Way RS Overflow), and Harbor Avenue Regulator Station Overflow (Harbor Ave. RS Overflow) (with an amendment to the Harbor Ave. RS Overflow Supplemental Compliance Plan submitted September 2013 and again in August 2016). These describe forthcoming operational and capital improvements to control these three CSOs. As a result of these actions, Dexter Ave. RS Overflow is controlled.

Denny Way RS Overflow and Harbor Ave. RS Overflow were not yet fully controlled as of December 31, 2018. However, the adjustments to the Denny Way RS were completed by third quarter 2018, per its Supplemental Compliance Plan. Denny Way is now being monitored to determine its control status. Similarly, the Harbor Ave. Supplemental Compliance Plan modifications were on target to be completed by the end of January 2019.

All CD project summaries detailing 2018 progress, planned work in 2019, and their schedule of milestones can be found in Section 3 of this report.

In addition to specific CSO project implementation, the original CD required several plans that are now completed or in progress. These plans include:

- The Sewer System Operations Plan was submitted in September 2013. A letter approving the SSOP was received from Ecology on May 30, 2014, and from EPA on July 29, 2014. The next review is in August 2019, which represents a relatively minor effort to ensure the information is current and any web links are correctly shown.
- The Joint Operations and System Optimization Plan with SPU was initially submitted to EPA and Ecology on February 10, 2016. The Final Joint Operations and System Optimization Plan was approved in February 2017. The CD requires the Joint Operations and System Optimization Plan to be reviewed every three years and updated as necessary. An updated plan is expected to be complete in January 2019.

An overview of these plans can be found in Sections 3.2 and 3.3 of this report.

1.4 Sediment Sampling and Analysis

In 1999, King County prepared a sediment management plan for addressing contaminated sediment at County CSO locations. The plan was updated and the “King County Sediment Management Plan (SMP) 2018 Update” was sent to Ecology November 2, 2018. The SMP update proposes a strategy for assessing and managing potential or determined sediment impacts related to the County’s CSOs, in order to meet permit obligations as well as provide information needed to plan for required or anticipated future cleanup actions. The SMP update also describes all of the King County CSO discharge locations, summarizes ongoing and previously performed sediment cleanup work, summarizes the results of CSO discharge modeling, and provides the status of existing sediment quality. As part of the update process, a predictive sediment contamination model for CSO discharges was developed. Supplemental sediment sampling data at CSO outfall locations collected in 2012 (ten

locations), 2014 (six locations), and 2016 (one location) were used to calibrate and verify model performance.

These sampling events also collected baseline conditions at Barton St. PS Overflow, Murray St. PS Overflow, North Beach PS Wet Well Overflow, and South Magnolia Overflow to support the post-construction monitoring requirement. In December 2018, post-construction monitoring results for these sites were provided to Ecology pursuant to the West Point NPDES permit (§S13.B, p. 41).

The NPDES permit (§S13.B, p. 41) required characterization at specific Lake Washington CSO outfalls (i.e., 011, 012, 049, 013, 045, 018, and 033) and the County's approved post-construction monitoring plan (PCMP) requires characterization by sampling or modeling. The sediment quality data report providing modeling results per the approved quality assurance project plan was provided to Ecology in December 2018.

When the County determined that a second overflow point at North Beach went to a separate overflow location, a sampling plan specific to the North Beach Pump Station (PS) Inlet Overflow site was developed in accordance with the PCMP. Sampling was completed on September 6, 2018. The sediment quality data report will be sent to Ecology by December 1, 2019.

In addition, permit condition S13.C required consolidation of all CSO sediment monitoring history information by revising a 2009 summary report. Results are presented in the Comprehensive Sediment Quality Summary Report for CSO Discharge Locations sent to Ecology on December 1, 2018.

1.5 Organization of this Report

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

- Report on implementation of EPA's Nine Minimum Controls (Section 2)
- Status of CSO control projects in design or construction (Section 3)
- Discussion of 2018 rainfall and untreated and treated CSO events (Section 4)
- Summary of CD violations in 2018 (Section 5)
- Table showing the 20-year average frequency of untreated CSO events (Section 6)
- Description of post-construction monitoring (Section 7)
- Detailed individual event-based tables for untreated CSOs in 2018 (Appendix A)
- Detailed individual event-based tables for treated CSOs in 2018 (Appendix B)
- Annual reports for the four satellite Wet Weather Treatment Stations (WWTSs): Alki Wet Weather Treatment Station (Alki WWTS), Carkeek Wet Weather

Treatment Station (Carkeek WWTS), Elliott West Wet Weather Treatment Station (Elliott West WWTS), and Henderson/MLK Jr. Way Wet Weather Treatment Station (Henderson/MLK Jr. Way WWTS) (Appendices C through F)

This report meets the requirements of annual reporting as defined by the CD, WAC, and the NPDES permit. The crosswalks shown in Table 1 indicate where information meeting the requirements of each can be found in this report.

Table 1. Consent Decree, Washington Administrative Code, and National Pollutant Discharge Elimination System Permit Regulations Crosswalks

Consent Decree Section	Content	Annual Report Location
VIII.43.a	(i) the status of all Consent Decree compliance measures, including Currently Underway and Early Action CSO Control Measures, the implementation of all CSO Control Measures in Appendix B, Post-Construction Monitoring Plan, SSOP, and Information Sharing/Coordination Program Plan Between County and the City of Seattle. (ii) any problems anticipated or encountered, along with the proposed or implemented solutions. (iii) any anticipated or ongoing operation and maintenance activities relating to all CSO Control Measures. (iv) remedial activities that will be performed in the upcoming year to comply with the requirements of this Consent Decree.	(i) 3.1 Project Summaries 3.2.1 Sewer System Operations Plan 3.2.2 Joint Operations and System Optimization Plan 3.2.3 WTD Coordination with SPU on CSO Control Projects 7.0 Post-construction monitoring (ii) Included in sections above, 4.4, and Appendices C–F for WWTSs (iii) 2.1 Reducing CSOs Through Operations and Maintenance Appendices C–F for WWTSs (iv) All of the above
VIII.43.b	A description of any non-compliance with the requirements of this Consent Decree and an explanation of the likely cause and duration of the violation and any remedial steps taken, or to be taken, to prevent or minimize such violation.	5.0 Summary of Consent Decree Violations 2.1 Reducing CSOs Through Operations and Maintenance Appendices C–F for WWTSs

WAC Section	Content	Annual Report Location
WAC 173-245-090(1)(a)	Details the past year's frequency and volume of combined sewage discharged from each CSO site, or group of CSO sites in close proximity. The report shall indicate whether a CSO site or group of sites has increased over the baseline annual condition.	4.0 Summary of Rainfall and CSO Events 6.2 Changes to Control Status of CSO locations Appendix A Untreated CSO Events Appendix B Treated CSO Events Appendices C–F for WWTSs
WAC 173-245-090(1)(b)	Explains the previous year's CSO reduction accomplishments.	3.1 Project Summaries
WAC 173-245-090(1)(c)	Lists the projects planned for the next year.	3.1 Project Summaries

NPDES Permit WA0029181	Content	Annual Report Location
S11.C.2	The CSO Annual Report must include the following information: a. A summary of the number and volume of untreated discharge events per outfall for that year. b. A summary of the 20-year moving average number of untreated discharge events per outfall, calculated once annually. c. An event-based reporting form (provided by Ecology) for all CSO discharges for the reporting period, summarizing all data collected according to the monitoring schedule in Special Condition S11.B.9. d. An explanation of the previous year's CSO reduction accomplishments. e. A list of CSO reduction projects planned for the next year. f. A list of which permitted CSO outfalls can be categorized as meeting the one untreated discharge per year on a 20-year moving average performance standard. This annual assessment may be based on historical long-term discharge data, modeling, or other reasonable methods as approved by Ecology. The Permittee must submit paper and electronic copies of the report, and Excel spreadsheet copies of significant spreadsheets.	6.1 Twenty-Year Moving Average of Event Frequencies Electronic Template submitted electronically with annual report; hardcopy of content in Appendices A and B
S11.B	The Permittee must document compliance with the nine minimum controls in the annual CSO report as required in Special Condition S11.C.	2.0 Programs to Meet EPA's Nine Minimum Controls
S11.F.b	The Permittee must report the running 20-year average number of overflow events per year during this permit term from these existing controlled CSO outfalls in the CSO annual report required in Section S11.C.	6.1 Twenty-Year Moving Average of Event Frequencies

2 Programs to Meet EPA's Nine Minimum Controls

The EPA's Nine Minimum Controls are actions that can be taken to minimize CSO impacts while long-term capital projects are underway. King County has implemented a number of programs to satisfy the requirements of the Nine Minimum Controls, which are part of EPA's codified CSO Control Policy and included in the West Point NPDES permit. The following sections describe King County's programs and activities regarding each of the Nine Minimum Controls, with emphasis on activities undertaken in 2018.

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.

West Point and South Plant staff manage proper facility operation using King County's supervisory control and data acquisition (SCADA) system. The SCADA system provides monitoring and control capabilities for the treatment plant collection systems. See Control 2 (Section 2.2) for information on King County's use of the SCADA system.

Under the Asset Management Program, King County employs asset management tools, including a standardized inventory system and condition rating systems, and is developing long-range asset replacement and renewal forecasts, including action plans, to replace assets. The Asset Management Program, implemented by West Point, South Plant, and Conveyance Inspection staff, ensures regular maintenance of CSO outfalls, regulator stations, and pump stations. Conveyance inspection 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.

In 2017, King County performed a review of the WTD Asset Management Program, including the Strategic Asset Management Plan (SAMP). The review identified strengths and opportunities for improvements to the SAMP and Asset Management Program. One of the recommendations of the review was to update the SAMP and asset management work plan in 2018 as well as early action recommendations to complete in 2018. Work began in 2018 to update the SAMP and is scheduled to be finalized in early 2019. The 2018 SAMP Update sets the priorities of the program and work plan and incorporates the findings from the 2017 review of the asset management program.

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.

The West conveyance system is essentially a deep in-line tunnel system that conveys and stores a wide range of flows. The sizing of the largest in-line tunnels is shown in Figure 2. Maximizing storage in the conveyance system works in concert with maximizing conveyance to West Point to minimize overflows and obtain high quality treatment for service area flows. The system has been built to operate as much as possible based on gravity flow and levels in the interceptors and trunks, with little operator intervention.

When levels reach pre-determined set points, programmable logic controllers automatically adjust gates and pumps to manage the flows. These set points have been determined over the years by operational experience, hydraulic analysis, and modeling to balance conveyance to the treatment plant while maximizing storage in the pipelines and off-line storage facilities and minimizing overflows and backups. Critical alarms and process data are communicated to the treatment plant operators using monitoring systems that report data in independent communication pathways from the control system. Operators at West Point's Main Control will remotely take control of certain facilities—primarily Interbay Pump Station to force storage in the Mercer St. Treatment Tunnel and the West Seattle Pump Station to force storage in the West Seattle Tunnel—to manage flows to and through West Point. The intent of this operations strategy is to avoid surges and oscillations in the plant, protect the biological system and avoid plant shutdown, optimize conveyance of flows to the plant for treatment, and maximize the use of system storage capacity.

Senior operators assess a range of system factors in making decisions to begin manual control. Which factors are most important depends on the direction storms come from, how fast flows are changing, and antecedent conditions. Decisions require extensive senior operator experience, a sense for antecedent conditions, and the ability to anticipate changing flows.

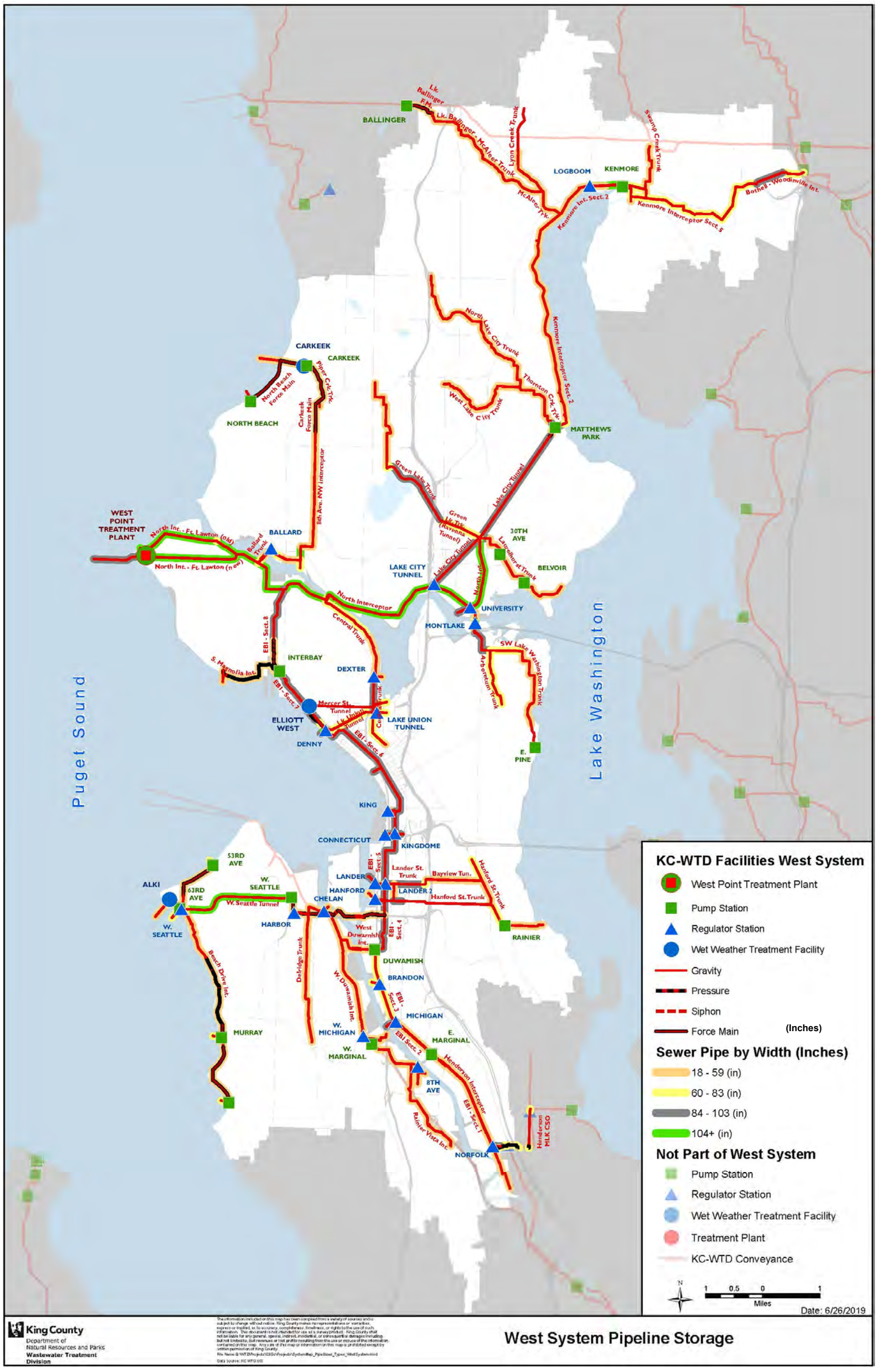

Figure 2. King County Wastewater West System Pipeline Storage

This page intentionally left blank.

2.3 Control 3—Optimizing Pretreatment Program

Review and modify, as appropriate, existing pretreatment program to minimize CSO impacts from discharges due to 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. King County works with the local sewer agencies during the permit approval and renewal process. 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 West Point are assessed for trends that would suggest concurrent changes in CSO discharges. In addition, biosolids quality data from West Point are tracked as an indicator of changed loading to the system that could influence CSO quality. No specific new trends were observed in 2018 in pollutant concentrations. Biosolids concentrations are relatively stable and well below EPA's standards.

Beginning in 2016, WTD began to include the downstream CSO to which each permitted industrial discharger contributes in the annual pretreatment report submitted to Ecology.

King County is currently working with Ecology on updating the County's Source Control Implementation Plan (SCIP) for the Lower Duwamish Waterway. The first draft was submitted in March 2018 and is subject to comments from Ecology. King County is currently implementing the plan, which covers activities from 2019 to 2023. Per the SCIP, King County submits Source Control Annual Reports documenting source control activities for that period. The 2018 Source Control Annual Report will be submitted in December 2019.

2.4 Control 4—Maximizing Flow to Treatment Plant

Operate the POTW [publicly owned treatment works] 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.

The 2014 SSOP describes how maximizing storage in the conveyance system works in concert with maximizing conveyance to the treatment plant to minimize CSOs and obtain high quality treatment for service area flows. As described in Control 2 (Section

2.2) and shown in Figure 2, the West conveyance system is essentially a deep in-line tunnel system that can convey a wide range of flows to West Point. SCADA is used to maximize flow to the secondary treatment plant while protecting the biological treatment system via operation of regulators and pump stations. The parallel Fort Lawton Tunnel was built in 1992 to convey up to 440 million gallons per day (MGD) to West Point. West Point provides secondary treatment for all base flows (defined by Ecology as 2.25 times the average wet weather flow) up to 300 MGD and primary treatment for all flows between 300 MGD and the designed instantaneous peak hydraulic capacity of 440 MGD. 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 reduction (i.e., 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 Plant from southeast Seattle to receive full secondary treatment. This conveyance minimizes CSOs to the Duwamish River along the Elliott Bay Interceptor.

Where captured CSOs cannot be conveyed to secondary treatment plants because of conveyance system limitations, flows are conveyed to WWTSs, where the flows are treated and discharged. King County currently operates four WWTSs: Alki WWTS, Carkeek WWTS, Elliott West WWTS, and Henderson/MLK Jr. Way WWTS.

Treatment process stability is monitored and optimized to manage flows based on information from automatic sensors and an array of analytical tests. Process control laboratories at each plant conduct testing and analysis, and then recommend adjustments to the processes, if necessary, to ensure that quality treatment is provided.

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. Similarly, during wet weather, CSOs occurring as a result of precipitation may be exacerbated by power outages, mechanical failures, or human error. King County takes each of these overflows seriously, and they are immediately corrected and reported to

Ecology (see Section 4.2). King County's ongoing Asset Management Program is working to reduce the likelihood of these kinds of failures.

To minimize the risk of a DWO due to power loss at a pump station, generators and automatic power transfer systems were installed at pump stations throughout the system, greatly reducing the risk of overflows associated with a loss of power.

To minimize the risk of mechanical failure, the King County Asset Management Program is doing 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 assets. These efforts will contribute to reducing overflows by decreasing the probability of mechanical failures.

O&M programs, as described for Control 1 (Section 2.1), focus on DWOs and exacerbated CSOs. The conveyance system is monitored through SCADA and direct inspection, and 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 secondary treatment plants 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 SPU 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. SPU's catch basin maintenance program limits the introduction of floatable materials to sewers.

- Educating the public on keeping trash and grease out of the sewers (http://www.kingcounty.gov/services/environment/wastewater/education/protect-environment/flush-trouble.aspx).

2.7 Control 7—Preventing Pollution

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

The following section describes the programs that comprise King County's pollution prevention program to reduce sources of flows and contaminant loading within the combined basins. It also describes ongoing efforts in 2018 to coordinate with SPU programs to ensure pollution prevention programs align, cover the geographic area fully, and are comprehensive in addressing all pollution types (solid waste, wastewater, stormwater, etc.). This section is divided into subsections that describe existing industrial and commercial programs, community programs, and stormwater programs.

Programs to Support Pollution Prevention with Industrial and Commercial Discharges

King County's Industrial Waste Program, along with the County's Local Hazardous Waste Management Program (LHWMP), contributes to source control within the combined sewer system. Industrial facilities throughout Seattle that are permitted through the Industrial Waste Program, are required to limit the discharge of chemicals and other substances to sanitary sewers that might adversely impact the environment and the wastewater treatment process. The Industrial Waste Program also manages construction dewatering permits within Seattle that propose to discharge wastewater to the sanitary sewer system.

The Industrial Waste Program 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 the Industrial Waste Program 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 the Industrial Waste Program'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.

King County completed the implementation of its first five-year Source Control Implementation Plan for the Lower Duwamish Waterway in 2018. The activities conducted under the Plan are summarized in a series of source control annual reports that are submitted to Ecology. The 2017 activities report was prepared in 2018 and submitted to Ecology in December 2018. The 2018 activities will be summarized in a report developed in 2019. The County has also developed its second five-year plan for the 2019 to 2023 period. The Plan includes working with Lower Duwamish businesses and residents on pollution prevention as well as County-performed source tracing activities and compliance with water quality permits and regulations at County-owned and operated facilities.

The LHWMP is a multi-jurisdictional effort of King County, SPU, two tribal governments, and 37 local towns and cities that is implemented through a "Management Coordination Committee" and enabled by the King County Board of Health. The LHWMP provides outreach to smaller facilities through a non-regulatory business inspection program, which includes partial-reimbursement vouchers for purchase of source control equipment or services. The LHWMP creates plans to manage hazardous wastes produced by households and in small quantities by businesses and other organizations. The LHWMP is funded by local hazardous waste fees on solid waste (garbage) and sewer accounts.

Programs to Support Community Pollution Prevention

King County and Seattle manage a number of general public education and outreach efforts and specific waste collection/reduction programs for the purpose of reducing contaminant discharges to the sanitary sewer and stormwater systems in combined basins (e.g., water conservation programs, Adopt-a-Road, Adopt-a-Street, recycling resources). Both King County's Industrial Waste Program and LHWMP maintain extensive online program information and availability of resources and events. The County's LHWMP manages free hazardous waste collection services for household and business wastes (e.g., mobile collection, hazardous waste collection/drop-off sites). The King County Board of Health passed the Secure Medicine Return Regulation in 2013 (also known as the "Drug Take Back" Program) that generates tax revenues from pharmaceutical sales for the LHWMP to facilitate the collection and disposal of prescription and over-the-counter medicines at pharmacies and law enforcement offices at no cost to residents. King County and Seattle also collaborate on various campaigns, including "Puget Sound Starts Here" and "Don't Drip and Drive," that provide free clinics to educate owners on how to inspect and repair automotive fluid leaks (e.g., oil and antifreeze). The agencies also promote proper pest waste disposal and Seattle

maintains "Mutt Mitt" plastic bag stations throughout the city. Seattle also stencils facilities or posts other signs to prevent dumping or discharge of wastes in the storm drainage systems. Educational materials on controlling trash disposal to sewers are also addressed as part of the larger public information programs described in Control 6 (Section 2.6).

In partnership with SPU, WTD has administered the RainWise Program since 2010. This program provides rebates to homeowners living in specific combined sewer areas for installing rain gardens and cisterns on their own property. RainWise helps to slow, detain, or retain stormwater, which reduces both the volume and timing of combined sewer flows and reduces sources of pollution into the combined system.

WTD manages grant programs to help residents and small businesses implement small-scale projects to improve air and water quality and to support the success of King County's CSO projects by controlling new and ongoing sources of pollution that could harm the environment or re-contaminate cleaned-up areas in the waterway. The grants 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 water quality projects.

In 2018, the following grants were awarded through King County WaterWorks competitive grant funding, funded and administered by WTD. Funding for these 12 projects totaled $1,860,000, not including administration, all of which will have water quality benefits.

1. *City of Kent: Downey Farmstead Contaminated Soil Removal ($125,000).* Supports removal of arsenic and lead contaminated soil to protect the Green/Duwamish River during a large salmon restoration project creating a side channel.
2. *City of Redmond: Public Outreach Truck Wraps ($20,000).* Supports educational outreach messaging about best practices for protecting water quality, such as what not to flush.
3. *City of Seattle: EnviroStars Business Outreach and Technical Assistance Support for Water Quality Actions ($100,000).* Supports outreach and assistance to diverse, ethnically-owned and operated businesses in King County to engage in the EnviroStars program, and reduce waste, spills, and prevent pollution.
4. *City of Shoreline: NE 148th Street Infiltration Facilities ($63,203).* Supports construction of bioretention and grid system infiltration facilities to reduce peak flows, reduce contaminants, and alleviate local flooding.

5. *Earth Corps: Duwamish River Stewards ($25,000).* Supports training and coordination of stewards-volunteers who adopt sites and organize community cleanups and restoration.
6. *Earth Corps: Sharing Our Resources for the Duwamish ($30,000).* Supports coordination between several partner organizations to engage teens and young adults in the community; providing green jobs training and experience in restoration, pollution prevention, and community outreach.
7. *Environmental Coalition of South Seattle: Environmental Stewards ($60,000).* Supports bilingual community outreach events in multiple languages, and home visits to work directly with residents on changing behaviors to prevent pollution.
8. *Forterra: Green Buffers to Clean the Green ($89,543).* Supports the water quality of the Lower Green River through on-the-ground riparian restoration and community education. This project will engage residents of Tukwila through focus groups and volunteer events.
9. *Na'ah Illahee Fund: Yahowt Permaculture Water Project ($50,000).* Engage community members and coordinate with stakeholders on evaluating assessment of ponds, and plan restoration. The ponds filter runoff from Discovery Park and the north end parking lot that empty directly into Puget Sound.
10. *National Audubon Society: Clean Water for the Birds: Education & Restoration at Seward Park ($29,500).* Supports active science learning and on-the-ground forest restoration in south Seattle for students and community volunteers by teaching the value of clean water to our urban ecosystem and the plants, animals, and birds that rely on it.
11. *National Wildlife Federation (NWF): Water-wise Habitat Stewards Trainings and Demonstration Gardens Education and Action ($55,000).* Supports 100 King County citizens in NWF's proven Habitat Steward Training to educate and take action in water-wise gardening techniques at home and in the community. NWF will install four demonstration gardens in Sammamish, Burien, Bellevue and Renton to improve water quality.
12. *Nature Vision: Water Quality Education and Stewardship Project ($39,622).* Supports custom water quality and wastewater education programs, including field trips and small-scale restoration projects to 26 classes from low income schools in the Green/Duwamish Watershed service area.
13. *Northwest Center for Alternatives to Pesticides: Raindrops to Rivers King County ($24,962).* Supports public education, outreach, and technical assistance to reduce urban pesticide pollution and improve water quality in the area by conducting two workshops and five to ten public presentations on alternative pest management.

14. *Pacific Marine Research: Marine Science Afloat ($35,000).* Supports students directly in hands-on marine science aboard our floating classroom, a 65-foot research ship, in a 5½ hour scientific cruise on Puget Sound. We strive to inspire observation of, involvement in, and care for Puget Sound through community education and engagement.
15. *Pacific Science Center: Lake Washington Watershed Internship Program (LWWIP) ($97,381).* Supports high school students to become informed stewards of the local ecosystem through hands-on learning, mentoring of local elementary students, ecosystem restoration, and monthly stream monitoring. The program will engage thirty interns in two cohorts.
16. *Puget Soundkeeper: Lost Urban Creeks Community Education and Revitalization Project ($67,500).* Supports equitable, community-based solutions through education and resource and power-sharing. It will create educational benefits for King County ratepayers and ultimately lead to the adoption and eventual water quality improvements in the Springbrook Creek Watershed.
17. *Seattle Parks Foundation: Duwamish Valley Green Connections ($100,000).* Supports water quality through community driven green infrastructure development in the street right of way along East Marginal way south of Ellis to north of Webster. This is an area lacking trees, greenery or other mechanisms for mitigating storm water run-off from the parking lot and road.
18. *Tilth Alliance: Soil and Water Stewardship Training Program ($150,000).* Supports water quality in the WTD service area by empowering trained volunteers to engage in community-based water quality improvement demonstration projects, and to lead educational workshops that encourage ratepayers and community organizations to adopt natural yard care practices, better manage runoff, and install a spectrum of green stormwater infrastructure.
19. *Trout Unlimited: Lower Laughing Jacobs Creek Channel and Water Quality Restoration Feasibility Study ($151,062).* Supports a feasibility study to direct future stream restoration on lower Laughing Jacobs Creek in Issaquah, WA. Laughing Jacobs Creek is identified on the current Ecology 303(d) list as impaired for bacteria, temperature, and dissolved oxygen.
20. *United Indians of All Tribes: Labateyah Native Water Stewards ($59,000).* Supports green stormwater infrastructure at Labateyah, including a demonstration rain garden. It will provide paid environmental internships for residents that include experiential learning on water stewardship and gardening. This project will reduce stormwater runoff, while also educating and empowering underserved youth to engage in water stewardship and advocacy.
21. *UW Green Futures Research and Design Lab: The Sweetgrass Shoreline Restoration Project ($236,000).* Supports restoring urbanized nearshore

emergent habitats to improve water quality and provide other ecosystem services by integrating science, planning, and stakeholder participation.

22. *World Relief: Hillside Paradise Parking Plots Community Garden ($144,227).* Supports green stormwater features at a community garden located on one acre of paved parking lot for refugee and immigrant gardeners. The project entails asphalt removal, cistern and rain garden installation, capturing stream water, and education.
23. *Zero Waste Washington: Plastic Pollution Youth-created Videos, Outreach and Education in the Duwamish Valley and Beyond ($108,000).* Supports education about ways to reduce plastic pollution in stormwater, along roadways, in creeks, in wastewater, and in compost (used in green infrastructure projects). Includes youth-led videos, informative factsheets and games, and conducting outreach, with a focus in the Duwamish Valley.

Implementation of Source Control Actions in CSO Basins

In 2018, WTD worked with SPU staff to develop a coordinated approach to the mutual tracking and sharing of information on stormwater pollution prevention BMPs that are implemented within combined basins consistent with the provisions of each agency's NPDES permit. Because all of King County's CSOs serve areas within the City's boundaries, the City's management and maintenance activities under their Stormwater Code and Side Sewer Code provide many of the source control actions commonly recognized as most effective for reducing contaminant discharges in CSO systems. Seattle provides area-wide services for solid waste collection, street sweeping, spill response, water quality complaint investigations, stormwater system maintenance, and catch basin cleaning. At WTD-owned facilities within Seattle, operations and maintenance staff also perform spill response, drainage facility maintenance, and catch basin cleaning. Both King County and SPU maintain hotlines for reporting of illegal dumping; the County routes reports to the appropriate jurisdictional entity for cleanup of sites.

Seattle Municipal Code Chapters 22.800 through 22.808 contains the City's Stormwater Code, which is the City's primary means of implementing the following requirements: (1) to practice stormwater pollution prevention during construction; (2) to reduce the introduction of pollutants into stormwater runoff as close to the source as possible; and (3) to install flow control, stormwater treatment facilities, or both depending on the size and nature of a project. The Stormwater Code is implemented through the Directors' Rule, promulgated jointly by the Director of SPU and the Director of the Seattle Department of Construction and Inspections. The Code and Manual establish SPU's authority to implement mandatory City-wide BMPs requirements as follows:

- Illicit Connection Identification and Elimination: Under this provision, sanitary side sewer systems must be inspected for illicit connections of sanitary or process wastewater flows. In addition, SPU and WTD also conduct inspections for illicit connections when they are suspected or determined to exist within a basin.
- Routine Maintenance: This program requires property owners to inspect, maintain, and periodically clean approved stormwater facilities such as collection, conveyance, catch basins, and treatment systems (e.g., oil/water separator), and properly dispose of wastes.
- Proper Disposal of Fluids and Wastes: Seattle requires all real property to implement proper liquid waste storage, disposal, and runoff prevention measures.
- Proper Storage of Solid Wastes: Seattle requires all real property to implement proper solid waste storage and disposal practices.
- Spill Prevention and Cleanup: This provision requires businesses and real properties that load, unload, store, or manage liquids or erodible materials (e.g., stockpiles) to maintain spill plans, equipment, and practices to prevent and clean spills as well as notification procedures for spills to the drainage and sewer systems.
- Provide Oversight and Training for Staff: Businesses and public entities that have activities requiring BMPs are required to have trained personnel for their implementation.
- Site Maintenance: Businesses and public entities that involve materials or wastes that may come into contact with stormwater are required to implement proper housekeeping practices to minimize discharge of contaminants such as inspections, avoidance measures (containment, covering, or locating activities away from drainage systems), and sweeping and cleaning procedures.

Ecology has determined that the City's Stormwater Code and Manual are equivalent to Ecology's Surface Water Design Manual for Western Washington. This equivalency establishes the City's legal authority to control discharges to and from municipal stormwater systems. SPU has a city-wide pollution prevention program and actions such as spill response, catch basin inspection and cleaning. These actions are conducted in WTD CSO basins in the spirit of coordination. Finally, both WTD and SPU conduct stormwater drainage and mapping programs to document the boundaries of separated, partially separated, and combined basins.

In reviewing the pollution prevention programs in combined basins described above, both WTD and SPU have determined that existing legal authorities are sufficient to effectively administer and implement these programs. WTD and SPU will continue to

implement the pollution prevention program that is consistent with each agency's NPDES permits and provides benefits to each agency's combined sewer system.

To meet NPDES permit obligations, the King County Department of Natural Resources and Parks (DNRP) relies on SPU to implement pollution prevention actions (e.g., spill response, water quality complaint response, and street sweeping) in areas of the City served by DNRP CSO facilities. SPU currently provides these pollution prevention actions but is not responsible for DNRP's NPDES permit compliance. At DRNP's request, SPU tracks and reports to DNRP on the limited set of BMPs identified above. SPU and DNRP will explore whether to continue this arrangement and, if so, how to document costs and responsibilities.

During 2018, SPU tracked the following pollution prevention BMPs in areas served by King County CSOs:

- Water Quality Complaints: SPU inspectors respond to complaints as they are received through the water quality hotline, web page, or agency referrals. In 2018, 118 water quality complaints were reported in these basins.
- Spill Response: Spills are dispatched through the SPU Operations Response Center to on-call spill coordinators as they are received. In 2018, SPU responded to 169 spills within these basins.
- Street Sweeping: SPU coordinates with the Seattle Department of Transportation (SDOT) to conduct street sweeping on arterials in Seattle using high-efficiency regenerative air street sweepers. In 2018, SPU and SDOT swept 10,555 lane miles in these basins.

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) 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 signs at publicly accessible CSO locations, an information phone line, websites, and other public outreach activities. In 2017 SPU and DNRP developed a new CSO outfall sign design with more languages, a link to the CSO overflow website, and a new phone number that is staffed 24 hours a day. SPU and DNRP intend to fabricate and install the new signs beginning in 2019.

A website providing real-time notification of recent and current CSO discharges went live in December 2007

(http://www.kingcounty.gov/environment/wastewater/CSOstatus.aspx). In April 2011, King County completed the process to incorporate City of Seattle near real-time overflow information on this website. The website presents overflow status for the majority of Seattle and County CSOs with links to and from each agency's independent website. The community has access to consolidated information to assist in making choices about use of local waters. In late 2015, the website was upgraded to be more usable on mobile devices and allows users to zoom in and out to get more details. This upgrade "redesigned" the site from a set of five pages (an overview map and four submaps) to a single-page map.

In 2018, the CSO Status Web pages had 5,697 page views (representing 4,803 unique page views, with 79 percent of users viewing and then leaving the page [bounce rate]). This represented a 35 percent decrease in page views from 2017, during which there were 8,774 page views.

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 will be used to document the existing baseline conditions, evaluate the efficacy of the technology-based controls, and determine the baseline conditions upon which to 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 combined sewer system.
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 waterbodies.
d. Water quality data for receiving waterbodies.
e. Water quality impacts directly related to CSOs (e.g., beach closing, floatables, wash-up episodes, fish kills).

In 1986, 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 Washington 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 previous NPDES permit for West Point effective July 1, 2009, King County developed a comprehensive sediment quality summary report for all CSO discharge locations (submitted December 2009 and to be renewed in 2019). The report can be found at: http://your.kingcounty.gov/dnrp/library/wastewater/cso/docs/SedQuality/0912_CompSedQualSumRptCSODischargeLoc.pdf.

King County's Post-Construction Monitoring Plan (PCMP) is designed to assess, document, and report on the effectiveness of its CSO Control Program in achieving performance requirements and complying with state water and sediment quality standards. (See also Chapter 7 for additional information.) The King County PCMP was submitted to Ecology in July 2010 and was approved 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.

King County published a comprehensive study of the water quality in Elliott Bay, Lake Union, the Ship Canal, and the Duwamish Estuary in 2017 with the WQA/MS (see Section 1.2.3). The study's Synthesis Report presents the following findings, including the following:

- Some long-term water quality trends show improvements—even as the Puget Sound region has grown. The region's water quality investments over the last 40 years have paid off.
    - Less bacteria that can make people sick
    - Fewer nutrients that can cause toxic algae blooms
    - More dissolved oxygen for fish to breath
- There is more to do to achieve water quality improvement.
    - Water temperature is getting warmer, which is worse for fish
    - Even with the long-term improvements, water does not always meet state water quality standards for bacteria, dissolved oxygen, temperature, or human health standards for banned industrial chemicals called polychlorinated biphenyls or PCBs
    - Historically contaminated sediments need to be cleaned up or contained
- Controlling all CSOs in the Seattle area will protect water quality.
    - This will reduce the amount of fecal coliform bacteria entering the waterbodies by 80 percent
    - It will take more than CSO control to achieve desired water quality improvement
- Stormwater runoff and upstream watersheds carry many pollutants to waterbodies.

- Many jurisdictions are developing new stormwater rules and regulations. A regional commitment and investment to address stormwater runoff, similar to wastewater treatment, will be needed

More details of the study can be found at the following link: (https://www.kingcounty.gov/services/environment/wastewater/cso/projects/water-quality-study.aspx).

3 CSO Control Measures Currently Underway

This section describes the progress made implementing current CSO control projects and other projects that affect CSO control. It includes project-specific summaries of progress made in 2018, planned activities for 2019, and where each project is in relation to its schedule of milestones.

The CD requires the County to report on projects underway and the status of early action CSO control measures. The CD milestone statuses through 2018 are summarized in Table 2. The locations of the CSOs and the status of the related project(s) are included in Figure 3.

Table 2. Summary of King County Consent Decree Milestones through 2018

CSO Name (Project Name)	DSN	Current CD Milestone and Required Date	Actual Milestone Completion Date
Barton Street Pump Station (Barton Street Roadside Raingardens)	057	CSO controlled by December 31, 2017	Did not meet control performance standard; Supplemental Compliance Plan submitted April 23, 2018
Ballard Siphon Regulator (Ballard Siphon Project)	003	CSO outfall controlled by December 31, 2014	Outfall Controlled December 2014
Chelan Ave. Regulator Station (Chelan Ave. CSO Project)	036	Submit Facility Plan by December 31, 2018	Facility plan submitted December 31, 2018.
Brandon St. Regulator Station/S. Michigan St. Regulator Station (Georgetown Wet Weather Treatment Station)	039, 041	Construction completion by December 31, 2022	NA
Hanford #2 Regulator Station/Lander St. Regulator Station/King St. Regulator Station/ Kingdome Regulator Station (Project Name TBD)	032 030 028 029	Submit Facility Plan by December 31, 2024	N/A
Montlake Regulator Station (Project Name TBD)	014	Submit Facility Plan by December 31, 2023	N/A

CSO Name (Project Name)	DSN	Current CD Milestone and Required Date	Actual Milestone Completion Date
Murray Street Pump Station (Murray St. Wet Weather Storage Project)	056	CSO controlled by December 31, 2017	Outfall Controlled December 2017
North Beach Pump Station (North Beach Wet Weather Storage Project)	048a, 048b	CSO outfall controlled by December 31, 2016	Outfall Controlled December 2016
Hanford #1 (Rainier Valley Wet Weather Storage Project)	031	Construction Completion by December 31, 2019	Construction Completed June 2018
11th Ave. NW/3rd Ave W (Ship Canal Water Quality Project)[1]	004, 008	(For King County) construction completion by December 31, 2025	NA
South Magnolia (South Magnolia Wet Weather Storage Project)[2]	006	Supplemental Compliance Plan required the corrective action be final by December 31, 2018	Corrective action completed December 2018, and project operational
University Regulator Station (Project Name TBD)	015	Submit Facility Plan by December 31, 2023	N/A
West Michigan St. Regulator/Terminal 115 (West Duwamish CSO Control Project)	038, 042	Submit Facility Plan by December 31, 2020	N/A
Dexter Ave. Regulator Station (Dexter Ave. Supplemental Compliance Plan)	009	Submit to Ecology & EPA within 30 days of CD (July 3, 2013)	Supplemental Compliance Plan submitted August 2013; Outfall controlled July 2016
Denny Way Regulator Station (Denny Way Supplemental Compliance Plan)	027a	Submit to Ecology & EPA within 30 days of CD (July 3, 2013) Revised Plan submitted to Ecology August 31, 2016 Completion of modification by December 2018	Modifications completed May 2018; ongoing monitoring to confirm achievement of performance standard.

CSO Name (Project Name)	DSN	Current CD Milestone and Required Date	Actual Milestone Completion Date
Harbor Ave. Regulator Station (Harbor Ave. Supplemental Compliance Plan)	037	Submit to Ecology & EPA within 30 days of CD (July 3, 2013) Revised Plan submitted to Ecology August 31, 2016 Completion of modification by December 2018.	Modifications will be completed by January 2019; Ecology notified of one-month delay. Monitoring for achievement of performance standard will follow.

Notes:

[1] Per October 25, 2016, Non-Material CD Modification. CD Appendix A refers to two stand-alone CSO outfalls, East Ballard (a.k.a. 11th Ave. NW) and 3rd Ave. W and Ewing St. (a.k.a. 3rd Ave. NW). The referenced CD modification allows these two outfalls to be controlled as part of the Ship Canal Water Quality Project in collaboration with the City of Seattle. SPU interim CD milestones will be used to measure progress but are not part of the King County CD modification, because SPU is the project lead and their dates are earlier than the County's CD dates for a joint project in the nonmaterial CD modification.

[2] CD Appendix A refers to this as Magnolia Overflow. Because this project did not meet its performance standard due to a pipeline break, the CD-required Supplemental Compliance Plan was submitted. See project-specific update on page 51.

Figure 3. King County CSO Control Projects

Project Summaries

A summary project status page for 2018 for each active project follows. These project summaries do not include past completed projects or upcoming projects.

Projects in progress include:

- Georgetown Wet Weather Treatment Station
- Rainier Valley Wet Weather Storage
- Ship Canal Water Quality Project
- West Duwamish
- University GSI
- Chelan Ave. CSO Project

CD/CSO Report Project Status

Georgetown Wet Weather Treatment Station

CSO(s): DSN 041 (Brandon St. RS Overflow) and DSN 039 (S. Michigan St. Overflow)
Project Description: Construct a WWTS, associated conveyance, and marine outfall. For more information see: http://www.kingcounty.gov/environment/wtd/Construction/Seattle/BrandonMichiganCSO.aspx.

Milestones	CD Milestone Date (Actual Date)	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Submission of Facilities Plan	12/31/2015 (draft submitted 11/2/2015)											
Completion of Bidding	12/31/2017 (11/30/2017)											
Construction Completion	12/31/2022 (N/A)											
Achievement of Performance Standard	12/31/2024 (N/A)											

2018 Accomplishments:

- Reached Substantial Completion and Final Acceptance on demolition, remediation, and site preparation of the treatment station site.
- Began construction of the treatment station, completed the regulator structure and rigid inclusion ground improvements, began the equalization basin structure, made progress on the treatment and electrical buildings electrical conduits concrete installation, and began yard piping.
- Notice-to-Proceed issued to J.W. Fowler on November 5, 2018 to begin construction of conveyance pipeline. Began installation of conveyance pipeline.
- Notice-to-Proceed issued to Pacific Pile & Marine on January 17, 2018, to begin construction of the outfall. All upland pipe and drop structure were installed.

2018 Challenges and Corrections:

- Treatment Plant construction contract – Due to delays in receiving shoring permits from Seattle Department of Constructions and Inspections, many construction activities were delayed by two months. Schedule adjustments

have also been performed to provide a margin to ensure that the construction can continue as planned.

- Conveyance construction contract – More contaminated soil discovered then estimated in the contract documents.
- Outfall construction contract – Due to numerous differing site conditions, the Contractor was not able to complete the outfall in one fish window.

2019 Activities in Progress or Expected:

- Re-initiate work on the outfall when the second fish window begins.
- Continue construction of conveyance pipeline.
- Continue construction of treatment plant structures and buildings.
- Finish conveyance piping on the treatment plant site.
- Finish regulator structure and turn over this portion of the site to the conveyance contractor.
- Finalize SRF loan agreements.

CD/CSO Report Project Status

Rainier Valley Wet Weather Storage

CSO(s): DSN 031 (Hanford #1 Overflow - Hanford @ Rainier Overflow, Bayview North Overflow, and Bayview South Overflow)
Project Description: Construct CSO Storage Tank and Conveyance Improvements. For more information see:
http://www.kingcounty.gov/environment/wtd/Construction/Seattle/HanfordCSO.aspx.

Milestones	CD Milestone Date (Actual Date)	2013	2014	2015	2016	2017	2018	2019	2020
Submission of Facilities Plan	12/31/2014 (draft 2/28/2014)								
Completion of Bidding	12/31/2016 (5/16/2016)								
Construction Completion	12/31/2019 (N/A)								
Achievement of Performance Standard	12/31/2020 (N/A)								

2018 Accomplishments:

- Substantial completion was achieved on 6/10/2018.
- CD Milestone met.
- Facility was turned over to King County operations.

2018 Challenges and Corrections:

- The Contractor was working on punch list items in order to achieve Final Acceptance.

2019 Activities in Progress or Expected:

- Final Acceptance scheduled for May 2019.
- Monitor for achievement of performance standard.

CD/CSO Report Project Status

Ship Canal Water Quality Project

CSO(s): DSN 004 (3rd Ave. W Outfall) and DSN 008 (11th Ave. NW Outfall)
Project Description: The Ship Canal Water Quality Project (Ship Canal Project) is a joint SPU-WTD project that will control CSOs from SPU's Wallingford, Fremont and Ballard areas (Outfalls 147, 150, 151, 152, and 174) and WTD's 3rd Avenue West (DSN 008) and 11th Avenue Northwest (DSN 004) outfalls.

SPU is the lead agency for design and construction, and will own, operate, and maintain the tunnel and its related structures. (WTD will continue to own its two outfall structures.) WTD is coordinating with SPU on the project through a Joint Project Agreement (JPA) approved by the Seattle and County Councils in July 2016. The JPA guides implementation, operation, and cost-sharing of the Ship Canal Project. The County is providing funding and technical expertise and participates in the JPA mandated Joint Oversight and Project Review and Change Management Committees. This project is in both King County and the City of Seattle's CDs. For more information see:
http://www.seattle.gov/util/EnvironmentConservation/Projects/ShipCanalWaterQuality/index.htm

As project lead, more detail is also provided in SPU's Annual CD/CSO Report.

Milestones	CD Milestone Date (Actual Date)	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
Submission of Draft Facilities Plan	3/31/2017 (1/15/2016)[1]												
Completion of Bidding	7/1/2021 (expected 2019)[2]												
Construction Completion	12/31/2025 [3] (N/A)												
Achievement of Performance Standard	12/31/2026 (N/A)												

Note: CD Milestones and Actual Dates are SPU's except for Construction Completion, which is the same for both agencies. WTD's CD does not have interim milestones for the joint city–county storage tunnel.
[1] The formal County submittal date was 1/22/2016.
[2] The completion of bidding for the tunnel portion is expected to take place in late 2019.
[3] Date represents completion of both the tunnel construction contract and the pump station construction contract.

2018 Accomplishments

- Submitted the Final Facility Plan Addendum including an updated Hydraulic Modeling Report to Ecology in February 2018.
- Submitted the draft (90 percent) design plans and specifications for the storage tunnel, the largest single subproject within the overall Ship Canal Project.
- Submitted final plans and specifications, received approval of final plans and specifications, and began construction on the Ballard Early Work Project, which will prepare the site for the future construction activities for the tunnel and pump station to be located on the site.
- Continued refinements and incorporated design changes to the Integrated Model. This model will be used for evaluating design performance and developing operational strategies. It includes the tunnel system, the County's North Interceptor, upstream flows from University and Montlake basins, and conveyance to West Point.
- Continued progress towards the 60 percent design milestone for the Tunnel Effluent Pump Station (TEPS), the second largest component of the overall project.
- Continued with developing a joint TEPS operational strategy to coordinate effective communications and operations between agencies once the project is completed.
- Integrated the selected construction management (and program support services) consultant into the project team to ensure quality and coordination throughout construction.
- Continued efforts to meet the requirements for a Platinum award level for environmental design using the Envision Rating System.
- Continued with community outreach.

2018 Challenges and Corrections:

- A significant scope change that could result in project savings was proposed and carefully analyzed - eliminating the conveyance line ("Shilshole pipe") from the TEPS to the existing Ballard regulator structure. Thorough modeling and engineering analysis ultimately proved that there was sufficient storage capacity in the tunnel as designed to allow drainage through an existing parallel local conveyance pipe in good condition. The analysis demonstrated that while there would be a marginal increase in tunnel holding times during the larger storms, all outfalls would remain controlled. Interagency cooperation successfully resolved all technical and other issues to achieve this.
- The contractor performing the Ballard Early Work site preparation was quite successful in building a new pier that will be used to barge construction spoils once the tunnel contract starts. Unfortunately, they have had difficulties keeping on

schedule with other aspects of the contract work. SPU staff has been working with them to ensure that they can meet the critical path scheduling needs of the project. Schedule analysis and adjustments have also been performed to provide a margin to ensure that the tunnel construction can start as planned.

2019 Activities in progress or expected:

- Complete the Ballard site preparation contract and be ready to start tunnel construction.
- Advertise, bid, and award the tunnel construction contract, with NTP expected by year-end.
- Finalize all necessary property easements.
- Continue design progress on all remaining aspects of the project, including TEPS and Ballard and Wallingford conveyance (other conveyance contributing to the tunnel is included in the tunnel contract).
- Complete necessary support activities for tunnel construction, including advance utility relocation and temporary power.

CD/CSO Report Project Status

West Duwamish CSO Control

CSO(s): DSN 038 (Terminal 115 Overflow) and DSN 042 (West Michigan Regulator Overflow)
Project Description: Construct a storage tank. For more information see: https://www.kingcounty.gov/depts/dnrp/wtd/capital-projects/active/west-duwamish-cso-control.aspx.

Milestones	CD Milestone Date (Actual Date)	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Submission of Facilities Plan	12/31/2020 (N/A)											
Completion of Bidding	12/31/2022 (N/A)											
Construction Completion	12/31/2025 (N/A)											
Achievement of Performance Standard	(N/A)											

2018 Accomplishments:

- Continued Preliminary Design - Baseline Design process.
- Pursued acquisition of proposed storage tank property.
- Continued community briefings through project website and mailings.

2018 Challenges and Corrections:

- None.

2019 Activities in Progress or Expected:

- Continue Preliminary Design - Baseline Design process.
- Complete acquisition of proposed storage tank property.
- Continue community briefings through project website and mailings.

CD/CSO Report Project Status

University Green Stormwater Infrastructure

CSO(s): DSN 015 (University RS Overflow)
Project Description: Construct GSI to minimize the gray infrastructure demands needed to achieve full CSO control. The timeline below corresponds to the CD's timeline for complete control of the University RS Overflow. For more information see: https://www.kingcounty.gov/depts/dnrp/wtd/capital-projects/active/university-gsi.aspx.

Milestones	CD Milestone Date (Actual Date)	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Submission of Facilities Plan [1]	12/31/2023 (N/A)												
Submission of Final Plans & Specifications	12/31/2025 (N/A)												
Start of Construction	N/A												
Construction Completion	12/31/2028 (N/A)												
Achievement of Performance Standard	N/A												

[1] An optional Green for Gray substitution report would be required by 12/31/22.

2018 Accomplishments:
- Preliminary Design - Alternatives Analysis continued throughout 2018.
- Continued community briefings through project website and mailings.

2018 Challenges and Corrections:
- None.

2019 Activities in Progress or Expected:
- Continue Preliminary Design - Alternatives Analysis process completion is expected in Q3 2019.
- Continue community briefings through project website and mailings.

CD/CSO Report Project Status

Chelan Avenue CSO Control Project

CSO(s): DSN 036 (Chelan Ave. RS Overflow)

Project Description: This project will control the Chelan Avenue combined sewer overflow to one event per year on a 20-year rolling average. It includes the siting, design, and construction of a buried storage tank or tunnel to hold approximately 4.3 MG of combined sewage; a pump station of approximately 7.7 MGD; and above-grade support facilities likely to include a facilities building, odor control, emergency generation, flow diversion, and discharge.
For more information see: https://www.kingcounty.gov/depts/dnrp/wtd/capital-projects/active/chelan-cso-control.aspx.

Milestones	CD Milestone Date (Actual Date)	2017	2018	2019	2020	2021	2022	2023	2024	2025
Submission of Facilities Plan	12/31/2018 (N/A)									
Submission of Final Plans & Specifications	N/A									
Start of Construction	12/31/2020 (N/A)									
Construction Completion	12/31/2023 (N/A)									
Achievement of Performance Standard	N/A									

2018 Accomplishments:

- SPU and WTD have identified a potential partnering opportunity to control both WTD's Chelan Avenue CSO and SPU's Delridge 99 CSO. Negotiations will continue as the project progresses.
- Acquisition of property for proposed site.
- Completed and submitted draft Facility Plan to Washington State Department of Ecology.

2018 Challenges and Corrections:

- No challenges were identified, and no corrections were required.

2019 Activities in Progress or Expected:

- Continue evaluating design alternatives that meet long-term strategic CSO reduction goals.

3.1 Supplemental Compliance Plan Summaries

A status page for each project under a Supplemental Compliance Plan follows.

Projects with active Supplemental Compliance Plans include:

- Barton Roadside Raingardens
- Denny Way RS Overflow
- Harbor Avenue RS Overflow
- South Magnolia Wet Weather Storage and Pipeline

CD/CSO Report Project Status

Barton St. Roadside Raingardens

CSO(s): DSN 057 (Barton St. PS Overflow)
Project Description: Construct GSI (bioretention swales and associated drainage structures) and underground injection control (UIC) wells for CSO control. The project did not initially meet the performance standard (an average of one uncontrolled CSO event per year on a 20-year moving average), and King County submitted a supplemental compliance plan in April 2018. For more information see: http://www.kingcounty.gov/environment/wtd/Construction/Seattle/BartonCSO-GSI.aspx.

2018 Accomplishments:

- King County staff continued to monitor compliance.

2018 Challenges and Corrections:

- Did not meet performance standard, requiring submittal of a supplemental compliance plan in April 2018. Lack of significant rain events to observe whether performance has improved remains a challenge.

2019 Activities in Progress or Expected:

- Completed modeling of operational improvements; determine whether Barton PS Overflow is controlled to the Consent Decree performance standard by March 2019.
- Further control optimization of the pump station will be done and monitoring during the wet season to determine compliance will be performed.
- Report progress on these measures as a part of each annual report for 2018, 2019 and 2020.

CD/CSO Report Supplemental Compliance Plan Status

Denny Way Regulator Station Overflow

CSO(s): DSN 027a (Denny Way RS Overflow)
Project Description: Adjust facilities built in 2005 to achieve final control per the Supplemental Compliance Plan included in the 2011 TM 970 and updated to Ecology and EPA in 2012. 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 set point by 2.25 feet and improve flow into the Elliott West facility. The weir modifications were completed in July 2011 and pumping strategy modifications were completed on November 17, 2011. Additional work on the pumping strategy was completed in the fall of 2015. Monitoring in 2016 still showed control issues with Denny Way and additional adjustments to pumping strategy were made in December 2016 and monitored over two wet-seasons. Model updates are scheduled to be complete by the end of 2019.

2018 Activities:

- Monitor compliance at Denny Way RS.
- Continued modeling of the pumping system at Elliott West.

2018 Challenges and Corrections:

- Operational fixes are implemented and up to an additional year is needed to monitor results. King County needs to monitor operations during major winter storms.

2019 Activities in Progress or Expected:

- Complete the model and begin to make operational adjustments.
- Monitor compliance at Denny Way RS.

CD/CSO Report Supplemental Compliance Plan Status

Harbor Avenue Regulator Station Overflow

CSO(s): DSN 037 (Harbor Ave. RS Overflow)
Project Description: A Revised Supplemental Compliance Plan was submitted October 15, 2016 (and approved by Ecology December 14, 2016). This committed WTD to construction and installation of a new gate actuator, modifications to electrical system and structural changes, to be completed by January 2019.

The regulator station did not achieve control in 2018. Revised modeling of the station found that if the CSO gate could open in one minute or less, the station would likely achieve control. A project was initiated to install a new actuator and incorporate associated modifications to the CSO gate operation.

2018 Activities:

- Ensured availability of adequate power to the regulator station to power a new actuator.
- Completed design.
- Procured actuator and contractor.
- Notified the Department of Ecology that work would be ongoing beyond December 31, 2018.

2019 Activities in Progress or Expected

- Start construction.
- Achieve substantial completion and final acceptance by January 31, 2019.
- Monitor compliance at Harbor Avenue Regulator Station.

CD/CSO Report Supplemental Compliance Plan Status

South Magnolia Wet Weather Storage and Pipeline

CSO(s): DSN 006 (S. Magnolia Overflow)
Project Description: Investigate solution to pipe break in the CSO conveyance pipe that was first discovered in fall 2016. A Supplemental Compliance Plan was submitted in January 2017 to comply with the CD deadline for notifications.
For more information see:
http://www.kingcounty.gov/environment/wtd/Construction/Seattle/SMagnoliaCSOStorage.aspx.

2018 Accomplishments:

- Implemented contractor's Corrective Action Plan (CAP) to restore project to controlled status.
- Provided Annual Report update on South Magnolia status.
- Submitted Supplemental Compliance Plan addendum (April 24, 2018) once the CAP expected schedule and actions were known.
- South Magnolia CSO Control Facility brought back online (late-December 2018).
- Submitted remaining State Revolving Fund documents to Ecology for the project.
- Completed as-built drawings for the constructed storage facility.
- Notified the Department of Ecology that work would be completed by December 31, 2019. (Supplemental Compliance Plan SCP Addendum stated September 2018.)

2018 Challenges and Corrections:

- Implementation of the CAP was a challenging, technical, logistical, and community stakeholder process that resulted in successful installation of the new pipe.
- Because of the pipe break and timing of the Supplemental Compliance Plan Addendum's CAP implementation, CSO Outfall 006 did not achieve performance standard compliance in 2018.

2019 Activities in Progress or Expected:

- Continue overflow performance monitoring to verify that the facilities are achieving CSO performance standard as intended.
- Complete above-ground restoration activities associated with implementation of the CAP.
- Report actual and modeled performance in 2019 CSO/CD Annual Report.

3.2 Program Plan Summaries

The CD required development and implementation of two plans: the SSOP and the Joint Operations and System Optimization Plan with the City of Seattle.

3.2.1 Sewer System Operations Plan

WTD submitted the SSOP on September 27, 2013. Ecology and EPA approved the SSOP on May 29, 2014 and July 29, 2014, respectively. The SSOP is an electronic, interactive document with imbedded links to the most current base documents, such as O&M manuals, plant manuals, safety plans, and maps. King County staff typically access the SSOP from the County's intranet site. Portable storage device (thumb drive) versions are also provided at each facility and to key staff for access in the field or from home. Once a year in August, the team representatives of Operations, Offsite, and CSO control planning go over the plan to ensure that the electronic links still work. In 2019, WTD will review the SSOP to ensure that base documents are being updated as needed, and that any new or changed information is reflected in the SSOP. Thumb drives will be replaced as needed.

3.2.2 Joint Operations and System Optimization Plan

The City of Seattle's and King County's CDs direct both agencies to work together to develop a single Joint Operations and System Optimization Plan. Staff from King County's DNRP and SPU focused on areas in the system that have the greatest potential for operational optimization and developed a set of multi-basin joint commitments. These commitments were approved by the Director of SPU's Drainage and Wastewater Line of Business and the Director of DNRP's WTD and were included in the Joint Operations and System Optimization Plan submitted to EPA and Ecology on February 10, 2016. Comments were received from EPA and Ecology and a revised plan was submitted on February 23, 2017. The following describes each commitment and the progress SPU and DNRP made in 2018:

- The Joint System Debrief Committee commitment is to evaluate performance of the SPU and DNRP systems, identify interconnections to improve operations, and share information after major storm events. To coordinate for the 2018/2019 wet season, a meeting was held in October 2018 to discuss pre-season maintenance activities, system changes, meteorological information, and emergency communication protocols.
- The Data Sharing commitment is supported by four activities: the formation of the Joint Operations Information Sharing Team (JOIST), implementation of a pilot project for sharing real-time SCADA data, development of data sharing protocols, and the improvement of regional ability to forecast storms and rainfall intensities.

  - JOIST held four meetings during which SPU and DNRP staff conducted tours of both SPU and DNRP facilities and shared information on the operation of existing facilities, progress of capital projects, and coordination of Joint Operations and System Optimization Plan commitments.
  - The SPU and DNRP data sharing committee established standard operating procedures for sharing information and to facilitate data transfer as requested. An annual data review workshop was held in June to review flow monitoring data collected by each agency and provide recommendations for future monitoring. Additionally, a mapping tool was developed to display SPU's and DNRP's flow monitoring locations in the system.
  - A Real-Time Data Sharing Pilot established a framework for real-time data sharing and resulted in development of a secure connection between DNRP's and SPU's Supervisory Control and Data Acquisition (SCADA) systems for the Windermere/ University basin where both DNRP and SPU have pump stations and CSO control facilities. A joint project team completed an options analysis of a permanent data sharing platform. SPU and DNRP are coordinating to complete the analysis in 2019 and begin implementing the recommendations to support future data sharing between other portions of SPU's and DNRP's SCADA systems.
  - Improved Rainfall Data for Forecasting with additional gauges. DNRP and SPU exchanged internal operational weather forecasts and impacts information. Both agencies worked together to incorporate climate change model output, including new projections of changing heavy precipitation, to better understand future impacts of intense rainfall on the wastewater systems. SPU and DNRP continued to engage the research community and co-develop predictive tools to enable operational adjustments to mitigate CSO and flooding events.

- The Joint Modeling Coordination Committee commitment is to share modeling tools and increase understanding of modeling analyses and system operation while developing stronger working relationships between DNRP and SPU modeling staff and improving efficiencies through better coordination efforts. Members of the Joint Modeling Coordination Committee held meetings in 2018 to review modeling results and coordinate model developments between each agency. Work activity continued to focus on development and application of the MIKE URBAN model of the North Interceptor system incorporating the proposed joint Ship Canal Water Quality Project Facility. A joint modeling work plan was developed by the Joint Modeling Coordination Committee in 2018. This plan is

intended to provide a framework for coordination and communication for upcoming modeling work.

- The Coordination during startup and commissioning of CSO Control Facilities commitment is to conduct document review, attend commissioning meetings, and implement data sharing for SPU and DNRP CSO control facilities. In 2018, SPU staff toured the DNRP Rainier Valley Wet Weather Facility that was commissioned this year.
- The Real Time CSO Notification commitment is to improve both onsite signs and website information to improve notification of CSO events and communication with customers. In 2018, SPU and DNRP finished an updated design for signs identifying CSO outfalls. The design includes the website address to obtain CSO status, multiple languages, a larger size for visibility, and a new phone number directed to SPU's Operations Response Center, which will serve as a single point of contact for both SPU and DNRP CSO outfalls located in the City of Seattle. Sign fabrication and installation is expected to begin in 2019.
- The Reduce Saltwater Intrusion commitment is continuing to work together on studies, data and solutions for reducing intrusion. In 2018, DNRP installed two continuous saltwater monitors in their system and plans to share the data with SPU. DNRP will continue to monitor saltwater in the conveyance system to monitor progress and identify any new sources of saltwater intrusion.

The Consent Decree requires that the Joint Operations and System Optimization Plan is reviewed every three years and updated as necessary to ensure the optimal level of coordination and information sharing between SPU and DNRP. In 2018, SPU and DNRP worked together to update the Joint Operations and System Optimization Plan through a series of meetings and internal reviews. The update includes new or revised information on each agency's organization, the addition of the System Operations Oversight Committee chartered in 2017, progress and accomplishments related to all joint commitments, and minor revisions to the JOIST commitment to allow discussion of technical resource sharing and voluntary job shadowing. The update was reviewed by DNRP and SPU management and will be submitted to Ecology and EPA in January 2019.

3.2.3 WTD and SPU Coordination on CSO Control Projects

WTD and SPU have been working together for many years to identify joint project and operational opportunities to improve each agency's efforts and better protect public health and the environment. The two agencies have agreed to guiding principles to ensure that neither agency will adversely impact the compliance of the other.

Given that SPU's combined sewers are upstream of King County's system, new or improved SPU CSO control facilities have the potential to affect flows in King County's regional system. For this reason, SPU and WTD coordinate before and after

construction of capital projects. Below is a list of projects constructed by SPU in recent years:

- Windermere – NPDES 13 and 15: construction completed in July 2015 with flows to the regional system in March 2015 (flows started during commissioning). Supplemental compliance measures were implemented in 2018.

WTD and the City of Seattle have monitoring in place for those Seattle projects with the potential to impact flows in the regional system. WTD will continue working with SPU on control and operational strategies as SPU starts up and continues operating Genesee, Delridge, North Union Bay, Leschi, South Park, Windermere, and the remaining components of the Henderson projects.

SPU and WTD continue to work together to ensure GSI projects in the City of Seattle use a consistent approach, per the GSI Memorandum of Agreement signed by the two agencies in 2013. The term *GSI* describes a variety of measures that use soil to absorb stormwater or slow the rate of stormwater entering the combined sewer system. GSI solutions control the sources of pollution by slowing, detaining, or retaining stormwater so that it does not carry runoff into nearby waterways. GSI projects reduce the volume and timing of flows into the combined sewer system. GSI facilities also are referred to as “natural drainage systems” and can be a component of low impact development. Collaborative work between WTD and SPU in 2018 included:

- Improving user access and updating multiple web resources in a jointly managed internet site: http://www.700milliongallons.org/.
- Incorporating lessons learned from SPU and WTD projects to improve future projects.
- Finalizing Volume III (Design Phase), issuing a draft final of Volume V (Operations & Maintenance) that addressed issues identified during finalization of Volume III, and initiating the update of Volume II (Options Analysis) of the joint SPU/DNRP Green Stormwater Infrastructure (GSI) Manuals.

Lastly, SPU and WTD are working closely on the Ship Canal Water Quality Project, a joint project that will control WTD’s 11th Ave. NW and 3rd Ave. W. CSOs and SPU Basins 147, 150/151, 152, and 174. Coordination for this project is ongoing, and the status of this joint project is described in Section 3.1 of this report.

4 Summary of Rainfall and CSO Events

King County measures rainfall in the Seattle area at many of its regulator stations, pump stations, overflow locations, and at West Point. It also monitors the frequencies and volumes of both untreated and treated CSOs at all of its permitted CSO locations.

This section describes rainfall data and reports on unpermitted overflows and summarizes frequency and volume for all untreated and treated CSO discharges in 2018. Additional information can be found in the appendices.

4.1 Annual Rainfall

Rainfall data are reported for each CSO event as measured by the nearest King County-owned rain gauge. Rainfall data for 2018 are included in Appendices A and B. The annual rainfall for 2018, as an average over local rain gauges, was 33.95 inches. The annual rainfall at Sea-Tac Airport was 35.73 inches, which is below the 20-year Sea-Tac Airport annual average of 37.59 inches. This broke the streak of four consecutive years of above average rainfall. Long-term, WTD will be looking at how storms over the last 20 years may compare to storms of the next 60 years. WTD is funding work at the University of Washington Climate Impacts Group to analyze impacts on precipitation over the next century.

4.2 Unpermitted Overflows

Overflows can occur from CSO structures, broken pipelines, and maintenance holes. Unpermitted overflows can be of three types: DWOs, exacerbated CSOs, or sewer overflows (SSOs).

Overflows in the combined system to CSO outfalls that occur beyond 24 hours after rainfall has ceased are called DWOs. In King County's system, when DWOs occur, they are usually a result of mechanical failures, power outages, or human error. Under EPA's Nine Minimum Controls, DWOs are to be prevented.

Overflows in controlled or uncontrolled basins to CSO outfalls that are increased or extended in duration as a result of mechanical failures, power outages, or human error, are referred to as "exacerbated CSOs."

The release of sanitary or combined flows at any location in the conveyance system other than the designated CSO outfalls, regardless of the basin's "control" status, presence/absence of precipitation or existing high flow events, or causes due to mechanical failures, power outages, or human error, are referred to as *SSOs*. Additionally, the CD defines an SSO as "any overflow, spill, diversion, or release of

wastewater from or caused by the Sanitary Sewer System or the Combined Sewer System" to surface waters of the state or United States, or to land. However, it is not considered an SSO when a wastewater release occurs on land where the overflow is completely contained in a system designed for the purpose of wastewater containment during construction activity.

In 2018, there were no exacerbated CSOs, DWOs, or SSOs within the combined basin facilities associated with any of King County's operations.

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 12 CSO locations not currently monitored by SCADA or to supplement SCADA monitoring: 11th Ave. NW Overflow, 3rd Ave. W and Ewing Street Overflow, 30th Ave. NE Overflow, Southwest Alaska Street Overflow (SW Alaska St. Overflow), Bayview North Overflow (Bayview N Overflow), Bayview South Overflow (Bayview S Overflow), East Duwamish Pump Station Overflow (E Duwamish PS Overflow), W Duwamish Overflow, Hanford @ Rainier Overflow, S Magnolia Overflow, North Beach PS Inlet Overflow, and Terminal 115 Overflow.

Hydraulic modeling predicts that King County CSOs will discharge 800 MG of untreated CSO in an average year of rainfall. In 2018, there were 29 storm events resulting in untreated CSO discharges. Some storm events spanned multiple days, and, at times, there were multiple discharges on the same day. Conditions in 2018 resulted in 160 untreated CSO events discharging about 839 MG and 36 treated CSO events discharging 333 MG, including West Point CSO events. This volume is near the predicted volume during a normal rainfall year. The highest precipitation occurred in January (8.12 inches) and resulted in 53 untreated events and 324 MG. The second highest precipitation occurred in December (6.08 inches), resulting in 24 untreated events and an overflow volume of 71 MG.

Appendix A lists the untreated events from County CSOs during 2018. These data are also provided in electronic form to Ecology with this report.

4.4 CSO Treatment

King County provides CSO treatment, defined in Chapter 173-245 WAC as "equivalent to primary" treatment and disinfection, at West Point for flows above its secondary capacity of 300 MGD and at four satellite facilities: Alki, Carkeek, Elliott West, and Henderson/MLK Jr. Way WWTSs.

The following sections summarize performance and compliance at each facility during 2018. Appendix B of this report provides more detail on volumes and events. Appendices C through F contain the annual reports for each WWTS.

4.4.1 West Point Treatment Plant CSO-related Events

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), West Point provides CSO treatment for flows above 300 MGD and up to a designed instantaneous peak of 440 MGD. Where captured CSOs cannot be conveyed to regional treatment plants because of conveyance system limitations, flows are conveyed to WWTSs or are discharged untreated. CSO treatment at West Point consists of blending primary treated flows (between 300 and 440 MGD) with full secondary treated flows (up to 300 MGD), followed by disinfection, dechlorination, and discharge of the final effluent from the deep marine outfall. The resulting effluent must meet secondary effluent quality limits, with a small reduction (i.e., 80 percent instead of 85 percent) in the monthly removal requirements of TSS during the typical wet season months of November through April. This practice is accepted by Ecology, provides a high level of treatment to CSO flows, and reduces program costs and impact to local waterbodies. West Point had 26 CSO treatment events during 2018. The total volume was 215.47 MG. All occurrences are listed in Appendix B.

Occasionally during either dry or wet weather conditions, power and equipment failures can result in secondary diversions that occur via CSO gates at West Point. During such events, flow from the primary treatment bypasses the secondary treatment system directly to the chlorine disinfection basins, and all final effluent is dechlorinated as usual. Secondary diversions are necessary to prevent exposure of workers to safety hazards and facility damage. In 2018, there were seven secondary diversions. These secondary diversions were short duration events where the bypassed flow mixes with substantial ongoing secondary treated flows entering the disinfection basin. The secondary diversion events did not result in exceedances of permit effluent limits in the final effluent that is discharged to Puget Sound.

4.4.2 Alki Wet Weather Treatment Station

The transfer of Alki area base flows to West Point was completed in 1998, and conversion of the Alki Treatment Plant from a continuously operating primary plant to a WWTS was completed in 2001. In 2018, there were 12 filling events and five discharge events. The Alki WWTS received 33.7 MG and discharged 19.7 MG.

Overall, TSS removal was 39.5 percent for 2018, which did not meet the annual 50 percent TSS removal limit. The annual average settleable solids (SS) was 0.12 milliliter per liter per hour (ml/L/hr), which met the SS limit of 0.3 ml/L/hr. The Alki WWTS did not

meet the instantaneous minimum pH less than 6.0 for two discharge days out of five days of discharges. In addition, Alki's effluent met the daily maximum average total residual chlorine (TRC) permit limit of 234 micrograms per liter (µg/L) on all five discharge days. Alki WWTS met the monthly fecal coliform geomean permit limit of 400 counts/ 100 ml during each month of discharge at Alki WWTS. More detail is available in Appendix C.

4.4.3 Carkeek Wet Weather Treatment Station

The transfer of Carkeek area base flows to West Point and the conversion of the Carkeek Treatment Plant from a continuously operating primary plant to a WWTS was completed in 1994. In 2018, Carkeek WWTS had ten filling events and four discharge events. The Carkeek WWTS received 4.5 MG and discharged 1.8 MG.

Overall, TSS percent removal was 79.5 percent in 2017, thereby meeting the NPDES permit limit of 50 percent for annual removal. Carkeek WWTS met its annual average SS limit with the average measured as 0.10 ml/L/hr, with the NPDES permit limit being 0.3 ml/L/hr. All remaining NPDES permit limits were met at Carkeek WWTS. More detail is available in Appendix D.

4.4.4 Elliott West Wet Weather Treatment Station

The Elliott West WWTS was brought online in May 2005 as a joint project with Seattle's East Lake Union CSO control projects. In 2018, there were 31 inflow events totaling 255 MG and seven discharge events totaling 95.6 MG, treated and discharged through the Elliott West Outfall at the Denny Way RS.

Overall, TSS removal was 49.4 percent for the year, thereby not meeting the NPDES 50 percent annual average TSS removal limit. Elliott West WWTS also did not meet the SS annual event average limit, with the average measured as 2.6 ml/L/hr and the NPDES permit limit being 0.3 ml/L/hr. Elliott West WWTS had permit violations for fecal coliform monthly geomean, maximum daily average total residual chlorine (TRC) and daily instantaneous minimum pH in 2018. There also was a disinfection failure in April during a CSO event when the chlorine disinfection pumps ceased for about 4 MG of the CSO discharge event. Operators worked diligently to troubleshoot the problem and restored pumping after about three hours by resetting the electrical process control. Elliott West WWTS performance limitations are being addressed through an assessment report (to be completed in 2019) to determine a plan for long term compliance. Operational efforts continue as well to improve compliance efforts. More detail can be found in Appendix E.

4.4.5 Henderson/MLK Jr. Way Wet Weather Treatment Station

The Henderson/MLK Jr. Way WWTS was brought online in May 2005. The Henderson/MLK Jr. Way WWTS had three filling events and one discharge event during 2018. The Henderson/MLK Jr. Way WWTS received a total inflow of 8.62 MG and discharged 3.6 MG of treated water through the Norfolk Street Overflow to the Duwamish Waterway.

Overall, TSS removal was 86 percent for the year, thereby meeting the NPDES 50 percent annual average TSS removal limit. The annual average effluent settleable solids was below the permit limit of 0.3 ml/L/hr.

There were no exceptions to the minimum pH limit, the maximum daily TRC limit, nor the monthly fecal coliform bacteria. Improvement projects have been in progress to increase the consistency in meeting NPDES permit requirements. More detail is available in Appendix F.

5 Summary of Consent Decree and NPDES Violations in 2018

Section VIII. 43 of the CD requires the listing of any violations of the CD in the annual report. Table 3 identifies CD violations in 2018 and related exceedances of NPDES wet-weather permit requirements for the CSO system.

Details on causes and corrective actions are provided in Appendices C through F. All notifications to Ecology were made in a timely manner.

Table 3. Summary of Effluent Limitation* and Consent Decree Violations in 2018

Date of Event	Facility	Description of Violation(s)
1/11/18	Elliott West WWTS	Total chlorine residual
1/11/18	Elliott West WWTS	pH
1/17/18	Elliott West WWTS	Total chlorine residual
1/17/18	Elliott West WWTS	pH
1/18/18	Elliott West WWTS	pH
1/29/18	Elliott West WWTS	pH
4/15/18	Elliott West WWTS	Disinfection failure
10/27/18	Alki WWTS	pH
11/26/18	Alki WWTS	pH
11/26/18	Elliott West WWTS	Total chlorine residual
11/26/18	Elliott West WWTS	pH
11/27/18	Elliott West WWTS	Total chlorine residual
11/27/18	Elliott West WWTS	pH
December 2018	Elliott West WWTS	Monthly fecal coliform
2018 annual	Alki WWTS	Annual average TSS removal
2018 annual	Elliott West WWTS	Annual average TSS removal
2018 annual	Elliott West WWTS	Annual average SS

* pH effluent limits and disinfection failures are specified in the NPDES permit but are not specified as violations subject to stipulated penalties under the CD.

6 Control Status of CSO Locations

6.1 Twenty-year Moving Average of Event Frequencies

The NPDES permit for West Point, effective July 1, 2009, implemented a new interpretation of the performance standard for CSO control, which is derived from the Washington state regulatory requirements for "greatest reasonable reduction" as specified in WAC 173-245-022(22). The CD recognizes this performance level. This standard of "not more than one untreated discharge event per year per outfall on average" is 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 4). This moving average is used each year to assess compliance with the performance standard. However, since the upgraded SCADA system was fully brought online in 2005 and began to report data for all sites over time, a full 20 years of data are not available for all sites. Locations lacking the full 20 years of measured data are noted. For sites where new control facilities have been built and lack the 20 years of measured data, the table substitutes modeled data of the new facilities simulated performance with the historic rainfall over those years for the unavailable measured data. For sites not identified as controlled, only available measured data are reported.

The following 19 CSOs were identified as controlled through the monitoring and modeling data:

1. 30th Avenue Northeast Overflow (30th Ave. NE)
2. 53rd Avenue Southwest Pump Station Overflow (53rd Ave. SW PS)
3. 8th Avenue South Overflow (8th Ave. S)
4. Ballard Siphon Overflow
5. Canal Street Overflow (Canal St.)
6. Dexter Ave. Regulator Station Overflow (Dexter Ave. RS)
7. East Duwamish Pump Station Overflow (E Duwamish PS)
8. East Marginal Way Pump Station Overflow (E Marginal Way PS)
9. East Pine Street Pump Station Overflow (E Pine St. PS)
10. Henderson Street Pump Station Overflow (Henderson St. PS)
11. Martin Luther King Junior Way Overflow (MLK Jr. Way)
12. Matthews Park Pump Station Overflow (Matthews Park PS)
13. Murray Pump Station Overflow (Murray PS)
14. Norfolk Street Overflow (Norfolk St.)
15. North Beach Pump Station Inlet Overflow (North Beach PS Inlet)
16. North Beach Pump Station Wet Well Overflow (North Beach PS Wet Well)
17. Rainier Avenue Pump Station Overflow (Rainier Ave. PS)
18. Southwest Alaska Street Overflow (SW Alaska St.)

19. West Duwamish Overflow (W Duwamish)

The following 15 CSOs were identified as uncontrolled through the monitoring and modeling data:

1. 11th Avenue Northwest Overflow (11th Ave NW)
2. 3rd Avenue West Overflow (3rd Ave W)
3. 63rd Avenue Southwest Overflow (63rd Ave SW)
4. Belvoir Pump Station Overflow (Belvoir PS)
5. Brandon Street Regulator Station Overflow (Brandon St. RS)
6. Chelan Avenue Regulator Station Overflow (Chelan Ave RS)
7. Hanford #2 Regulator Station Overflow (Hanford #2 RS)
8. King Street Regulator Station Overflow (King St RS)
9. Kingdome Regulator Station Overflow (Kingdome RS)
10. Lander Street Regulator Station Overflow (Lander St. RS)
11. Montlake Regulator Station Overflow (Montlake RS)
12. South Michigan Street Regulator Station Overflow (S Michigan St. RS)
13. Terminal 115 Overflow
14. University Regulator Station Overflow (University RS)
15. West Michigan Street Regulator Station Overflow (W Michigan St. RS)

The following 5 CSOs were identified as needing further monitoring to determine their control status:

1. Denny Way Regulator Station Overflow (Denny Way RS)
2. Barton Street Pump Station Overflow (Barton St. PS)
3. Hanford #1 Overflow
4. Harbor Avenue Regulator Station Overflow (Harbor Ave RS)
5. South Magnolia Overflow (S Magnolia)

6.2 Changes to Control Status of CSO Locations

In a letter submitted to DOE in December 2017, WTD outlined the status of compliance for the Belvoir PS Overflow. Belvoir PS Overflow, which is within King County's CSO system, has historically been reported as controlled. However, updated modeling indicates that the CSO frequency has increased due to hydraulic and hydrologic changes upstream of the pump station. As of 2016, Belvoir PS Overflow (No. 012) does not meet the CSO control performance standard.

WTD and SPU recognize that hydraulic and hydrologic changes have affected compliance at the Belvoir PS Overflow. WTD is committed to coordinating and developing mutually beneficial solutions with SPU. This includes working with SPU to

meet the approach and schedule included in SPU's approved Windermere Basins 13 and 15 Supplemental Compliance Plans, dated December 7, 2016 and April 18, 2018, respectively. In addition, SPU and King County are working together to develop strategies for controlling Belvoir as part of WTD's LTCP planning. SPU is a member of WTD's planning team. The goal is to develop a preferred strategy and implementation schedule as part of WTD's next LTCP Update.

The 63rd Avenue Southwest Pump Station (63rd Ave. SW PS) Outfall, which is within King County's CSO system, has historically been reported as controlled. However, in 2017, monitoring data indicated that the CSO frequency increased because of hydraulic changes. As of 2017, the 63rd Ave. SW PS Outfall (No. 054) does not meet the CSO control performance standard.

Actions to improve compliance include the optimizing of the West Seattle portion of CSO system, which includes operating the Alki WWTS more frequently. Recent improvements have also been made to the 63rd Ave. SW PS, including changing two constant speed pumps to variable speed pumps as well as electrical and control upgrades. These upgrades will increase operating flexibility and improve performance of the 63rd Ave. SW PS and the Alki WWTS when optimization is complete. A comprehensive computer model of the West Seattle System was completed in 2018, and it is being used to optimize operations by 2020. Operations staff will continue to monitor and work to maintain control of the 63rd Ave. SW PS during the optimization period.

This page intentionally left blank.

Table 4. King County Untreated CSO Events, Averages, and Baselines, 1998–2017

Overflow Name	Discharge Serial Number (DSN)	1999 [a]	2000[b]	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	20-Year Average[c]	1983 Baseline (24-hr inter-event)
11th Ave. NW[d]	004	12	14	14	8	8	6	11	22	10	7	16	19	16	20	12	25	17	22	21	13	**14.7**	16
30th Ave. NE	049	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	5	0	3	1	1	2	3	1	0	1	**0.9**	1
3rd Ave. W[e]	008	4	1	11	4	6	4	5	13	6	3	9	8	7	13	5	12	7	5	6	7	**6.8**	17
53rd Ave. SW PS[f]	052	NM	0	0	0	0	0	0	2	1	0	0	0	0	1	0	0	0	0	1	0	**0.3**	<1
63rd Ave. SW	054	NM	0	0	0	2	0	1	0	0	0	0	1	1	3	2	2	4	5	4	1	**1.4**	2
8th Ave. S	040	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	**0.1**	6
Ballard Siphon[g]	003	*0*	*0*	*0*	*0*	*0*	*0*	*1*	*0*	*0*	*0*	*0*	*0*	*1*	*0*	*0*	2	0	0	0	0	**0.2**	13
Barton St. PS[f]	057	2	0	3	0	2	1	2	2	1	1	3	1	0	2	3	0	2	2	2	2	**1.6**	9
Belvoir PS	012	0	0	0	0	4	0	0	1	1	0	5	1	2	2	2	2	5	2	2	1	**1.5**	1
Brandon St. RS[h]	041	32	30	30	21	28	21	27	11	NM	3	16	11	7	12	7	16	14	12	6	3	**16.2**	36
Canal St.	007	0	1	0	0	0	0	0	0	1	0	1	1	0	1	0	1	1	0	0	0	**0.4**	1
Chelan Ave. RS	036	5	2	7	2	3	1	2	5	2	0	0	3	4	13	4	13	13	9	10	8	**5.3**	7
Denny Way RS	027a	23	25	26	15	25	20	11	9	1	2	4	2	2	1	2	1	5	1	3	0	**8.9**	32
Dexter Ave. RS	009	0	0	1	0	0	1	0	1	1	0	0	0	0	0	0	1	1	0	0	0	**0.3**	15
E Duwamish PS[d]	034	0	0	0	0	0	0	1	0	1	0	0	1	0	0	0	0	0	0	0	0	**0.2**	1
E Marginal Way PS	043	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.0**	1
E Pine St.	011	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.0**	1
Hanford #1[d,i]	031a	5	0	0	3	6	8	NM	16	4	6	14	13	13	18	10	26	16	22	13	8	**10.6**	30
Hanford #2 RS	032	18	17	13	10	12	16	15	26	12	8	17	17	15	23	9	27	16	24	18	17	**16.5**	28
Harbor Ave. RS[j]	037	0	0	2	0	2	0	3	5	2	0	0	1	1	3	2	1	4	2	3	1	**1.6**	30
Henderson St. PS[k]	045	*0*	*0*	*0*	*0*	*0*	*0*	*0*	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.0**	12
King St. RS	028	14	10	14	12	16	15	20	27	7	3	15	18	15	13	2	23	19	14	3	4	**13.2**	16
Kingdome RS	029	0	1	0	0	0	2	5	4	5	1	8	6	2	11	6	22	17	12	16	15	**6.7**	29

Control Status of CSO Locations

Overflow Name	Discharge Serial Number (DSN)	1999 [a]	2000 [b]	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	20-Year Average [c]	1983 Baseline (24-hr inter-event)
Lander St. RS	030	15	11	10	10	12	9	8	28	8	6	19	17	15	25	8	29	17	25	21	19	**15.6**	26
Matthews Park PS	018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.0**	1
MLK Jr. Way [l]	013	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.0**	16
Montlake RS	014	0	2	0	5	11	5	6	NM	0	1	3	10	8	18	7	20	15	16	12	7	**7.7**	6
Murray PS [f]	056	0	1	2	0	2	1	0	1	2	1	0	1	0	1	2	1	2	0	1	1	**1.0**	5
Norfolk St. [l]	044a	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	**0.1**	20
North Beach PS Inlet [d]	048b	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	0	1	1	**0.1**	18
North Beach PS Wet Well [l]	048a	0	0	1	0	2	0	0	0	1	0	0	1	2	1	1	1	2	1	3	1	**0.9**	18
Rainier Ave. PS	033	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.0**	1
S Magnolia [d]	006	5	0	0	5	18	17	26	30	21	26	25	38	22	36	16	38	23	15	30	21	**20.6**	25
S Michigan St. RS	042	10	8	12	8	9	6	5	13	5	3	10	12	14	16	8	26	17	16	13	17	**11.4**	5
SW Alaska St. [d]	055	0	0	0	0	0	0	0	1	1	1	0	1	1	1	0	0	0	0	0	0	**0.3**	1
Terminal 115 [d,m]	038	NM	NM	NM	NM	2	0	2	7	4	0	3	3	0	1	1	0	1	1	2	1	**1.8**	4
University RS	015	4	3	5	4	4	4	3	12	5	3	9	8	6	13	4	14	11	9	7	7	**6.8**	13
W Duwamish [d]	035	NM	NM	NM	NM	NM	NM	1	0	1	0	0	1	0	0	1	0	0	0	1	0	**0.4**	1
W Michigan St. RS [n]	039	3	2	7	5	4	1	3	8	4	0	8	9	3	5	2	3	6	9	6	4	**4.6**	34

Notes: Modeled numbers are shown in *italics*.

[a] CSO "event" definition based on a 48-hour dry period in 1999.

[b] CSO "event" definition changed to be based on a 24-hour dry period in 2000.

[c] Blue 20-year averages are those that meet the no more than one event per year on a 20-year average and therefore are in control. Black 20-year averages are for uncontrolled basins.

[d] Portable monitors are used at 11th Ave. NW, 30th Ave NE, SW Alaska St., Bayview North and South, E Duwamish, W Duwamish, Hanford @ Rainier, S Magnolia, North Beach PS Inlet, and Terminal 115. The Bayview North monitor was installed in 2010; the Bayview South monitor was installed in 2011.

[e] The 3rd Ave. W monitor was down June 2006 through November 2006.

[f] Monitoring began in June 2000 at 53rd Ave. SW PS, 63rd Ave. SW, Barton St., and Murray St.

[g] Years 1997–2013 are modeled data and numbers may be updated in future reports as new information is gathered. Modeled data have been substituted to simulate how current facilities would have performed under historic rain patterns during that time.

[h] The monitor at Brandon St. RS 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.

[i] The monitor at Hanford #1 was down June 2000 through May 2001 and was not operating properly June 2007 to December 2007. From June 2005 to May 2006 the portable meter provided questionable data.

[j] No data were recorded at Harbor Ave. in April and May 2004.

[k] Henderson, MLK Jr. Way, and Norfolk St. were controlled as of 2006. Modeled data through 2005 (in italics) have been substituted to simulate how current facilities would have performed under historic rain patterns during that time.

[l] Monitoring began in June 2005 at North Beach wet well.

[m] Monitoring began in June 2003 at Terminal 115.

[n] Monitoring began at W Duwamish in June 2005.

7 Post-construction Monitoring

King County's PCMP was approved by Ecology on September 28, 2012. Monitoring volume and frequency of overflows at the controlled untreated discharge locations listed above is ongoing, reported monthly to Ecology, and summarized in each CSO Annual Report (Appendix A). Volume, frequency, and NPDES permit effluent monitoring and effluent compliance for the wet weather treatment stations are reported monthly and summarized in Appendix B.

King County's ongoing ambient monitoring program provides data for post-construction monitoring as described in the PCMP. Additional details can be found in the PCMP's Appendix D (Receiving Water Characterization Study Sampling and Analysis Plan and Quality Assurance Project Plan), Appendix E (Major Lakes Sampling and Analysis Plan), and Appendix F (Freshwater Swimming Beach Monitoring Sampling and Quality Assurance Project Plan).

Sediment monitoring for controlled sites is being performed as described in the PCMP. Details can be found in the PCMP's Appendix C (Sampling and Analyses Plan). Sediment characterization data completed in this reporting period are summarized below.

A sampling plan specific to the five Lake Washington CSOs was completed in December 2016. Modeling was chosen for these sites in accordance with the PCMP. The CSO Sediment Quality Modeling for Lake Washington Report was sent to Ecology December 1, 2018.

Design of a sampling plan specific to the North Beach Pump Station Inlet Overflow site was completed in August 2018, in accordance with the PCMP. Sampling was completed on September 6, 2018. The North Beach PS Inlet Overflow Sediment Quality Data Report will be sent to Ecology by December 1, 2019.

The PCMP outlines the County's required process for sediment characterization by sampling or modeling, hazard assessment/site identification, and cleanup actions (where necessary), and data reporting. That characterization approach was applied to all CSO and CSO treatment plant outfalls and presented in the King County Sediment Management Plan (SMP) 2018 Update sent to Ecology November 2, 2018. The SMP Update also assesses each site to determine if a hazard assessment/site identification is necessary, in accordance with the PCMP.

In addition, permit condition S13.C required consolidation of all CSO monitoring history information by revising a 2009 summary report. Results are presented in the Comprehensive Sediment Quality Summary Report for CSO Discharge Locations sent to Ecology on December 1, 2018.

Appendices

Appendix A. Untreated CSO Events, January–December 2018

Appendix B. Treated CSO Events, January–December 2018

Appendix C. Alki Wet Weather Treatment Station 2018 Annual Report

Appendix D. Carkeek Wet Weather Treatment Station 2018 Annual Report

Appendix E. Elliott West Wet Weather Treatment Station 2018 Annual Report

Appendix F. Henderson/MLK Jr. Way Wet Weather Treatment Station 2018 Annual Report

Appendix A
Untreated CSO Events

January–December 2018

DSN #	Overflow Name	Receiving Water	Event Starting Date & Time	Event Ending Date & Time	Duration (hours)	Volume (gallons)	Precipitation (inches)	Storm Duration (hours)	Note if DWO or SSO
004	East Ballard (AKA 11th Ave NW)	Lake Washington Ship Canal	1/11/18 8:39 AM	1/11/18 12:56 PM	4.28	256,656	1.48	61.63	
004	East Ballard (AKA 11th Ave NW)	Lake Washington Ship Canal	1/18/18 1:44 AM	1/18/18 8:57 PM	19.22	75,546	1.09	38.27	
004	East Ballard (AKA 11th Ave NW)	Lake Washington Ship Canal	1/27/18 1:33 AM	1/27/18 1:55 AM	0.37	8,344	2.17	143.82	
004	East Ballard (AKA 11th Ave NW)	Lake Washington Ship Canal	1/29/18 1:31 PM	1/29/18 4:48 PM	3.28	847,010	0.85	10.02	
004	East Ballard (AKA 11th Ave NW)[1]	Lake Washington Ship Canal	4/7/18 8:55 AM	4/7/18 9:20 AM	0.42	126,000	1.06	77.68	
004	East Ballard (AKA 11th Ave NW)	Lake Washington Ship Canal	4/12/18 1:14 AM	4/12/18 1:41 AM	0.45	9,846	0.84	20.98	
004	East Ballard (AKA 11th Ave NW)[2]	Lake Washington Ship Canal	4/14/18 6:00 PM	4/15/18 12:35 AM	6.58	294,570	2.58	92.30	
004	East Ballard (AKA 11th Ave NW)[3]	Lake Washington Ship Canal	5/19/18 8:27 PM	5/19/18 8:41 PM	0.23	2,576	0.20	0.80	
004	East Ballard (AKA 11th Ave NW)	Lake Washington Ship Canal	10/27/18 7:10 PM	10/27/18 10:25 PM	3.25	1,137,724	1.03	6.07	
004	East Ballard (AKA 11th Ave NW)	Lake Washington Ship Canal	11/26/18 3:57 PM	11/27/18 2:36 AM	10.65	195,485	2.04	22.32	
004	East Ballard (AKA 11th Ave NW)	Lake Washington Ship Canal	12/18/18 2:33 PM	12/18/18 2:52 PM	0.32	54,253	0.89	23.22	
004	East Ballard (AKA 11th Ave NW)	Lake Washington Ship Canal	12/22/18 7:34 PM	12/23/18 8:37 AM	13.05	186,063	0.81	14.72	
004	East Ballard (AKA 11th Ave NW)	Lake Washington Ship Canal	12/29/18 3:19 PM	12/29/18 3:30 PM	0.18	316	0.63	34.33	
006	Magnolia Overflow	Elliot Bay/Puget Sound	1/5/18 5:34 PM	1/6/18 4:02 AM	10.47	2,995	0.65	31.82	
006	Magnolia Overflow	Elliot Bay/Puget Sound	1/11/18 7:52 AM	1/11/18 1:02 PM	5.17	138,879	0.98	19.50	
006	Magnolia Overflow	Elliot Bay/Puget Sound	1/17/18 4:14 PM	1/18/18 8:52 PM	28.63	39,908	1.18	40.30	
006	Magnolia Overflow	Elliot Bay/Puget Sound	1/22/18 5:18 AM	1/22/18 5:38 AM	0.33	2,392	0.35	27.52	

DSN #	Overflow Name	Receiving Water	Event Starting Date & Time	Event Ending Date & Time	Duration (hours)	Volume (gallons)	Precipitation (inches)	Storm Duration (hours)	Note if DWO or SSO
006	Magnolia Overflow	Elliot Bay/Puget Sound	1/23/18 9:56 AM	1/24/18 1:04 AM	15.13	19,783	0.97	16.70	
006	Magnolia Overflow[2]	Elliot Bay/Puget Sound	1/27/18 1:06 AM	1/27/18 5:52 AM	4.77	11,801	1.94	93.55	
006	Magnolia Overflow	Elliot Bay/Puget Sound	1/29/18 7:16 AM	1/29/18 5:02 PM	9.77	86,598	0.89	9.85	
006	Magnolia Overflow	Elliot Bay/Puget Sound	2/1/18 6:10 PM	2/1/18 9:08 PM	2.97	1,860	0.45	8.07	
006	Magnolia Overflow	Elliot Bay/Puget Sound	2/28/18 8:34 PM	2/28/18 10:36 PM	2.03	8	0.62	29.80	
006	Magnolia Overflow	Elliot Bay/Puget Sound	4/7/18 4:02 AM	4/7/18 9:12 AM	5.17	13,489	1.00	77.63	
006	Magnolia Overflow	Elliot Bay/Puget Sound	4/10/18 8:56 AM	4/10/18 9:18 AM	0.37	18	0.16	2.38	
006	Magnolia Overflow[2]	Elliot Bay/Puget Sound	4/12/18 12:14 AM	4/12/18 1:28 AM	1.23	2,746	0.64	42.03	
006	Magnolia Overflow[2]	Elliot Bay/Puget Sound	4/13/18 7:04 PM	4/15/18 12:54 AM	29.83	7,579	2.56	114.07	
006	Magnolia Overflow	Elliot Bay/Puget Sound	4/28/18 8:50 AM	4/28/18 8:54 AM	0.07	2	0.28	4.88	
006	Magnolia Overflow	Elliot Bay/Puget Sound	9/14/18 5:38 AM	9/14/18 6:38 AM	1.00	823	0.21	0.77	
006	Magnolia Overflow	Elliot Bay/Puget Sound	10/25/18 11:56 PM	10/26/18 2:14 AM	2.30	1,894	0.59	17.42	
006	Magnolia Overflow	Elliot Bay/Puget Sound	10/27/18 6:50 PM	10/28/18 6:46 PM	23.93	3,815	1.19	26.42	
006	Magnolia Overflow	Elliot Bay/Puget Sound	11/6/18 12:52 AM	11/6/18 1:32 AM	0.67	549	0.14	0.20	
006	Magnolia Overflow	Elliot Bay/Puget Sound	12/16/18 4:05 AM	12/16/18 4:10 AM	0.08	236	0.34	5.52	
006	Magnolia Overflow	Elliot Bay/Puget Sound	12/17/18 5:45 PM	12/18/18 5:55 PM	24.17	17,078	1.75	67.20	
006	Magnolia Overflow	Elliot Bay/Puget Sound	12/22/18 7:10 PM	12/23/18 8:10 AM	13.00	19,811	0.74	25.03	
008	3rd Ave W and Ewing St	Lake Washington Ship Canal	1/11/18 10:01 AM	1/11/18 1:41 PM	3.67	2,469,882	1.49	62.43	
008	3rd Ave W and Ewing St	Lake Washington Ship Canal	1/18/18 1:35 AM	1/18/18 3:08 AM	1.55	1,243,831	0.65	20.60	
008	3rd Ave W and Ewing St	Lake Washington Ship Canal	1/29/18 1:55 PM	1/29/18 5:18 PM	3.38	2,561,479	0.85	10.02	
008	3rd Ave W and Ewing St	Lake Washington Ship Canal	4/12/18 12:58 AM	4/12/18 1:52 AM	0.90	159,143	0.84	20.98	
008	3rd Ave W and Ewing St	Lake Washington Ship Canal	4/14/18 4:51 PM	4/15/18 2:06 AM	9.25	4,473,427	2.63	93.02	

DSN #	Overflow Name	Receiving Water	Event Starting Date & Time	Event Ending Date & Time	Duration (hours)	Volume (gallons)	Precipitation (inches)	Storm Duration (hours)	Note if DWO or SSO
008	3rd Ave W and Ewing St	Lake Washington Ship Canal	10/27/18 8:21 PM	10/27/18 11:22 PM	3.02	3,282,403	1.04	6.50	
008	3rd Ave W and Ewing St	Lake Washington Ship Canal	11/26/18 6:54 PM	11/27/18 3:06 AM	8.20	1,018,381	2.04	22.32	
012	Belvoir Pump Station Emergency Overflow	Lake Washington	4/14/18 5:44 PM	4/14/18 8:59 PM	3.25	241,853	2.75	110.20	
014	Montlake Overflow	Lake Washington Ship Canal	1/11/18 10:35 AM	1/11/18 1:04 PM	2.48	2,994,771	0.93	19.67	
014	Montlake Overflow	Lake Washington Ship Canal	1/18/18 1:10 AM	1/18/18 2:32 AM	1.37	1,654,002	0.87	19.80	
014	Montlake Overflow	Lake Washington Ship Canal	1/29/18 1:47 PM	1/29/18 5:10 PM	3.38	4,856,241	0.94	10.08	
014	Montlake Overflow	Lake Washington Ship Canal	4/12/18 12:38 AM	4/12/18 1:21 AM	0.72	1,107,925	0.93	42.53	
014	Montlake Overflow[2]	Lake Washington Ship Canal	4/14/18 4:34 PM	4/15/18 2:02 AM	9.47	13,087,781	3.11	114.70	
014	Montlake Overflow	Lake Washington Ship Canal	10/27/18 7:52 PM	10/27/18 10:40 PM	2.80	3,150,429	0.93	6.25	
014	Montlake Overflow	Lake Washington Ship Canal	11/27/18 2:10 AM	11/27/18 2:36 AM	0.43	365,599	1.79	22.40	
015	University Regulator	Lake Washington Ship Canal	1/11/18 11:06 AM	1/11/18 1:12 PM	2.10	5,341,475	0.93	19.67	
015	University Regulator	Lake Washington Ship Canal	1/18/18 1:21 AM	1/18/18 2:42 AM	1.35	4,956,753	0.87	19.80	
015	University Regulator	Lake Washington Ship Canal	1/29/18 2:08 PM	1/29/18 5:14 PM	3.10	8,165,203	0.94	10.08	
015	University Regulator	Lake Washington Ship Canal	4/7/18 9:20 AM	4/7/18 9:41 AM	0.35	911,305	1.08	78.88	
015	University Regulator	Lake Washington Ship Canal	4/14/18 4:59 PM	4/15/18 2:00 AM	9.02	16,711,697	3.11	114.70	
015	University Regulator	Lake Washington Ship Canal	10/27/18 8:08 PM	10/27/18 10:52 PM	2.73	7,189,751	0.94	6.73	
015	University Regulator	Lake Washington Ship Canal	11/27/18 2:22 AM	11/27/18 2:49 AM	0.45	928,195	1.79	22.40	
028	King Street Regulator	Elliott Bay	4/14/18 4:48 PM	4/14/18 6:35 PM	1.78	107,951	1.76	107.78	
028	King Street Regulator	Elliott Bay	10/26/18 2:02 AM	10/26/18 2:12 AM	0.17	30,684	0.60	17.30	
028	King Street Regulator	Elliott Bay	10/27/18 8:20 PM	10/27/18 11:33 PM	3.22	1,163,998	0.82	5.97	

DSN #	Overflow Name	Receiving Water	Event Starting Date & Time	Event Ending Date & Time	Duration (hours)	Volume (gallons)	Precipitation (inches)	Storm Duration (hours)	Note if DWO or SSO
028	King Street Regulator	Elliott Bay	11/26/18 8:12 PM	11/27/18 3:20 AM	7.13	501,033	1.65	22.98	
029	Connecticut St. Regulator (AKA Kingdome)	Elliott Bay	1/7/18 9:02 PM	1/8/18 1:07 AM	4.08	362,002	1.00	73.68	
029	Connecticut St. Regulator (AKA Kingdome)	Elliott Bay	1/11/18 8:53 AM	1/12/18 2:21 AM	17.47	4,535,364	0.79	27.77	
029	Connecticut St. Regulator (AKA Kingdome)	Elliott Bay	1/18/18 1:58 AM	1/18/18 2:20 AM	0.37	122,446	0.66	19.75	
029	Connecticut St. Regulator (AKA Kingdome)	Elliott Bay	1/23/18 4:16 PM	1/23/18 5:35 PM	1.32	288,296	0.55	9.30	
029	Connecticut St. Regulator (AKA Kingdome)[2]	Elliott Bay	1/27/18 2:35 AM	1/27/18 5:57 AM	3.37	636,097	1.45	93.45	
029	Connecticut St. Regulator (AKA Kingdome)	Elliott Bay	1/29/18 1:48 PM	1/29/18 5:54 PM	4.10	3,180,037	0.72	9.85	
029	Connecticut St. Regulator (AKA Kingdome)	Elliott Bay	2/1/18 9:40 PM	2/1/18 10:08 PM	0.47	23,281	0.43	9.17	
029	Connecticut St. Regulator (AKA Kingdome)	Elliott Bay	4/7/18 9:26 AM	4/7/18 10:14 AM	0.80	52,503	0.85	77.88	
029	Connecticut St. Regulator (AKA Kingdome)	Elliott Bay	4/14/18 4:29 PM	4/15/18 12:00 AM	7.52	9,164,830	2.29	114.47	
029	Connecticut St. Regulator (AKA Kingdome)	Elliott Bay	10/26/18 1:44 AM	10/26/18 3:35 AM	1.85	711,407	0.65	18.63	
029	Connecticut St. Regulator (AKA Kingdome)	Elliott Bay	10/27/18 8:31 PM	10/28/18 12:48 AM	4.28	2,890,529	0.89	7.02	
029	Connecticut St. Regulator (AKA Kingdome)	Elliott Bay	11/26/18 6:37 PM	11/27/18 3:56 AM	9.32	4,428,282	1.65	22.98	
029	Connecticut St. Regulator (AKA Kingdome)	Elliott Bay	12/17/18 7:53 PM	12/18/18 8:26 AM	12.55	849,203	1.29	57.30	
029	Connecticut St. Regulator (AKA Kingdome)	Elliott Bay	12/23/18 8:39 AM	12/23/18 10:15 AM	1.60	405,121	0.78	14.72	
029	Connecticut St. Regulator (AKA Kingdome)	Elliott Bay	12/29/18 5:03 PM	12/29/18 5:30 PM	0.45	35,906	0.50	34.80	
030	Lander St Regulator	Elliott Bay	1/11/18 9:17 AM	1/11/18 2:40 PM	5.38	13,504,872	0.95	23.13	
030	Lander St Regulator	Elliott Bay	1/17/18 6:45 PM	1/18/18 5:59 PM	23.23	18,656,392	1.14	35.65	
030	Lander St Regulator	Elliott Bay	1/23/18 1:14 PM	1/24/18 3:25 PM	26.18	9,285,154	1.18	31.10	
030	Lander St Regulator[2]	Elliott Bay	1/27/18 2:00 AM	1/27/18 5:47 AM	3.78	5,057,142	2.02	93.58	

DSN #	Overflow Name	Receiving Water	Event Starting Date & Time	Event Ending Date & Time	Duration (hours)	Volume (gallons)	Precipitation (inches)	Storm Duration (hours)	Note if DWO or SSO
030	Lander St Regulator	Elliott Bay	1/29/18 12:10 PM	1/29/18 6:17 PM	6.12	25,104,424	0.94	10.40	
030	Lander St Regulator	Elliott Bay	2/1/18 7:27 PM	2/1/18 10:20 PM	2.88	3,841,897	0.59	12.00	
030	Lander St Regulator	Elliott Bay	2/28/18 10:10 PM	2/28/18 11:17 PM	1.12	855,540	0.71	31.32	
030	Lander St Regulator	Elliott Bay	3/23/18 12:02 PM	3/23/18 12:34 PM	0.53	340,103	0.77	36.88	
030	Lander St Regulator	Elliott Bay	4/7/18 7:41 AM	4/7/18 10:16 AM	2.58	2,213,524	0.56	5.88	
030	Lander St Regulator	Elliott Bay	4/14/18 3:41 PM	4/15/18 6:35 AM	14.90	31,793,437	2.82	114.75	
030	Lander St Regulator	Elliott Bay	10/26/18 1:41 AM	10/26/18 3:08 AM	1.45	2,321,163	0.74	18.10	
030	Lander St Regulator	Elliott Bay	10/27/18 8:43 PM	10/28/18 1:23 AM	4.67	5,999,093	0.99	7.97	
030	Lander St Regulator	Elliott Bay	11/23/18 8:02 AM	11/23/18 10:06 AM	2.07	4,339,964	1.16	44.88	
030	Lander St Regulator	Elliott Bay	11/26/18 10:47 AM	11/27/18 7:12 PM	32.42	95,961,534	2.14	38.72	
030	Lander St Regulator	Elliott Bay	12/11/18 3:53 PM	12/11/18 3:54 PM	0.02	194	1.11	54.78	
030	Lander St Regulator	Elliott Bay	12/17/18 7:44 PM	12/18/18 7:25 AM	11.68	6,056,588	1.70	56.50	
030	Lander St Regulator	Elliott Bay	12/22/18 9:55 PM	12/23/18 9:57 AM	12.03	8,052,879	0.98	16.25	
030	Lander St Regulator	Elliott Bay	12/28/18 2:53 PM	12/28/18 3:06 PM	0.22	24,269	0.38	9.17	
030	Lander St Regulator[2]	Elliott Bay	12/29/18 4:31 PM	12/29/18 9:42 PM	5.18	1,187,603	0.95	39.67	
031	Hanford #1	Duwamish River via Diagonal Storm Drain	1/11/18 9:04 AM	1/11/18 2:21 PM	5.28	2,656,968	0.95	23.13	
031	Hanford #1	Duwamish River via Diagonal Storm Drain	1/18/18 1:59 AM	1/18/18 5:44 AM	3.75	190,154	0.91	23.47	
031	Hanford #1	Duwamish River via Diagonal Storm Drain	1/23/18 4:19 PM	1/23/18 4:44 PM	0.42	35,741	0.69	8.67	
031	Hanford #1[2]	Duwamish River via Diagonal Storm Drain	1/27/18 1:36 AM	1/27/18 2:02 AM	0.43	76,993	1.78	90.13	
031	Hanford #1	Duwamish River via Diagonal Storm Drain	1/29/18 1:41 PM	1/29/18 5:56 PM	4.25	3,215,575	0.94	10.40	
031	Hanford #1	Duwamish River via Diagonal Storm Drain	4/7/18 9:20 AM	4/7/18 9:33 AM	0.22	48,359	0.56	5.88	
031	Hanford #1	Duwamish River via Diagonal Storm Drain	4/14/18 4:09 PM	4/15/18 4:56 AM	12.78	17,954,508	2.82	114.75	

DSN #	Overflow Name	Receiving Water	Event Starting Date & Time	Event Ending Date & Time	Duration (hours)	Volume (gallons)	Precipitation (inches)	Storm Duration (hours)	Note if DWO or SSO
031	Hanford #1	Duwamish River via Diagonal Storm Drain	10/27/18 9:24 PM	10/27/18 10:37 PM	1.22	378,665	0.89	5.22	
032	Hanford #2 Regulator	Duwamish River - East Waterway	1/11/18 9:21 AM	1/11/18 6:09 PM	8.80	23,190,645	0.96	28.43	
032	Hanford #2 Regulator	Duwamish River - East Waterway	1/17/18 6:45 PM	1/18/18 6:46 PM	24.02	15,854,523	1.14	35.65	
032	Hanford #2 Regulator	Duwamish River - East Waterway	1/23/18 1:13 PM	1/24/18 4:17 PM	27.07	33,873,845	1.19	32.23	
032	Hanford #2 Regulator[2]	Duwamish River - East Waterway	1/27/18 2:03 AM	1/27/18 9:06 AM	7.05	19,534,039	2.04	95.00	
032	Hanford #2 Regulator	Duwamish River - East Waterway	1/29/18 12:07 PM	1/29/18 10:40 PM	10.55	25,008,296	0.94	10.40	
032	Hanford #2 Regulator	Duwamish River - East Waterway	2/1/18 7:27 PM	2/2/18 12:02 AM	4.58	12,965,832	0.6	13.30	
032	Hanford #2 Regulator	Duwamish River - East Waterway	3/23/18 12:02 PM	3/23/18 1:10 PM	1.13	2,501,860	0.77	36.88	
032	Hanford #2 Regulator	Duwamish River - East Waterway	4/7/18 7:41 AM	4/7/18 11:28 AM	3.78	8,385,786	0.56	5.88	
032	Hanford #2 Regulator	Duwamish River - East Waterway	4/14/18 3:41 PM	4/15/18 11:59 AM	20.30	62,417,406	2.83	124.15	
032	Hanford #2 Regulator	Duwamish River - East Waterway	10/26/18 1:43 AM	10/26/18 4:40 AM	2.95	7,197,666	0.79	19.37	
032	Hanford #2 Regulator	Duwamish River - East Waterway	10/27/18 8:45 PM	10/28/18 2:17 AM	5.53	18,896,786	0.99	7.97	
032	Hanford #2 Regulator	Duwamish River - East Waterway	11/27/18 6:25 PM	11/27/18 7:38 PM	1.22	1,856,902	2.14	38.72	
032	Hanford #2 Regulator	Duwamish River - East Waterway	12/11/18 3:32 PM	12/11/18 5:12 PM	1.67	2,355,644	1.11	54.78	
032	Hanford #2 Regulator	Duwamish River - East Waterway	12/17/18 7:46 PM	12/18/18 10:09 AM	14.38	27,165,277	1.71	57.07	
032	Hanford #2 Regulator	Duwamish River - East Waterway	12/22/18 9:54 PM	12/23/18 12:44 PM	14.83	12,560,501	0.98	16.25	
032	Hanford #2 Regulator	Duwamish River - East Waterway	12/28/18 2:52 PM	12/28/18 3:39 PM	0.78	1,332,868	0.38	9.17	
032	Hanford #2 Regulator[2]	Duwamish River - East Waterway	12/29/18 4:32 PM	12/30/18 12:00 AM	7.47	9,272,757	0.96	40.40	
036	Chelan Ave. Regulator	West Waterway of Duwamish River	1/11/18 9:11 AM	1/11/18 3:03 PM	5.87	1,593,576	0.95	23.13	
036	Chelan Ave. Regulator	West Waterway of Duwamish River	1/23/18 1:18 PM	1/23/18 4:02 PM	2.73	25,923	0.64	8.05	
036	Chelan Ave. Regulator	West Waterway of Duwamish River	1/27/18 2:12 AM	1/27/18 4:06 AM	1.90	229,820	1.93	92.13	
036	Chelan Ave. Regulator	West Waterway of Duwamish River	1/29/18 1:05 PM	1/29/18 7:13 PM	6.13	2,554,829	0.94	10.40	

DSN #	Overflow Name	Receiving Water	Event Starting Date & Time	Event Ending Date & Time	Duration (hours)	Volume (gallons)	Precipitation (inches)	Storm Duration (hours)	Note if DWO or SSO
036	Chelan Ave. Regulator	West Waterway of Duwamish River	2/1/18 7:56 PM	2/1/18 8:31 PM	0.58	32,802	0.50	11.27	
036	Chelan Ave. Regulator	West Waterway of Duwamish River	4/14/18 4:12 PM	4/15/18 6:19 AM	14.12	6,840,621	2.82	114.75	
036	Chelan Ave. Regulator	West Waterway of Duwamish River	10/27/18 9:02 PM	10/28/18 3:53 AM	6.85	823,014	1.02	10.12	
036	Chelan Ave. Regulator	West Waterway of Duwamish River	11/27/18 12:28 AM	11/27/18 2:44 AM	2.27	34,568	1.81	22.63	
037	Harbor Avenue Regulator	Duwamish River into Elliott Bay	4/13/18 6:59 PM	4/13/18 7:00 PM	0.02	2,330	0.93	84.28	
038	Terminal 115 Overflow[4]	Duwamish River	4/14/18 7:15 PM	4/14/18 8:35 PM	1.33	35,201	2.76	109.78	
039	Michigan Regulator (AKA S. Michigan Regulator)	Duwamish River	1/11/18 8:24 AM	1/11/18 2:26 PM	6.03	39,748,670	1.42	63.45	
039	Michigan Regulator (AKA S. Michigan Regulator)	Duwamish River	1/17/18 5:05 PM	1/18/18 3:27 AM	10.37	1,461,361	0.72	22.95	
039	Michigan Regulator (AKA S. Michigan Regulator)[2]	Duwamish River	1/21/18 4:43 PM	1/21/18 5:08 PM	0.42	303,014	1.44	108.63	
039	Michigan Regulator (AKA S. Michigan Regulator)	Duwamish River	1/23/18 11:28 AM	1/24/18 2:54 PM	27.43	1,737,616	1.29	31.08	
039	Michigan Regulator (AKA S. Michigan Regulator)[2]	Duwamish River	1/27/18 1:09 AM	1/27/18 5:28 AM	4.32	4,537,833	2.24	93.68	
039	Michigan Regulator (AKA S. Michigan Regulator)	Duwamish River	1/29/18 10:19 AM	1/29/18 7:32 PM	9.22	30,996,523	1.02	10.37	
039	Michigan Regulator (AKA S. Michigan Regulator)	Duwamish River	2/1/18 6:23 PM	2/1/18 10:01 PM	3.63	1,668,262	0.71	14.52	
039	Michigan Regulator (AKA S. Michigan Regulator)	Duwamish River	2/27/18 4:45 PM	2/27/18 6:59 PM	2.23	1,548,889	0.36	2.62	
039	Michigan Regulator (AKA S. Michigan Regulator)	Duwamish River	3/23/18 10:31 AM	3/23/18 11:50 AM	1.32	1,282,531	0.39	3.37	
039	Michigan Regulator (AKA S. Michigan Regulator)	Duwamish River	4/7/18 6:15 AM	4/7/18 9:49 AM	3.57	732,917	1.07	77.77	
039	Michigan Regulator (AKA S. Michigan Regulator)	Duwamish River	4/14/18 6:12 AM	4/15/18 2:59 AM	20.78	49,736,903	3.15	114.82	
039	Michigan Regulator (AKA S. Michigan Regulator)	Duwamish River	10/26/18 1:56 AM	10/26/18 2:32 AM	0.60	35,539	0.72	18.10	
039	Michigan Regulator (AKA S. Michigan Regulator)	Duwamish River	10/27/18 8:04 PM	10/27/18 10:43 PM	2.65	1,424,990	0.83	5.38	
039	Michigan Regulator (AKA S. Michigan Regulator)	Duwamish River	11/26/18 11:57 PM	11/27/18 2:40 AM	2.72	408,805	1.76	22.75	

DSN #	Overflow Name	Receiving Water	Event Starting Date & Time	Event Ending Date & Time	Duration (hours)	Volume (gallons)	Precipitation (inches)	Storm Duration (hours)	Note if DWO or SSO
039	Michigan Regulator (AKA S. Michigan Regulator)	Duwamish River	12/17/18 7:06 PM	12/18/18 6:47 AM	11.68	139,559	1.73	56.02	
039	Michigan Regulator (AKA S. Michigan Regulator)	Duwamish River	12/23/18 8:24 AM	12/23/18 9:42 AM	1.30	1,230,288	1.01	15.45	
039	Michigan Regulator (AKA S. Michigan Regulator)	Duwamish River	12/29/18 3:37 PM	12/29/18 4:37 PM	1.00	109,860	0.76	35.33	
041	Brandon Street Regulator	Duwamish River	4/14/18 4:47 PM	4/14/18 8:00 PM	3.22	676,306	2.48	109.23	
041	Brandon Street Regulator	Duwamish River	10/27/18 9:19 PM	10/27/18 9:27 PM	0.13	53	0.73	4.27	
041	Brandon Street Regulator	Duwamish River	12/23/18 8:44 AM	12/23/18 8:59 AM	0.25	3,920	0.97	15.20	
042	West Michigan (AKA SW Michigan St regulator)	Duwamish River	1/11/18 11:48 AM	1/11/18 1:39 PM	1.85	189,470	1.42	63.45	
042	West Michigan (AKA SW Michigan St regulator)	Duwamish River	1/29/18 2:22 PM	1/29/18 6:30 PM	4.13	451,111	1.02	10.37	
042	West Michigan (AKA SW Michigan St regulator)	Duwamish River	4/14/18 5:27 PM	4/14/18 9:36 PM	4.15	574,354	2.82	110.82	
042	West Michigan (AKA SW Michigan St regulator)	Duwamish River	12/23/18 9:29 AM	12/23/18 9:52 AM	0.38	25,798	1.01	15.45	
048a	North Beach Pump Station (wet well)	Puget Sound	4/15/2018 0:50:05	4/15/2018 1:50:05	1.00	37,017	2.55	93.59	
048a	North Beach Pump Station (wet well)	Puget Sound	10/27/18 10:21 PM	10/27/18 10:34 PM	0.21	1,327	1.21	6.08	
049	30th Avenue NE Pump Station	Lake Washington	4/14/18 6:30 PM	4/14/18 6:35 PM	0.08	2,059	2.46	107.63	
054	63rd Avenue SW Pump Station	Puget Sound	4/14/18 7:47 PM	4/15/18 12:09 AM	4.37	22,259,140	2.75	113.25	
056	Murray Street Pump Station	Puget Sound	4/14/18 6:36 PM	4/14/18 8:43 PM	2.12	1,888,782	2.80	109.90	
057	Barton Street Pump Station	Puget Sound	4/14/18 6:25 PM	4/14/18 6:38 PM	0.22	20,172	2.21	125.82	
057	Barton Street Pump Station	Puget Sound	11/28/18 3:50 AM	11/28/18 3:52 AM	0.03	1,210	2.59	48.33	
	Total Volume					**838,857,481**			

Notes:

[1] Portable flow meter data is incomplete, and overflow volume is estimated based on available data.

[2] This storm event includes the previous storm event.

[3] Outfall #004 East Ballard - Data gap from 5/8/18 to 5/10/18 due to flow logger problems. No overflow during this time

[4] Outfall #038 Terminal 115 - Data gap from 5/30/18 to 5/31/18 due to flow logger problems but it is unlikely that there were overflows on those days since the site did not overflow on other days in January with more rain.

Appendix B
Treated CSO Events

January–December 2018

DSN #	Overflow Name	Receiving Water	Event Ending Date/Time	Event Starting Date/Time	Event Duration (hours)	Volume (million gallons)	Precipitation (inches)	Storm Duration (hours)	Note if DWO
051b	Alki WWTS	Puget Sound	1/11/18 2:06 PM	1/11/18 12:42 PM	1.40	0.72	0.99	23.13	
051b	Alki WWTS	Puget Sound	1/29/18 10:16 PM	1/29/18 3:58 PM	6.30	4.55	0.95	10.40	
051b	Alki WWTS	Puget Sound	4/15/18 5:29 AM	4/14/18 6:24 PM	7.10	11.73	2.83	114.75	
051b	Alki WWTS	Puget Sound	10/27/18 10:40 PM	10/27/18 9:56 PM	0.73	0.69	1.07	5.22	
051b	Alki WWTS	Puget Sound	11/27/18 4:04 AM	11/27/18 1:52 AM	2.20	2.03	1.86	23.88	
046b	Carkeek WWTS	Puget Sound	1/11/18 2:50 PM	1/11/18 12:40 PM	2.18	0.13	1.55	62.43	
046b	Carkeek WWTS	Puget Sound	1/29/18 9:39 PM	1/29/18 3:44 PM	5.97	0.64	0.88	12.24	
046b	Carkeek WWTS	Puget Sound	4/14/18 6:27 AM	4/14/18 9:51 PM	8.62	0.80	2.87	96.91	
046b	Carkeek WWTS	Puget Sound	11/26/18 12:00 AM	11/26/18 12:00 AM	2.93	0.21	2.08	22.32	
027b	Elliott West WWTS	Puget Sound	1/11/18 5:30 PM	1/11/18 11:48 AM	5.70	8.94	1.01	20.25	
027b	Elliott West WWTS	Puget Sound	1/18/18 12:06 PM	1/18/18 2:40 AM	9.40	7.35	1.22	25.08	
027b	Elliott West WWTS	Puget Sound	1/29/18 5:14 PM	1/29/18 3:18 PM	1.95	9.00	1.02	9.85	
027b	Elliott West WWTS	Puget Sound	4/14/18 12:00 AM	4/14/18 12:00 AM	15.59	31.99	2.73	120.84	
027b	Elliott West WWTS	Puget Sound	10/27/18 12:00 AM	10/27/18 12:00 AM	8.03	13.18	1.1	11.6	
027b	Elliott West WWTS	Puget Sound	11/26/18 7:04 PM	11/27/18 9:47 PM	12.64	23.90	2.24	39.96	

Appendix B Treated CSO Events

DSN #	Overflow Name	Receiving Water	Event Ending Date/Time	Event Starting Date/Time	Event Duration (hours)	Volume (million gallons)	Precipitation (inches)	Storm Duration (hours)	Note if DWO
027b	Elliott West WWTS	Puget Sound	12/18/18 12:00 AM	12/18/18 12:00 AM	1.97	1.20	1.76	67.46	
044b	MLK/Henderson CSO Treatment Facility Outfall	Duwamish River	4/14/18 21:43	4/15/19 6:25	8.7	7.3	2.45	115.50	
1	West Point[1]	Puget Sound	1/11/2018 16:37	1/11/2018 9:09	7.37	22.84	1.49	62.43	
1	West Point[1]	Puget Sound	1/18/2018 7:51	1/17/2018 18:04	10.80	14.85	0.8	22.88	
1	West Point[3]	Puget Sound	1/20/2018 1:23	1/20/2018 1:02	0.40	0.43			
1	West Point[1]	Puget Sound	1/24/2018 16:46	1/23/2018 12:35	13.70	14.81	1.62	86.63	
1	West Point[12]	Puget Sound	1/27/2018 7:45	1/27/2018 2:05	5.70	8.64	2.47	149.4	
1	West Point[1]	Puget Sound	1/29/2018 20:48	1/29/2018 12:10	8.60	18.83	0.86	12.23	
1	West Point[1]	Puget Sound	2/1/2018 23:18	2/1/2018 18:50	4.50	3.72	0.44	9.57	
1	West Point[1]	Puget Sound	2/28/2018 23:53	2/28/2018 21:14	2.60	2.59	0.74	28.27	
1	West Point[1]	Puget Sound	4/7/2018 12:07	4/7/2018 7:39	4.30	4.15	1.06	77.68	
1	West Point[1]	Puget Sound	4/12/2018 4:02	4/12/2018 0:15	3.60	6.64	0.84	20.98	
1	West Point[12]	Puget Sound	4/15/2018 5:27	4/14/2018 16:33	12.50	35.6	2.68	96.92	
1	West Point[4]	Puget Sound	5/19/2018 21:23	5/19/2018 21:02	0.30	1.28			
1	West Point[4]	Puget Sound	5/26/2018 1:03	5/26/2018 0:47	0.30	0.43			
1	West Point[5]	Puget Sound	6/21/2018 5:21	6/21/2018 5:17	0.10	0.1			
1	West Point[5]	Puget Sound	6/27/2018 13:17	6/27/2018 13:15	0.08	0.1			
1	West Point[1]	Puget Sound	10/26/2018 4:10	10/26/2018 1:07	3.08	3.97	0.70	19.48	
1	West Point[1]	Puget Sound	10/28/2018 2:20	10/27/2018 20:10	6.18	18.36	1.09	8.68	
1	West Point[1]	Puget Sound	11/22/2018 18:32	11/22/2018 16:31	1.68	1.2	0.67	31.48	

Appendix B Treated CSO Events

DSN #	Overflow Name	Receiving Water	Event Ending Date/Time	Event Starting Date/Time	Event Duration (hours)	Volume (million gallons)	Precipitation (inches)	Storm Duration (hours)	Note if DWO
1	West Point[1]	Puget Sound	11/27/2018 5:27	11/26/2018 9:07	16.63	38.94	2.05	25.52	
1	West Point[4]	Puget Sound	11/30/2018 21:16	11/30/2018 21:09	0.10	0.4			
1	West Point[4]	Puget Sound	12/5/2018 11:15	12/5/2018 11:06	0.13	0.4			
1	West Point[1]	Puget Sound	12/9/2018 17:51	12/9/2018 15:09	2.26	1.4	0.48	8.28	
1	West Point[1]	Puget Sound	12/18/2018 20:10	12/17/2018 19:08	10.85	6.76	1.03	26.65	
1	West Point[1]	Puget Sound	12/23/2018 11:17	12/22/2019 20:57	5.11	4.48	0.82	16.1	
1	West Point[1]	Puget Sound	12/28/2018 15:42	12/28/2018 13:41	2.05	1.64	0.33	8.85	
1	West Point[1,2]	Puget Sound	12/29/2018 18:58	12/29/2018 16:02	2.96	2.91	0.76	37.72	
Total Volume						**335.70**			

Notes:
[1] Flow at West Point exceeded 300 MGD
[2] This storm event includes the previous storm event
[3] Secondary diversion caused by power outage at West Point Treatment Plant
[4] Secondary diversion caused by IPS pump failure at West Point Treatment Plant
[5] Secondary diversion caused by human error at West Point Treatment Plant

Appendix C
Alki Wet Weather Treatment Station
Annual Report

January–December 2018

Executive Summary

This 2018 annual report summarizes the performance of King County's Alki Wet Weather Treatment Station (Alki WWTS). The Alki WWTS came online for CSO treatment in 1998; it operates under the NPDES permit for the West Point Treatment Plant (WA00291811).

A total of 34.18 inches of rain fell in calendar year 2018, as measured at the rain gauge located at the Chelan Avenue Regulator, the nearest gauge to the Alki WWTS. 2018 annual rainfall recorded at Sea-Tac is 35.73 inches for; the 18-year average at Sea-Tac is 39.41. There were twelve filling events and five discharge events during 2018. The Alki WWTS received 33.7 million gallons (MG) and discharged 19.7 MG.

Alki's performance in 2018 is summarized in Table C-1. Total suspended solids (TSS) removal average was 39.5 percent in 2018 thereby not meeting the NPDES permit limit of 50 percent for annual removal. Alki WWTS met its annual average settleable solids (SS) limit with the average measured as 0.12 milliliters/liter/hour (mL/L/hr.) the NPDES permit limit being 0.3 mL/L/hr. The Alki WWTS did not meet the instantaneous minimum pH less than 6.0 for two discharge days out of five days of discharges. In addition, Alki's effluent met the daily maximum average total residual chlorine (TRC) permit limit of 234 µg /L on all the five discharge days. Alki WWTS also met the monthly fecal coliform geomean permit limit of 400 counts/ 100 mL during each month of discharge at Alki WWTS. The performance for 2018 has been summarized below in Table C-1.

Table C-1. Alki WWTS Permit Performance in 2018

Parameter	Performance	Permit Conditions
Discharge events (number)[a]	**5**	**29**
Discharge volume million gallons (MG)[a]	**19.7**	**108**
Annual average SS (mL/L/hr)	**0.12**	**0.3**
Annual average TSS removal- including all discharge events (%)	**39.5**	**50**
Instantaneous minimum effluent pH, frequency of discharge days with pH < 6.0	**2 out of 5 discharge days**	**≥ 6.0**
Instantaneous maximum effluent pH, frequency of discharge days with pH > 9.0	**0 out of 5 discharge days**	**≤ 9.0**
Total residual chlorine (TRC), maximum of daily averages (µg/L), frequency of discharge days with TRC >234 µg/L	**0 out of 5 discharge days**	**≤ 234 µg/L**
Monthly fecal coliform geomean, frequency of months with monthly geomean >400/100mL	**0 out of 4 discharge months**	**400/ 100 mL**

[a] Compliance assessed over a 5-year average.
Numbers in red indicate a permit exceedance.

Suspended and Settleable Solids

The annual TSS removal was calculated to be 39.5 percent, which did not meet its annual average TSS removal permit level of 50 percent. The annual event average SS was 0.12 mL/L/hr.; therefore, meeting the annual average NPDES permit level of 0.3 mL/L/hr.

Solids removal at Alki WWTS has not met the 50 percent limit in the past and past operational changes to improve the removal were not effective. These changes included changing the set point to start the solids flights in the sedimentation tanks earlier as the sedimentation tanks fill so that as solids settle the flights will move the solids to the sump to be removed sooner and avoid any potential solid wash out or carry over to the effluent flow. In addition, King County operators cleaned out and removed accumulated solids and debris from the effluent channel as part of the summer dry-weather work. It should be noted that the one discharge day in the month of April resulted in a negative solids removal and the April solids performance impacted the annual removal calculation. The April discharge had the highest peak flow of the year at 60 million gallons per day (MGD). It is possible that high flow rate resulted in solids re-suspended and washed out in the effluent.

High rates of flow and swings of inflows from the 63rd Avenue pump station can also impact solids removal at Alki WWTS. In 2017 variable frequency drives (VFDs) were added to all three CSO pumps at the 63rd Avenue pump station as part of the capital

project to improve flow control into Alki. Programming the VFD to control pumping and fine-tuning of the program was completed in 2018. Pump station performance is evaluated after each CSO event for any additional changes as necessary. However, the current evaluation of the VFD influence on solids removal performance is ongoing due to the limited number of events since they were fine-tuned. The one Alki WWTS discharge event in 2018 (11-26-2018) that had the VFDs at 63rd Ave pump station optimized still had below 50 percent TSS removal for the event. There are several factors that can impact the solids removal efficiency in a primary sedimentation tank, such as tank configuration, flow rates and influent solids concentration. In 2018, staff began development of a pilot testing to operate the settling basins in a sequential versus batch filling mode. The objective is to determine if solids washout can be reduced by reducing the hydraulic energy in the system suspected of solids resuspension at various times within the CSO treatment cycle. Pilot testing is planned for the 2019-2020 wet weather season.

As part of the CSO control program, King County staff and consultants evaluated plant performance in 2016 with the intent of identifying deficiencies and recommendations on how to improve solids removal. The consultant review and recommendations are available in the Existing Facility Assessment and Optimization TM, dated July 2016.

Fecal Coliform Bacteria

There were four months with treated discharges in 2018 at Alki treatment station and each of the four monthly geomean values for fecal coliform were below the NPDES permit monthly geomean limit of 400 counts/100 mL. The maximum fecal coliform geomean was 130 counts /100 mL which occurred in October. The annual average of the monthly fecal coliform geomean was 46 counts /100 mL.

Total Residual Chlorine

The Alki WWTS was in compliance with the daily average TRC permit limit of 234-μg/L on all five discharge days of 2018. The 2018 annual TRC average was 7 μg/L with the annual maximum daily average of 11 μg/L occurred on April 14, 2018 discharge.

Instantaneous Minimum and Maximum Effluent pH

The daily instantaneous minimum pH below 6.0, the permit limit occurred twice out of the five discharge days in 2018. The minimum pH exceedances occurred on October 27 and November 26 discharge events. Both of these pH violations lasted less than an hour duration of the discharge. It appears that both of these low pH exceedances are not representative of the effluent discharges and may be related to issues with the pH probe exposed to very low pH stagnant sample water during intra-event periods and when the sample pump starts flow the pH probe has a slow response to the discharge sample flow. The delayed response by the pH probe can extend into the discharge event; thus, a low pH is reported. To resolve this the preventative maintenance tasks

that include weekly calibration has been modified to replace pH probes when observed response time has deteriorated. There were no discharge events with a maximum pH above 9.0, the permit limit. The minimum and maximum pH values for all 2018 discharge events were 2.7 and 6.5 respectively.

Operation and Maintenance

Major upgrades to the Alki WWTS were completed in recent years; staff evaluated and made adjustments as needed in 2018. Highlights of O&M activities during 2018 include:

- Conducted annual CSO refresher training for the operators in September 2018.
- Quarterly/monthly testing of hypochlorite and bisulfite solution strength; set point changes made to chemical feed pumps based on solution strength; shipments of full-strength solutions ordered as necessary.
- Continued to conduct debriefings with O&M staff after discharge events to review and discuss the discharge and treatment performance and make any needed operational adjustments for subsequent events.
- Periodic cleaning the effluent channel of accumulated solids and debris to improve treatment including solids removal.
- Ongoing, routine preventive maintenance practice to exercise the chemical feed pumps monthly.
- Offsite Instrumentation and Electrical staff will continue to fine tune and monitor the 63rd Avenue Pump Station pump VFD controls.
- Continue preventative maintenance by Offsite Instrumentation and Electrical staff of online chlorine and pH analyzers including weekly calibration and replacement of probes and other instrumentation components as necessary.

Hypochlorite Feed System Improvement Project

A project was initiated in 2016 to improve the hypochlorite feed system at Alki. This project was completed in summer 2018. The project involved replacement of the aging pumps and chemical piping. The project changed the hypochlorite feed system from one feed pump per force main to a manifold system with three chemical feed pumps-lead, lag and standby pumps, a chemical feed flow meter, and hypochlorite feed diffuser. New hypochlorite feed piping and venting was included in the project.

Near Future Operation

As with all wet weather treatment stations, opportunities to operate and then to optimize the Alki WWTS operations are 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. WTD staff will continue to investigate, make any necessary adjustments in the O&M. In addition, WTD staff responding to Alki WWTS will:

- Continue with the evaluation, testing and adjustments of the new Variable Frequency Drives for the 63rd Avenue pumps, as it relates to improved treatment performance.
- Continue with the evaluation, testing and adjustments of the new hypochlorite feed system.
- Will evaluate consultant recommendations and consider appropriate and feasible actions for implementation.

Table C-2. Alki WWTS 2018 Annual Event Data Summary

Month	Day	Alki Inflow Event Number	Alki Inflow Volume (MG)	Alki Discharge Event Number	Alki Discharge Volume (MG)	Total Influent TSS (lbs)	Total Effluent TSS Discharged @ Alki + WP (lbs)	% removal	Alki Effl. Daily Settl Solids (ml/l/hr)	Alki Effl. Settl Solids Event Avg (ml/l/hr)	Alki Effl. Fecal Coliforms (#/100 ml)	Alki Effl. Residual Chlorine Daily Average (µg/l)	Daily Min/Max pH
January	11	1	2.76	1	0.72	2,486	709		0.1	0.1	20	5	6.2/6.5
	17	2	0.54	ND	ND	477	24						
	23	3	0.31	ND	ND	165	27						
	26	4	0.53	ND	ND	345	17						
	29	5	6.19	2	4.55	878	907		0.1	0.1	1/1	8	6.2/6.5
	Instant. Min/Max pH												**6.2/6.5**
	Event/Daily Max									**0.10**		**8**	
	Monthly Total/Avg/GeoMean	**5**	**10.33**	**2**	**5.27**	**4,351**	**1,685**	**61.3%**			**2.7**		
February	1	1	0.24	ND	ND	142	10		ND	ND	ND	ND	ND
	Instant. Min/Max pH												**ND**
	Event/Daily Max									**ND**		**ND**	
	Monthly Total/Avg/GeoMean	**1**	**0.24**	**0**	**0.0**	**142**	**10**	**92.7%**			**ND**		
March	No Inflow/No Disch.												
	Instant. Min/Max pH												**ND**
	Event/Daily Max									**ND**		**ND**	
	Monthly Total/Avg/GeoMean	**0**	**0.0**	**0**	**ND**	**ND**	**ND**	**ND**			**ND**		
April	14	1	15.84	1	11.73	4359	5369		0.1	0.10	45/1	11	6.2/6.5
	15	1	0.64	ND	ND	662	165		ND				
	Instant. Min/Max pH												**6.2/6.5**
	Event/Daily Max									**0.10**		**11**	

Month	Day	Alki Inflow Event Number	Alki Inflow Volume (MG)	Alki Discharge Event Number	Alki Discharge Volume (MG)	Total Influent TSS (lbs)	Total Effluent TSS Discharged @ Alki + WP (lbs)	% removal	Alki Effl. Daily Settl Solids (ml/l/hr)	Alki Effl. Settl Solids Event Avg (ml/l/hr)	Alki Effl. Fecal Coliforms (#/100 ml)	Alki Effl. Residual Chlorine Daily Average (µg/l)	Daily Min/Max pH
	Monthly Total/Avg/GeoMean	1	16.48	1	11.73	5,021	5,535	-10.2%			6.7		
May	No Inflow/No Disch.												
	Instant. Min/Max pH												ND
	Event/Daily Max									ND		ND	
	Monthly Total/Avg/GeoMean	0	0.0	0	ND	ND	ND	ND			ND		
June	No Inflow/No Disch.												
	Instant. Min/Max pH												ND
	Event/Daily Max									ND		ND	
	Monthly Total/Avg/GeoMean	0	0.0	0	ND	ND	ND	ND			ND		
July	No Inflow/No Disch.												
	Instant. Min/Max pH												ND
	Event/Daily Max									ND		ND	
	Monthly Total/Avg/GeoMean	0	0.0	0	ND	ND	ND	ND			ND		
August	No Inflow/No Disch.												
	Instant. Min/Max pH												ND
	Event/Daily Max									ND		ND	
	Monthly Total/Avg/GeoMean	0	0.0	0	ND	ND	ND	ND			ND		
September	No Inflow/No Disch.												
	Instant. Min/Max pH												ND
	Event/Daily Max									ND		ND	

Month	Day	Alki Inflow Event Number	Alki Inflow Volume (MG)	Alki Discharge Event Number	Alki Discharge Volume (MG)	Total Influent TSS (lbs)	Total Effluent TSS Discharged @ Alki + WP (lbs)	% removal	Alki Effl. Daily Settl Solids (ml/l/hr)	Alki Effl. Settl Solids Event Avg (ml/l/hr)	Alki Effl. Fecal Coliforms (#/100 ml)	Alki Effl. Residual Chlorine Daily Average (µg/l)	Daily Min/Max pH
	Monthly Total/Avg/GeoMean	**0**	**0.0**	**0**	**ND**	**ND**	**ND**	**ND**			**ND**		
October	25	1	0.15	ND	ND	85	2						
	27	2	2.48	1	0.69	3,123	603		0.2	0.2	130	9	**2.7**/5.9
	Instant. Min/Max pH												**2.7**/5.9
	Event/Daily Max									**0.2**		**9**	
	Monthly Total/Avg/GeoMean	**2**	**2.63**	**1**	**0.69**	**3208**	**605**	**81.1%**			**130**		
November	26	1	3.56	1	2.03	1,158	677		0.1	0.1	45	3	**5.6/6.4**
	Instant. Min/Max pH												**5.6/6.4**
	Event/Daily Max									**0.10**		**3**	
	Monthly Total/Avg/GeoMean	**1**	**3.56**	**1**	**2.03**	**1,158**	**677**	**41.5%**			**45**		
December	17	1	0.26	ND	ND	91	7						
	23	2	0.18	ND	ND	134	8						
	Instant. Min/Max pH												**ND**
	Event/Daily Max									**ND**		**ND**	
	Monthly Total/Avg/GeoMean	**2**	**0.44**	**0**	**0.0**	**225**	**15**	**93.2%**			**ND**		
Total		**12**	**33.68**	**5**	**19.7**	**14,106**	**8,527**						
Inst. pH Min/Max													**2.7/6.5**
Max (GEM, SS, TRC)										**0.30**	**130**	**11**	
Annual Average							by mass:	**39.5%**		**0.12**	**46**	**7.20**	

Notes:
ND= No discharge.
Red= NPDES permit exceedance.

	Inflow Volume (MG)	Discharge Volume (MG)	Total Alki CSO TSS lbs-in	Total Alki CSOTSS lbs Discharged	Annual Average Alki CSO %TSS Removal	Maximum of Event Averages Settleable Solids (ml/l/hr)	Annual Average Settleable Solids Concentration (ml/l/hr)	Maximum of Monthly Geomean Alki CSO Effl. Fecal Coliforms (#/100 ml)	Annual Average of Monthly Geomean Alki CSO Effl. Fecal Coliforms (#/100 ml)	Maximum of Daily Averages of Alki CSO Effl. Res. Cl2 (ug/l)	Instant. Min/Max pH
Includes all events	33.7	19.7	14,106	8,527	39.5%	0.30	0.12	130	46	11	2.7/6.5

Appendix D
Carkeek Wet Weather Treatment Station
Annual Report

January–December 2018

Executive Summary

This 2018 report summarizes the performance of Carkeek Wet Weather Treatment Station (Carkeek WWTS). The Carkeek WWTS began to operate as a CSO treatment facility on November 1, 1994. The Carkeek WWTS operates under the NPDES permit for the West Point Treatment Plant, Washington State Department of Ecology permit number WA00291811.

The total rainfall for the reporting period was 33.5 inches, as measured by the Ballard Station rain gauge. 2018 annual rainfall recorded at Sea-Tac is 35.73 inches for; the 18-year average at Sea-Tac is 39.41. There were ten filling events and four discharge events during 2018. The Carkeek WWTS received 4.5 million gallons (MG) and discharged 1.8 MG. Carkeek WWTS performed well in 2018.

The annual average TSS removal was 79.5 percent for the year thereby meeting the NPDES permit limit of 50 percent for annual removal. Carkeek WWTS met its annual average settleable solids (SS) limit with the average measured as 0.10 milliliters/liter/hour (mL/L/hr) with the NPDES permit limit being 0.3 mL/L/hr. The Carkeek WWTS met all NPDES permit limits. The performance for 2018 has been summarized below in Table D-1.

Table D-1. Carkeek WWTS Permit Performance in 2018

Parameter	Performance	Permit Conditions
Discharge events (number)[a]	**4**	**10**
Discharge volume million gallons (MG)[a]	**1.8**	**46**
Annual average SS (mL/L/hr)	**0.1**	**0.3**
Annual average TSS removal- including all discharge events (%)	**79.5**	**50**
Instantaneous minimum effluent pH, frequency of discharge days with pH < 6.0	**0 out of 4 discharge days**	**≥ 6.0**
Instantaneous maximum effluent pH, frequency of discharge days with pH> 9.0	**0 out of 4 discharge days**	**≤ 9.0**
Total residual chlorine (TRC), maximum of daily averages (µg/L), frequency of discharge days with TRC> 490 µg/L	**0 out of 4 discharge days**	**≤ 490 µg/L**
Monthly fecal coliform geomean, frequency of months with monthly geomean >400/100mL	**0 out of 3 discharge months**	**400/100 mL**

[a] Compliance assessed over a 5-year average.
Numbers in red indicate a permit exceedance.

Suspended and Settleable Solids

TSS removal averaged 79.5 percent, thereby meeting the annual TSS removal NPDES permit limit of 50 percent. The annual SS for the year averaged 0.10 ml/L/hr, thereby meeting the NPDES Permit limit annual average of 0.3 ml/L/hr.

Fecal Coliform Bacteria

Carkeek met the permit limit for monthly geomean for fecal coliform during each of the three months with discharges in 2018. The maximum geomean was 12 which occurred in the month of January. The 2018 annual average of the monthly geomeans was five counts/100 ml.

Instantaneous Minimum/Maximum pH

The instantaneous minimum and maximum pH during the 2018 reporting period was 6.0 and 8.1, respectively, thereby meeting the NPDES permit limits for instantaneous minimum pH equal to or greater than 6.0 and for the maximum pH permit limit of equal to or less than 9.0.

Total Residual Chlorine

Carkeek met the daily maximum average TRC on all four discharge days in 2018. The annual average of the TRC was 50 µg/L. The maximum daily average effluent TRC

during the 2018 reporting year was 99 µg/L, thereby meeting the NPDES permit limit of 490 µg/L. The final effluent sampling system was upgraded in 2017 with two sampling pumps- duty and standby pumps. Operators will need to manually valve in the standby pump in the event the duty pump fails.

Operation and Maintenance

Highlights of O&M activities during 2018 include:

- Conducted annual CSO refresher training for the operators in September 2018.
- Received shipments of both sodium hypochlorite and sodium bisulfite treatment chemicals.
- Continued to conduct debriefings with O&M staff after discharge events to review and discuss the discharge and treatment performance and make any needed operational adjustments for subsequent events.
- Periodic cleaning out the sedimentation tanks and effluent channel of accumulated solids and debris to improve solids removal.
- Continued monthly testing of the treatment chemicals' concentrations (sodium hypochlorite and sodium bisulfite solutions) and made necessary changes to the feed programs or ordered fresh chemicals.
- Continued a preventive maintenance practice to exercise the chemical feed pumps monthly.
- Continued preventative maintenance by Offsite Instrumentation and Electrical staff of online chlorine and pH analyzers including weekly calibration and replacement of probes and other instrumentation components as necessary.
- Carkeek Pump Station evaluation and adjustments of the VFDs installed in 2017 is ongoing.

Near Future Operation

As with all wet weather treatment stations, opportunities to operate and then to optimize the Carkeek WWTS operations are 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 "normal" challenges of an intermittently operated facility, WTD has essentially had to make improvements continuously, and several improvements have been identified to be addressed during subsequent dry seasons.

- Continued to conduct debriefings with O&M staff after discharge events to review and discuss the discharge and treatment performance and make any needed operational adjustments for subsequent events.
- Continued monthly or quarterly testing of the treatment chemicals' concentrations (sodium hypochlorite and sodium bisulfite solutions) and made necessary changes to the feed programs or ordered fresh chemicals.
- Continued a preventive maintenance practice to exercise the chemical feed pumps monthly. And weekly calibration and preventive maintenance of online instrumentation.
- Continued to monitor and evaluated the completed flow measurement improvements

Table D-2. Carkeek WWTS Annual Plant Performance 2018

Month	Day	Carkeek Inflow Event Number	Carkeek Inflow Volume (MG)	Carkeek Discharge Event Number	Carkeek Discharge Volume (MG)	Total Influent TSS (lbs)	Total Effluent TSS Discharged @ Carkeek + WP (lbs)	% removal	Carkeek Effl. Daily Settl Solids (ml/l/hr)	Carkeek Effl. Settl Solids Event avg (ml/l/hr)	Carkeek Avg daily Effl. Fecal Coliforms (#/100 ml)	Carkeek Effl. Residual Chlorine Daily Average (ug/l)	Daily Min/Max pH
January	9	1	0.016	ND	ND	2.8	0.31						
	11	2	0.606	1	0.132	1,173	222		0.1	0.1	80	6	6.6/6.7
	18	3	0.049	ND	ND	82	11						
	23	4	0.062	ND	ND	33	5						
	24	4	0.256	ND	ND	1,029	203						
	27	5	0.078	ND	ND	60	10						
	29	6	1.139	2	0.638	1,035	245		0.1	0.1	20/1	99	6.4/6.7
	Instant. Min/Max pH												**6.4/6.7**
	Event/Daily Max									**0.10**		**99**	
	Monthly Total/Avg/GeoMean	**6**	**2.2**	**2**	**0.77**	**3,415**	**696**	**79.6%**			**11.7**		
February	No Inflow/No Disch.												
	Instant. Min/Max pH												**ND**
	Event/Daily Max									**ND**		**ND**	
	Monthly Total/Avg/GeoMean	**0**	**0.0**	**0**	**ND**	**-**	**-**	**ND**			**ND**		
March	No Inflow/No Disch.												
	Instant. Min/Max pH												**ND**
	Event/Daily Max									**ND**		**ND**	
	Monthly Total/Avg/GeoMean	**0**	**0.00**	**0**	**ND**	**-**	**-**				**ND**		
April	14	1	1.39	1	0.80	1,626	351		0.1	0.10	1/1	38	6.7/8.1
	Instant. Min/Max pH												**6.7 /8.1**
	Event/Daily Max									**0.10**		**38**	

Month	Day	Carkeek Inflow Event Number	Carkeek Inflow Volume (MG)	Carkeek Discharge Event Number	Carkeek Discharge Volume (MG)	Total Influent TSS (lbs)	Total Effluent TSS Discharged @ Carkeek + WP (lbs)	% removal	Carkeek Effl. Daily Settl Solids (ml/l/hr)	Carkeek Effl. Settl Solids Event avg (ml/l/hr)	Carkeek Avg daily Effl. Fecal Coliforms (#/100 ml)	Carkeek Effl. Residual Chlorine Daily Average (ug/l)	Daily Min/Max pH
	Monthly Total/Avg/GeoMean	**1**	**1.39**	**1**	**0.80**	**1,626**	**351**	**78.4%**			**1.0**		
May	19	1	0.018	ND	ND	23	1.2						
	Instant. Min/Max pH												**ND**
	Event/Daily Max									**ND**		**ND**	
	Monthly Total/Avg/GeoMean	**1**	**0.02**	**ND**	**ND**	**23**	**1.2**	**94.8%**			**ND**		
June	No Inflow/No Disch.												
	Instant. Min/Max pH												**ND**
	Event/Daily Max									**ND**		**ND**	
	Monthly Total/Avg/GeoMean	**0**	**0.0**	**ND**	**ND**	**ND**	**ND**	**ND**			**ND**		
July	No Inflow/No Disch.												
	Instant. Min/Max pH												**ND**
	Event/Daily Max									**ND**		**ND**	
	Monthly Total/Avg/GeoMean	**0**	**0.0**	**ND**	**ND**	**ND**	**ND**	**ND**			**ND**		
August	No Inflow/No Disch.												
	Instant. Min/Max pH												**ND**
	Event/Daily Max									**ND**		**ND**	
	Monthly Total/Avg/GeoMean	**0**	**0.0**	**ND**	**ND**	**ND**	**ND**	**ND**			**ND**		
September	No Inflow/No Disch.												
	Instant. Min/Max pH												**ND**
	Event/Daily Max									**ND**		**ND**	

Month	Day	Carkeek Inflow Event Number	Carkeek Inflow Volume (MG)	Carkeek Discharge Event Number	Carkeek Discharge Volume (MG)	Total Influent TSS (lbs)	Total Effluent TSS Discharged @ Carkeek + WP (lbs)	% removal	Carkeek Effl. Daily Settl Solids (ml/l/hr)	Carkeek Effl. Settl Solids Event avg (ml/l/hr)	Carkeek Avg daily Effl. Fecal Coliforms (#/100 ml)	Carkeek Effl. Residual Chlorine Daily Average (ug/l)	Daily Min/Max pH
	Monthly Total/Avg/GeoMean	**0**	**0.0**	**ND**	**ND**	**ND**	**ND**	**ND**			**ND**		
October	27	1	0.295	ND	ND	317	34						
	Instant. Min/Max pH												**ND**
	Event/Daily Max									**ND**		**ND**	
	Monthly Total/Avg/GeoMean	**1**	**0.30**	**ND**	**ND**	**317**	**34**	**89.3%**			**ND**		
November	26	1	0.57	1	0.21	262.84	73.47		0.1	0.1	1.0	58.0	6.0/6.4
	Instant. Min/Max pH												**6.0/6.4**
	Event/Daily Max									**0.1**		**58**	
	Monthly Total/Avg/GeoMean	**1**	**0.57**	**1**	**0.21**	**263**	**73**	**72.0%**			**1**		
December	No Inflow/No Disch.												
	Instant. Min/Max pH												**ND**
	Event/Daily Max									**ND**		**ND**	
	Monthly Total/Avg/GeoMean	**0**	**0.0**	**0**	**ND**	**-**	**-**				**ND**		
Total		**10**	**4.5**	**4**	**1.78**	**5,645.2**	**1,156**						
Inst. pH Min/Max													**6.0/8.1**
Max (GEM, SS, TRC)										**0.10**	**12**	**99**	
Annual Average								**79.5%**		**0.10**	**5**	**50**	

Notes:
ND= No discharge.
^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.
Red= NPDES permit exceedance.
%NS= No sample collected; No online instrumentation values to report

* NR= Not Reported due to lab error.

	Inflow Volume (MG)	Discharge Volume (MG)	Total TSS Infl. (lbs)	Total TSS Effl. (lbs)	Annual Average TSS Removal (%)	Maximum of Event Averages SS (ml/l/lhr)	Annual Average SS Concentration (ml/l/hr)	Maximum of Monthly Geomean Effl. Fecal Coliforms (#/100 ml)	Annual Average of Monthly Geomean Effl. Fecal Coliforms (#/100 ml)	Maximum of Daily Averages of Effl. TRC (µg/l)	Instant. Min/Max pH
Includes all events	**4.5**	**1.78**	**5,645**	**1,156**	**79.5%**	**0.10**	0.10	**12**	**5**	**99**	**6.0/8.1**

Appendix E
Elliott West Wet Weather Treatment Station
Annual Report

January–December 2018

Executive Summary

This 2018 annual report summarizes the performance of the Elliott West Wet Weather Treatment Station (WWTS). Elliott West WWTS began operating in July 2005. The facility operates under the permit for the West Point Treatment Plant, Washington State Department of Ecology permit number WA00291811. The current permit went into effect on February 1, 2015.

Total rainfall recorded in 2018 was 32.71 inches as measured at the Denny Way rain gauge station which is located at 3165 Alaskan Way in Seattle. 2018 annual rainfall recorded at Sea-Tac is 35.73 inches for; the 20-year average at Sea-Tac is 39.4. There were 31 inflow events and seven discharge events in 2018. Elliott West WWTS received a total of 255 million gallons (MG) out of which 95.6 MG were treated and discharged through the Elliott West Outfall at the Denny Way Regulator Station located in Myrtle Edwards Park.

The average total suspended solids (TSS) removal for all events during the year was 49.4 percent thereby not meeting the NPDES 50 percent annual average TSS removal limit. Elliott West WWTS also did not meet the settleable solids (SS) annual event average limit with the average measured as 2.6 milliliters/liter/hour (mL/L/hr.) and the NPDES permit limit being 0.3 mL/L/hr. Elliott West WWTS had permit violations for fecal coliform monthly geomean, maximum daily average total residual chlorine (TRC) and daily instantaneous minimum pH in 2018. The performance for 2018 has been summarized below in Table E-1.

Table E-1. Elliott West WWTS Permit Performance in 2018

Parameter	Performance	Permit Conditions
Discharge events (number)	**7**	**NA**
Discharge volume million gallons (MG)	**95.6**	**NA**
Annual average SS (mL/L/hr)	**2.6**	**0.3**
Annual average TSS removal- including all discharge events (%)	**49.4**	**50**
Instantaneous minimum effluent pH, frequency of discharge days with pH < 6.0	**6 out of 10 discharge days**	**≥ 6.0**
Instantaneous maximum effluent pH, frequency of discharge days with pH > 9.0	**0 out of 10 discharge days**	**≤ 9.0**
Total residual chlorine (TRC), maximum of daily averages (µg/L), frequency of discharge days with TRC >109 µg/L	**4 out of 10 discharge days**	**≤ 109 µg/L**
Monthly fecal coliform geomean, frequency of months with monthly geomean >400/100mL	**1 out of 5 discharge months**	**400/100 mL**

Numbers in red indicate a permit exceedance.

Suspended and Settleable Solids

In 2018, the annual TSS removal was calculated to be 49.4 percent; therefore, Elliott West WWTS did not meet the NPDES permit limit of 50 percent. The renewed NPDES permit effective February 1, 2015 removed the SS event maximum limit and kept the annual average of 0.3 ml/L/hr. Meeting the SS NPDES permit limit continues to be a challenge. The annual SS concentration for the 2018 discharge events averaged 2.6 mL/L/hr., exceeding the NPDES permit limit of 0.3 mL/L/hr. The event maximum in 2018 was 10.0 mL/L/hr., occurring on January 29, 2018. With the ongoing challenges of meeting the NPDES permit limits, King County has started a project with consultant engineers to evaluate potential treatment technologies to treat CSO flows at Elliott West WWTS. In late 2017 a pilot project was initiated and by early 2019 a CSO treatment pilot unit will be set up to test the feasibility of using flat ceramic membranes to treat CSO flows.

Fecal Coliform Bacteria

In 2018, Elliott West WWTS did not meet the fecal coliform NPDES permit limit of 400/100 mL monthly geomean once out of the five discharge months. The maximum monthly geomean for fecal coliform bacteria was calculated as 49000 counts/100 mL occurred in the month of December. The annual average of the monthly geomeans was 9855 counts/100 mL. The single event that had the high fecal coliform count and resulted in geomean greater than the permit limit occurred on December 18, 2018. This event was a very short duration with less than two hours of discharge. The event occurred at the end of a two-day rain storm. When the fecal coliform sample was

collected, the flows and pumping had started to diminish. During the event, the sodium hypochlorite dose was high, averaging 17.6 mg/L and the pre-dechlorination total residual chlorine (TRC) averaged 6.85 mg/L. Based on both the sodium hypochlorite dosage and the pre-dechlorination TRC data, there should have been sufficient disinfection for the event. It is unknown as to the cause of high fecal coliform numbers from the single sample collected. King County believes that the sample was not representative of the entire 1.2 MG discharge.

In 2018 Elliott West WWTS had a disinfection failure that occurred during an April 14, 2018 discharge event. The disinfection failure was a result of the hypochlorite feed pump, which stopped pumping during the discharge event. When the operators were unsuccessful in restarting the feed pumps, they called in maintenance staff. The electricians were able to reset the equipment and resume chemical feed. It is unclear what caused the hypochlorite feed pumps to stop operating. King County staff were unable to trace the cause, nor replicate the conditions, that led to the interruption in hypochlorite feed.

Actions taken throughout the year to address the high fecal coliform levels included cleaning and shock dosing the final effluent sample line and increasing the hypochlorite dose. Further increases in hypochlorite dose set point will be applied for future events. However, the increased hypochlorite dose will require additional diligence to assure compliance with the effluent Cl_2 and/or pH limits. Additional steps to improve fecal coliform inactivation include review of the hypochlorite and dechlorination chemical feed system pumps and program controls as part of the 2016 Elliott West WWTS assessment and improvement project by King County.

Total Residual Chlorine

During 2018, there were four discharge days out of ten that exceeded the maximum daily average total residual chlorine (TRC) NPDES permit level of 109 µg/L. Please refer to Table E-2 for the discharge events that exceeded the TRC limits. The annual average of all daily TRC values was 154 µg/L and the maximum value of 733 µg/L was measured by the online effluent chlorine analyzer. There are several potential causes for the TRC permit limit exceedances. Several of the discharge events had intermittent flows and many events had wide pumping fluctuations by the main pumps causing challenges to the chemical systems to respond quickly enough to the changes in the discharge flows. In addition, the TRC exceedances may have been caused by inadequate sodium bisulfite (SBS) feed and mixing and the continuous adjustments made to the SBS feed in direct response to the minimum pH excursions. It is possible that SBS under-feeding contributed to the TRC exceedances. From examining event data trends, it is possible the SBS mixing may be inadequate. WTD staff is continuing to adjust the chemical feed controls as well as the monitoring equipment (i.e., the online chlorine analyzers and pH meter).

In 2016, a capital project was initiated to build a separate dedicated sampling and instrumentation room at Denny Station for the final effluent compliance sampling and monitoring and pre-dechlorination sample delivery improvements. This project included increasing the water system capacity to provide higher flows for the SBS carrier water. The Instrumentation and Sample Room Improvement project was completed in 2017 with ongoing fine tuning and adjustments by King County staff. A modified dechlorination control program has been added in 2016 to allow operators to switch between automatic SBS feed control to “semi-auto” feed control. In semi-auto feed control, the inputs from the pre-dechlorination chlorine analyzer are disengaged which will allow the operator to enter a pre-dechlorination chlorine residual value. The pre-dechlorination chlorine analyzer provides a control input for the automatic dechlorination feed program and frequently becomes clogged, thus, generating false chlorine residual inputs to the SBS feed program and resulting in incorrect dosing of SBS. Furthermore, installation of a two-tier diffuser for SBS application was completed in the summer of 2018. The preliminary results of evaluation of the three treatment and discharge events in fall 2018 using the new SBS diffuser seem positive. Continued evaluation to occur in future treatment events. Along with the new SBS diffuser, King County has completed a project to install an inline SBS dilution system at Elliott West WWTS to dilute the 38 percent SBS to 20 percent solution when SBS is transferred to the day tank at Denny Station. Using a more dilute SBS along with additional carrier water will aid in chemical dispersion and improved mixing. The SBS post-dilution system was implemented in summer 2018.

Instantaneous Minimum and Maximum Effluent pH

Instantaneous minimum and maximum effluent pH in 2018 was measured as 3.0 and 7.7, respectively. There was a total of ten discharge days in 2018, and six of those discharge days had the instantaneous minimum effluent pH measured below the NPDES permit level of 6.0, and there were no events exceeding the maximum pH limit of 9.0.

A low effluent pH tends to occur during extreme storm flows when the alkalinity of the CSO flows can be quite low. Alkalinity of the final effluents have been in the range 10 to 50 milligrams per liter (mg/L) as CaCO3. Though the influent pH tends to be above pH 6.5 even with low influent alkalinity, the low alkalinity will provide little buffer to the acidic compounds that can be introduced during the dechlorination process. SBS is not only acidic in nature, it will also react with dissolved oxygen in the effluent to form sulfate, or sulfuric acid (H2SO4), which will then consume alkalinity and drop the effluent pH. The key to complying with the minimum pH limit is the ability to vary or control the SBS dose so it just neutralizes the pre-SBS chlorine residual. In fact, staff has been fine-tuning the SBS feed control program as well as trying to reduce the hypochlorite dose so the necessary SBS dose to meet the coliform limits is also reduced. Nonetheless, these actions did not prevent all exceedances in 2018. WTD staff will continue to respond to

Elliott West WWTS discharges in order to adjust the chlorination and dechlorination controls. Some projects to improve treatment chemical feed controls and SBS mixing mentioned in the previous section on final chlorine residual permit performance will also benefit in meeting the pH permit limits of the discharge effluents. Further analysis of the data trends of discharge events is on-going.

Operation and Maintenance

Highlights of O&M activities at EWCSO during 2018:

- Conducted annual CSO refresher training for the operators in September 2018.
- Provided remote monitoring support team in anticipation of a treatment and discharge event, and during the event.
- Received shipments of both sodium hypochlorite and sodium bisulfite treatment chemicals as needed.
- Continued the automated Mercer Tunnel flushing program at the East Portal flushing gate as an attempt to flush and capture the solids settled in the Mercer Tunnel.
- Continued to monitor the effectiveness of the automated Mercer Tunnel flushing by taking additional samples from the return flows and running laboratory solids analyses on the samples.
- 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 the West Point Treatment Plant.
- Continued to conduct debriefings with O&M staff after discharge events to review and discuss the discharge and treatment performance and make any needed operational adjustments for subsequent events.
- Continued with additional procedures to the post-discharge event routines including equipment testing, cleaning and de-ragging within the dechlor and final effluent vaults/structures. Equipment includes both pre-dechlor and final effluent sample pumps and sample intakes and SBS mixers.
- Continued to exercise the hypochlorite chemical feed pumps monthly as a preventive maintenance measure.
- Continued monthly testing of the treatment chemicals' concentrations (sodium hypochlorite and sodium bisulfite solutions) and made necessary changes to the feed programs or ordered fresh chemicals.
- Made changes to main pump control program with the goal to minimize large pump flow swings impacting treatment and impacts to upstream conveyance.
- SBS diffuser for SBS application has been installed in summer 2018. Evaluation of the diffuser will continue.

- Installed in summer 2018 and currently operating a post – inline SBS dilution system at Elliott West WWTS EW WWTS to dilute the 38 percent SBS to 20 percent solution.
- Implemented a “semi-auto” mode for SBS feed control which would disable the input from the pre-dechlorination chlorine analyzer to the SBS feed program during times when the analyzer is not working properly.

Improvement Projects at Elliott West Wet Weather Station

The Instrumentation and Sampling Equipment Relocation project was completed in September 2017. The work on the project including the design phase and necessary construction permitting was carried out by King County Capital Projects team in 2015. This project was to improve sample delivery and to relocate the process instrumentation and monitoring equipment at Denny Way Station (the location of Elliott West WWTS dechlorination and final effluent monitoring). The instrumentation and sampling equipment were relocated to a separate dedicated room out of the SBS day tank room. In addition to relocating the instrumentation, the pre-dechlorination and final effluent amperometric chlorine residual analyzers were updated with newer models that has the programed to enter a “sleep-mode” during non-discharge days, saving instrument wear, and reducing city water and reagent chemical use. As part of this project, the sample lines and copper flushing water lines were replaced with non-metal materials that will meet the standards for priority pollutant sampling and eliminate the non-compatible material contamination of samples. Monitoring of the new sampling and instrumentation system performance and any necessary modifications are currently being made. One of these modifications is the discovery of the need to increase sample flow velocities through strainers and separators in order to achieve better particle straining and drop – out prior to the sample flow into the total chlorine residual analyzers (pre-dechlorination and final effluent TRC analyzers) and minimize clogging of the analyzers.

In a separate project, the SBS post-dilution system, was started in 2016 and was completed in 2018. This project will dilute the SBS from the stored concentration of 38 percent to 20 percent solution during the transfer of SBS from storage tanks at Elliott West facility to the day tank at Denny Station. Use of a more dilute SBS will minimize freezing and crystallization of SBS in the transfer line and will aid in SBS dispersion at dechlorination vault located at Denny Station. It is anticipated that the SBS feed pumps will perform better when pumping at higher speeds to adjust for a more dilute SBS chemical.

A project to evaluate the use of ceramic flat plate membranes to treat CSO flows at WWTSs was initiated in early 2018 with the design and implementation of a pilot plant in spring 2019. The ceramic flat plate membrane technology to treat CSO flows requires a coagulant to form a floc with the solids in the CSO flows. The membrane acts as a barrier for solids flocculant as treated effluent is pumped through the membrane. The

pilot project will be set up to evaluate solids, metals and bacterial removals as well as other water quality parameters. The pilot unit will be operated by King County staff and is currently located at West Point to conduct process testing under simulated CSO conditions with support from the project team of county staff, consultants and the membrane vendor. If the pilot unit reliably performs under simulated CSO conditions at West Point, the unit will be moved to Elliott West WWTS during the 2019-2020 wet weather season to conduct performance testing under actual CSO conditions.

In late October 2017, it was discovered that the Elliott West WWTS effluent pipe drain gate (a.k.a. wet well drain gate) failed to close. This drain gate is normally closed during discharge events, but will open after events, to allow the facility to drain the treated flow in the effluent pipeline that was not discharged, back into the facility where it can be transferred to West Point for treatment. The partially open gate allows recycling of some flow that has already been disinfected and dechlorinated, so proper dosing becomes more of a challenge. The work to address the failed drain gate was originally set for late January 2018; however, the gate repair has been re-scheduled for spring/summer 2019.

Near Future Operation

During the thirteen 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 Elliott West WWTS'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 early 2016 King County hired consultant engineering team to address issues of solids capture and removal, screenings of CSO flows, and improve compliance at Elliott West WWTS. Two options were evaluated to improve performance of Elliott West. The first option was to modify the existing WWTS to improve performance and included analyses of retrofits such as:

- Influent sampling and flow measurement locations and methodology to better characterize WWTS performance.
- Installation of a baffle/weir wall within the wet well to improve solids removal.
- Modifications to influent pumping controls to prevent large oscillations that impact downstream disinfection and dechlorination controls.
- Modifications to improve screening.
- Modifications to improve disinfection and dechlorination.

In addition, WTD staff will:

- Continue to investigate and, if possible, correct the cause(s) of the instantaneous minimum pH exceedances.
- Continue to implement the remote monitoring response team to Elliott West WWTS as the wet well fills and in anticipation of a discharge.
- Continue evaluation and fine-tuning of the chlorination and dechlorination controls.
- Continue evaluation and fine-tuning of systems after completing the sample and instrumentation relocation project.
- Continue to sample and monitor copper and dissolved oxygen of Elliott West WWTS flow per NPDES permit requirement.
- Continue with laboratory solids analyses on all flows sampled at Elliott West WWTS as part of the monitoring of the automated Mercer Tunnel flushing program.
- The SBS post-dilution system was implemented in summer 2018 and fine-tuning will occur as necessary.
- Continue evaluation and fine-tuning of changes in the main pump control program.
- Provide support in operating and evaluating the ceramic membrane pilot unit for wet weather/CSO treatment.
- Begin planning level concept and basis of estimate development for high rate clarification treatment application at Elliott West.

Table E-2. Elliott West WWTS Annual Plant Performance 2018

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 @ EW + WP (lbs)	% removal	EWCSO Effl. Daily Settl Solids (ml/l/hr)	EWCSO Effl. Settl Solids Event Average (ml/l/hr)	EWCSO Effl. Fecal Coliforms (#/100 ml)	EWCSO Effl. Residual Chlorine Daily Average (ug/l)	Daily Min/Max pH
January	5	1	0.83	ND	ND	553	16		ND		ND	ND	ND
	6	1	0.87	ND	ND	340	19		ND		ND	ND	ND
	7	1	0.60	ND	ND	154	17		ND		ND	ND	ND
	8	1	0.05	ND	ND	26	2		ND		ND	ND	ND
	9	1	0.52	ND	ND	86	10		ND		ND	ND	ND
	11	2	15.83	1	8.94	29,937	15,487		4.5	4.50	500/40	148	5.2/6.8
	12	2	1.35	ND	ND	248	18		ND		ND	ND	ND
	13	2	0.83	ND	ND	125	4		ND		ND	ND	ND
	17	3	5.71	2	4.71	7,073	6,660		4.5		220	257	3.2/7.7
	18	3	10.75	2	2.64	2,497	1,135		0.1	2.30	1	0	4.4/5.1
	19	3	1.21	ND	ND	111	9		ND		ND	ND	ND
	20	3	0.69	ND	ND	144	5		ND		ND	ND	ND
	23	4	2.94	ND	ND	3,502	576		ND		ND	ND	ND
	24	4	4.38	ND	ND	215	43		ND		ND	ND	ND
	25	4	0.98	ND	ND	220	20		ND		ND	ND	ND
	26	4	0.63	ND	ND	178	9		ND		ND	ND	ND
	27	4	4.29	ND	ND	1,204	194		ND		ND	ND	ND
	29	5	15.14	3	9.00	26,187	21,629		10.0	10.00	8,000	62	3.0/7.5
	30	5	2.22	ND	ND	451	43		ND		ND	ND	ND
	31	5	0.83	ND	ND	636	28		ND		ND	ND	ND
	Instant. Min/Max pH												3.0/7.7
	Event/Daily Max									**5.6**		257	
	Monthly Total/Avg/GeoMean	**5**	**70.64**	**3**	**25.29**	**73,887**	**45,925**	**37.8%**			**129**		
February	1	1	2.22	ND	ND	643	47		ND		ND	ND	ND
	2	1	1.31	ND	ND	252	13		ND		ND	ND	ND
	3	1	0.47	ND	ND	282	24		ND		ND	ND	ND
	13	2	0.35	ND	ND	263	10		ND		ND	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 @ EW + WP (lbs)	% removal	EWCSO Effl. Daily Settl Solids (ml/l/hr)	EWCSO Effl. Settl Solids Event Average (ml/l/hr)	EWCSO Effl. Fecal Coliforms (#/100 ml)	EWCSO Effl. Residual Chlorine Daily Average (ug/l)	Daily Min/Max pH
	28	3	0.89	ND	ND	571	122		ND		ND	ND	ND
	Instant. Min/Max pH												**ND**
	Event/Daily Max									**ND**		**ND**	
	Monthly Total/Avg/GeoMean	**3**	**5.25**	**ND**	**ND**	**2,012**	**216**	**89.3%**			**ND**		
March	1	1	1.26	ND	ND	189	40		ND		ND	ND	ND
	2	1	0.22	ND	ND	299	36		ND		ND	ND	ND
	8	2	1.01	ND	ND	478	423		ND		ND	ND	ND
	9	2	0.06	ND	ND	30	2		ND		ND	ND	ND
	22	3	0.55	ND	ND	519	33		ND		ND	ND	ND
	23	3	1.17	ND	ND	476	77		ND		ND	ND	ND
	24	3	0.60	ND	ND	1994	173		ND		ND	ND	ND
	Instant. Min/Max pH												**ND**
	Event/Daily Max									**ND**		**ND**	
	Monthly Total/Avg/GeoMean	**3**	**4.86**	**ND**	**ND**	**3,986**	**784**	**80.3%**			**ND**		
April	2	1	0.31	ND	ND	490	19						
	4	2	0.44	ND	ND	518	23						
	7	3	3.92	ND	ND	897	59						
	8	3	0.97	ND	ND	138	7						
	10	4	0.35	ND	ND	177	7						
	11	4	2.72	ND	ND	1,394	53						
	12	4	1.30	ND	ND	249	21						
	13	4	0.81	ND	ND	298	14						
	14	4	31.73	1	30.62	56,785	55,779		2	2	45	108	6.4/6.7
	15	4	8.20	1	1.37	5,449	4,430		ED		45	7	6.4/6.8
	16	4	1.31	ND	ND	14,379	1,027						

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 @ EW + WP (lbs)	% removal	EWCSO Effl. Daily Settl Solids (ml/l/hr)	EWCSO Effl. Settl Solids Event Average (ml/l/hr)	EWCSO Effl. Fecal Coliforms (#/100 ml)	EWCSO Effl. Residual Chlorine Daily Average (ug/l)	Daily Min/Max pH
	17	4	0.30	ND	ND	346	14						
	28	5	0.58	ND	ND	463	113						
	Instant. Min/Max pH												**6.4/6.8**
	Event/Daily Max									**2.0**		**108**	
	Monthly Total/Avg/GeoMean	**5**	**52.93**	**1**	**31.99**	**81,584**	**61,567**	**24.5%**			**45**		
May	No Inflow/No Disch.												
	Instant. Min/Max pH												**ND**
	Event/Daily Max									**ND**		**ND**	
	Monthly Total/Avg/GeoMean	**0**	**0.00**	**ND**	**ND**	**-**	**-**	**ND**			**ND**		
June	13	1	0.37	ND	ND	625.76	46.81						
	24	2	0.28	ND	ND	104.18	3.97						
	25	2	0.18	ND	ND	240.22	8.75						
	Instant. Min/Max pH												**ND**
	Event/Daily Max									**ND**		**ND**	
	Monthly Total/Avg/GeoMean	**2**	**0.83**	**ND**	**ND**	**970.16**	**59.53**	**93.9%**			**ND**		
July	No Inflow/No Disch.												
	Instant. Min/Max pH												
	Event/Daily Max												
	Monthly Total/Avg/GeoMean	**0**	**0.00**	**ND**	**ND**	**ND**	**ND**	**ND**					
August	31	1	0.38	ND	ND	114.18	3.04						
	Instant. Min/Max pH												**ND**
	Event/Daily Max									**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 @ EW + WP (lbs)	% removal	EWCSO Effl. Daily Settl Solids (ml/l/hr)	EWCSO Effl. Settl Solids Event Average (ml/l/hr)	EWCSO Effl. Fecal Coliforms (#/100 ml)	EWCSO Effl. Residual Chlorine Daily Average (ug/l)	Daily Min/Max pH
	Monthly Total/Avg/GeoMean	**1**	**0.38**	**ND**	**ND**	**114**	**3**	**97.3%**			**ND**		
September	10	1	0.24	ND	ND	232.29	7.69						
	16	2	0.36	ND	ND	203.06	8.09						
	Instant. Min/Max pH												**ND**
	Event/Daily Max									**ND**		**ND**	
	Monthly Total/Avg/GeoMean	**2**	**0.61**	**ND**	**ND**	**435**	**16**	**96.4%**			**ND**		
October	8	1	0.30	ND	ND	364	8						
	25	2	0.35	ND	ND	117	3						
	26	2	4.13	ND	ND	4231	373						
	27	2	16.03	1	13.18	20218	12965		1.40	1.4	130/1	12	6.6/6.7
	28	2	5.77	ND	ND	771	44						
	29	2	1.11	ND	ND	4160	115						
	Instant. Min/Max pH												**6.6/6.7**
	Event/Daily Max									**1.4**		**12**	
	Monthly Total/Avg/GeoMean	**2**	**27.69**	**1**	**13.18**	**29,861**	**13,508**	**54.8%**			**11.4**		
November	3	1	0.48	ND	ND	717	56						
	7	2	0.27	ND	ND	211	11						
	22	3	1.81	ND	ND	395	22						
	23	3	2.03	ND	ND	184	13						
	24	3	0.56	ND	ND	111	3						
	26	4	23.59	1	21.42	15071	6755		0.2		78/490	**208**	**5.6**/6.9
	27	4	19.10	1	2.48	16049	3833		0.2	0.2	20	**733**	**5.4**/7.1
	28	4	9.73	ND	ND	3665	241						
	29	4	4.50	ND	ND	2214	79						
	Instant. Min/Max pH												**5.4/7.1**
	Event/Daily Max									**0.2**		**733**	

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 @ EW + WP (lbs)	% removal	EWCSO Effl. Daily Settl Solids (ml/l/hr)	EWCSO Effl. Settl Solids Event Average (ml/l/hr)	EWCSO Effl. Fecal Coliforms (#/100 ml)	EWCSO Effl. Residual Chlorine Daily Average (ug/l)	Daily Min/Max pH
	Monthly Total/Avg/GeoMean	**4**	**62.07**	**1**	**23.90**	**38,619**	**11,014**	**71.5%**			**91.4**		
December	9	1	1.93	ND	ND	1129	66						
	10	1	0.21	ND	ND	850	25						
	11	1	1.47	ND	ND	1067	44						
	16	2	1.99	ND	ND	648	36						
	17	2	2.03	ND	ND	1677	128						
	18	2	9.35	1	1	5809	1331		0.10	0.1	49000	0	6.2/7.1
	19	2	1.67	ND	ND	3226	75						
	20	2	0.93	ND	ND	581	24						
	22	3	2.04	ND	ND	823	25						
	23	3	2.73	ND	ND	387	24						
	24	3	0.13	ND	ND	193	5						
	28	4	1.82	ND	ND	728	43						
	29	4	2.27	ND	ND	18205	1554						
	30	4	1.12	ND	ND	3353	207						
	31	4	0.04	ND	ND	242	7						
	Instant. Min/Max pH												**6.2/7.1**
	Event/Daily Max									**0.1**		**0**	
	Monthly Total/Avg/GeoMean	**4**	**29.74**	**1**	**1.20**	**38,919**	**3,592**	**90.8%**			**49000**		
Total		**31**	**255.0**	**7**	**95.56**	**270,386**	**136,683**						
Inst. pH Min/Max													**3.0/7.7**
Max (GEM, SS, TRC)										**10.00**	**49000**	**733**	
Annual Average							by mass:	**49.4%**		**2.56**	**9855**	**154**	

Notes:

ND= No Discharge.

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

NS= No Sample.
%NR= Not Reported due to lab error
Red= NPDES permit exceedance

	Inflow Volume (MGD)	Discharge Volume (MGD)	Total TSS Infl. (lbs)	Total TSS Effl. (lbs)	Annual Average TSS Removal (%)	Maximum of Event Averages SS (ml/l/lhr)	Annual Average SS Concentration (ml/l/hr)	Maximum of Monthly Geomean Effl. Fecal Coliforms (#/100 ml)	Annual Average of Monthly Geomean Effl. Fecal Coliforms (#/100 ml)	Maximum of Daily Averages of Effl. TRC (µg/l)	Instant. Min/Max pH
Includes all events	255.0	95.6	270,386	136,683	49.4%	10.00	2.56	49000	9855	733	5.3/9.7

Appendix F
Henderson/MLK Jr. Way Wet Weather Treatment Station Annual Report

January–December 2018

Executive Summary

This 2018 annual report summarizes the performance of King County's Henderson/Martin Luther King Junior Way Wet Weather Treatment Station (Henderson/MLK Jr. Way WWTS). The Henderson/MLK Jr. Way WWTS came online in 2005 and operates under the National Pollutant Discharge Elimination System (NPDES) permit for the West Point Treatment Plant (West Point) (WA00291811).

A total of 28.70 inches of rain fell in 2018, as measured at Henderson Street Pump Station. SeaTac Airport recorded 35.73 inches for 2018, compared to the historical annual average measured at Sea-Tac of 37.49 inches (20-year average).

There were three filling events and one discharge event during 2018. The one discharge event resulted in a single discharge day for determining compliance (a "compliance" day is based on a 7:00 a.m. to 7:00 a.m. clock). The Henderson/MLK Jr. Way WWTS received a total inflow of 8.62 million gallons (MG) and discharged 3.6 MG of treated water through the Norfolk Street Overflow to the Duwamish Waterway. Table F-1 summarizes NPDES permit performance in 2018.

Table F-1. Henderson/MLK Jr. Way WWTS Permit Performance in 2018

Parameter	Performance	Permit Conditions
Annual average effluent settleable solids (ml/L/hr)	0.3	0.3
Annual average total suspended solids removal - based all discharge events (%)	86.4%	50
Instantaneous minimum effluent pH: number of discharge days with pH < 6.0	0 out of 1 discharge days	≥ 6.0
Instantaneous maximum effluent pH: number of discharge days with pH > 9.0	0 out of 1 discharge days	≤ 9.0
Total residual chlorine (TRC), daily average (µg/L): number of discharge days with TRC > 39 µg/L	0 out of 5 discharge days	39
Monthly fecal coliform geomean (cfu/100 ml): number of months with monthly geomean > 400	0 out of 2 discharge months	400

Note: Numbers in red indicate a permit exceedance.

Annual Suspended Solids Removal and Settleable Solids

The annual average total suspended solids (TSS) removal was 86.4 percent; the minimum permit limit is 50 percent. All annual average effluent settleable solids were at 0.3 milliliters/liter/hour (ml/L/hr).

Monthly Fecal Coliform Bacteria

All monthly fecal coliform results were below the 400 colony forming units (cfu)/100 ml.

Instantaneous Minimum/Maximum pH

There were no exceptions to the minimum or maximum pH limit. The lowest and highest effluent pH recorded during the nine-hour discharge period was pH 6.3 and 6.4.

Daily Total Residual Chlorine

There were no exceptions to the maximum daily total residual chlorine (TRC) limit.

Operation and Maintenance

The equipment and facilities of the Henderson/MLK Jr. Way WWTS were fully functioning and available during 2018. Preventive maintenance was performed routinely. Routine operation and maintenance (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 combined sewer overflow facilities, and post-event debriefs and corrective work orders, as appropriate. All samples and analyses listed in West Point's monitoring schedule were collected and measured. Priority pollutant samples were collected and measured for the single April discharge event. More details are available in the monthly discharge monitoring reports.

The newly installed fine-range level sensor at the tunnel's inlet weir provided much better disinfection control. The total residual chlorine (TRC) measured at the tunnel outlet prior to dechlorination (manual sampling) was regularly 1.3-mg/L through the event, while effluent fecal coliform levels were well below 400-cfu/100-mL.

With regards to flow measurement, the accuracy of the inlet weir level measurement was verified early this spring by visually confirming that flow measurement started when water first went over the inlet weir. We were unable to perform the same verification for the new level sensor at the tunnel outlet weir. In fact, subsequent analysis of this event demonstrated that the outlet level sensor started to record flow before flow was actually being discharged. The discharge volume was not based on the outlet flow measurement but was based on the inflow volume minus the storage tunnel volume. Corrections will

be made to the outlet level sensor to accurately measure the flow discharged from the tunnel.

Henderson/MLK Jr. Way WWTS Improvements Project

In 2015, a consultant study recommended improvements to address challenges with consistently meeting NPDES permit requirements for disinfection and dechlorination. In 2016, a capital project was funded to complete improvements based on the consultant's recommendations. Project tasks were separated into two phases. Phase-1 improvements, which were completed in late 2017, are intended to enhance the flow-pacing accuracy of the existing hypochlorite and sodium bisulfite (SBS) pumps. Phase 1 improvements included:

- Re-level the existing inlet and outlet rectangular weirs to provide a more accurate inlet and outlet flow calculation over these very long weirs, which, in turn, will provide better control of chemical dosing.
- Install new fine-range bubbler sensors directly upstream of the tunnel's inlet and outlet weirs to provide greater accuracy at the small incremental level changes that occur over these very long weirs. A more accurate flow reading will provide better control of chemical dosing. The existing level sensors will be retained for redundancy and full-depth readings.
- Install flow meters on the hypochlorite and SBS chemical dosing lines to verify that the actual applied chemical dose is equal to the dose set point (e.g., lbs/MG) in the control system. The chemical flow meters will also be used in the control systems for feed control after the new chemical feed pumps and pre-dechlorination analyzer are installed.
- Improve venting of the chemical supply lines by removing and relocating pressure-relief valves at various locations on the hypochlorite supply lines.

Phase 2 improvements are based on "right-sizing" the chemical dosing pumps to better match actual flows and doses and installing tools to improve control of the dechlorination process. Right-sizing the chemical pumps was very important given that actual flows have been far lower than the 146 million gallons per day (MGD) peak design flow. The largest inflow recorded at the facility thus far is only 55 MGD; current modeling suggests that peak flows will only reach about 75 MGD in the foreseeable future. Right-sizing the chemical pumps was also important because actual doses have been much lower than the dose assumed during initial design. Hypochlorite doses required to meet the 400 cfu/100 ml have usually been near 3 to 4 milligrams per liter (mg/L) as chlorine (Cl_2), while the initial design assumed 10 mg/L. Thus, the current hypochlorite pump capacity is nearly five times the demand required during most events. The new chemical pumps, while providing the lower doses with more accuracy, will still provide a sufficient dose if a 146-MGD peak flow occurs. Thus, the new equipment will maintain Henderson/MLK Jr. Way WWTS's rated capacity of 146 MGD.

Phase 2 improvements are currently at 100 percent design. Construction was scheduled to begin in the fall 2018 and to be completed in 2019, but the start of construction was delayed until after the wet season. Staff are re-trained on operating procedures at the beginning of each wet season. The delay was necessary because it didn't make sense to make changes to equipment in a periodically operated facility in the middle of the wet season. Phase 2 improvements include the following tasks:

- Replace the three existing hypochlorite chemical feed pumps. The existing hypochlorite pumps in the Tunnel Inlet Regulator are as much as five times larger than necessary, based on historic operating conditions. The prior plan had been to modify the existing metering pumps; however, during design it was decided that new smaller capacity pumps would better match the range of actual and expected doses. The new pumps are self-venting and provide much more accurate dosing control over the wide, and fluctuating flows entering the Tunnel Inlet Regulator.
- Replace the two existing SBS chemical feed pumps. The two existing SBS chemical feed pumps in the Tunnel Outlet Regulator are as much as two times larger than necessary, based on historic operating conditions. As with the hypochlorite pumps, it was decided to replace the existing SBS metering pumps with smaller capacity pumps for more accurate dosing control over the wide and fluctuating CSO flows exiting the tunnel during a CSO event.
- Install a sampling system for tunnel effluent upstream of the tunnel CSO discharge weir (referred to as *pre-dechlorination sampling*). A submersible sample pump will be installed in the Tunnel Outlet and the discharge will be sent through a series of filters to provide a clean "pre-dechlor" sample to a sample feed tank in the Flow Control Room. This location allows the sample to flow by gravity to the new "pre-dechlor" chlorine residual analyzer discussed later.
- Install a new pre-dechlorination chlorine residual analyzer. The SBS metering pumps are currently only controlled by CSO discharge flow rate, resulting in poor control depending on the chlorine concentration of the tunnel outlet flow. A new "pre-dechlor" chlorine residual analyzer will be installed next to other sampling equipment in the existing Equipment Room. The "pre-dechlor" chlorine residual signal will be used by the new pump control system, along with the CSO discharge rate, to provide "feed-forward" control of the sodium bisulfite metering pumps. The dosing rate signal will be sent to the new SBS metering pumps, which will change speeds to meet the required rate.
- Install a strainer on the SBS metering pump suction lines to remove impurities, debris, and chemical residues to avoid interference with the metering pumps.
- Modify the exhaust ventilation intake duct in the SBS chemical room to provide more efficient collection and removal of potential chemical fumes in this room, and to comply with chemical safety codes.

As with all wet weather treatment stations, and especially the Henderson/MLK Jr. Way WWTS, opportunities to optimize operations are limited because of the infrequent number of events. Challenges may be identified during one wet season, and design and implementation of major improvements may not be completed until the next wet season, with opportunities to test and monitor the improvements subsequently dependent on following storm events. Given the complexity and “normal” challenges of an intermittently operated WWTS facility, King County Wastewater Treatment Division staff will continue to monitor, evaluate, and make necessary adjustments in the station’s operation and maintenance. Similarly, equipment improvements will follow a design-construct-operate-monitor-adjust cycle. Additional improvements will be made as necessary.

Table F-2. Henderson/MLK Jr. Way WWTS Annual Plant Performance 2018

Month	Day/Parameter	Inflow Event Number	Inflow Volume (MG)	Discharge Event Number	Discharge Volume (MG)	Total Influent TSS (lbs)	Effl. TSS @ MLK + WP (lbs)	TSS Removal (%)	Effl. Daily SS (ml/l/hr)	Effl. SS Event Max (ml/l/hr)	Effl. Fecal Coliforms (#/100 ml)	Effl. TRC Daily Average (µg/l)	Daily Min/Max pH
January	11	1	0.45	ND	ND	210	34		ND	ND	ND	ND	ND
	29	2	0.87	ND	ND	421	46		ND	ND	ND	ND	ND
	Instant. Min/Max pH												
	Event/Daily Max								**ND**	**ND**		**ND**	**ND**
	Monthly Total/Avg/GeoMean		**1.32**	**ND**	**ND**	**631**	**1447**	**87.3**			**ND**		
February	No Inflow/ No discharge												
	Instant. Min/Max pH												
	Event/Daily Max								**ND**	**ND**		**ND**	**ND**
	Monthly Total/Avg/GeoMean			**ND**	**ND**	**ND**	**ND**				**ND**		
March	No Inflow/ No discharge												
	Instant. Min/Max pH												**ND**
	Event/Daily Max									**ND**		**ND**	
	Monthly Total/Avg/GeoMean			**ND**	**ND**	**86**	**67**				**ND**		
April	14	**1**	**7.3**	**1**	**3.6**	**8463**	**1157**		**0.3**				
	Instant. Min/Max pH												**6.3/6.4**
	Event/Daily Max									**0.3**		**4**	
	Monthly Total/Avg/GeoMean	**1**	**7.3**	**ND**	**ND**	**8463**	**1157**	**86.3**			**22**		
May	No Inflow/ No Discharge												
	Instant. Min/Max pH												**ND**
	Event/Daily Max									**ND**		**ND**	
	Monthly Total/Avg/GeoMean			**ND**	**ND**	**0**	**0**				**ND**		
June	No Inflow/ No Discharge												
	Instant. Min/Max pH												**ND**
	Event/Daily Max									**ND**		**ND**	
	Monthly Total/Avg/GeoMean			**ND**	**ND**	**0**	**0**				**ND**		

Month	Day/Parameter	Inflow Event Number	Inflow Volume (MG)	Discharge Event Number	Discharge Volume (MG)	Total Influent TSS (lbs)	Effl. TSS @ MLK + WP (lbs)	TSS Removal (%)	Effl. Daily SS (ml/l/hr)	Effl. SS Event Max (ml/l/hr)	Effl. Fecal Coliforms (#/100 ml)	Effl. TRC Daily Average (µg/l)	Daily Min/Max pH
July	No Inflow/ No Discharge												
	Instant. Min/Max pH Event/Daily Max Monthly Total/Avg/GeoMean			**ND**	**ND**	**0**	**0**			**ND**	**ND**	**ND**	**ND**
August	No Inflow/ No Discharge												
	Instant. Min/Max pH Event/Daily Max Monthly Total/Avg/GeoMean			**ND**	**ND**	**0**	**0**			**ND**	**ND**	**ND**	**ND**
September	No Inflow/ No Discharge												
	Instant. Min/Max pH Event/Daily Max Monthly Total/Avg/GeoMean			**ND**	**ND**	**0**	**0**			**ND**	**ND**	**ND**	**ND**
October	No Inflow/ No Discharge												
	Instant. Min/Max pH Event/Daily Max Monthly Total/Avg/GeoMean			**ND**	**ND**	0	0			**ND**	**ND**	**ND**	**ND**
November	No Inflow/ No Discharge												
	Instant. Min/Max pH Event/Daily Max Monthly Total/Avg/GeoMean			**ND**	**ND**	**0**	**0**			**ND**	**ND**	**ND**	**ND**
December	No Inflow/ No Discharge												
	Instant. Min/Max pH Event/Daily Max Monthly Total/Avg/GeoMean			**ND**	**ND**					**ND**	**ND**	**ND**	**ND**
		3	**8.62**	**1**	**3.6**	**8403**	**1237**						
Annual Total								**86.4**					

Month	Day/Parameter	Inflow Event Number	Inflow Volume (MG)	Discharge Event Number	Discharge Volume (MG)	Total Influent TSS (lbs)	Effl. TSS @ MLK + WP (lbs)	TSS Removal (%)	Effl. Daily SS (ml/l/hr)	Effl. SS Event Max (ml/l/hr)	Effl. Fecal Coliforms (#/100 ml)	Effl. TRC Daily Average (µg/l)	Daily Min/Max pH
Inst. pH Min/Max										0.3		4	6.3/6.4
Max (GEM, SS, TRC)								86.4		0.3	22		
Annual Average													

Notes:
N/A= Not applicable
ND= No discharge
Red= NPDES permit exceedance

	Inflow Volume (MG)	Discharge Volume (MG)	Total TSS Infl (lbs)	Total TSS Effl. (lbs)	Annual Average TSS Removal (%)	Maximum of Event Averages SS (ml/l/lhr)	Annual Average SS Concentration (ml/l/hr)	Maximum of Monthly Geomean Effl. Fecal Coliform (#/100 ml)	Annual Average of Monthly Geomean Effl. Fecal Coliform (#/100 ml)	Maximum of Daily Averages of Effl. TRC (µg/l)	Instant. Min/Max pH
Includes all events	8.62	3.6	8403	1237	86.4	0.3	0.3	22	22	4	6.3/6.4