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July 27, 2021

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RE: King County amended 2019 and 2020 Combined Sewer Overflow (CSO) Control Program Consolidated Annual Consent Decree and NPDES Reports

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 2021. The 2020 Annual Report addresses the County's CSO control project and compliance activities from January through December 2020. The 2019 Annual Report was originally submitted in July 2020, but was amended and is now being re-submitted to correct specific sections, including:

- The total volume of untreated CSO volume discharged.

- The date that the County requested the extension of Chelan Ave. CSO's Consent Decree milestones.
- The control status of Belvoir PS and 63rd Ave CSO from uncontrolled to monitoring.

Additionally, minor modifications to formatting and verbiage were made throughout the report.

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. The amended 2019 CSO Annual Report documents CSO control program activities for calendar year 2019. Similarly, the 2020 CSO Annual Report documents CSO control program activities for calendar year 2020.

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, these reports respond to the reporting requirements of the Consent Decree (§ VIII, paragraph 43), WAC, and NPDES permit in a single document.

Thank you for your review of the King County amended 2019 and 2020 Annual CSO and Consent Decree Reports. If you have any questions or would like additional information, please contact me at 206-263-5767 or kgurol@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.

DocuSigned by:
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7/27/2021

Kamuron Gurol, Division Director
Wastewater Treatment Division
King County Department of Natural Resources and Parks

Date

cc: Verna Bromley, Senior Deputy Prosecuting Attorney, King County Prosecuting Attorney's Office
Jeff Lafer, NPDES Permit Administrator, Wastewater Treatment Division (WTD), Department of Natural Resources and Parks (DNRP)
Susan Kaufman-Una, Project Resources Unit Manager, WTD, DNRP
Janice Johnson, CSO Program Manager, WTD, DNRP

Combined Sewer Overflow Control Program

2020 Annual CSO and Consent Decree Report

July 2021

King County

Protecting Our Waters

Doing our part on rainy days

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

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List of Abbreviations and Acronyms

BMPs	best management practices
CD	consent decree
CHLKK	Chelan/Hanford/Lander/King/Kingdome
County	King County
CSO	combined sewer overflow
DNRP	Department of Natural Resources and Parks
DOJ	U.S. Department of Justice
DSN	discharge serial number
DWO	dry weather overflow
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
FOG	fats, oils, and grease
GSI	green stormwater infrastructure
HLKK	Hanford/Lander/King/Kingdome
hr	hour
HWMP	Hazardous Waste Management Program
JOIST	Joint Operations Information Sharing Team
JPA	Joint Project Agreement
L	liter
LTCP	long-term control plan
Metro	Municipality of Metropolitan Seattle
MG	million gallons
MGD	million gallons per day
µg/L	micrograms per liter

ml	milliliter
MLK	Martin Luther King
MOA	memorandum of agreement
NPDES	National Pollutant Discharge Elimination System
NTP	notice to proceed
O&M	operations and maintenance
PCMP	Post-Construction Monitoring Plan
Plan	Clean Water Plan
PS	pump station
RCW	Revised Code of Washington
RS	regulator station
RWSP	Regional Wastewater Services Plan
SBS	sodium bisulfite
SCADA	supervisory control and data acquisition
SCIP	Source Control Implementation Plan
SDOT	Seattle Department of Transportation
Seattle	City of Seattle
Ship Canal	Lake Washington Ship Canal
SMP	Sediment Management Plan
South Plant	South Treatment Plant
SPU	Seattle Public Utilities
SS	settleable solids
SSO	sanitary sewer overflow
SSOP	Sewer System Operations Plan
TEPS	Tunnel Effluent Pump Station
TRC	total residual chlorine

TSS	total suspended solids
UIC	underground injection control
VFD	variable frequency drive
WIFIA	Water Infrastructure Finance and Innovation Act
WAC	Washington Administrative Code
West Point	West Point Treatment Plant
WTD	Wastewater Treatment Division
WWTS	wet weather treatment station

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. The application for renewal of the NPDES permit for West Point was submitted in January 2019. The current NPDES permit expired on January 31, 2020, and Ecology has not yet completed renewal of the permit. The current permit has been administratively extended until renewal occurs.

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 critical 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. WTD is working to ensure the County is able to meet the required milestones and actions of the CD.

This report documents King County CSO Control Program and CD implementation activities and information for the 2020 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
- 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 King County wet weather treatment stations (WWTSs)
- Coordination with SPU on implementation of source control best management practices (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.

Wastewater flows to WTD's regional system from the City of Seattle and 33 other component agencies. The newer parts of WTD's service area use separate pipes to convey wastewater to WTD's system and stormwater to local receiving water bodies. Much of Seattle is served by a combined sewer system that conveys wastewater and stormwater runoff in the same pipes. WTD's responsibility begins where Seattle's pipes have collected sewage from areas of 1,000 acres. WTD conveys most of the flow from Seattle (including most of the combined sewage flows) to West Point, located in Discovery Park. A small amount of sewage from Seattle is treated at WTD's South Treatment Plant (South Plant) in Renton.

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 82 CSO locations in their local sewer system. SPU is responsible for separately managing and reporting on those locations.

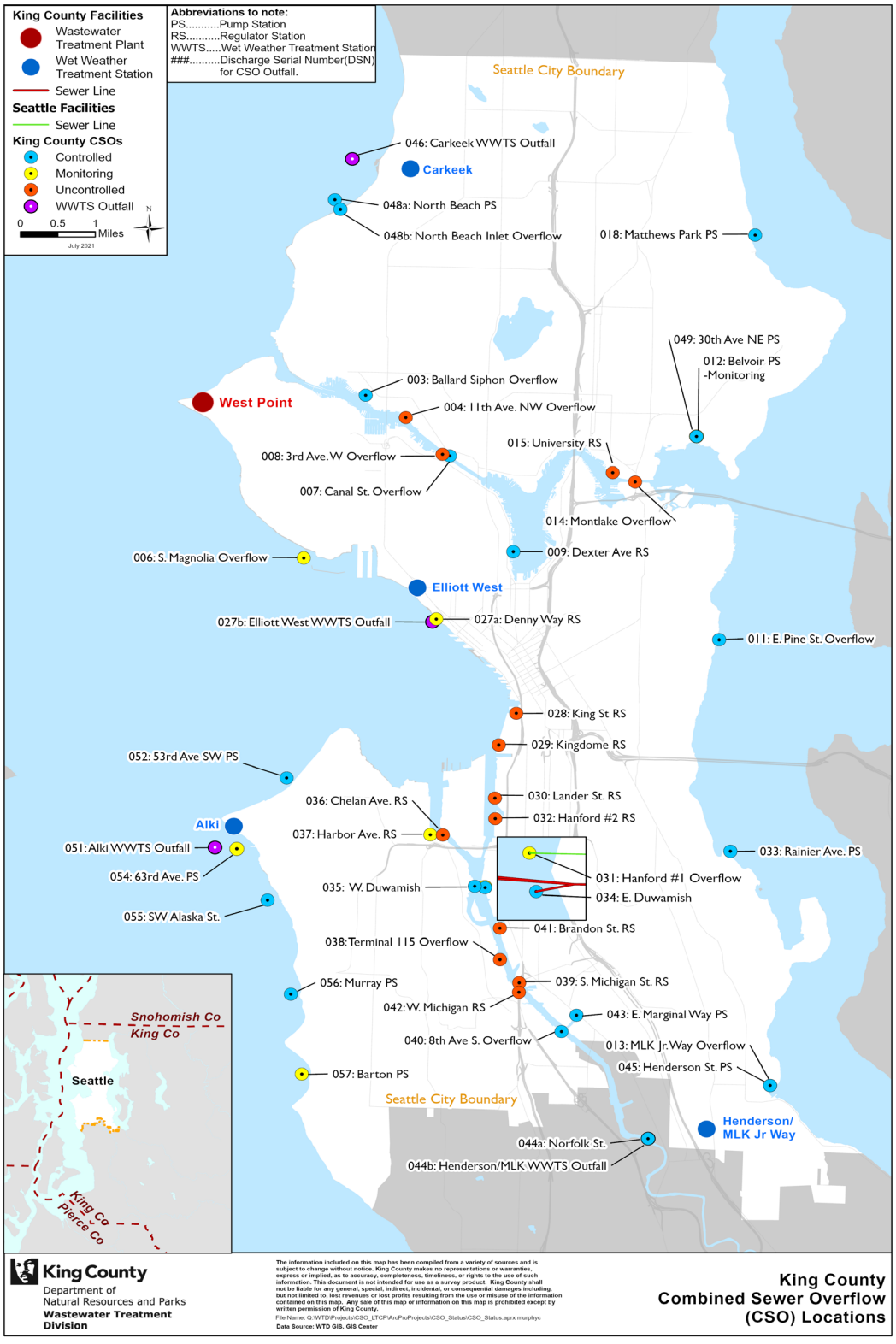

Figure 1. King County CSO Locations

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 made 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

In 1968, the Forward Thrust Bond issue was approved, and extensive sewer separation was completed through 1977 in the Seattle area.

Metro first formalized CSO control with 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 [Revised Code of Washington]) 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.

1.2.2 2018 CSO Control Program Update and CSO Control Planning

In 2015, King County began a comprehensive review and update of the CSO Control Program, including the 2012 LTCP approved in 2013. Updates to the LTCP are required in conjunction with the application for renewal of the NPDES permit by WAC 173-245-090, which typically occurs on a five-year cycle; 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.

The 2018 CSO Program Update documented the status of 2012 LTCP implementation, progress on projects underway, planning-level control volume updates for future projects, and ongoing implementation of CSO Program public involvement activities. The Program Update also reported on environmental studies completed since the 2012 LTCP that inform the CSO Control Program, including the Water Quality Assessment/Monitoring Study, a Climate Change study completed with the University of Washington Climate Impact Group, and the County's ongoing water and sediment monitoring programs. WTD did not recommend any revisions to the LTCP at that time. In its current phase of LTCP implementation and CSO control planning, WTD is working to identify opportunities for further project refinement, facility optimization, and new water quality projects, and will quantify the potential water quality benefits and costs of these opportunities.

Concurrent with LTCP implementation, King County has initiated the Clean Water Plan (Plan), a planning process to update its comprehensive wastewater system plan (see Section 1.2.3). The purpose of the Plan 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 for the best water quality outcomes. Because 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, component agencies (including SPU), and interested parties, as these planning processes unfold.

1.2.3 Clean Water Plan

King County is facing critical decisions that will shape the scope and focus of water quality investments in the coming decades. The purpose of the Clean Water Plan is to guide decisions on future investments in the regional wastewater system and water quality through 2060. The planning process is underway for the Plan, and has been moving systematically through a series of steps to lay the foundation for a thoughtful and transparent evaluation to inform these decisions.

In 2020, the Plan characterized actions that represent specific programs, or sets of projects, that address one of the Decision Areas the Clean Water Plan needs to consider. Decision Areas represent existing and emerging issues that King County needs to consider in order to make choices and to plan for the future. The Clean Water Plan focuses on the following seven Decision Areas:

- Wastewater treatment plants capacity and level of treatment
- Capacity in sewer pipes and pumps
- Aging sewer systems, natural disasters, and climate change
- Recycling resources from wastewater
- Stormwater and combined sewer overflows
- Preventing pollution at the source
- Pollution from historical activities

After characterizing Actions individually, King County intends to combine and shape the various Actions into a handful of potential Strategies. Strategies are complete investment approaches to our wastewater and water quality challenges. Strategies address multiple Decision Areas and consider the timing, sequencing, and interrelationships of the Actions. Work on Strategies will commence in 2021.

The King County Executive will recommend a preferred Clean Water Plan including an implementation sequence to the King County Council which is anticipated to begin their review in 2022. Review of the Clean Water Plan under the State Environmental Policy Act will be incorporated into the planning process. The Clean Water Plan will amend the RWSP and will require approval by Ecology per RCW 90.48.110 and WAC Chapter 173-240.

In developing the Clean Water Plan, King County is committed to a thoughtful, inclusive, and transparent planning process for the region and its residents. Extensive engagement with Ecology, partner utilities, and interested parties in the region has and will continue to occur throughout the process through in-person engagement and online activities, consistent with COVID 19 guidelines.

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 various CSO control measures and compliance activities to achieve full compliance with the Clean Water Act, applicable state law and regulations, and terms and conditions of the West Point NPDES permit, and meet the requirements of EPA's CSO control policy. The CD also commits King County to complete construction of all CSO control projects by December 31, 2030. Compliance activities described in the CD include:

- Implementation of CSO control projects in accordance with milestones established in the CD (Section 3)
- Development of a Sewer System Optimization Plan and Joint Operations and System Optimization Plan (described in Sections 3.2.1 and 3.2.2, respectively)
- Establishment of conditions for developing supplemental compliance plans to implement remedial measures for CSO control projects (Section 3.1)
- Establishment of requirements for proposals to substitute, in part, GSI control measures for gray infrastructure control measures

Meeting the conditions set forth in the CD is a high priority for King County. To date, the County has met all conditions outlined in the CD with one exception, that is, for a milestone associated with the Chelan CSO control project.

On October 28, 2019, King County submitted a formal request to EPA and Ecology to delay the interim CD milestones for the Chelan CSO control project (specifically, Completion of Bidding and Construction Completion milestones) to match the milestones in the CD for Hanford #2, Lander, King, and Kingdome Wet Weather Station (HLKK), while still committing to complete the project within the overall deadline of the CD (i.e., December 31, 2030). In conjunction with the request to delay the interim CD milestones for the Chelan CSO control project, the County requested to initiate negotiations to modify the CD to accommodate changed conditions from 2013 when the CD was filed.

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 on 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 to 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 were collected in 2012 (ten locations), 2014 (six locations), and 2016 (one location).

The NPDES permit (§S13.B, p. 41) requires post-construction monitoring once CSO control projects are completed. The County's approved Post-Construction Monitoring Plan (PCMP) requires characterization by sampling or modeling to calibrate and verify model performance. The post-construction monitoring results for several overflows per the approved quality-assurance project plan were provided to Ecology in December 2018 and supplemented for the North Beach Pump Station (North Beach PS) Inlet Overflow site in December 2019. No post-construction monitoring was required in 2020.

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 PS Inlet Overflow site was developed in accordance with the PCMP. Sampling was completed in late 2018. The sediment quality data report was sent to Ecology in December 2019 to complete post-construction monitoring for this overflow.

1.5 Organization of this Report

This report presents the following information in subsequent sections and appendices:

- Report on implementation of EPA's Nine Minimum Controls (Section 2)
- Status of CSO control projects in design or construction (Section 3)
- Discussion of 2020 rainfall and untreated and treated CSO events (Section 4)
- Detailed individual event-based table for unpermitted overflows in 2019 (Table 4)
- Summary of CD violations in 2020 (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 2020 (Appendix A)

- Detailed individual event-based tables for treated CSOs in 2020 (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 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; hard copy 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 2020.

2.1 Control 1—Reducing CSOs through Operations 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. King County's 2018 Strategic Asset Management Plan (SAMP) Update set the priorities of the Asset Management Program and work plan, and WTD is now working on implementation of the plan's recommendations.

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 upon request.

In 2020, King County performed corrective work at two outfalls: the Canal Street Outfall (DSN 007) and the 3rd Ave. West Outfall (DSN 008). Riprap, mud, and organic material were removed from the outfall openings and placed to the side, thereby ensuring that the outfalls can function properly.

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 setpoints, programmable logic controllers automatically adjust gates and pumps to manage the flows. These setpoints 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 offline 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 (Interbay PS)—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 customer overflows and backups, 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. Important factors taken into consideration include rainfall forecasts, 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.

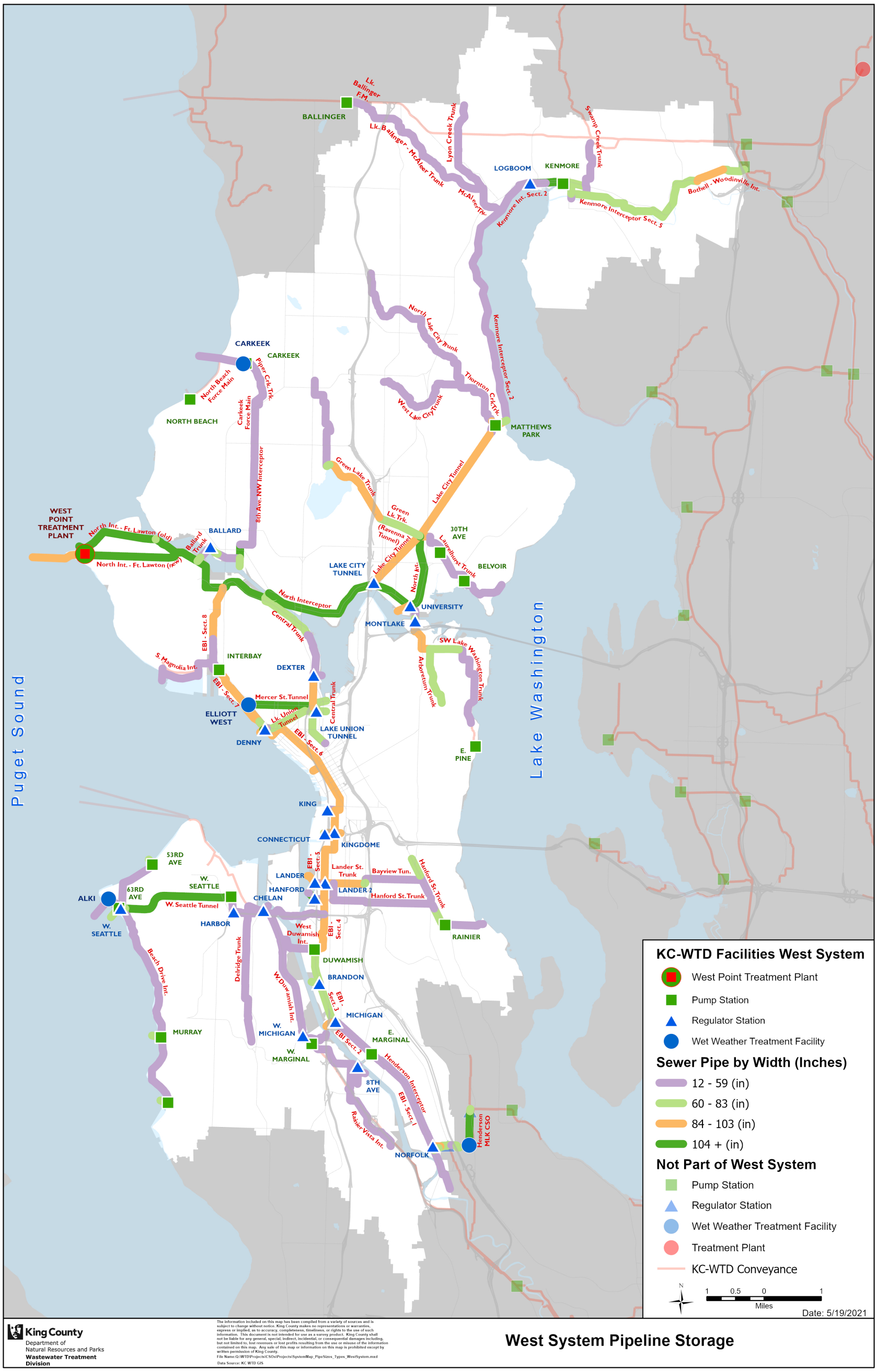

Figure 2. King County Wastewater West System Pipeline Storage

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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.

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 2020 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 also administers and helps fund the Hazardous Waste Management Program (HWMP). The Business Services Team of HWMP provides site visits to businesses that generate hazardous wastes (and that typically fall below the threshold for receiving a discharge authorization or permit from the Industrial Waste Program). Their efforts focus on on-site technical assistance visits to businesses for hazardous material and waste management, including discharges to sanitary and storm drains and identifying safer chemical substitutions. HWMP issues vouchers to reimburse businesses 75 percent of their costs (up to $599) for purchasing and installing pollution prevention equipment, if needed. They also provide spill kits and spill management plans to the businesses they visit.

In 2019, King County worked with Ecology to develop the County's second five-year Source Control Implementation Plan (SCIP) for the Lower Duwamish Waterway. The SCIP was finalized in October 2019. 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 Source Control Annual Report documenting 2019 activities was submitted to Ecology in

December 2020. The Source Control Annual Report for 2020 activities will be submitted in 2021.

The Industrial Waste Program and Sediment Management Program (as well as King County Stormwater Services and International Airport) participate in the Lower Duwamish Waterway Source Control Work Group, which was formed to promote discussions of source control issues that may affect sediment remediation of the Lower Duwamish Waterway. The group is composed of the three members of the Lower Duwamish Waterway Group (King County, Port of Seattle, and City of Seattle), as well as the City of Tukwila, Washington State Department of Transportation, and the two agencies with regulatory responsibility for different aspects of Lower Duwamish Waterway sediment remediation (i.e., Ecology and EPA). Ecology is the lead agency for this group, which has been meeting regularly for several years.

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

Up to 24 MGD of combined flows are conveyed to South Plant from southeast Seattle to receive full secondary treatment. This conveyance reduces 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 dry weather 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).

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 maintains a Strategic Asset Management Plan that is updated on a five-year cycle. The plan, which was updated in 2018, includes an assessment to determine the criticality of pump station equipment. This assessment identifies assets essential to pumping sewage, and inspection and maintenance routines have been developed to increase service time and reduce failures for these assets. Assessments and evaluations are continuously updated to reduce the likelihood of system failure. These efforts will contribute to reducing overflows by decreasing the probability of mechanical failures.

Operations and maintenance (O&M) programs, as described for Control 1 (Section 2.1), focus on eliminating 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 2020 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 HWMP, 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, oils, 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. Polar FOG has a screening level, but limits can be established on a case-by-case basis.

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 development of its second five-year SCIP for the Lower Duwamish Waterway in 2019. This second five-year Plan covers the period from 2019 to 2023. 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 activities conducted under the Plan are summarized in a series of source control annual reports that are submitted to Ecology. The 2019 activities report was prepared in 2020 and submitted to Ecology in December 2020. The 2020 source control activities associated with this second five-year plan will be summarized in a report developed in 2021.

The HWMP 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 HWMP 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 HWMP creates plans to manage hazardous wastes produced by households and in small quantities by businesses and other organizations. The HWMP 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 HWMP maintain extensive online program information and availability of resources and events. The County's HWMP 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 HWMP 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 as well as sources of pollution into the combined system. As of December 31, 2020, WTD has rebated 991 projects in King County CSO basins. These projects capture runoff from over 1.23 million square feet of roof area on private property, controlling an estimated 12.48 million gallons of stormwater per year.

WTD funds and administers the WaterWorks competitive grant program and Council-allocated funding to help residents, local agencies, schools, 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 our waters. The projects 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 projects are all within the sewer service area and help King County residents protect their long-term investment in water quality. Between 2015 and 2020, a total of $12.3 million was awarded to 175 water quality improvement projects through WaterWorks. In 2020, organizations that were funded in previous grant cycles continued their work, and 37 projects were completed.

Also, in 2020, the 69 new projects authorized in 2019 (with funding totaling $4,651,840) were finalized and launched. The projects will be implemented in the 2020–2023 timeframe and are expected to protect water quality, control pollution, and build healthy communities. Finally, in late 2020, staff prepared and started outreach for the new biennial grant cycle for 2021–2022.

Implementation of Source Control Actions in CSO Basins

WTD and SPU staff coordinate 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, O&M 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 contain 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 BMP 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 and 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. Accordingly, WTD and SPU will

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. During 2020, 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. This program provides outreach and education on proper BMPs to residents and businesses within the City. In 2020, SPU responded to 190 water quality complaints in these basins.
- Spill Response: Spills are dispatched through the SPU Operations Response Center to on-call spill coordinators as they are received. In 2020, SPU responded to 191 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 2020, SDOT swept 6,663 lane miles in these basins.

2.8 Control 8—Notifying the Public

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 2018, 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. DNRP fabricated and installed the new signs in 2019. SPU will complete installation of new signs in 2021.

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 the use of local waters. In late 2015, the website was upgraded to be more usable on mobile devices and to allow 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 2020, the CSO status web page had 7,706 page views (representing 6,374 unique page views, with 80 percent of users viewing and then leaving the page [bounce rate]). This represented a 16 percent increase in page views from 2019, during which there were 6,668 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. The data must include:

- 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
- Total number of CSO events and the frequency and duration of CSOs for a representative number of events
- Locations and designated uses of receiving water bodies.
- Water quality data for receiving water bodies
- 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 supplemented in 2018).

A summary of the report includes discussion of receiving water characteristics based on sampling results from the County's long-term marine ambient and point source monitoring program. Overall, the study showed that ambient water in the Duwamish area met the Washington State water quality standards for aquatic life or EPA's recommended human health criteria for metals.

The reports can be found at:
http://your.kingcounty.gov/dnrp/library/wastewater/cso/docs/SedQuality/0912_CompSedQualSumRptCSODischargeLoc.pdf.
https://www.kingcounty.gov/~/media/services/environment/wastewater/cso/docs/sed-qual/2018-Comprehensive-Sediment-Quality-Summary-Report.ashx?la=en

King County's 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 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.

The post-construction monitoring results for several overflows per the approved quality assurance project plan were provided to Ecology in December 2018 and supplemented for the North Beach PS Inlet Overflow site in December 2019. No post-construction monitoring was required in 2020.

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 2020, planned activities for 2021, and the status of each project relative to the schedule of CD milestones.

The CD requires the County to report on projects underway and the status of early action CSO control measures. Table 2 summarizes the CD milestone statuses through 2020. 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 2020

CSO Name (Project Name)	DSN	Current Consent Decree Commitment	Current Status
Barton Street Pump Station (Barton Street Roadside Raingardens)	057	Did not meet control performance standard; Supplemental Compliance Plan submitted April 23, 2018; monitoring to demonstrate control status due in 2020 Annual Report.	Supplemental Compliance Plan commitments have been completed; ongoing monitoring for control status. See Section 3.1 for more updates.
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)[i]	036	Completion of bidding by December 31, 2020	Request to modify milestones submitted October 28th, 2019. Notice of missed milestone submitted March 2021. See 3.1 for more updates.

CSO Name (Project Name)	DSN	Current Consent Decree Commitment	Current Status
Brandon St. Regulator Station/S. Michigan St. Regulator Station (Georgetown Wet Weather Treatment Station)[i]	039, 041	Construction completion by December 31, 2022	Construction continued in 2020 to meet the CD commitment.
Hanford #2 Regulator Station/Lander St. Regulator Station/King St. Regulator Station/ Kingdome Regulator Station (Project Name TBD)[i]	032 030 028 029	Submit Facility Plan by December 31, 2024	N/A
Montlake Regulator Station (Project Name TBD)[i]	014	Submit Facility Plan by December 31, 2023	N/A
Murray Street Pump Station (Murray St. Wet Weather Storage Project)	056	CSO controlled by December 31, 2017	Outfall Controlled December 2017
North Beach PS (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)[i]	031	Construction completed in 2018. Post-construction monitoring conducted in 2019, and the CSO outfall did not meet the control performance standard. Supplemental Compliance Plan submitted in 2020. Achievement of Performance Standard by July 2024	Supplemental Compliance activities began in 2020.
11th Ave. NW/3rd Ave W (Ship Canal Water Quality Project)[ii]	004, 008	(For King County) construction completion by December 31, 2025	Construction continued in 2020 to meet the CD commitment

CSO Name (Project Name)	DSN	Current Consent Decree Commitment	Current Status
South Magnolia (South Magnolia Wet Weather Storage Project)	006	Supplemental Compliance Plan required the corrective action be final by December 31, 2018; monitoring to demonstrate control status due in 2020 Annual Report.	Corrective action completed December 2018, and project operational. See Section 3.1 for more updates.
University Regulator Station (Project Name TBD)[i]	015	Submit Facility Plan by December 31, 2023	N/A
West Michigan St. Regulator/Terminal 115 (West Duwamish CSO Control Project)[i]	038, 042	Completion of Bidding by December 31, 2022	Submitted Facility Plan by December 31, 2020
Dexter Ave. Regulator Station (Dexter Ave. Supplemental Compliance Plan)	009	Supplemental Compliance Plan submitted August 2013; control status reported in 2016 Annual Report.	Outfall controlled July 2016
Denny Way Regulator Station (Denny Way Supplemental Compliance Plan)	027a	Revised Supplemental Compliance Plan submitted to Ecology August 31, 2016. Completion of modifications by December 2018 and monitoring to demonstrate control status due in 2020 Annual Report.	Modifications completed in 2018. See Section 3.1 for more updates
Harbor Ave. Regulator Station (Harbor Ave. Supplemental Compliance Plan)	037	Submitted to Ecology & EPA within 30 days of CD (July 3, 2013). Revised Plan submitted to Ecology August 31, 2016. Completion of modification and monitoring for control to be achieved by December 2018, and monitoring to demonstrate control status due in 2020 Annual Report.	Modifications were completed in January 2019; See Section 3.1 for more updates.

[i] Capital project set forth in Appendix B of the CD.

[ii] 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.

Figure 3. King County CSO Control Projects

Project Summaries

A summary project status page for 2020 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
- 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. Regulator Station 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 (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)											

2020 Accomplishments:

- Completed construction of the outfall in 2020.
- Continued construction of the treatment station and equalization basin.
- Continued construction of the conveyance pipeline.

2020 Challenges and Corrections:

- Treatment station construction contract – Various changes to the contract were executed in 2020 to account for design changes/clarifications, differing site conditions, and impacts resulting from the COVID-19 pandemic.
- Conveyance construction contract – Various changes to the contract were executed in 2020 to account for design changes/clarifications, differing site conditions, and impacts resulting from the COVID-19 pandemic.

2021 Activities in Progress or Expected:

- Complete work on the conveyance construction contract.

- Continue construction of treatment station structures and buildings.
- Begin treatment station startup and commissioning process.

CD/CSO Report Project Status

Ship Canal Water Quality Project

CSO(s): DSN 008 (3rd Ave. W Outfall) and DSN 004 (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, 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 will help complete the requirements of both King County and City of Seattle's CSO Consent Decrees for identified outfalls. For more information, see: https://www.seattle.gov/utilities/environment-and-conservation/projects/ship-canal-water-quality

As project lead, more details are 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 (12/26/2019)[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] This was the completion of bidding for the tunnel construction contract, which, per Ecology, qualified as achieving this CD milestone. Bidding (Notice to Proceed) for the remaining major portions (pump station, conveyance, etc.) is projected to be completed by 2023.

[3] Date represents completion of all substantial construction and ability to accept CSO flow diversion.

2020 Accomplishments

- Construction for the Ballard Early Work and Advance Utilities work packages achieved final completion.
- Construction of the Storage Tunnel work package began and has progressed to include work at all five of the tunnels' drop shaft sites. Work accomplished in 2020 includes: completing excavation of the drop shaft in Ballard (the launch site for the storage tunnel boring machine), ground improvement and/or installation of drop shafts at four other drop shaft sites, completing manufacturing and factory testing of the storage tunnel boring machine, removing the underground storage tank and contaminated soil at the Wallingford site, and execution of a cost-saving change order to eliminate the requirement to barge away tunnel spoils (they will now be hauled by truck).
- The Tunnel Effluent Pump Station (TEPS) work package completed 60 percent design and the Ballard Conveyance work package completed 90 percent design. The Ship Canal Program decided in 2020 to merge the TEPS and Ballard Conveyance design documents into a single construction contract. This decision will greatly reduce coordination and construction risks for the two projects.
- The Wallingford Conveyance work package team completed 90 percent design.
- SPU completed an ordinance with the Seattle City Council allowing the project team to acquire property rights (such as temporary and permanent easements for construction).
- SPU submitted an application for a 2022 State Revolving Fund loan and executed a Water Infrastructure Finance and Innovation Act (WIFIA) loan agreement with the US Environmental Protection Agency. The $192 million loan will save SPU ratepayers an estimated $52.5 million in interest costs when compared to traditional bond funding.
- King County executed a separate WIFIA loan in December 2020 with EPA. The $97 million loan will save King County ratepayers an estimated $35 million in interest costs when compared to traditional bond funding.

2020 Challenges and Corrections:

- The project team participated in a cost reduction effort that was completed in July 2020. The effort reduced base costs, increased reserves, and evaluated risks, all while maintaining the existing budget confidence level.

2021 Activities in Progress or Expected:

- In 2021, the project team anticipates continued progress on project design and construction.
- Construction will continue for the Storage Tunnel work package. Work will include completion of all five drop shafts, completion of the eight-foot diameter

conveyance tunnel beneath the Ship Canal and launching of the storage tunnel boring machine from the Ballard site.

- Design revisions for the Queen Anne conveyance system and hydraulic modeling will be completed to confirm that the project will not unacceptably impact the hydraulics of the system.
- Design progress on all remaining aspects of the project will continue, including TEPS and Ballard and Wallingford Conveyance (other conveyance contributing to the tunnel is included in the tunnel contract).
- The TEPS and Ballard Conveyance work packages are scheduled to complete a joint 90 percent deliverable in the second quarter of 2021. This deliverable will be submitted to Ecology as the Draft Plans and Specifications.
- The Wallingford Conveyance work package is scheduled to complete a 100 percent design deliverable in the second quarter of 2021, which will be submitted to Ecology for review and approval. Following the 100 percent deliverable, the project will be put on hold temporarily until it is ready to advertise for bids in 2022.
- The Ship Canal Water Quality Project (SCWQP) program is scheduled to complete a 60 percent O&M Manual deliverable for the overall facility in the third quarter of 2021.
- The tunnel boring machine was delivered in sections to the job site in early 2021. The tunnel boring machine was lowered into the Ballard shaft in April 2021. Tunneling is scheduled to begin in June 2021.
- Ground improvements and shaft construction will continue in Fremont, Wallingford, and Queen Anne.

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 (12/22/2020)											
Completion of Bidding	12/31/2022 (N/A)											
Construction Completion	12/31/2025 (N/A)											
Achievement of Performance Standard	(N/A)											

2020 Accomplishments:

- Completed Facility Plan and submitted for review on 12/22/2020.
- Continued Preliminary Design - Baseline Design process.
- Continued land acquisition negotiations with the Port of Seattle.
- RainWise activities continued in South Park and Highland Park basins (see Section 3.2.3).

2020 Challenges and Corrections:

- In July 2020, Ecology issued the "Terminal 115 Plant 1 MTCA Agreed Order, No. DE 18064" with the Boeing Company and the Port. The preferred location of the storage tank is a parcel that is included within the site boundaries of the Agreed Order.

2021 Activities in Progress or Expected:

- Continue flow modeling to ensure tank is properly sized.

- Continue Preliminary Design - Baseline Design process.
- Continue acquisition of proposed storage tank property.
- Amend engineering consultant contract through final design phase.
- Continue community briefings through project website and mailings.
- Evaluate schedule to incorporate continued flow modeling and expected impacts from negotiations in property acquisition and the requirements of the Agreed Order on the property. Coordinate with Ecology to address any projected schedule impacts.
- Continue RainWise program activities in South Park and Highland Park.

CD/CSO Report Project Status

University Green Stormwater Infrastructure

CSO(s): DSN 015 (University Regulator Station 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)												
Completion of Bidding	12/31/2025 (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.

2020 Accomplishments:

- RainWise activities continued in University basin (see Section 3.2.3).
- Further refinement of the GSI BMP modeling tool and associated materials to support application.
- Ongoing outreach and public involvement activities to update residents and community groups in the project area.

2020 Challenges and Corrections:

- A contract extension was issued to complete development of the GSI BMP modeling tool and manual.
- In light of updated estimated cost performance of CSO volume control through GSI alternative, staff recommendation approved by Delivery Board to pause further development of the GSI portion of the University CSO Control project pending direction from the King County Clean Water Plan. Project team

maintained coordination with CSO planning efforts to ensure Clean Water Plan and LTCP evaluations are supported by updated project-based information for basin-scale GSI opportunities to control CSOs in the University basin.

2021 Activities in Progress or Expected:

- Continue funding RainWise program activities in the University Basin.
- The consultant team is documenting the final status and composition of the GSI BMP modeling tool, and the tool will be completed by the end of 2021.

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 Ave. CSO 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 power 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
Submission of Facilities Plan	12/31/2018 (12/31/2018)								
Completion of Bidding[1]	12/31/2020 (N/A)								
Construction Completion[2]	12/31/2023 (N/A)								
Achievement of Performance Standard[3]	12/31/2024 (N/A)								

[1] The new requested deadline for the Completion of Bidding Milestone is 12/31/2026.

[2] The new requested deadline for the Construction Completion Milestone is 12/31/2030.

[3]The new requested deadline for the Achievement of Performance Standard Milestone is 12/31/2032.

2020 Accomplishments:

- On October 28, 2019, the County sent a letter to EPA and Ecology to formally request initiation of negotiations to modify the CD. The letter also requested extension of two interim milestone dates associated with the Chelan Ave. CSO control project to be consistent with the HLKK project: completion of bidding by December 31, 2026, and construction completion by December 31, 2030.
- Continued communication with regulators regarding request for milestone date change.

• Continued coordination with SPU.
2020 Challenges and Corrections: • The Completion of Bidding milestone deadline of December 31, 2020 was missed. Official notification was sent to EPA and Ecology.
2021 Activities in Progress or Expected: • Planning effort to re-evaluate CSO control for Chelan and HLKK (CHLKK) will begin in June 2021.The CHLKK Control Plan Re-evaluation will identify and assess options to control the CHLKK outfalls while assessing benefits to other pressing sewer system needs. • WTD will continue to coordinate with SPU throughout the CHLKK Control Plan Re-evaluation. • Continue discussion regarding potential CD modification.

3.1 Supplemental Compliance Plan Summaries

Supplemental Compliance Plans are documents that describe remedial measures King County will take to achieve CSO control for completed CSO control projects. According to the 2013 CD, Supplemental Compliance Plans are required when:

- CSO control projects are not constructed in accordance with design criteria set forth in the CD,
- King County is not complying with all requirements of its NPDES permit pertaining to CSOs, or
- The CSO control project does not result in meeting the CSO control performance standard of no more than one overflow event per year on a 20-year moving average.

To date, King County has only developed supplemental compliance plans for CSO control projects that did not result in meeting the CSO control performance standard.

A status page for each project under a Supplemental Compliance Plan follows Table 3 (“Summary of King County Supplemental Compliance Plans”) and provides updates for each of King County’s Supplemental Compliance Plans.

A Supplemental Compliance Plan was submitted for the Dexter CSO outfall in 2013. That plan is complete, and Dexter is now in control.

Projects with active Supplemental Compliance Plans include:

- Barton St. PS Overflow
- Denny Way RS Overflow
- Hanford #1 CSO

- Harbor Ave. RS Overflow
- South Magnolia Wet Weather Storage and Pipeline

In December 2017, King County submitted a CSO compliance actions letter to Ecology acknowledging that Belvoir PS outfall does not meet the CSO control performance standards as specified in the NPDES permit and CD. WTD is committed to working closely with SPU to support completion of operational and capital improvements underway. All necessary steps needed to bring Belvoir PS into compliance will be completed by December 31, 2030. The County also submitted a letter to Ecology in May 2018 acknowledging that the 63rd Ave. SW PS outfall does not meet the CSO control performance standard. The letter provided information on actions the County will be taking so that the 63rd Ave. SW PS will meet the performance standard by December 31, 2030.

Table 3. Summary of King County Supplemental Compliance Plans

CSO Name (Project Name)	DSN	Supplemental Compliance Plan Background	Outfall Status
Barton Street PS	057	Supplemental Compliance Plan submitted April 23, 2018, and monitoring to demonstrate compliance due in this Annual Report. Supplemental Compliance Plan commitments completed June 2019.	Monitoring for achievement of performance standard
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.	Monitoring for achievement of performance standard.
Dexter Ave. Regulator Station (Dexter Ave. Supplemental Compliance Plan)	009	Supplemental Compliance Plan submitted August 2013; control to be achieved by July 31, 2017.	Outfall controlled in 2016.

CSO Name (Project Name)	DSN	Supplemental Compliance Plan Background	Outfall Status
Denny Way Regulator Station (Denny Way Supplemental Compliance Plan)	027a	Revised Supplemental Compliance Plan submitted to Ecology August 31, 2016; completion of modifications by May 2018.	Monitoring for achievement of performance standard.
Hanford #1 CSO (Rainier Valley Wet Weather Storage)	031	Supplemental Compliance Plan submitted to Ecology August 28, 2020. Initial work detailed in the Supplemental Compliance Plan has begun.	Initial remedial actions are underway; performance of the outfall will continue to be monitored.
Harbor Ave. Regulator Station (Harbor Ave. Supplemental Compliance Plan)	037	Submit to Ecology and EPA within 30 days of CD (July 3, 2013). Revised Plan submitted to Ecology August 31, 2016; completion of modification in January 2019.	Monitoring for achievement of performance standard

CD/CSO Report Project Status

Barton Street Pump Station CSO

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.

2020 Activities:

- Performed operational improvements to achieve optimum pump performance.
- Completed modeling using updated performance data to assess pump performance needed to reach control.
- Monitored for achievement of performance standard.

2020 Challenges and Corrections:

- Operational modifications to the pumps have been completed to ensure they are running at 100 percent capacity when running on the primary controller, as well as the backup controller.
- Operational adjustments performed in 2020 did not bring the facility into control.

2021 Activities in Progress or Expected:

- WTD engineering is currently analyzing data to determine why the pumps are not performing as expected and exploring with the pump manufacturer the feasibility of over speeding the pumps. If it is determined that the pumps can be over sped consistently and reliably, then subsequent operational changes will be completed in 2021.
- Modeling will occur in 2021 to confirm that the completed operational improvement brought the facility into control.
- WTD staff will continue monitoring for achievement of the performance standard after changing the pump settings.

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 setpoint 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 were completed in 2019. Current model of the facility indicated that it is very close to being in control; however, more modeling and monitoring are planned in 2021 to confirm control status.

2020 Activities:

- Performed operational adjustments regarding pump control strategy.
- Modeling was completed to confirm the model is calibrated and validated.
- Monitored for achievement of performance standard.
- The facility is on the path to compliance, with only one overflow in 2020.

2020 Challenges and Corrections:

- Operational adjustments performed in 2020 did not bring the facility into control.
- The modeling results indicated inconsistencies in the model's ability to replicate the real-time response of operators limiting flow to West Point through Interbay PS during large storm events, which affects Denny's performance. Currently, the model is throttling flows from Interbay PS more than actually occurs and affecting the facility's control status.

2021 Activities in Progress or Expected:

- Continue monitoring for achievement of the performance standard.
- Additional modeling is planned to confirm the model is calibrated and validated and if it is possible to reflect operational strategy and observed conditions.

CD/CSO Report Supplemental Compliance Plan Status

Hanford #1

CSO(s): DSN 031 (Hanford #1 Overflow - Hanford @ Rainier Overflow, Bayview North Overflow, and Bayview South Overflow)

Project Description: The project achieved substantial completion in 2018 and has completed its first full year of monitoring. The project has recorded two events in 2019, and modeling indicates the project did not achieve the performance standard. WTD submitted a Supplemental Compliance Plan in August 2020. For more information, see: https://www.kingcounty.gov/depts/dnrp/wtd/capital-projects/completed/rainier-valley-wet-weather-storage.aspx

2020 Accomplishments:

- Assigned a project manager and kicked off work on the Supplemental Compliance Plan.
- Executed work order to survey the weir heights for the facility.
- Installed flow monitoring equipment to revise the model for the facility.

2020 Challenges and Corrections:

- Timeline for work was constrained by wet season.
- The project is in early phases of its Supplemental Compliance Plan and will assess its status as remedial actions are completed.

2021 Activities in Progress or Expected:

- Complete survey of the weir heights.
- On track to evaluate flow data and assess potential operational improvements.
- Continue modeling activities started in 2020.

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. WTD met the substantial completion date of January 31, 2019. King County completed all commitments in the Revised Supplemental Compliance Plan. Current model of the facility indicated that it is very close to being in control, however more modeling is planned in 2021 to confirm control status.

2020 Activities:

- Monitored for achievement of performance standard.
- The facility is on the path to compliance, with only one overflow in 2020.

2020 Challenges and Corrections:

- The new CSO gate actuator was installed in 2019 to better respond to the fast inflow conditions, but the gate control algorithm and settings may need to be further adjusted to take advantage of increased actuator speed and to perform in a stable, reliable manner.
- Previously modeled results indicated that the outfall is not in control.

2021 Activities in Progress or Expected

- An analysis will be performed in 2021 by the instrument technician to refine real-time operational responses of the CSO gate actuator.
- The model of the facility will then be updated to reflect the inflow conditions, gate setpoints, and operational adjustments. If the modeling results indicate that further operational adjustments need to be made, the adjustments will occur and be documented.
- Continue monitoring of the facility for achievement post-operational adjustments to determine compliance.

CD/CSO Report Supplemental Compliance Plan Status

South Magnolia Wet Weather Storage and Pipeline

CSO(s): DSN 006 (S Magnolia Overflow)

Project Description: A 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.

King County completed all commitments in the Revised Supplemental Compliance Plan. Current model of the facility indicated that it is very close to being in control; however, more modeling is planned in 2021 to confirm control status.

For more information, see: http://www.kingcounty.gov/environment/wtd/Construction/Seattle/SMagnoliaCSOStorage.aspx.

2020 Activities:

- Performed operational adjustments to achieve control.
- Modeling was performed to confirm the model is calibrated and validated to reflect operational strategy and observed conditions.
- Monitored for achievement of performance standard.

2020 Challenges and Corrections:

- Use of the storage tank during heavy storm events was a challenge. A gate was adjusted at the S Magnolia upper diversion structure from 50 percent open to 40 percent open to decrease the flow going toward the “old” diversion structure and overflow weir and increase the flow going toward the storage tank. Further adjustments may be necessary because the storage tank may not have been fully used before overflows occurred.
- Operational improvements performed in 2020 did not achieve control.

2021 Activities in Progress or Expected:

- Continue monitoring for achievement of performance standard.
- Additional modeling is planned to confirm the model is calibrated and validated and if it is possible to reflect operational strategy and observed conditions.
- Report actual and modeled performance in 2020 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 embedded 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 and SharePoint sites. Representatives from Operations, Offsite, and CSO control planning continue to review the plan regularly to ensure the electronic links still work and base documents are being updated 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 Joint Operations and System Optimization Plan (Joint Plan) and to review the Joint Plan every three years and update it as necessary. In developing the original Joint Plan (submitted to EPA and Ecology in February 2016), DNRP and SPU staff 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 reviewed, updated, approved by SPU's Drainage and Wastewater Line of Business Branch Executive and DNRP's WTD Director, and included in the Joint Plan Update submitted to EPA and Ecology in January 2019.

In 2020, Joint Operational activities were partially curtailed due to restrictions enacted in response to the COVID-19 pandemic. The following describes each commitment and the progress made in 2020:

- The Joint System Event Debrief Committee commitment includes preparing for the wet season and debriefing after major storm events to exchange information, reviewing and updating emergency communication protocols between the agencies, discussing meteorological data, evaluating CSO performance, and assessing operational decision impacts on the combined system. To coordinate for the 2020/2021 wet season, a meeting was held in October 2020 to discuss pre-season maintenance activities, system changes, meteorological information, and emergency communication protocols.
- The Data Sharing commitment includes supporting a Joint Operations Information Sharing Team (JOIST), implementing a pilot project for sharing real-

time SCADA data, developing data sharing protocols, and improving the regional ability to forecast storms and rainfall intensities.

  - JOIST held one meeting during which SPU and DNRP staff shared information on the operation of existing facilities, progress of capital projects, and coordination of Joint Plan commitments. Other 2020 meetings were cancelled due to COVID-19 restrictions.
  - SPU and DNRP held two workshops in June as part of the annual process to review flow monitoring data collected by each agency and provide recommendations for future monitoring.
  - SPU and DNRP held a series of workshops in the fall to determine the scope and schedule of the upgraded real-time data sharing platform.
  - The Joint Modeling Coordination Committee commitment includes sharing modeling tools and increasing understanding of modeling analyses and system operations 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 2020 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 planned joint Ship Canal Water Quality Project Facility. In addition, King County shared information about development of the West Core model for downtown Seattle, North Queen Anne, and North Magnolia. The joint modeling work plan, initially developed in 2018, was updated to reflect current and future work. This plan will continue to provide a framework for coordination and communication for upcoming modeling work.

- The Coordination during Startup and Commissioning of CSO Control Facilities commitment includes conducting document review, attending commissioning meetings, and implementing data sharing for SPU and DNRP CSO control facilities. In 2020, SPU commissioned the Portage Bay (Basin 138) sewer system improvement project and provided an overview to DNRP during a JOIST meeting.
- The Real Time CSO Notification commitment includes revising both agencies' on-site signs and website information to improve notification of CSO events and communication with customers. In 2019, 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 serves as a single point of contact for both SPU and DNRP CSO outfalls located

in the City of Seattle. Installation of the signs at DNRP CSO outfalls was completed in 2019. Installation of the signs at SPU's CSO outfalls was delayed due to O&M staffing reductions resulting from the COVID-19 pandemic and will be completed in 2021.

- The Reduce Saltwater Intrusion commitment involves continuing to work together on studies, data, and solutions for reducing intrusion. In 2020, DNRP monitored over 33 locations with sondes, drafted a new monitoring and modeling plan, tested and purchased monitoring equipment to measure salinity levels continuously, and developed a GIS tool to track salinity measurements in the conveyance system.

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 CSO control facilities in one agency's system have the potential to affect flows in the other agency's system. For this reason, SPU and WTD coordinate before and after construction of capital projects. Below is a list of SPU projects completed in recent years:

- Delridge Basin 99 CSO Sewer System Improvement Project – SPU commissioned the project in 2019 and provided an overview to DNRP during a JOIST meeting.
- North Central Waterfront (Basin 69) – SPU completed an evaluation of alternatives to control the basin; submitted a Draft Engineering Report on June 26, 2019; and submitted a Final Engineering Report on December 20, 2019. The preferred alternative would send flows north from the basin to DNRP's Elliott Bay Interceptor.
- Central Waterfront Project (SPU basins 70, 71, and 72) – Following removal of the Alaskan Way Viaduct, SPU is eliminating two CSO locations and providing conveyance and storage to control two other CSO outfalls. Construction is underway. More flows will be conveyed to WTD's Elliott Bay Interceptor as a result of the project. Monitoring is in place to confirm expected flow changes, and WTD will model the changes and impacts to the downstream system in 2021.
- SPU Pump Station 22 (SPU Basin 60) was upgraded from 0.86 MGD to 4 MGD in 2020.

- SPU Lift Station #20 in Portage Bay was upgraded in 2020 from 1.1 MGD to 1.5 MGD in 2020.
- SPU is upgrading Lift Station #13 in East Montlake (SPU Basin 168) from 0.9 MGD to 2.8 MGD. Completion is expected in June 2021.

WTD and the City of Seattle have flow monitoring in place for those Seattle projects with the potential to impact flows in the regional system. Flow data are collected and reviewed annually to determine if flow monitoring adjustments need to occur. WTD will continue working with SPU on control and operational strategies as SPU starts up any new facilities and continues operating its existing facilities.

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 2020 included:

- Upgrading the joint www.700milliongallons.org website, including improving user access to RainWise materials. The platform is continuing to become more mobile friendly and RainWise information will be easier to access and understand.
- Finalizing Volume III (Design Phase), issuing a draft final of Volume II (Options Analysis), issuing a draft of Volume IV (Construction and Commissioning) to document procedures and practices and help ensure the quality of projects based on lessons learned from recent projects, and issuing a draft final of Volume V (Operations & Maintenance) to address issues identified during finalization of Volume III of the joint SPU/DNRP Green Stormwater Infrastructure (GSI) Manuals.
- Holding a series of six workshops with SPU and DNRP representatives and subject matter experts to develop and document guidance for design, construction, and maintenance of UIC facilities that may be included as part of bioretention projects to help achieve volume reduction.

In 2021, planned collaborative work includes:

- Finalizing Volume II (Options Analysis), Volume IV (Construction and Commissioning), and Volume V (Operations & Maintenance) of the joint GSI Manuals, including incorporating the UIC guidance.

- Coordination with SPU on a re-evaluation of control options for King County's CHLKK outfalls as well as opportunities to perform joint planning and project delivery to address nearby SPU outfalls.
- Ongoing coordination wherever close system relationships present the opportunity, including current projects in design (such as West Duwamish) and future projects still in planning (such as University and Montlake CSO Control).
- 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 2020. 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 2020 are included in Appendices A and B. The annual rainfall for 2020, as an average over local rain gauges, was 38.73 inches. The annual rainfall at Sea-Tac Airport was 41.32 inches, which is above the 20-year Sea-Tac Airport annual average of 39.24 inches. Long-term, WTD has been looking at how storms over the last 40 years may compare to storms of the next 60 years. WTD worked with the University of Washington Climate Impacts Group who forecasted precipitation in the Seattle area over the next century, and then WTD quantified how the forecasted change in precipitation might affect WTD's CSO control volumes.

4.2 Unpermitted Overflows

Overflows can occur from CSO structures and outfalls, broken pipelines, and maintenance holes. Unpermitted overflows can be of three types: DWOs, exacerbated CSOs, or sanitary 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. Per the EPA's Nine Minimum Controls and the West Point NPDES permit, DWOs are prohibited.

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 other than through a designated CSO outfall or to land.

Table 3 shows that, in 2020, there was an SSO due to a conveyance system leak. During a record-breaking rainfall event on December 21, 2020, there were likely exacerbated CSO overflow conditions due to intermittent pumping interruptions at three pump stations, as well as one sewer backup at a residence in the South Park area. There also was a brief overflow on December 2, 2020 unrelated to wet weather conditions to the Puget Sound from the Emergency bypass outfall at the West Point headworks that was inadvertently triggered by an operator during a maintenance procedure.

Table (4) Summary of Unpermitted Overflows in 2020

Date of Event	Facility	Description of Violation(s)
1/27/20 – 2/12/20	North Beach PS	SSO: Leaking force main at North Beach PS caused a sinkhole. Extensive investigation took over two weeks conducted to find, isolate, and repair. Leak soaked into ground and exact volume was undetermined.
12/2/20	West Point	Bypass Overflow: While performing a maintenance activity to cycle influent control structure gates, an operator error resulted in the emergency bypass gate opening briefly (three min).
12/21/20	Duwamish, 53rd Ave., and 63rd Ave. pump stations	Exacerbated CSOs: During a peak rainfall event, a portion of the overflows at Duwamish, 53rd Ave., and 63rd Ave. pump stations may have been exacerbated due to pumping-related interruptions at those stations during the storm event.
12/21/20	8th Ave. Regulator	During a peak rainfall event, a resident in the South Park area with direct connection to a WTD trunk sewer reported a sewer backup. Community services assisted the resident with cleanup activities.

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 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 2020, there were 30 storm events resulting in untreated CSO discharges. Some storm events spanned multiple days, and, at times, there were discharges from multiple outfalls on the same day. Conditions in 2020 resulted in 182 untreated CSO events discharging about 1,144 MG.

Appendix A lists the untreated events from County CSOs during 2020. These data are also provided in electronic form to Ecology with this report.

4.4 CSO Treatment

King County provides CSO treatment and disinfection at four satellite facilities: Alki, Carkeek, Elliott West, and Henderson/MLK Jr. Way WWTSs. West Point also provides primary treatment for CSO flow, and blending with secondary treated flows, when the total inflow at West Point exceeds its secondary treatment capacity of 300 MGD. Conditions in 2020 resulted in 31 events, with treated CSO discharges from the WWTS facilities and West Point totaling 157 MG.

The following sections summarize performance and compliance at each facility during 2020. 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 primary treatment plus disinfection/dechlorination for flows above 300 MGD and up to a designed instantaneous peak of 440 MGD. Where captured flows into King County's conveyance system cannot be conveyed to regional treatment plants because of conveyance system limitations, flows are conveyed to WWTSs or are discharged untreated. West Point flows in excess of 300 MGD and up to 440 MGD receive primary treatment and are blended 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 wet weather flows, and reduces program costs and impact to local water bodies. West Point had 21 wet weather treatment events during 2020 where peak flows received primary treatment

prior to blending with secondary treated flows, disinfection, dechlorination, and discharge. The total volume of flows that exceeded 300 MGD and received primary treatment only was 152.77 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 2020, there were three 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 was 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 2020, there were five filling events and three discharge events. The Alki WWTS received 36.7 MG and discharged 30.6 MG.

Overall, TSS removal was 58.2 percent for 2020, which met the annual 50 percent TSS removal limit. The annual average settleable solids (SS) was 0.18 milliliter per liter per hour (ml/L/hr), which met the SS limit of 0.3 ml/L/hr. The Alki WWTS complied with the instantaneous PH limits throughout 2020 except during the January 28, 2020, event when the effluent PH briefly fell below pH 6.0. 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 four discharge days. Alki WWTS met the monthly fecal coliform geomean permit limit of 400 counts/100 ml during one month of discharge at Alki WWTS. More details are 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 2020, Carkeek WWTS had nine filling events and three discharge events. The Carkeek WWTS received 11.3 MG and discharged 9.0 MG. Rainfall at the Ballard Station rain gauge—the gauge used for Carkeek WWTS reporting—totaled 37.45 inches in 2020. By comparison, 2020 annual rainfall at Sea-Tac was 41.32 inches; the 20-year average of annual total rainfall at Sea-Tac is 39.24 inches.

Overall, TSS percent removal averaged 62 percent using all discharge events. Carkeek WWTS's annual average SS limit was 0.40 ml/L/hr, which is greater than the NPDES permit limit of 0.3 ml/L/hr. All remaining NPDES permit limits were met at Carkeek WWTS. More details are 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 2020, there were 36 inflow events totaling 235.9 MG and six discharge events totaling 69.7 MG that were treated and discharged through the Elliott West Outfall at the Denny Way RS.

Overall, TSS removal averaged 60.9 percent for the year, thereby meeting the NPDES 50 percent annual average TSS removal limit. Elliott West WWTS did not meet the SS annual event average limit, with the average measured as 2.18 ml/L/hr and the NPDES permit limit being 0.3 ml/L/hr. Daily average TRC exceeded the permitted level of 109 µg/L on two of nine discharge days; it reached as high as 694 µg/L. Effluent pH dropped below the permitted minimum limit of pH 6.0 on five of the nine discharge days; it reached as low as pH 5.5 during any event.

Effluent fecal coliform geomeans were no greater than 149 cfu/100 ml over any month in 2020.

All required samples were collected, and all required measurements were completed, in 2020, except for TRC and pH for the May 30, 2020 event. These values were reported as "Not Measured/ Not Reported" in the May 2020 Discharge Monitoring Reports (DMR). These non-reported values were due to a failure of the final effluent sample pump. Thus, no effluent was being fed to the composite sampler as well as the online TRC and pH analyzers. Complete information on Elliott West WWTS 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 six filling events and one discharge event during 2020. The treatment station received 10.6 million gallons (MG) of combined sewer wastewater and discharged 1.72 MG of treated water to the Duwamish Waterway.

Overall, TSS removal was 78 percent for the year, thereby meeting the NPDES 50 percent annual average TSS removal limit. The annual average effluent SS recorded 0.4 ml/L/hr, exceeding the maximum permit limit of 0.3 ml/L/hr.

There were no exceptions to the minimum pH limit. Improvement projects have been in progress to increase the consistency in meeting NPDES permit requirements. More details are available in Appendix F.

5 Summary of Consent Decree and NPDES Violations in 2020

Section VIII. 43 of the CD requires the listing of any violations of the CD in the annual report. Table 4 identifies CD violations in 2020 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 (5). Summary of Effluent Limitation* and Consent Decree Violations in 2020

Date of Event	Facility	Description of Violation(s)
1/27/20	Elliott West WWTS	Total chlorine residual
1/27/20	Elliott West WWTS	pH
1/28/20	Alki WWTS	pH
1/31/20	Elliott West WWTS	pH
2/1/20	Elliott West WWTS	pH
2/5/20	Elliott West WWTS	pH
2/6/20	Elliott West WWTS	pH
12/21/20	Elliott West WWTS	Total residual chlorine
2020 Annual	Carkeek WWTS	Annual average SS
2020 Annual	Elliott West WWTS	Annual average SS
2020 Annual	Henderson/MLK WWTS	Annual average SS

* pH effluent limits 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 Washington state CSO performance standard is defined in WAC 173-245-020(22) as, “control of each CSO in such a way that an average of one untreated discharge may occur per year.” According to the West Point NPDES permit, effective July 1, 2009, Ecology evaluates compliance with the CSO performance standard annually based on a 20-year moving average. The CD also recognizes this performance standard. The number of untreated discharges that occurred over each of the previous 20 years is reported for each outfall in Table 4 along with the 20-year moving average. This moving average is used each year to assess compliance with the CSO 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 post-construction 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.

The following 19 CSO outfalls, with the corresponding DSN, were identified as controlled through the monitoring and modeling data:

1. 30th Avenue Northeast Overflow, 049 (30th Ave. NE)
2. 53rd Avenue Southwest Pump Station Overflow, 052 (53rd Ave. SW PS)
3. 8th Avenue South Overflow, 040 (8th Ave. S)
4. Ballard Siphon Overflow, 003
5. Canal Street Overflow, 007 (Canal St.)
6. Dexter Ave. Regulator Station Overflow, 009 (Dexter Ave. RS)
7. East Duwamish Pump Station Overflow, 034 (E Duwamish PS)
8. East Marginal Way Pump Station Overflow, 043 (E Marginal Way PS)
9. East Pine Street Pump Station Overflow, 011 (E Pine St. PS)
10. Henderson Street Pump Station Overflow, 045 (Henderson St. PS)
11. Martin Luther King Junior Way Overflow, 013 (MLK Jr. Way)
12. Matthews Park Pump Station Overflow, 018 (Matthews Park PS)
13. Murray Pump Station Overflow, 056 (Murray PS)
14. Norfolk Street Overflow, 044a (Norfolk St.)
15. North Beach Pump Station Inlet Overflow, 048a (North Beach PS Inlet)
16. North Beach Pump Station Wet Well Overflow, 048b (North Beach PS Wet Well)
17. Rainier Avenue Pump Station Overflow, 033 (Rainier Ave. PS)

18. Southwest Alaska Street Overflow, 055 (SW Alaska St.)
19. West Duwamish Overflow, 035 (W Duwamish)

The following 13 CSO outfalls, with the corresponding DSN, were identified as uncontrolled through the monitoring and modeling data:

1. 11th Avenue Northwest Overflow, 004 (11th Ave NW)
2. 3rd Avenue West Overflow, 008 (3rd Ave W)
3. Brandon Street Regulator Station Overflow, 041 (Brandon St. RS)
4. Chelan Avenue Regulator Station Overflow, 036 (Chelan Ave. RS)
5. Hanford #2 Regulator Station Overflow, 032 (Hanford #2 RS)
6. King Street Regulator Station Overflow, 028 (King St. RS)
7. Kingdome Regulator Station Overflow, 029 (Kingdome RS)
8. Lander Street Regulator Station Overflow, 030 (Lander St. RS)
9. Montlake Regulator Station Overflow, 014 (Montlake RS)
10. South Michigan Street Regulator Station Overflow, 042 (S Michigan St. RS)
11. Terminal 115 Overflow, 038
12. University Regulator Station Overflow, 015 (University RS)
13. West Michigan Street Regulator Station Overflow, 039 (W Michigan St. RS)

The following five CSO outfalls, with the corresponding DSN, were identified as needing supplemental compliance and further monitoring to determine their control status:

1. Denny Way Regulator Station Overflow, 027a (Denny Way RS)
2. Barton Street Pump Station Overflow, 057 (Barton St. PS)
3. Harbor Avenue Regulator Station Overflow, 037 (Harbor Ave. RS)
4. South Magnolia Overflow, 006 (S Magnolia)
5. Hanford #1 Overflow, 031a (Hanford #1)

The following outfalls, with the corresponding DSN, were in control when the CD was signed, but were identified as needing supplemental compliance activities and further monitoring. A letter was submitted to Ecology in December 2017 acknowledging that Belvoir PS Overflow fell out of control in 2016. Another letter was submitted to Ecology in May 2018 acknowledging that 63rd Ave. SW PS Overflow fell out of control in 2017. WTD is working to bring these outfalls into control by 2030.

1. 63rd Avenue Southwest Overflow, 054 (63rd Ave SW)
2. Belvoir Pump Station Overflow, 012 (Belvoir PS)

6.2 Changes to Control Status of CSO Locations

In a letter submitted to Ecology in December 2017, WTD outlined the control status 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 indicated that the CSO frequency has increased due to hydraulic and hydrologic changes upstream of the pump station. As of the 2016 Annual CSO and CD Report, 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 team member on WTD's planning team. The goal is to develop a preferred strategy and implementation schedule as part of WTD's next LTCP Update. WTD is working closely with SPU to bring this outfall into compliance by December 31, 2030.

In a letter submitted to Ecology in May 2018, WTD outlined the control status for the 63rd Ave. SW PS Outfall. The 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 optimization of the West Seattle portion of the 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. A comprehensive computer model of the West Seattle System was completed in 2018, and it is being used to optimize operations. A flap gate was also installed on the 63rd Ave. SW PS outfall to prevent saltwater intrusion. The majority of the flap gate installation work was completed in 2018, and the final outstanding item was completed in 2020. Operations staff will continue to monitor and determine if further operational adjustments are needed to control this outfall.

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Table 6. King County Untreated CSO Events, Averages, and Baselines, 2001–2020

Overflow Name	Discharge Serial Number (DSN)	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	20-Year Average[1]	1983 Baseline
Ballard Siphon	003	***0***	***0***	***0***	***0***	***1***	***0***	***0***	***0***	***0***	***0***	***1***	***0***	***0***	2	0	0	0	0	0	**1**	0.3	13
11th Ave. NW[2]	004	14	8	8	6	11	22	10	7	16	19	16	20	12	25	17	22	21	13	10	**18**	**14.8**	16
S Magnolia[2]	006	***1***	***0***	***2***	***1***	***0***	***0***	***1***	***0***	***1***	***2***	***2***	***1***	***3***	***1***	***4***	***1***	***0***	***0***	2	**3**	**1.3**	25
Canal St.	007	0	0	0	0	0	0	1	0	1	1	0	1	0	1	1	0	0	0	1	**1**	0.4	1
3rd Ave. W[3]	008	11	4	6	4	5	13	6	3	9	8	7	13	5	12	7	5	6	7	2	**9**	**7.1**	17
Dexter Ave. RS	009	***1***	***0***	***0***	***1***	***0***	***1***	***1***	***0***	***0***	***0***	***0***	***0***	***0***	***1***	***3***	0	0	0	0	**1**	0.5	15
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
Belvoir PS	012	0	0	4	0	0	1	1	0	5	1	2	2	2	2	5	2	2	1	1	**1**	**1.6**	1
MLK Jr. Way[4]	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	5	11	5	6	NM	0	1	3	10	8	18	7	20	15	16	12	7	6	**11**	**8.5**	6
University RS	015	5	4	4	4	3	12	5	3	9	8	6	13	4	14	11	9	7	7	2	**7**	**6.9**	13
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
Denny Way RS	027a	***1***	***0***	***1***	***1***	***0***	***2***	***2***	***0***	***1***	***2***	***1***	***1***	***1***	***2***	***4***	***2***	***1***	***0***	0	**1**	**1.2**	32
King St. RS	028	14	12	16	15	20	27	7	3	15	18	15	13	2	23	19	14	3	4	3	**6**	**12.5**	16
Kingdome RS	029	0	0	0	2	5	4	5	1	8	6	2	11	6	22	17	12	16	15	5	**16**	**7.7**	29
Lander St. RS	030	10	10	12	9	8	28	8	6	19	17	15	25	8	29	17	25	21	19	9	**28**	**16.2**	26
Hanford #1[2]	031	***2***	***1***	***2***	***0***	***0***	***4***	***1***	***0***	***3***	***2***	***2***	***2***	***3***	***3***	***3***	***2***	***3***	***1***	2	**7**	**2.2**	30
Hanford #2 RS	032	13	10	12	16	15	26	12	8	17	17	15	23	9	27	16	24	18	17	9	**28**	**16.6**	28
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
E Duwamish PS[2]	034	0	0	0	0	1	0	1	0	0	1	0	0	0	0	0	0	0	0	0	**1**	**0.2**	1

[1] 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.
[2] Portable monitors are used at 11th Ave. NW, 30th Ave NE, SW Alaska St., Bayview North and South, E Duwamish, W Duwamish, Hanford #1, 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.
[3] The 3rd Ave. W monitor was down June 2006 through November 2006.
[4] 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.

Control Status of CSO Locations

Overflow Name	Discharge Serial Number (DSN)	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	20-Year Average[1]	1983 Baseline
W Duwamish[2,5]	035	NM	NM	NM	NM	1	0	1	0	0	1	0	0	1	0	0	0	1	0	1	**1**	**0.4**	1
Chelan Ave. RS	036	7	2	3	1	2	5	2	0	0	3	4	13	4	13	13	9	10	8	2	**5**	**5.3**	7
Harbor Ave. RS	037	***0***	***2***	***2***	***0***	***1***	***1***	***2***	***0***	***1***	***2***	***1***	***1***	***0***	***1***	***3***	***1***	***2***	***0***	1	**1**	**1.1**	30
Terminal 115[2,6]	038	NM	NM	2	0	2	7	4	0	3	3	0	1	1	0	1	1	2	1	1	**1**	**1.7**	4
S Michigan St. RS	039	12	8	9	6	5	13	5	3	10	12	14	16	8	26	17	16	13	17	6	**14**	**11.5**	5
8th Ave. S	040	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	1	**1**	**0.2**	6
Brandon St. RS[7]	041	30	21	28	21	27	11	NM	3	16	11	7	12	7	16	14	12	6	3	2	**6**	**13.3**	36
W Michigan St.	042	7	5	4	1	3	8	4	0	8	9	3	5	2	3	6	9	6	4	1	**3**	**4.6**	34
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
Norfolk St.	044a	***0***	***0***	***0***	***0***	***0***	0	0	0	0	0	0	0	0	0	1	0	0	0	0	**0**	**0.1**	20
Henderson St. PS	045	***0***	***0***	***0***	***0***	***0***	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.0**	12
North Beach PS Wet Well	048a	***1***	***0***	***2***	***0***	***0***	***0***	***1***	***0***	***0***	***1***	***2***	***1***	***1***	***1***	***2***	1	3	1	1	**1**	**0.95**	18
North Beach PS Inlet[2]	048b	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	0	1	1	1	**1**	**0.2**	18
30th Ave. NE[2]	049	0	0	0	0	0	0	0	0	5	0	3	1	1	2	3	1	0	1	0	**1**	**0.9**	1
53rd Ave. SW PS	052	0	0	0	0	0	2	1	0	0	0	0	1	0	0	0	0	1	0	0	**2**	**0.4**	<1
63rd Ave. SW	054	0	0	2	0	1	0	0	0	0	1	1	3	2	2	4	5	4	1	1	**2**	**1.5**	2
SW Alaska St.[2]	055	0	0	0	0	0	1	1	1	0	1	1	1	0	0	0	0	0	0	1	**1**	**1.0**	1
Murray St. PS	056	***1***	***0***	***2***	***0***	***0***	***2***	***1***	***1***	***1***	***1***	***0***	***1***	***2***	***1***	***2***	***0***	1	1	1	**2**	**1.2**	5
Barton St. PS	057	***2***	***0***	***0***	***0***	***2***	***1***	***3***	***2***	***2***	***0***	***0***	***1***	***3***	***1***	***2***	***0***	***0***	***1***	2	**2**	**1.2**	9

Notes: All events use 24-hour inter-event dry period as the basis for an event. Modeled numbers are shown in ***shaded bold italics***.

[5] Monitoring began at W Duwamish in June 2005.
[6] Monitoring began at Terminal 115 in June 2003.
[7] 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.

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 WWTSs 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). All monitoring is currently up to date.

No post-construction monitoring was required in 2020.

A post-construction monitoring report required under NPDES permit condition S11.F(d) was submittal to Ecology November 26, 2019. The report demonstrates how CSO outfalls that were controlled prior to permit issuance, as well as CSOs brought under control during the permit term, achieve performance requirements and comply with the state's water quality and Sediment Management Standards (SMS). For outfalls with SMS exceedances associated with CSO discharges, the report describes cleanup activities in the vicinity, including cleanup actions planned or that have been performed, targeted chemicals, any available pre- and post-cleanup monitoring results, cleanup project schedule, post-project monitoring schedule, and a list of parties involved.

Appendices

Appendix A. Untreated CSO Events, January–December 2020

Appendix B. Treated CSO Events, January–December 2020

Appendix C. Alki Wet Weather Treatment Station 2020 Annual Report

Appendix D. Carkeek Wet Weather Treatment Station 2020 Annual Report

Appendix E. Elliott West Wet Weather Treatment Station 2020 Annual Report

Appendix F. Henderson/MLK Jr. Way Wet Weather Treatment Station 2020 Annual Report

Appendix A
Untreated CSO Events

January–December 2020

DSN #	CSO Name	Receiving Water	Event Starting Date & Time	Event Ending Date & Time	Duration (hours)	Volume (gallons)	Precipitation (inches)	Storm Duration (hours)	Note if DWO
003	Ballard Siphon Regulator via Seattle Storm Drain	Lake Washington Ship Canal	12/21/20 3:26 PM	12/21/20 4:06 PM	0.67	2,077,865	1.95	15.77	
004	East Ballard (AKA 11th Ave NW)	Lake Washington Ship Canal	1/18/20 4:26 AM	1/18/20 4:46 AM	0.33	16,690	0.31	3.97	
004	East Ballard (AKA 11th Ave NW)	Lake Washington Ship Canal	1/21/20 3:37 PM	1/21/20 9:02 PM	5.42	373,159	0.81	35.48	
004	East Ballard (AKA 11th Ave NW)	Lake Washington Ship Canal	1/23/20 1:39 PM	1/24/20 3:25 AM	13.77	328,771	2.15	90.08	
004	East Ballard (AKA 11th Ave NW)	Lake Washington Ship Canal	1/27/20 8:45 PM	1/28/20 9:04 AM	12.32	335,586	3.73	191.58	
004	East Ballard (AKA 11th Ave NW)	Lake Washington Ship Canal	2/1/20 1:34 AM	2/1/20 5:31 AM	3.95	347,178	5.30	284.43	
004	East Ballard (AKA 11th Ave NW)	Lake Washington Ship Canal	2/23/20 7:26 AM	2/23/20 7:45 AM	0.32	43,713	0.18	1.98	
004	East Ballard (AKA 11th Ave NW)	Lake Washington Ship Canal	3/24/20 9:25 PM	3/24/20 11:12 PM	1.78	269,149	0.36	13.05	
004	East Ballard (AKA 11th Ave NW)	Lake Washington Ship Canal	3/28/20 11:06 PM	3/29/20 1:00 AM	1.90	9,928	0.34	7.10	
004	East Ballard (AKA 11th Ave NW)	Lake Washington Ship Canal	5/16/20 11:15 PM	5/16/20 11:41 PM	0.43	13,338	0.37	14.35	
004	East Ballard (AKA 11th Ave NW)	Lake Washington Ship Canal	5/30/20 9:54 AM	5/30/20 6:58 PM	9.07	62,219	0.78	9.88	
004	East Ballard (AKA 11th Ave NW)	Lake Washington Ship Canal	9/23/20 2:04 PM	9/23/20 2:16 PM	0.20	3,269	0.65	10.08	
004	East Ballard (AKA 11th Ave NW)	Lake Washington Ship Canal	9/25/20 9:33 AM	9/25/20 3:11 PM	5.63	27,697	2.20	58.82	
004	East Ballard (AKA 11th Ave NW)	Lake Washington Ship Canal	10/21/20 11:00 AM	10/21/20 11:17 AM	0.28	45,775	0.53	43.02	
004	East Ballard (AKA 11th Ave NW)	Lake Washington Ship Canal	11/3/20 8:24 AM	11/3/20 8:43 AM	0.32	14,800	0.30	1.80	
004	East Ballard (AKA 11th Ave NW)	Lake Washington Ship Canal	11/16/20 1:49 PM	11/17/20 6:04 PM	28.25	284,638	1.29	33.30	
004	East Ballard (AKA 11th Ave NW)	Lake Washington Ship Canal	11/30/20 3:58 AM	11/30/20 4:12 AM	0.23	2,076	0.32	1.63	

DSN #	CSO Name	Receiving Water	Event Starting Date & Time	Event Ending Date & Time	Duration (hours)	Volume (gallons)	Precipitation (inches)	Storm Duration (hours)	Note if DWO
004	East Ballard (AKA 11th Ave NW)	Lake Washington Ship Canal	12/21/20 8:05 AM	12/21/20 6:49 PM	10.73	3,712,870	2.27	18.42	
004	East Ballard (AKA 11th Ave NW)	Lake Washington Ship Canal	12/30/20 10:24 AM	12/30/20 10:37 AM	0.22	2,936	0.58	16.48	
006	Magnolia Overflow	Elliot Bay/Puget Sound	1/22/20 6:55 AM	1/24/20 2:20 PM	55.42	42,297	2.01	122.30	
006	Magnolia Overflow	Elliot Bay/Puget Sound	9/24/20 10:15 AM	9/24/20 10:40 AM	0.42	146,878	2.87	30.85	
006	Magnolia Overflow	Elliot Bay/Puget Sound	12/21/20 2:40 PM	12/21/20 9:50 PM	7.17	257,256	2.14	21.37	
007	Canal Street Overflow	Lake Washington Ship Canal	12/21/20 3:11 PM	12/21/20 4:40 PM	1.48	265,366	2.02	16.35	
008	3rd Ave W and Ewing St	Lake Washington Ship Canal	1/21/20 8:13 PM	1/21/20 9:39 PM	1.43	843,801	0.82	36.57	
008	3rd Ave W and Ewing St	Lake Washington Ship Canal	1/23/20 2:34 PM	1/23/20 2:47 PM	0.22	1,157	1.71	77.72	
008	3rd Ave W and Ewing St	Lake Washington Ship Canal	1/27/20 10:31 PM	1/27/20 11:36 PM	1.08	318,142	3.26	181.60	
008	3rd Ave W and Ewing St	Lake Washington Ship Canal	2/1/20 2:42 AM	2/1/20 6:22 AM	3.67	2,389,083	5.30	284.43	
008	3rd Ave W and Ewing St	Lake Washington Ship Canal	2/5/20 9:04 AM	2/6/20 1:44 PM	28.67	509,405	1.74	43.55	
008	3rd Ave W and Ewing St	Lake Washington Ship Canal	5/30/20 6:59 PM	5/30/20 8:01 PM	1.03	40,172	0.86	10.58	
008	3rd Ave W and Ewing St	Lake Washington Ship Canal	9/24/20 10:27 AM	9/24/20 12:10 PM	1.72	2,156,928	1.49	31.07	
008	3rd Ave W and Ewing St	Lake Washington Ship Canal	11/16/20 3:00 PM	11/16/20 3:42 PM	0.70	33,218	0.69	7.18	
008	3rd Ave W and Ewing St	Lake Washington Ship Canal	12/21/20 2:23 PM	12/21/20 10:37 PM	8.23	5,626,438	2.41	21.20	
009	Dexter Ave Regulator	Lake Union	12/21/20 3:08 PM	12/21/20 4:02 PM	0.90	455,351	1.71	15.75	
011	E Pine St. Pump Station Emergency Overflow	Lake Washington	N/A	N/A	0	0	N/A	N/A	
012	Belvoir Pump Station Emergency Overflow	Lake Washington	12/21/20 2:52 PM	12/21/20 7:12 PM	4.33	769,951	2.38	18.52	
013	Martin Luther King Way Trunkline Overflow	Lake Washington via storm drain	N/A	N/A	0	0	N/A	N/A	
014	Montlake Overflow	Lake Washington Ship Canal	1/21/20 7:40 PM	1/21/20 9:01 PM	1.35	2,241,766	1.05	57.83	

DSN #	CSO Name	Receiving Water	Event Starting Date & Time	Event Ending Date & Time	Duration (hours)	Volume (gallons)	Precipitation (inches)	Storm Duration (hours)	Note if DWO
014	Montlake Overflow	Lake Washington Ship Canal	1/27/20 10:50 PM	1/28/20 7:41 AM	8.85	1,774,014	3.92	212.37	
014	Montlake Overflow	Lake Washington Ship Canal	1/31/20 4:51 PM	2/1/20 7:53 AM	15.03	5,285,434	5.64	308.65	
014	Montlake Overflow	Lake Washington Ship Canal	2/5/20 3:13 PM	2/6/20 1:38 PM	22.42	2,158,639	2.44	44.77	
014	Montlake Overflow	Lake Washington Ship Canal	5/30/20 5:26 PM	5/30/20 6:55 PM	1.48	934,160	0.94	10.43	
014	Montlake Overflow	Lake Washington Ship Canal	9/25/20 9:44 AM	9/25/20 9:57 AM	0.22	158,509	1.54	53.50	
014	Montlake Overflow	Lake Washington Ship Canal	10/9/20 11:10 PM	10/9/20 11:46 PM	0.60	444,676	0.39	2.32	
014	Montlake Overflow	Lake Washington Ship Canal	10/21/20 11:19 AM	10/21/20 11:59 AM	0.67	1,044,614	0.37	9.50	
014	Montlake Overflow	Lake Washington Ship Canal	11/3/20 9:31 AM	11/3/20 10:14 AM	0.72	887,987	0.56	3.08	
014	Montlake Overflow	Lake Washington Ship Canal	11/16/20 2:41 PM	11/16/20 3:01 PM	0.33	230,929	0.52	19.48	
014	Montlake Overflow	Lake Washington Ship Canal	12/21/20 2:11 PM	12/21/20 8:24 PM	6.22	29,368,424	2.34	19.88	
015	University Regulator	Lake Washington Ship Canal	1/21/20 8:09 PM	1/21/20 9:21 PM	1.20	2,805,818	1.05	57.83	
015	University Regulator	Lake Washington Ship Canal	2/1/20 4:14 AM	2/1/20 5:57 AM	1.72	1,933,747	5.59	306.8	
015	University Regulator	Lake Washington Ship Canal	2/5/20 3:19 PM	2/6/20 2:46 PM	23.45	8,779,465	2.49	45.87	
015	University Regulator	Lake Washington Ship Canal	5/30/20 7:06 PM	5/30/20 7:31 PM	0.42	335,107	0.99	11.03	
015	University Regulator	Lake Washington Ship Canal	9/24/20 10:37 AM	9/24/20 11:21 AM	0.73	5,002,215	1.16	30.78	
015	University Regulator	Lake Washington Ship Canal	11/17/20 5:49 PM	11/17/20 6:23 PM	0.57	1,337,462	0.60	1.92	
015	University Regulator	Lake Washington Ship Canal	12/21/20 2:22 PM	12/21/20 8:40 PM	6.30	32,134,268	2.43	20.20	
018	Matthews Park Pump Station Emergency Overflows	Lake Washington	N/A	N/A	0	0	N/A	N/A	
027a	Denny Way Regulator	Elliott Bay	12/21/20 2:47 PM	12/21/20 4:35 PM	1.80	8,404,022	1.70	16.25	
028	King Street Regulator	Elliott Bay	1/21/20 7:24 PM	1/21/20 9:15 PM	1.85	685,725	0.83	57.83	

DSN #	CSO Name	Receiving Water	Event Starting Date & Time	Event Ending Date & Time	Duration (hours)	Volume (gallons)	Precipitation (inches)	Storm Duration (hours)	Note if DWO
028	King Street Regulator	Elliott Bay	1/28/20 12:37 AM	1/28/20 9:42 AM	9.08	556,370	3.34	212.42	
028	King Street Regulator	Elliott Bay	1/31/20 4:21 PM	2/1/20 8:14 AM	15.88	1,905,342	1.14	37.52	
028	King Street Regulator	Elliott Bay	9/23/20 1:45 PM	9/25/20 9:37 AM	43.87	729,681	1.80	53.55	
028	King Street Regulator	Elliott Bay	11/3/20 10:29 AM	11/3/20 11:37 AM	1.13	165,401	0.53	4.32	
028	King Street Regulator	Elliott Bay	12/21/20 2:14 PM	12/21/20 11:09 PM	8.92	3,750,349	2.62	21.00	
029	Connecticut St. Regulator (AKA Kingdome)	Elliott Bay	1/21/20 7:43 PM	1/21/20 11:33 PM	3.83	2,083,192	0.86	59.75	
029	Connecticut St. Regulator (AKA Kingdome)	Elliott Bay	1/24/20 4:28 AM	1/24/20 5:57 AM	1.48	164,431	1.86	113.68	
029	Connecticut St. Regulator (AKA Kingdome)	Elliott Bay	1/27/20 10:24 PM	1/28/20 10:34 AM	12.17	2,688,058	3.34	212.42	
029	Connecticut St. Regulator (AKA Kingdome)	Elliott Bay	1/31/20 4:17 PM	2/1/20 9:26 AM	17.15	5,502,793	1.14	37.52	
029	Connecticut St. Regulator (AKA Kingdome)	Elliott Bay	2/5/20 4:21 PM	2/6/20 3:03 PM	22.70	3,315,051	1.75	50.53	
029	Connecticut St. Regulator (AKA Kingdome)	Elliott Bay	5/17/20 1:30 AM	5/17/20 2:08 AM	0.63	281,472	0.57	13.62	
029	Connecticut St. Regulator (AKA Kingdome)	Elliott Bay	5/30/20 6:00 PM	5/30/20 8:53 PM	2.88	1,352,558	0.87	11.05	
029	Connecticut St. Regulator (AKA Kingdome)	Elliott Bay	9/23/20 1:57 PM	9/25/20 11:12 AM	45.25	4,434,899	1.82	54.40	
029	Connecticut St. Regulator (AKA Kingdome)	Elliott Bay	10/10/20 12:27 AM	10/10/20 1:33 AM	1.10	167,848	0.49	3.98	
029	Connecticut St. Regulator (AKA Kingdome)	Elliott Bay	10/13/20 7:29 AM	10/13/20 8:36 AM	1.12	411,788	0.93	44.55	
029	Connecticut St. Regulator (AKA Kingdome)	Elliott Bay	11/3/20 10:15 AM	11/3/20 12:47 PM	2.53	847,498	0.59	5.28	

DSN #	CSO Name	Receiving Water	Event Starting Date & Time	Event Ending Date & Time	Duration (hours)	Volume (gallons)	Precipitation (inches)	Storm Duration (hours)	Note if DWO
029	Connecticut St. Regulator (AKA Kingdome)	Elliott Bay	11/13/20 3:39 AM	11/13/20 7:17 AM	3.63	552,778	0.84	14.58	
029	Connecticut St. Regulator (AKA Kingdome)	Elliott Bay	11/14/20 6:53 PM	11/14/20 8:23 PM	1.50	281,821	0.42	5.12	
029	Connecticut St. Regulator (AKA Kingdome)	Elliott Bay	11/16/20 2:26 PM	11/16/20 4:20 PM	1.90	645,148	0.98	49.03	
029	Connecticut St. Regulator (AKA Kingdome)	Elliott Bay	12/21/20 9:31 AM	12/22/20 12:21 AM	14.83	16,721,829	2.62	21.00	
029	Connecticut St. Regulator (AKA Kingdome)	Elliott Bay	12/30/20 11:21 AM	12/30/20 11:54 AM	0.55	14,494	0.63	16.97	
030	Lander St Regulator	Elliott Bay	1/7/20 1:55 AM	1/7/20 3:00 AM	1.08	548,134	1.18	110.05	
030	Lander St Regulator	Elliott Bay	1/18/20 6:01 AM	1/18/20 6:50 AM	0.82	482,648	0.47	6.73	
030	Lander St Regulator	Elliott Bay	1/21/20 5:03 PM	1/21/20 10:39 PM	5.60	5,291,739	0.93	40.77	
030	Lander St Regulator	Elliott Bay	1/23/20 8:31 AM	1/24/20 8:46 PM	36.25	44,237,606	2.34	110.32	
030	Lander St Regulator	Elliott Bay	1/26/20 3:58 AM	1/26/20 6:21 AM	2.38	3,176,621	2.71	142.25	
030	Lander St Regulator	Elliott Bay	1/27/20 8:28 PM	1/28/20 10:41 AM	14.22	32,151,470	3.82	193.97	
030	Lander St Regulator	Elliott Bay	1/29/20 12:04 PM	1/29/20 12:32 PM	0.47	83,768	4.05	222.73	
030	Lander St Regulator	Elliott Bay	1/31/20 1:38 PM	2/1/20 12:34 PM	22.93	40,558,652	5.85	290.33	
030	Lander St Regulator	Elliott Bay	2/5/20 5:53 AM	2/6/20 5:34 PM	35.68	40,831,307	1.68	54.42	
030	Lander St Regulator	Elliott Bay	2/7/20 7:03 PM	2/7/20 8:04 PM	1.02	1,201,635	1.92	79.77	
030	Lander St Regulator	Elliott Bay	3/6/20 3:44 AM	3/6/20 4:23 AM	0.65	377,150	0.49	18.08	
030	Lander St Regulator	Elliott Bay	3/29/20 2:34 AM	3/29/20 3:47 AM	1.22	1,794,542	0.47	9.48	
030	Lander St Regulator	Elliott Bay	3/30/20 5:59 AM	3/30/20 6:43 AM	0.73	567,074	0.34	3.82	
030	Lander St Regulator	Elliott Bay	5/17/20 12:38 AM	5/17/20 3:41 AM	3.05	7,861,354	0.53	15.32	

DSN #	CSO Name	Receiving Water	Event Starting Date & Time	Event Ending Date & Time	Duration (hours)	Volume (gallons)	Precipitation (inches)	Storm Duration (hours)	Note if DWO
030	Lander St Regulator	Elliott Bay	5/30/20 5:50 PM	5/30/20 8:28 PM	2.63	4,810,629	0.96	11.00	
030	Lander St Regulator	Elliott Bay	9/23/20 1:59 PM	9/25/20 10:39 AM	44.67	11,545,084	2.24	54.52	
030	Lander St Regulator	Elliott Bay	10/10/20 12:10 AM	10/10/20 6:41 AM	6.52	2,571,495	0.85	9.33	
030	Lander St Regulator	Elliott Bay	10/13/20 6:49 AM	10/13/20 8:41 AM	1.87	2,390,869	1.02	44.25	
030	Lander St Regulator	Elliott Bay	11/3/20 10:19 AM	11/3/20 12:59 PM	2.67	1,725,669	0.60	5.18	
030	Lander St Regulator	Elliott Bay	11/13/20 12:31 AM	11/13/20 7:09 AM	6.63	4,777,772	1.04	14.80	
030	Lander St Regulator	Elliott Bay	11/14/20 6:57 PM	11/14/20 7:43 PM	0.77	729,627	0.48	4.68	
030	Lander St Regulator	Elliott Bay	11/16/20 2:21 PM	11/16/20 6:15 PM	3.90	12,905,999	1.16	51.13	
030	Lander St Regulator	Elliott Bay	11/18/20 3:28 PM	11/18/20 5:42 PM	2.23	591,906	0.74	21.35	
030	Lander St Regulator	Elliott Bay	11/30/20 6:08 AM	11/30/20 7:43 AM	1.58	2,015,999	0.43	22.50	
030	Lander St Regulator	Elliott Bay	12/16/20 5:28 PM	12/16/20 6:54 PM	1.43	2,692,593	0.95	89.02	
030	Lander St Regulator	Elliott Bay	12/21/20 7:43 AM	12/22/20 12:35 AM	16.87	52,027,556	2.90	55.28	
030	Lander St Regulator	Elliott Bay	12/25/20 8:11 PM	12/25/20 8:26 PM	0.25	29,082	0.34	4.77	
030	Lander St Regulator	Elliott Bay	12/30/20 8:33 AM	12/30/20 11:32 AM	2.98	1,927,300	0.69	17.00	
031	Hanford #1	Duwamish River via Diagonal Storm Drain	1/21/20 8:05 PM	1/21/20 8:54 PM	0.82	299,420	0.89	39.28	
031	Hanford #1	Duwamish River via Diagonal Storm Drain	1/28/20 6:31 AM	1/28/20 8:01 AM	1.50	230,037	3.82	193.97	
031	Hanford #1	Duwamish River via Diagonal Storm Drain	2/1/20 3:22 AM	2/1/20 10:35 AM	7.22	2,969,906	5.85	290.33	
031	Hanford #1	Duwamish River via Diagonal Storm Drain	2/6/20 11:56 AM	2/6/20 2:16 PM	2.33	548,207	1.62	51.12	
031	Hanford #1	Duwamish River via Diagonal Storm Drain	9/24/20 12:10 PM	9/24/20 12:25 PM	0.25	163,117	1.62	32.55	
031	Hanford #1	Duwamish River via Diagonal Storm Drain	12/21/20 2:23 PM	12/21/20 10:38 PM	8.25	48,968,504	2.90	55.28	

DSN #	CSO Name	Receiving Water	Event Starting Date & Time	Event Ending Date & Time	Duration (hours)	Volume (gallons)	Precipitation (inches)	Storm Duration (hours)	Note if DWO
031	Hanford #1	Duwamish River via Diagonal Storm Drain	12/30/20 9:40 AM	12/30/20 10:15 AM	0.58	511,210	0.66	16.33	
032	Hanford #2 Regulator	Duwamish River - East Waterway	1/7/20 1:54 AM	1/7/20 3:58 AM	2.07	3,498,198	1.18	110.05	
032	Hanford #2 Regulator	Duwamish River - East Waterway	1/18/20 6:01 AM	1/18/20 8:03 AM	2.03	4,217,304	0.5	8.18	
032	Hanford #2 Regulator	Duwamish River - East Waterway	1/21/20 4:58 PM	1/22/20 1:37 AM	8.65	17,588,692	0.93	40.77	
032	Hanford #2 Regulator	Duwamish River - East Waterway	1/23/20 8:34 AM	1/24/20 9:47 PM	37.22	44,474,752	2.35	112.15	
032	Hanford #2 Regulator	Duwamish River - East Waterway	1/26/20 4:01 AM	1/26/20 5:08 AM	1.12	1,696,696	2.71	142.25	
032	Hanford #2 Regulator	Duwamish River - East Waterway	1/27/20 8:33 PM	1/29/20 1:36 PM	41.05	36,920,093	4.06	223.88	
032	Hanford #2 Regulator	Duwamish River - East Waterway	1/31/20 1:37 PM	2/1/20 6:58 PM	29.35	65,763,955	5.85	290.33	
032	Hanford #2 Regulator	Duwamish River - East Waterway	2/5/20 5:52 AM	2/7/20 10:05 PM	64.22	103,304,058	1.93	82.63	
032	Hanford #2 Regulator	Duwamish River - East Waterway	3/6/20 3:45 AM	3/6/20 7:15 AM	3.50	1,574,452	0.58	21.12	
032	Hanford #2 Regulator	Duwamish River - East Waterway	3/29/20 2:37 AM	3/29/20 4:35 AM	1.97	5,270,342	0.48	10.73	
032	Hanford #2 Regulator	Duwamish River - East Waterway	3/30/20 5:56 AM	3/30/20 7:10 AM	1.23	2,734,571	0.34	3.82	
032	Hanford #2 Regulator	Duwamish River - East Waterway	5/17/20 12:39 AM	5/17/20 2:27 AM	1.80	956,946	0.52	13.40	
032	Hanford #2 Regulator	Duwamish River - East Waterway	5/30/20 5:49 PM	5/30/20 9:54 PM	4.08	11,698,722	0.98	12.90	
032	Hanford #2 Regulator	Duwamish River - East Waterway	6/28/20 3:06 AM	6/28/20 3:46 AM	0.67	671,378	0.48	17.08	
032	Hanford #2 Regulator	Duwamish River - East Waterway	9/23/20 2:03 PM	9/25/20 11:52 AM	45.82	29,676,774	2.24	54.52	
032	Hanford #2 Regulator	Duwamish River - East Waterway	10/10/20 12:11 AM	10/10/20 7:12 AM	7.02	10,439,364	0.86	9.43	
032	Hanford #2 Regulator	Duwamish River - East Waterway	10/13/20 6:50 AM	10/13/20 10:02 AM	3.20	7,992,745	1.02	44.25	
032	Hanford #2 Regulator	Duwamish River - East Waterway	11/3/20 10:20 AM	11/3/20 1:53 PM	3.55	9,832,564	0.61	6.85	
032	Hanford #2 Regulator	Duwamish River - East Waterway	11/13/20 12:25 AM	11/13/20 8:32 AM	8.12	18,677,352	1.04	14.80	
032	Hanford #2 Regulator	Duwamish River - East Waterway	11/14/20 6:59 PM	11/14/20 10:14 PM	3.25	5,874,450	0.52	6.13	

DSN #	CSO Name	Receiving Water	Event Starting Date & Time	Event Ending Date & Time	Duration (hours)	Volume (gallons)	Precipitation (inches)	Storm Duration (hours)	Note if DWO
032	Hanford #2 Regulator	Duwamish River - East Waterway	11/16/20 2:24 PM	11/16/20 6:53 PM	4.48	3,006,870	1.16	51.13	
032	Hanford #2 Regulator	Duwamish River - East Waterway	11/18/20 3:25 PM	11/18/20 5:28 PM	2.05	2,707,660	0.74	21.37	
032	Hanford #2 Regulator	Duwamish River - East Waterway	11/30/20 6:28 AM	11/30/20 8:20 AM	1.87	1,536,609	0.43	22.50	
032	Hanford #2 Regulator	Duwamish River - East Waterway	12/16/20 5:45 PM	12/16/20 7:44 PM	1.98	3,563,020	0.96	89.23	
032	Hanford #2 Regulator	Duwamish River - East Waterway	12/19/20 9:20 PM	12/19/20 10:15 PM	0.92	1,050,533	0.38	7.55	
032	Hanford #2 Regulator	Duwamish River - East Waterway	12/21/20 7:41 AM	12/22/20 5:06 AM	21.42	75,706,665	2.90	55.28	
032	Hanford #2 Regulator	Duwamish River - East Waterway	12/25/20 8:10 PM	12/25/20 8:57 PM	0.78	1,295,502	0.35	5.45	
032	Hanford #2 Regulator	Duwamish River - East Waterway	12/30/20 8:31 AM	12/30/20 1:36 PM	5.08	11,950,562	0.71	19.63	
033	Rainier Ave. Pump Station	Lake Washington	N/A	N/A	0	0	N/A	N/A	
034	East Duwamish	Duwamish River	12/21/20 3:58 PM	12/21/20 8:10 PM	4.20	60,994	2.84	53.90	
035	West Duwamish	Duwamish River	12/21/20 3:51 PM	12/21/20 8:20 PM	4.48	37,491	2.85	54.08	
036	Chelan Ave. Regulator	West Waterway of Duwamish River	1/21/20 8:16 PM	1/21/20 9:59 PM	1.72	41,032	0.92	39.92	
036	Chelan Ave. Regulator	West Waterway of Duwamish River	1/24/20 2:16 PM	1/24/20 2:28 PM	0.20	519	2.26	104.18	
036	Chelan Ave. Regulator	West Waterway of Duwamish River	1/27/20 10:08 PM	1/28/20 9:58 AM	11.83	378,622	3.82	193.97	
036	Chelan Ave. Regulator	West Waterway of Duwamish River	1/31/20 3:54 PM	2/1/20 4:53 PM	24.98	1,577,846	5.85	290.33	
036	Chelan Ave. Regulator	West Waterway of Duwamish River	2/6/20 8:26 AM	2/6/20 2:31 PM	6.08	142,741	1.62	51.12	
037	Harbor Avenue Regulator	Duwamish River into Elliott Bay	12/21/20 3:20 PM	12/21/20 4:21 PM	1.02	798,610	2.49	50.18	
038	Terminal 115 Overflow	Duwamish River	12/21/20 3:25 PM	12/21/20 8:55 PM	5.50	384,885	1.93	20.82	
039	Michigan Regulator (AKA S. Michigan Regulator)	Duwamish River	1/18/20 4:43 AM	1/18/20 5:07 AM	0.40	1,874	0.41	6.18	
039	Michigan Regulator (AKA S. Michigan Regulator)	Duwamish River	1/21/20 7:40 PM	1/21/20 10:40 PM	3.00	1,588,000	1.02	36.37	

DSN #	CSO Name	Receiving Water	Event Starting Date & Time	Event Ending Date & Time	Duration (hours)	Volume (gallons)	Precipitation (inches)	Storm Duration (hours)	Note if DWO
039	Michigan Regulator (AKA S. Michigan Regulator)	Duwamish River	1/24/20 3:03 AM	1/24/20 2:29 PM	11.43	1,035,179	2.39	99.83	
039	Michigan Regulator (AKA S. Michigan Regulator)	Duwamish River	1/27/20 9:31 PM	1/28/20 9:58 AM	12.45	2,514,547	4.05	191.28	
039	Michigan Regulator (AKA S. Michigan Regulator)	Duwamish River	1/31/20 3:40 PM	2/1/20 8:38 AM	16.97	8,528,169	1.69	38.52	
039	Michigan Regulator (AKA S. Michigan Regulator)	Duwamish River	2/5/20 4:32 PM	2/6/20 1:54 PM	21.37	1,279,162	1.43	49.05	
039	Michigan Regulator (AKA S. Michigan Regulator)	Duwamish River	4/25/20 9:43 AM	4/25/20 10:24 AM	0.68	263,561	0.44	3.03	
039	Michigan Regulator (AKA S. Michigan Regulator)	Duwamish River	5/16/20 11:20 PM	5/16/20 11:49 PM	0.48	36,240	0.43	15.50	
039	Michigan Regulator (AKA S. Michigan Regulator)	Duwamish River	5/30/20 10:13 AM	5/30/20 7:27 PM	9.23	425,736	0.89	10.82	
039	Michigan Regulator (AKA S. Michigan Regulator)	Duwamish River	6/28/20 1:08 AM	6/28/20 1:58 AM	0.83	80,510	0.41	16.42	
039	Michigan Regulator (AKA S. Michigan Regulator)	Duwamish River	9/23/20 12:29 PM	9/25/20 10:14 AM	45.75	2,357,170	1.95	54.13	
039	Michigan Regulator (AKA S. Michigan Regulator)	Duwamish River	10/9/20 10:50 PM	10/10/20 12:58 AM	2.13	881,719	0.59	2.80	
039	Michigan Regulator (AKA S. Michigan Regulator)	Duwamish River	10/13/20 5:16 AM	10/13/20 5:51 AM	0.58	44,674	0.35	4.37	
039	Michigan Regulator (AKA S. Michigan Regulator)	Duwamish River	12/21/20 2:11 PM	12/21/20 6:43 PM	4.53	24,819,654	1.80	18.62	
040	8th Ave South Regulator (AKA W. Marginal Way Pump Station)	Duwamish River	12/21/20 3:47 PM	12/21/20 5:54 PM	2.12	225,804	1.73	17.90	
041	Brandon Street Regulator	Duwamish River	1/21/20 7:59 PM	1/21/20 8:26 PM	0.45	2,798	0.88	38.87	
041	Brandon Street Regulator	Duwamish River	1/24/20 1:37 PM	1/24/20 1:56 PM	0.32	17,883	2.26	104.18	
041	Brandon Street Regulator	Duwamish River	1/28/20 6:27 AM	1/28/20 6:27 AM	0.00	14	3.73	192.88	

DSN #	CSO Name	Receiving Water	Event Starting Date & Time	Event Ending Date & Time	Duration (hours)	Volume (gallons)	Precipitation (inches)	Storm Duration (hours)	Note if DWO
041	Brandon Street Regulator	Duwamish River	9/23/20 12:21 PM	9/25/20 9:34 AM	45.22	2,425,498	2.21	53.58	
041	Brandon Street Regulator	Duwamish River	11/3/20 9:39 AM	11/3/20 9:41 AM	0.03	134,785	0.40	2.70	
041	Brandon Street Regulator	Duwamish River	12/21/20 3:02 PM	12/21/20 5:56 PM	2.90	7,972,712	2.69	51.80	
042	West Michigan (AKA SW Michigan St regulator)	Duwamish River	1/28/20 7:13 AM	1/28/20 8:42 AM	1.48	122,879	4.04	190.93	
042	West Michigan (AKA SW Michigan St regulator)	Duwamish River	2/1/20 2:19 AM	2/1/20 10:16 AM	7.95	1,154,090	1.69	38.52	
042	West Michigan (AKA SW Michigan St regulator)	Duwamish River	12/21/20 3:06 PM	12/21/20 9:30 PM	6.40	957,625	1.96	21.43	
043	East Marginal Pump Station	Duwamish River	N/A	N/A	0	0	N/A	N/A	
044a	Norfolk local drainage	Duwamish River	N/A	N/A	0	0	N/A	N/A	
045	Henderson Pump Station	Lake Washington	N/A	N/A	0	0	N/A	N/A	
048a	North Beach Pump Station (wet well)	Puget Sound	12/21/20 2:48 PM	12/21/20 8:35 PM	5.78	3,040,250	2.10	18.72	
048b	North Beach Pump Station (inlet structure)	Puget Sound	12/21/20 2:55 PM	12/21/20 3:40 PM	0.75	250,397	1.72	15.22	
049	30th Avenue NE Pump Station	Lake Washington	12/21/20 2:30 PM	12/21/20 4:25 PM	1.92	28,512	2.10	15.92	
052	53rd Avenue SW Pump Station	Puget Sound	9/24/20 12:05 PM	9/24/20 12:50 PM	0.75	89,016	1.69	32.75	
052	53rd Avenue SW Pump Station	Puget Sound	12/21/20 2:38 PM	12/21/20 6:27 PM	3.82	1,088,792	2.74	52.25	
054	63rd Avenue SW Pump Station	Puget Sound	2/1/20 3:01 AM	2/1/20 8:56 AM	5.92	37,116,883	2.37	38.72	
054	63rd Avenue SW Pump Station	Puget Sound	12/21/20 3:16 PM	12/22/20 12:20 AM	9.07	46,060,447	3.02	21.42	
055	SW Alaska Street Overflow	Puget Sound	12/21/20 3:08 PM	12/21/20 3:42 PM	0.57	29,438	2.27	16.25	
056	Murray Street Pump Station	Puget Sound	12/21/20 3:38 PM	12/21/20 6:00 PM	2.37	2,884,562	2.80	18.45	
057	Barton Street Pump Station	Puget Sound	1/24/20 1:30 PM	1/24/20 1:46 PM	0.27	88,766	2.51	100.32	
057	Barton Street Pump Station	Puget Sound	12/21/20 3:06 PM	12/21/20 4:37 PM	1.52	969,567	1.88	16.70	

DSN #	CSO Name	Receiving Water	Event Starting Date & Time	Event Ending Date & Time	Duration (hours)	Volume (gallons)	Precipitation (inches)	Storm Duration (hours)	Note if DWO
	Total Volume					1,143,563,045			

Appendix B
Treated CSO Events

January–December 2020

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 CSO Treatment Facility	Puget Sound	1/28/20 10:04:00 AM	1/28/20 8:17:00 AM	1.10	0.35	4.83	191.60	
051b	Alki CSO Treatment Facility	Puget Sound	2/1/20 4:29:00 PM	2/1/20 2:34:00 AM	13.92	16.95	2.37	38.72	
051b	Alki CSO Treatment Facility	Puget Sound	12/22/20 4:28:00 AM	12/21/20 3:38:00 PM	10.87	13.28	3.02	21.42	
046b	Carkeek CSO Treatment Facility	Puget Sound	2/1/20 12:42:00 PM	2/1/20 5:40:00 AM	7.03	0.43	5.39	286.11	
046b	Carkeek CSO Treatment Facility	Puget Sound	2/7/20 4:26:00 AM	2/5/20 5:52:00 PM	30.91	4.78	1.89	57.90	
046b	Carkeek CSO Treatment Facility	Puget Sound	12/22/20 3:09:00 AM	12/21/20 2:44:00 PM	11.93	3.79	2.42	21.20	
027b	Elliott West CSO Treatment Facility	Puget Sound	1/21/20 10:37:00 PM	1/21/20 8:38:00 PM	1.98	2.79	0.95	59.88	
027b	Elliott West CSO Treatment Facility	Puget Sound	1/28/20 9:49:00 AM	1/28/20 12:56:00 AM	5.40	5.44	0.93	16.42	
027b	Elliott West CSO Treatment Facility	Puget Sound	2/1/20 2:34:00 AM	2/1/20 10:01:00 AM	7.45	10.73	1.03	37.50	
027b	Elliott West CSO Treatment Facility	Puget Sound	2/6/20 4:51:00 PM	2/5/20 8:02:00 PM	13.20	7.71	1.71	47.33	

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 CSO Treatment Facility	Puget Sound	5/30/20 9:35:00 PM	5/30/20 7:16:00 PM	2.32	2.80	0.98	13.05	
027b	Elliott West CSO Treatment Facility	Puget Sound	12/22/20 12:22:00 AM	12/21/20 2:24:00PM	9.85	40.20	2.15	21.70	
044b	MLK/Henderson CSO Treatment Facility	Duwamish River	12/21/20 7:05:00 PM	12/22/20 12:33:00 AM	5.47	1.72	1.99	22	
1	West Point[1]	Puget Sound	1/18/20 8:33:00 AM	1/18/20 5:45:00 AM	2.78	3.11	0.52	7.32	
1	West Point1	Puget Sound	1/21/20 11:55:00 PM	1/21/20 8:03:00 PM	3.87	6.35	0.83	37.58	
1	West Point[1]	Puget Sound	1/24/20 5:47:00 AM	1/23/20 9:32:00 AM	7.37	5.75	2.15	90.08	
1	West Point[1]	Puget Sound	1/28/20 11:00:00 AM	1/27/20 9:08:00 PM	9.80	12.11	3.73	191.58	
1	West Point[1]	Puget Sound	2/1/20 9:56:00 AM	1/31/20 5:16:00 PM	11.40	18.56	5.35	286.12	
1	West Point[1]	Puget Sound	2/6/20 7:20:00 PM	2/5/20 5:11:00 AM	33.99	44.99	1.80	46.52	
1	West Point[2]	Puget Sound	3/6/20 3:57:00 AM	3/6/20 2:26:00 AM	1.51	0.88	0.44	8.97	
1	West Point[2]	Puget Sound	3/29/20 3:36:00 AM	3/29/20 12:26:00 AM	2.80	3.28	0.56	9.10	
1	West Point[1]	Puget Sound	5/17/20 2:40:00 AM	5/17/20 12:42:00 AM	1.96	0.85	0.5	17.35	
1	West Point[2]	Puget Sound	5/20/20 6:37:00 PM	5/20/20 6:22:00 PM	0.26	0.35			DWO
1	West Point[1]	Puget Sound	5/30/20 9:46 PM	5/30/20 6:14:00 PM	3.30	5.80	0.9	12.58	
1	West Point	Puget Sound	6/30/20 8:24:00 AM	6/30/20 8:16:00 AM	0.13	0.12			DWO

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[1,4]	Puget Sound	9/25/20 12:18:00 PM	9/23/20 2:21:00 PM	8.15	6.77	2.13	55.52	
1	West Point[1]	Puget Sound	10/11/20 5:07:00 PM	10/11/20 4:42:00 PM	0.42	0.50			DWO
1	West Point[1]	Puget Sound	10/13/20 9:43:00 AM	10/13/20 7:12:00 AM	2.52	1.45	1.03	44.13	
1	West Point[1]	Puget Sound	11/3/20 1:10:00 PM	11/3/20 10:15:00 AM	2.96	1.35	0.52	5.18	
1	West Point[1]	Puget Sound	11/16/20 6:19:00 PM	11/16/20 2:30:00 PM	3.50	5.31	0.78	9.60	
1	West Point[1]	Puget Sound	11/18/20 1:47:00 AM	11/17/20 6:30:00 PM	3.45	1.56	1.61	41.07	
1	West Point[1]	Puget Sound	12/22/20 1:15 AM	12/21/20 6:40:00 AM	15.94	33.04	2.41	21.20	
1	West Point[1]	Puget Sound	12/25/20 9:29:00 AM	12/25/20 7:46:00 AM	1.72	0.61	0.44	5.52	
1	West Point[1]	Puget Sound	12/30/20 12:25:00 PM	12/30/20 11:21:00 AM	1.11	0.002	0.58	16.48	
Total Volume						**263.74**			

Notes:
[1] Flow at West Point exceeded 300 MGD.
[2] Secondary diversion caused by power outage at West Point Treatment Plant.
[3] Secondary diversion caused by IPS pump failure at West Point Treatment Plant.
[4] This event is part of a three-day-long storm and CSO event.

Appendix C
Alki Wet Weather Treatment Station
Annual Report

January–December 2020

Executive Summary

This 2020 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 (WA-0029181-1).

2020 was slightly wetter than normal, producing five filling events and three discharge events at Alki WWTS. The three discharge events occurred over four reporting days and two reporting months. The Alki WWTS received a total of 36.7 million gallons (MG) and discharged 30.6 MG. 44.66 inches of rain fell in 2020 as measured at the rain gauge at the Murray wet weather station. King County switched to the Murray wet weather station rain gauge in late 1999 to report Alki WWTS rainfall data. 2020 annual rainfall at Sea-Tac is 41.32 inches; the 20-year average of annual total rainfall at Sea-Tac is 39.24 inches.

Alki's performance in 2020 is summarized in Table C-1. Alki WWTS complied with all permit conditions except the minimum effluent pH 6.0 limit during the January 28, 2020 discharge. Total suspended solids (TSS) removal averaged 58.2 percent. Effluent settleable solids (SS) averaged 0.18 milliliters/liter/hour (ml/L/hr). The effluent total residual chlorine (TRC) averaged no greater than 32 µg/L on any discharge day. The effluent fecal coliform geomeans were no greater than 13 cfu/100 ml over any month.

Table C-1. Alki WWTS Permit Performance in 2020

Parameter	Performance	Permit Conditions
Discharge events (number)[a]	**3**	**29**
Discharge volume million gallons (MG)[a]	**30.6**	**108**
Annual average SS (ml/L/hr)	**0.18**	**0.3**
Annual average TSS removal- including all discharge events (%)	**58.2**	**50**
Instantaneous minimum effluent pH, frequency of discharge days with pH < 6.0	**1 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 >234 µg/L	**0 out of 4 discharge days**	**≤ 234 µg/L**
Monthly fecal coliform geomean, frequency of months with monthly geomean >400/100 ml	**0 out of 2 discharge months**	**400/ 100 ml**

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

Suspended and Settleable Solids

Total suspended solids (TSS) removal averaged 58.2 percent in 2020 (using all discharge events), which met the annual average TSS removal permit level of 50 percent. The annual event average settleable solids (SS) was 0.18 ml/L/hr; therefore, meeting the annual average NPDES permit level of 0.3 ml/L/hr.

Historically, complying with the annual 50 percent TSS removal limit at the Alki WWTS has been a challenge. One modification was made in late 2019 to hopefully improve TSS removal. The filling operation of the sedimentation tanks was changed to simultaneously fill all six sedimentation tanks. This change was made to slow the flows entering all of the sedimentation tanks and thus, allow more solids to settle and be removed by the sludge removal system. In early 2020, a project was started to evaluate the feasibility of converting the abandoned digesters into solids holding tanks to also improve TSS removal. The “holding tanks” would store Alki solids during treatment and discharge events and return the solids post-event. See below for more details on this project.

Fecal Coliform Bacteria

Both discharge months in 2020 met the fecal coliform monthly geomean limit of 400 cfu/100 ml: 13 cfu/100 ml in January 2020, and 1 cfu/100 ml in December 2020. All fecal coliform samples collected during these months were valid except for the one sample collected during the short-term January 28, 2020, discharge event. The sample arrived at the lab in a partially frozen state. Though the laboratory completed the fecal coliform analysis (with a recorded value of 310 cfu/100 ml), the result was reported as invalid and not used to calculate the monthly geomean. Temperature log and scheduled preventive maintenance has been setup on all sample refrigerators.

Total Residual Chlorine

All four discharge days at the Alki WWTS met the daily average total residual chlorine (TRC) permit limit of 234 mg/L. The 2020 annual effluent TRC average was 12 µg/L with the maximum daily average of 32 µg/L during the December 21, 2020 discharge event.

Instantaneous Minimum and Maximum Effluent pH

Alki WWTP complied with the instantaneous pH permit limits throughout 2020 except during the January 28, 2020 event when the effluent pH briefly fell below pH 6.0. That discharge event started with the effluent pH less than pH 6.0, but it rose steadily to above pH 6.0 during the 1.1-hour event. This low pH exceedance may be related to where the pH analyzer's sample pump pulled from the effluent channel. The sample pump drew from the bottom of a stilling well which was close to the effluent channel floor. During the initial stages of an event, it's possible that the analyzer's sample contained sodium bisulfite (SBS) at a higher concentration than would otherwise be found throughout the effluent channel, and especially at the effluent weir. The higher concentration of SBS—an acidic compound—would result in a lower pH value. As the effluent discharge continued, greater flow within still well brought the pH above 6.0. As a corrective action, the sample pump's stilling well was modified (after the January 28, 2020, event) to pull a sample more representative of effluent going over the discharge weir.

Operation and Maintenance

Major upgrades to the Alki WWTS were completed in recent years; staff evaluated and made adjustments as needed in 2020. Highlights of operations and maintenance (O&M) activities during 2020 include:

- Conducted annual CSO refresher training for the operators in September 2020.

- Quarterly/monthly testing of hypochlorite and bisulfite solution strength; setpoint 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 on a monthly basis.
- Completed work on the final effluent sampling pump stilling well to improve effluent flow through the stilling well and prevent low pH exceedances.
- 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 the Alki WWTS. This project was completed in summer 2018. The project replaced aging pumps and chemical piping and changed the dosing system to use a three-pump manifold system with controlled dosing into the inlet channel (prior to the bar screens) using dedicated chemical feed flow meters and diffusers. New hypochlorite feed piping and venting was included in the project. The initial results using the new hypochlorite feed system have indicated a reliable hypochlorite feed. Staff will continue to monitor the hypochlorite feed system and make adjustments as needed.

Near Future Operation

As with all wet weather treatment stations, opportunities to operate and then to optimize 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 issues and 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 hypochlorite feed system.
- Evaluate the TSS removal performance by switching the operation of the sedimentary tanks to all six tanks filling simultaneously.
- Continue discussions on the use of Alki digester tanks as a solids holding tank as a process to improve TSS removal at Alki WWTS.

Table C-2. Alki WWTS 2020 Annual Event Data Summary

Alki 2020 Compliance Table													
Month	**Day**	**Alki Inflow Event Number**	**Alki Inflow Volume (MG)**	**Alki Discharge Event Number**	**Alki Discharge Volume (MG)**	**Total Influent TSS (lb)**	**Total Effluent TSS Discharged @ Alki + WP (lb)**	**% 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	28	1	2.11	1	0.35	4,012	1,440		0.2	0.2	**NR**	**7**	5.5/6.2
	31	2	9.53	2	7.86	2,384	1,786		0.3	0.3	170/1	7	6.1/6.4
	Instant. Min/Max pH												**5.5/6.4**
	Event/Daily Max									**0.3**		**7**	
	Monthly Total/Avg/ GeoMean	**2**	**11.6**	**2**	**8.2**	**6,397**	**3,225**	**49.6 %**			**13.0**		
February	1	1/31/2020	9.79	1/31/2020	9.1	1306	1686		0.1	0.1	**Reported 1/31**	3	6.4/6.8
	6	1	0.08	ND	ND	21	5						

	Instant. Min/Max pH												**6.4/6.8**
	Event/Daily Max									**0.1**		**3**	
	Monthly Total/Avg/ GeoMean	**1**	**9.9**	**0**	**9.1**	**1,327**	**1,691**	**-27.4 %**			**ND**		
March	No Inflow/No Disch.												
	Instant. Min/Max pH												**ND**
	Event/Daily Max									**ND**		**ND**	
	Monthly Total/Avg/ GeoMean	**0**	**0.0**	**0**	**0.0**	**-**	**-**	**-**			**ND**		
April	No Inflow/No Disch.												
	Instant. Min/Max pH												**ND**
	Event/Daily Max									**ND**		**ND**	

	Monthly Total/Avg/ GeoMean	**0**	**0.0**	**0**	**0.0**	**-**	**-**	**-**			**ND**		
May	30	1	0.32	ND	ND	934	68						
	Instant. Min/Max pH												**ND**
	Event/Daily Max									**ND**		**ND**	
	Monthly Total/Avg/ GeoMean	**1**	**0.3**	**0**	**0.0**	**934**	**68**	**92.7 %**			**ND**		
June	No Inflow/No Disch.												
	Instant. Min/Max pH												**ND**
	Event/Daily Max									**ND**		**ND**	
	Monthly Total/Avg/ GeoMean	**0**	**0.0**	**0**	**0.0**	**-**	**-**	**-**			**ND**		
July	No Inflow/No Disch.												
	Instant. Min/Max pH												**ND**

	Event/Daily Max									**ND**		**ND**	
	Monthly Total/Avg/ GeoMean	**0**	**0.0**	**0**	**0.0**	**-**	**-**	**-**			**ND**		
August	No Inflow/No Disch.												
	Instant. Min/Max pH												**ND**
	Event/Daily Max									**ND**		**ND**	
	Monthly Total/Avg/ GeoMean	**0**	**0.0**	**0**	**0.0**	**-**	**-**	**-**			**ND**		
Septemb er	No Inflow/No Disch.												
	Instant. Min/Max pH												**ND**
	Event/Daily Max									**ND**		**ND**	
	Monthly Total/Avg/ GeoMean	**0**	**0.0**	**0**	**0.0**	**-**	**-**	**-**			**ND**		

October	No Inflow/No Disch.												
	Instant. Min/Max pH												**ND**
	Event/Daily Max									**ND**		**ND**	
	Monthly Total/Avg/ GeoMean	**0**	**0.0**	**0**	**0.0**	**-**	**-**	**-**			**ND**		
Novemb er	No Inflow/No Disch.												
	Instant. Min/Max pH												**ND**
	Event/Daily Max									**ND**		**ND**	
	Monthly Total/Avg/ GeoMean	**0**	**0.0**	**0**	**0.0**	**-**	**-**	**-**			**ND**		
Decemb er	21	1	14.89	1	13.28	17,510	5,944		0.1	0.1	1/1	32	6.2/6.8
	Instant. Min/Max pH												**6.2/6.8**
	Event/Daily Max									**0.1**		**32**	

	Monthly Total/Avg/ GeoMean	**1**	**14.9**	**1**	**13.3**	**17,510**	**5,944**	**66.1 %**			**1.0**		
Total		**5**	**36.72**	**3**	**30.58**	**26,168**	**10,928**						
Inst. pH Min/Max													**5.5/6.8**
Max (GEM, SS, TRC)											**13.0**	**32**	
Annual Average							by mass:	**58.2 %**		**0.18**	**7.0**	**12**	

Notes:
ND = No discharge.
Red = NPDES permit exceedance.
%NS = No sample collected
^ED = End of discharge; fecal coliform samples were collected for 0–3 and 4–8 hour grabs, then discharge ended before next grab sample was required.

Appendix D
Carkeek Wet Weather Treatment Station
Annual Report

January–December 2020

Executive Summary

This 2020 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 WA-0029181-1.

Year 2020 was slightly wetter than normal for the region, producing nine filling events and three discharge events at Carkeek WWTS. The three discharge events occurred over five reporting days and three months. Carkeek WWTS received a total of 11.3 million gallons (MG) and discharged 9.0 MG. Rainfall at the Ballard Station rain gauge—the gauge used for Carkeek WWTS reporting—totaled 37.45 inches in 2020. By comparison, 2020 annual rainfall at Sea-Tac was 41.32 inches; the 20-year average of annual total rainfall at Sea-Tac is 39.24 inches.

Carkeek WWTS' performance in 2020 is summarized in Table D-1. Carkeek WWTS complied with all permit conditions except the annual average settleable solids (SS) limit. Carkeek WWTS's annual average SS was 0.40 milliliters/liter/hour (ml/L/hr), which is greater than the NPDES permit limit of 0.3 ml/L/hr. Total suspended solids (TSS) removal averaged 62 percent (using all discharge events). The effluent total residual chlorine (TRC) averaged no greater than 168 µg/L on any discharge day. The effluent fecal coliform geomeans were no greater than 5 cfu/100 ml on any discharge month. The effluent pH was between the pH 6.0 to pH 9.0 permit limits for all discharge events.

Table D-1. Carkeek WWTS Permit Performance in 2020

Parameter	Performance	Permit Conditions
Discharge events (number)[a]	**3**	**10**
Discharge volume million gallons (MG)[a]	**9.0**	**46**
Annual average SS (ml/L/hr)	**0.4**	**0.3**
Annual average TSS removal - including all discharge events (%)	**62.1**	**50**
Instantaneous minimum effluent pH, frequency of discharge days with pH < 6.0	**0 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 >490 µg/L	**0 out of 5 discharge days**	**≤ 490 µg/L**
Monthly fecal coliform geomean, frequency of months with monthly geomean >400/100 ml	**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

Total suspended solids (TSS) removal averaged 62.1 percent, thereby meeting the annual TSS removal NPDES permit limit of 50 percent. The annual settleable solids (SS) for the year averaged 0.40 ml/L/hr., not meeting the NPDES Permit limit annual average of 0.3 ml/L/hr. Carkeek WWTS has typically met the annual percent TSS removal and SS annual average over a year. The 2020 average SS was driven by the unusually high effluent SS value of 1.0 ml/L/hr on December 21, 2020. However, it's unclear at this time why the SS value was so high. One possible reason for the high Dec. 21 SS value was the higher inflow volume, and higher flow rates (with peak flows reaching 20 MGD), when compared with the February 2020 storm which had a similar influent TSS load. The fact that the December 21 storm was the first discharge in ten months, with only three very small filling events in the interim, may have also played a role. The rated surface overflow rate (SOR) as gallons per day per square foot (gpd/sq ft) of the Carkeek sedimentation tanks is 5,500 gpd/sq ft. In comparing the SOR of the sedimentation tanks during both storms indicated that the December 21, 2020, storm

resulted in SOR approximately twice the rated specifications and nearly three times that of the SOR during the February 5–6, 2020, storm event (10,600 vs. 3,700 gpd/sq ft). These results support the suggestion that the December storm event resulted in washing out of solids including settleable solids resulting in the high SS value and low TSS removal for the event.

Fecal Coliform Bacteria

Carkeek met the permit limit for monthly geomean for fecal coliform for the three discharge months in 2020. The annual average of the monthly geomean was 2.7 counts/100 ml.

Instantaneous Minimum/Maximum pH

The instantaneous minimum and maximum pH during the 2020 reporting period was 6.3 and 7.7, respectively, thereby meeting the NPDES permit limits of ≥pH 6.0 and ≤pH 9.0.

Total Residual Chlorine

Carkeek met the daily maximum average total residual chlorine (TRC) on all five discharge days during 2020. The maximum daily average effluent TRC during the 2020 reporting year was 168 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.

Operations and Maintenance

Highlights of O&M activities during 2020 include:

- Conducted annual CSO refresher training for the operators in October 2020.
- 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.
- 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.
- Carkeek Pump Station evaluation and adjustments of the VFD is ongoing.

Dechlorination Improvement Project

In late 2019, a new capital project was initiated to improve the reliability of the dechlorination system at Carkeek WWTS. This project entails upgrading the storage of sodium bisulfite (SBS) chemical solution from a single 1000-gallon tank to two 500-gallon tanks, upgrading the HVAC system, new chemical feed pumps, and upgraded amperometric chlorine analyzers. The project will also locate the sampling and instrumentation equipment in a dedicated room, separated from SBS chemical storage, in order to provide a safer workspace for staff during monitoring and maintenance. The project team has set a potential start of construction for summer 2022 with potential commissioning in late 2022 or early 2023.

Near Future Operation

As with all wet weather treatment stations, opportunities to operate and then to optimize 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 a number of 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 evaluate the completed flow measurement improvements.

- Support the Dechlorination Improvement capital project to upgrade the sodium bisulfite chemical storage and feed system.

Table D-2. Carkeek WWTS Annual Plant Performance 2020

Month	Day	Carkeek Inflow Event Number	Carkeek Inflow Volume (MG)	Carkeek Discharge Event Number	Carkeek Discharge Volume (MG)	Total Influent TSS (lb)	Total Effluent TSS Discharged @ Carkeek + WP (lb)	% 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 (µg/L)	Daily Min/Max pH	
January	21	1	0.085	ND	ND	84	9							
	23	2	0.588	ND	ND	466	63							
	27	3	0.241	ND	ND	426	31							
	28	3	0.232	ND	ND	104	32							
	31	4	0.513	1	0.098	377	67		0.1	**0.1**	1/1	73	6.3/7.5	
	Instant. Min/ Max pH												**6.3/7.5**	
	Event/ Daily Max									**0.10**		**73**		
	Monthly Total Avg Geo-Mean	**4**	**1.66**	**1**	**0.10**	**1,457**	**203**	**86.1%**			**1**			

February	1	1/31/2020	0.4	1/31/2020	0.33	339	115		0.1		**Reported 1/31**	7	6.4/6.5	
	5	1	2.4	1	2.02	4873	1029		0.1	0.1	20/1	144	6.3/7.1	
	6	1	2.6	1	2.77	1084	543		0.1		1	81	6.4/6.6	
	Instant. Min /Max pH												**6.3/7.1**	
	Event/ Daily Max									**0.10**		**144**		
	Monthly Total Avg Geo-Mean	**1**	**5.33**	**1**	**5.11**	**6296**	**1686**	**73.2%**			**2.7**			
March	24	1	0.06	ND	ND	241	**5**							
	Instant. Min/Max pH												**ND**	
	Event/Daily Max									**ND**		**ND**		
	Monthly Total Avg Geo-Mean	**1**	**0.06**	**ND**	**0.00**	**241**	**5**	**97.8%**			**ND**			

April	No Inflow/ No Disch.													
	Instant. Min/Max pH												**ND**	
	Event/ Daily Max									**ND**		**ND**		
	Monthly Total Avg Geo-Mean	**0**	**0.00**	**ND**	**0.00**	**-**	**-**	**-**			**ND**			
May	No Inflow/ No Disch.													
	Instant. Min/Max pH												**ND**	
	Event/ Daily Max									**ND**		**ND**		
	Monthly Total Avg Geo-Mean	**0**	**0.00**	**ND**	**0.00**	**-**	**-**	**-**			**ND**			
June	13	1	0.16	ND	ND	414	11							

	Instant. Min/Max pH												**ND**	
	Event/ Daily Max									**ND**		**ND**		
	Monthly Total Avg Geo-Mean	**1**	**0.16**	**ND**	**0.00**	**414**	**11**	**97.3%**			**ND**			
July	No Inflow/ No Disch.													
	Instant. Min/Max pH												**ND**	
	Event/ Daily Max									**ND**		**ND**		
	Monthly Total Avg Geo-Mean	**0**	**0.00**	**ND**	**0.00**	**-**	**-**	**-**			**ND**			
August	No Inflow/ No Disch.													
	Instant. Min/Max pH												**ND**	

	Event/ Daily Max									**ND**		**ND**		
	Monthly Total Avg Geo-Mean	**0**	**0.00**	**ND**	**0.00**	**-**					**ND**			
September	25	1	0.08	ND	ND	125	11							
	Instant. Min/Max pH												**ND**	
	Event/ Daily Max									**ND**		**ND**		
	Monthly Total Avg Geo-Mean	**1**	**0.08**	**ND**	**0.00**	**125**	**11**	**91.5%**			**ND**			
October	No Inflow/ No Disch.													
	Instant. Min/Max pH												**ND**	
	Event/ Daily Max									**ND**		**ND**		

	Monthly Total Avg Geo-Mean	**0**	**0.00**	**ND**	**0.00**	**-**	**-**	**-**			**ND**			
November	No Inflow/ No Disch.													
	Instant. Min/Max pH												**ND**	
	Event/ Daily Max									**ND**		**ND**		
	Monthly Total Avg Geo-Mean	**0**	**0.00**	**ND**	**0.00**	**-**	**-**	**-**			**ND**			
December	21	1	4.03	1	3.79	3963	2823		1.0	1.0	20/1	168	6.4/7.7	
	Instant. Min/Max pH												**6.4/7.7**	
	Event/ Daily Max									**1.0**		**168**		
	Monthly Total Avg Geo-Mean	**1**	**4.03**	**1**	**3.79**	**3963**	**2823**	**28.8%**			**4.5**			

Total		**9**	**11.32**	**3**	**9.00**	**12,496**	**4,739**							
Inst. pH Min/Max													**6.3/7.7**	
Max (GEM, SS, TRC)											**4.5**	**168**		
Annual Average								**62.1%**		**0.40**	**2.7**	**95**		

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.

Appendix E
Elliott West Wet Weather Treatment Station
Annual Report

January–December 2020

Executive Summary

This 2020 annual report summarizes the performance of the Elliott West Wet Weather Treatment Station (Elliott West 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 WA-0029181-1. The current permit went into effect on February 1, 2015.

In 2020. There were 36 inflow events and six discharge events at Elliott West WWTS. The six discharge events occurred over nine reporting days and four reporting months. Elliott West WWTS influent totaled 235.9 million gallons (MG) and 69.7 MG were discharged in 2020. Total rainfall in 2020 was 33.12 inches as measured at the Denny Way rain gauge (3165 Alaskan Way in Seattle). The annual total at Denny Way is lower than the 2020 annual rainfall total of 41.32 inches at Seattle Tacoma International Airport (Sea-Tac). The 20-year average of annual rainfall at Sea-Tac is 39.42 inches.

The performance of Elliott West WWTS in 2020 has been summarized below in Table E-1. Elliott West WWTS did not comply with eight of a possible 33 permit conditions in 2020. Elliott West WWTS fully complied with the permit limits for annual total suspended solids (TSS) removal, instantaneous effluent maximum pH 9.0, and monthly geomean effluent fecal coliforms. TSS removal averaged 60.9 percent over the year (which accounts for all events). Effluent fecal coliform geomeans were no greater than 149 cfu/100 ml over any month. Elliott West WWTS did not comply with the annual average settleable solids (SS) limit of 0.3 milliliters/liter/hour (ml/L/hr); effluent SS averaged 2.18 ml/L/hr in 2020. Daily average total residual chlorine (TRC) exceeded the permitted level of 109 µg/L on two of nine discharge days; it reached as high as 694 µg/L. Effluent pH dropped below the permitted minimum limit of pH 6.0 on five of the nine discharge days; it reached as low as pH 5.5 during any event.

All required samples were collected, and all required measurements were completed, in 2020, except for the TRC and pH for the May 30, 2020, event. These values were reported as “Not Measured/ Not Reported” in the May 2020 DMR. These non-reported values were due to a failure of the final effluent sample pump. Thus, no effluent was being fed to the composite sampler as well as the online TRC and pH analyzers. Because of the short duration of the event, Operations staff did not have sufficient time to use the portable field instruments to measure TRC and pH. Staff did collect grab

samples for fecal coliform analyses, and manually composited effluent sample so the lab could test for the five-day biochemical oxygen demand (BOD), TSS, and SS. The performance for 2020 has been summarized below in Table E-1.

Performance in 2020

Table E-1 summarizes NPDES permit performance in 2020.

Table E-1. Elliott West WWTS Permit Performance in 2020

Parameter	Performance	Permit Conditions
Discharge events (number)	**6**	**NA**
Discharge volume million gallons (MG)	**69.7**	**NA**
Annual average SS (ml/L/hr)	**2.18**	**0.3**
Annual average TSS removal- including all discharge events (%)	**60.9**	**50**
Instantaneous minimum effluent pH, frequency of discharge days with pH < 6.0	**5 out of 9 discharge days**	**≥ 6.0**
Instantaneous maximum effluent pH, frequency of discharge days with pH > 9.0	**0 out of 9 discharge days**	**≤ 9.0**
Total residual chlorine (TRC), maximum of daily averages (µg/L), frequency of discharge days with TRC >109 µg/L	**2 out of 9 discharge days**	**109 µg/L**
Monthly fecal coliform geomean, frequency of months with monthly geomean >400/100 ml	**0 out of 4 discharge months**	**400/100 ml**

Numbers in red indicate a permit exceedance.

Suspended and Settleable Solids

In 2020, Elliott West WWTS met the permit annual TSS removal limit of 50 percent with an average of 60.9 percent. Elliott West WWTS did not meet the permit annual SS average limit of 0.3 ml/L/hr. The annual SS concentration for 2020 averaged 2.18 ml/L/hr with a maximum event SS value of 3.0 ml/L/hr on December 21, 2021.

In August 2020, King County hired a contractor to clean out the Elliott West WWTS wet well of the accumulated solids. The expectation is that by removing the accumulated solids from the wet well would reduce the potential for resuspension of solids including the settleable solids during subsequent inflow and discharge events by the main discharge pumps. It is suspected that resuspension of accumulated solids contributes to the high SS concentrations in the final effluent flow resulting in non-compliance of SS permit limits. The contractor was able to remove approximately 32 tons of material from the wet well. Staff will continue to monitor the effectiveness of the wet well clean out in reducing the SS concentration in the pumped flows including discharge flows. Along with the wet well cleaning, King County started a project in 2020 to model particle deposition and resuspension in the Elliott West WWTS wet well to understand and

evaluate alternative approaches in an automated wet well cleaning and flushing in comparison with the suggestion to schedule wet well cleaning as part of a reoccurring preventive maintenance plan.

With the ongoing challenges of meeting the NPDES permit limits at Elliott West WWTS, King County started a project to evaluate alternative CSO treatment technologies. In early 2019, a pilot-scale flat ceramic membrane facility was operated at the West Point Treatment Plant to evaluate its feasibility and treatment effectiveness including solids removal. A final project report is scheduled to be available by late summer 2021.

Fecal Coliform Bacteria

EW WWTS met the fecal coliform NPDES permit limit of 400 cfu/100 ml monthly geomean during all four discharge months in 2020. The highest fecal coliform monthly geomean in 2020 was 149 MPN/100 ml in December. The annual average of the four monthly geomeans was 79.5 MPN/100 ml.

Hypochlorite dosing setpoint have been increased in response to high fecal coliform values during past events. To date, this seems to have helped as fecal coliforms values have improved. However, the increased hypochlorite dose requires additional diligence to assure compliance with the effluent chlorine 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 Elliott West WWTS assessment and improvement project by King County.

Total Residual Chlorine

During 2020, there were two out of nine discharge days when the effluent daily average TRC exceeded the 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 146 µg/L. The maximum daily average TRC of 694 µg/L occurred December 21, 2020. During that event, high flows overwhelmed the sodium bisulfite (SBS) dechlorination system resulting in high TRC values. Only after operators switched to a higher capacity SBS dosing pump (higher pump stroke) did SBS feed match the dechlorination demand.

Efforts are ongoing to address the dechlorination system at Elliott West WWTS. The Elliott West WWTS improvement project will include evaluating the SBS metering pumps' capacities and level of turn-down. Additional past actions include feeding a diluted SBS solution to aid in dispersion, increased C2 water capacity for reliable SBS carrier water, the use of an in-pipe SBS diffuser (in place of flash mixers), and the use of the "semi-auto" mode for SBS feed control during times of questionable pre-dechlorination analyzer output. King County staff will continue to monitor and adjust the hypochlorite and sodium bisulfite (SBS) dosing and further investigate areas to improve the chemical feed control.

Instantaneous Minimum and Maximum Effluent pH

Instantaneous minimum effluent pH in 2020 exceeded the minimum permit limit of pH <6.0 on five out of nine total discharge days. The instantaneous maximum pH limit of <9.0 was met for each of the discharge days in 2020.

The effluent pH reached as low as pH 5.5 on February 5, 2020; this was the lowest effluent pH of the year. The low alkalinity CSO flows, along with potential for over-dosing the acidic SBS during high effluent TRC values, can cause the effluent pH to drop below 6.0; and it only takes a short moment below pH 6.0 to have a permit exceedance. Realizing these challenges, staff continue to fine-tune the SBS feed control program, and optimize hypochlorite feed to reduce the SBS feed. Part of the challenge is merely the fact that the inflow can drop so low in alkalinity, for example, as low as 12 to 40 milligrams per liter (mg/L) as $CaCO_3$. By comparison, the influent alkalinity at the West Point Treatment Plant tends to be near 200–225 mg/L $CaCO_3$ on dry weather days. Further analysis of the data trends of discharge events is on-going. Some of the projects and actions to address dechlorination and TRC exceedances, as described in the previous section on final effluent TRC permit performance, will also benefit in meeting the minimum pH permit limits of the discharge effluents.

Operations and Maintenance

Highlights of O&M activities at EWCSO during 2020:

- Conducted annual CSO refresher training for the operators in September 2020.
- Provide 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 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 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.
- Continue to monitor the effectiveness of the automated Mercer Tunnel flushing by taking additional samples from the return flows and running laboratory solids analyses on those 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 West Point.
- 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.
- Continued to exercise the hypochlorite chemical feed pumps on a monthly basis as a preventive maintenance measure.
- 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 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

A project to improve the reliability of the dechlorination system - the SBS post-dilution system - was started in 2016 and completed in September 2018. This project involved the design and installation of an in-line SBS dilution system. Stored 38 percent SBS solution is diluted to 20 percent solution before transfer to the day SBS 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 the 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, as well.

A project to evaluate the use of ceramic flat plate membranes to treat CSO flows at Elliott West WWTS was initiated in early 2018. Design and implementation of a pilot plant was started in spring 2019. The ceramic flat plate membrane technology requires coagulant addition to form a floc with the CSO solids. The membranes then remove the coagulated solids floc at a very high flow per surface area of membrane. The project evaluated solids, metals and bacterial removals as well as other water quality parameters. The pilot unit was operated by King County staff during wet weather events with support from the project team of county staff, consultants and the membrane vendor. A final report to be submitted to King County with findings of pilot testing will be available by summer 2021.

Near Future Operation

During the 15 years of operation, opportunities to operate and then to optimize Elliott West WWTS 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 late October 2017 it was discovered that the Elliott West WWTS 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. In September 2019 the drain gate was repaired; however, the contractor, during the repair work discovered that the rails and frame of the gate were seriously corroded and damaged and in need of repair or replacement. The repair and replacement of the gate, and the corroded rails and frame, are scheduled for summer 2022. Currently the gate is operated automatically as intended.

A project started in 2020 to evaluate various options to improve solids removal from the Elliott West WWTS wet well between inflow and discharge events. Solid deposition occurs within the wet well as solids are brought in with CSO flows from Mercer Street Storage Tunnel and CSO overflows from the Elliott Bay Interceptor (EBI) at the EBI control structure weir near Denny Regulator. The wet well at Elliott West WWTS is difficult to clean and remove accumulated solids. This project developed particle settling and resuspension models in 2020. These models will be used to assess various dewatering and solids removal approaches such as spray washdown or tipping bucket flushing of the wet well. The project will evaluate the potential for a larger set of dewatering pumps to increase the rate of Mercer Street Tunnel dewatering. Discussions and design alternatives are ongoing through 2021.

An alternatives analysis is being conducted to review the modifications required to bring Elliott West WWTS into full NPDES compliance. Study elements under consideration are, different approaches to floatables and solids removal, disinfection, and dispersion at the outfall. There are constraints with respect to hydraulic grade line, footprint, construction in the area by other agencies and permitting related to outfall modifications. The alternative analysis will be conducted through 2022.

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 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.
- Continue evaluation of the August 2020 wet well clean out in reducing solids in the discharge flows.
- Continue the evaluation of alternatives for development of a long-term compliance plan

Table E-2. Elliott West WWTS Annual Plant Performance 2020

Month	Day	EWCSO Inflow Event Number	EWCSO Inflow Volume (MG)	EWCSO Discharge Event Number	EWCSO Discharge Volume (MG)	Total Influent TSS (lb)	Total Effluent TSS Discharged @ EW + WP (lb)	% 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	1	1	0.65	ND	ND	11,088.74	294.39		ND		ND	ND	ND
	2	1	0.24	ND	ND	209.82	10.43		ND		ND	ND	ND
	3	1	0.22	ND	ND	0.00	0.00		ND		ND	ND	ND
	6	2	0.55	ND	ND	319.16	11.40		ND		ND	ND	ND
	7	2	0.33	ND	ND	382.45	15.20		ND		ND	ND	ND
	10	3	1.03	ND	ND	618.73	28.45		ND		ND	ND	ND
	18	4	3.00	ND	ND	1,284	102		ND		ND	ND	ND
	20	5	0.10	ND	ND	40	1		ND		ND	ND	ND
	21	5	9.01	1	2.79	10,603	4,773		6.4	6.4	33,000	22	6.2/6.6
	22	5	2.96	ND	ND	824	138						
	23	5	2.64	ND	ND	6,397	868						
	24	5	4.35	ND	ND	1,172	166						
	25	5	1.47	ND	ND	9,145	788						
	26	5	0.85	ND	ND	4,222	327						
	27	5	4.04	2	2.61	3,416	2,247		3.2		490	300	5.8/7.3
	28	5	10.29	2	2.83	5,095	2,640		0.3	1.8	170	34	6.1/6.5
	29	5	1.19	ND	ND	742	56						
	31	6	11.69	3	9.55	4,684	3,645		0.6	0.6	20/1	10	5.9/6.9
	Instant. Min/Max pH												**5.8/7.3**
	Event/Daily Max									**6.4**		**300**	
	Monthly Total/Avg/GeoMean	**6**	**54.61**	**3**	**17.78**	**60,242**	**16,114**	**73.3%**			**141**		
February	1	1/31/2020	7.74	1/31/2020	1.18	2,725	820		0.0		**Reported 1/31**	15	5.7/6.2
	5	1	4.66	1	1.82	1,236	633		0.1		78	3	5.5/7.3
	6	1	11.07	1	5.89	3,312	1,808		0.1	0.1	1	89	5.6/6.6
	7	1	3.55	ND	ND	439	50						
	8	1	0.64	ND	ND	4,037	299						
	15	2	0.27	ND	ND	285	8						
	23	3	0.51	ND	ND	532	14						
	25	4	0.06	ND	ND	12	0						
	Instant. Min/Max pH												**5.5/7.3**
	Event/Daily Max									**0.1**		**89.0**	
	Monthly Total/Avg/GeoMean	**4**	**28.49**	**1**	**8.89**	**12,578**	**3633**	**71.1%**			**8.8**		
March	5	1	0.42	ND	ND	306	6						
	6	1	1.95	ND	ND	325	15						
	7	1	0.37	ND	ND	727	17						
	24	2	0.64	ND	ND	694	16						
	28	3	0.79	ND	ND	323	8						
	29	3	0.67	ND	ND	377	26						

	30	3	1.33	ND	ND	233	13						
	31	3	0.66	ND	ND	7,575	244						
	Instant. Min/Max pH												ND
	Event/Daily Max									ND		ND	
	Monthly Total/Avg/GeoMean	**3**	**6.83**	**ND**	**0.00**	**10,559**	**346**	**96.7%**			**ND**		
April	22	1	1.42	ND	ND	888	25						
	23	1	0.51	ND	ND	243	7						
	25	2	0.84	ND	ND	230	4						
	Instant. Min/Max pH												ND
	Event/Daily Max									ND		ND	
	Monthly Total/Avg/GeoMean	**2**	**2.77**	**ND**	**0.00**	**1,361**	**36**	**97.4%**			**ND**		
May	16	1	2.71	ND	ND	649	21						
	21	2	0.71	ND	ND	3,440	155						
	22	2	1.03	ND	ND	258	9						
	30	3	10.51	1	2.80	6,283	1,845		1.2	1.2	**20**	**NM**	**NM**
	31	3	2.06	ND	ND	292	13						
	Instant. Min/Max pH												**NM**
	Event/Daily Max									**1.2**		**NM***	
	Monthly Total/Avg/GeoMean	**3**	**17.02**	**1**	**2.8**	**10,922**	**2,044**	**81.3%**			**20**		
June	27	1	0.78	ND	ND	352	6						
	28	1	1.26	ND	ND	357	18						
	30	2	0.08	ND	ND	60	1						
	Instant. Min/Max pH												ND
	Event/Daily Max									ND		ND	
	Monthly Total/Avg/GeoMean	**2**	**2.12**	**ND**	**0.00**	**769**	**26**	**96.6%**			**ND**		
July	No Inflow/No Discharge	0	0.00	ND	ND	0	0						
	Instant. Min/Max pH												ND
	Event/Daily Max									ND		ND	
	Monthly Total/Avg/GeoMean	**0**	**0.00**	**ND**	**0.00**	**0.00**	**0**				**ND**		
August	6	1	0.45	ND	ND	212	5						
	Instant. Min/Max pH												ND
	Event/Daily Max									ND		ND	
	Monthly Total/Avg/GeoMean	**1**	**0.45**	**ND**	**0.00**	**212**	**5**	**97.5%**			**ND**		
September	18	1	1.13	ND	ND	501	22						
	19	1	0.74	ND	ND	235	9						
	23	2	6.26	ND	ND	2,498	189						
	24	2	6.50	ND	ND	2,153	115						
	25	2	5.59	ND	ND	1,118	95						
	Instant. Min/Max pH												ND
	Event/Daily Max									ND		ND	

	Monthly Total/Avg/GeoMean	**2**	**20.22**	**ND**	**0.00**	**6,505**	**429**	**93.4%**			**ND**		
October	9	1	1.20	ND	ND	313	8						
	10	1	4.93	ND	ND	1405	70						
	11	1	1.09	ND	ND	5352	178						
	12	1	0.80	ND	ND	17251	575						
	13	1	4.54	ND	ND	4757	203						
	16	2	0.61	ND	ND	470	10						
	21	3	1.82	ND	ND	4486	122						
	Instant. Min/Max pH												**ND**
	Event/Daily Max									**ND**		**ND**	
	Monthly Total/Avg/GeoMean	**3**	**15.00**	**ND**	**0.00**	**34,035**	**1,166**	**96.6%**			**ND**		
November	3	1	6.42	ND	ND	1278	76						
	4	1	0.37	ND	ND	92	4						
	12	2	1.02	ND	ND	1629	58						
	13	2	4.37	ND	ND	947	67						
	14	2	1.79	ND	ND	764	50						
	15	2	0.73	ND	ND	794	44						
	16	2	3.60	ND	ND	13133	881						
	17	2	4.61	ND	ND	4396	330						
	18	2	2.59	ND	ND	1558	110						
	19	2	0.27	ND	ND	288	9						
	22	3	0.03	ND	ND	186	5						
	30	4	3.41	ND	ND	5090	234						
	Instant. Min/Max pH												**ND**
	Event/Daily Max									**ND**		**ND**	
	Monthly Total/Avg/GeoMean	**4**	**29.21**	**ND**	**0.00**	**30,156**	**1,865**	**93.8%**			**ND**		
December	8	1	1.04	ND	ND	1310	54						
	15	2	0.09	ND	ND	185	7						
	16	2	1.79	ND	ND	923	52						
	17	2	0.42	ND	ND	379	16						
	19	3	1.12	ND	ND	672	37						
	21	4	43.74	1	40.20	74591	71244		3.00	3.0	170/130	694	6.4/8.3
	22	4	5.81	ND	ND	1811	139						
	23	4	0.28	ND	ND	325	13						
	25	5	1.44	ND	ND	300	11						
	26	5	0.77	ND	ND	161	7						
	30	6	2.66	ND	ND	570	28						
	Instant. Min/Max pH												**6.4/8.3**
	Event/Daily Max									**3.0**		**694**	
	Monthly Total/Avg/GeoMean	**6**	**59.15**	**1**	**40.20**	**81,225**	**71,608**	**11.8%**			**148.7**		
Total		**36**	**235.87**	**6**	**69.67**	**248,564**	**97,272**						
Inst. pH Min/Max													**5.5/8.3**
Max (GEM, SS, TRC)										**3.00**	**148.7**	**694**	

Annual Average						by mass:	**60.9%**		**2.18**	**79.5**	**146**	

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

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

January–December 2020

Executive Summary

This 2020 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 (WA0029181).

There were six filling events and one discharge event at the Henderson/MLK Jr. Way WWTS in 2020. The treatment station received 10.6 million gallons (MG) of combined – sewer wastewater and discharged 1.72 MG of treated water to the Duwamish Waterway. A daily rainfall total of 1.99 inches on December 21 (as measured by the Henderson Pump Station rain gauge) caused the single discharge event that spanned December 21 and December 22.The discharge event resulted in only one discharge or "compliance" day based on a 7 a.m. to 7 a.m. clock. Total inflow for the December 21–22 event was 5.40 million gallons (MG) and 1.72 MG of treated water was discharged to the Duwamish Waterway.

In 2020, a rainfall total of 41.3 inches (Sea-Tac) and the 20-year annual average rainfall is 39.2 inches was observed. Consistent rainfall in January (particularly heavy in the latter half) led to an unusually wet month. May and June rainfall was higher than average, but had little impact on the annual total. Otherwise, rainfall tracked historical rates. A total of 35.3 inches of rain fell in 2020, as measured at the Henderson Street Pump Station.

Performance in 2020

Table F-1 summarizes NPDES permit performance in 2020. Henderson/MLK Jr. Way WWTS was out of compliance with one effluent permit limit (settleable solids) in 2020.

Table F-1. Henderson/MLK Jr. Way WWTS Permit Performance in 2020

Parameter	Performance	Permit Conditions
Annual average effluent settleable solids (ml/L/hr)	0.4	0.3
Annual average total suspended solids removal (%) - all	78%	50
Instantaneous minimum effluent pH: number of days with pH <6.0	0 of 1 discharge days	≥ 6.0
Instantaneous maximum effluent pH: number of days with pH >9.0	0 of 1 discharge days	≤ 9.0
Daily average total residual chlorine (TRC, µg/L): number of days with TRC >39 µg/L	0 of 1 discharge days	39
Monthly geomean fecal coliform (cfu/100 ml): number of months with >400 cfu/100 ml	0 of 1 discharge month	400

Annual Suspended Solids Removal and Settleable Solids

The 2020 annual average total suspended solids (TSS) removal was 78 percent; the minimum permit limit is 50 percent. The annual average effluent settleable solids was 0.4 milliliters/liter/hour (ml/L/hr); this exceeds the maximum permit limit of 0.3 ml/L/hr.

The settleable solids result of 0.4 ml/L/hr is likely an artificially high result due to the circumstances of sample collection. To obtain enough volume for all required analysis, some of the effluent grab sample (collected at the beginning of the event) was added to the composite sample. Since the event was the first flush of the wet season and began with high flows relative to the event average flow, the initial discharge likely had a much higher solids concentration than the remainder of the event. Adding some of the grab sample to the composite likely biased the composite sample toward representing the start of the event rather than the whole. Had the composite sample truly reflected the event average settleable solids concentration, it would likely have been 0.3 ml/L/hr or lower.

Monthly Fecal Coliform Bacteria and Daily Total Residual Chlorine

There were no exceptions to the maximum monthly fecal coliform limit of 400 colony forming units (cfu)/100 ml and the maximum daily total residual chlorine (TRC) limit of 39 mg/L. The maximum monthly effluent fecal coliform concentration in 2020 was <1-cfu/100 ml. The maximum daily effluent TRC in 2020 was 21 µg/L.

Instantaneous Minimum/Maximum pH

There were no exceptions to the minimum and maximum pH limits. The lowest and highest effluent pH measured in 2020 was pH 7.0 and pH 8.1, respectively.

Operations and Maintenance

Routine operations and maintenance (O&M) activities 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. Preventive maintenance was performed routinely.

During the December 21 event, effluent composite samplers did not collect sufficient volume to perform all analysis. The conventional composite sample was combined with grab samples taken at the beginning of the discharge event and all conventional analyses were performed. The effluent composite sampler used for priority pollutants collected a volume sufficient in size to only allow for metals analyses; no organics analyses were performed. Both samplers were subsequently reprogrammed to ensure that an adequate volume would be collected during a similar discharge event.
The online effluent total chlorine analyzer (Wallace &Tiernan's, W&T) was verified at the beginning of the discharge event using an ultra-low range spectrophotometer. However, due to sampling issues and total residual chlorine (TRC) above the 100-ppm maximum output of the analyzer (for a short time at the beginning of the event), measurements from the W&T online analyzer were not used to calculate the average TRC for the event. Instead, the effluent TRC concentration was calculated. Improper output scaling on the sodium bisulfite pumps was the root cause of the initial high TRC. The pump settings were set properly after the event.

Henderson/MLK Jr. Way WWTS Improvements Project

Major equipment modifications and improvements were made to Henderson/MLK Jr. Way WWTS from 2017 through 2019 to address challenges with consistently meeting NPDES permit requirements for disinfection and dechlorination.

<u>2017 improvements</u>

- Levelled the existing inlet and outlet rectangular weirs.
- New fine-range bubbler sensors at the tunnel's inlet and outlet weirs.

- Flow meters on the sodium hypochlorite (NaOCl) and sodium bisulfite (SBS) chemical dosing lines.
- Improved venting of the chemical supply lines.

2019 improvements

- New NaOCl chemical feed pumps.
- New SBS chemical feed pumps.
- A pre-dechlorination total residual chlorine monitoring system.
- A strainer on the SBS metering pump suction lines.
- Improved exhaust ventilation in the SBS chemical room.

Planned Improvements

The sample pump that provides effluent to online analyzers is prone to getting air-bound at the beginning of a discharge event. Modifications to the effluent sampling pump discharge piping are expected to resolve the issue and improve effluent sampling.

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; there was only one event in 2020. 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 2020

Month	Day	Inflow Event Number	Inflow Volume (MG)	Discharge Event Number	Discharge Volume (MG)	Total Influent TSS (lb)	Total Effluent TSS Discharged @ MLK + WP (lb)	% removal	Effl. Daily Settl Solids (ml/L/hr)	Effl. Settl Solids Event Avg (ml/L/hr)	Effl. Fecal Coliforms (#/100 ml)	Effl. Residual Chlorine Daily Average (µg/L)	Daily Min/Max pH
January	7	1	1.05	ND	ND	123	5	96%	ND	ND	ND	ND	ND
	28	2	0.2	ND	ND	93	29	69%	ND	ND	ND	ND	ND
	31	3	1.59	ND	ND	716	85	88%	ND	ND	ND	ND	ND
	Instant. Min/Max pH												**ND**
	Event/Daily Max									**ND**		**ND**	
	Monthly Total/Avg/Geo Mean	**3**	**2.84**	**ND**	**ND**	**932**	**119**	**84%**			**ND**		
February	1	1	1.55	ND	ND	646	169	74%					
	Instant. Min/Max pH												**ND**
	Event/Daily Max									**ND**		**ND**	
	Monthly Total/Avg/Geo Mean	**1**	**1.55**	**ND**	**ND**	**646**	**169**	**74%**			**ND**		
March	No Inflow/No Disch.												
	Instant. Min/Max pH												**ND**
	Event/Daily Max									**ND**		**ND**	
	Monthly Total/Avg/Geo Mean	**0**	**0.0**	**0**	**0.0**	**-**	**-**	**-**			**ND**		

April	No Inflow/No Disch.												
	Instant. Min/Max pH												**ND**
	Event/Daily Max									**ND**		**ND**	
	Monthly Total/Avg/Geo Mean	**0**	**0.0**	**0**	**0.0**	**-**	**-**	**-**			**ND**		
May	No Inflow/No Disch.												
	Instant. Min/Max pH												**ND**
	Event/Daily Max									**ND**		**ND**	
	Monthly Total/Avg/Geo Mean	**0**	**0.0**	**0**	**0.0**	**-**	**-**	**-**			**ND**		
June	No Inflow/No Disch.												
	Instant. Min/Max pH												**ND**
	Event/Daily Max									**ND**		**ND**	
	Monthly Total/Avg/Geo Mean	**0**	**0.0**	**0**	**0.0**	**-**	**-**	**-**			**ND**		
July	27	1	0.83	ND	ND	1288	23	98%					
	Instant. Min/Max pH												**ND**
	Event/Daily Max									**ND**		**ND**	
	Monthly Total/Avg/Geo Mean	**1**	**0.83**	**ND**	**ND**	**1,288**	**23**	**98%**			**ND**		
August	No Inflow/No Disch.												
	Instant. Min/Max pH												**ND**

	Event/Daily Max Monthly Total/Avg/Geo Mean	**0**	**0.0**	**0**	**0.0**	**-**	**-**	**-**		**ND**	**ND**	**ND**	
September	No Inflow/No Disch.												
	Instant. Min/Max pH Event/Daily Max Monthly Total/Avg/Geo Mean	**0**	**0.0**	**0**	**0.0**	**-**	**-**	**-**		**ND**	**ND**	**ND**	**ND**
October	No Inflow/No Disch.												
	Instant. Min/Max pH Event/Daily Max Monthly Total/Avg/Geo Mean	**0**	**0.0**	**0**	**0.0**	**-**	**-**	**-**		**ND**	**ND**	**ND**	**ND**
November	No Inflow/No Disch.												
	Instant. Min/Max pH Event/Daily Max Monthly Total/Avg/Geo Mean	**0**	**0.0**	**0**	**0.0**	**-**	**-**	**-**		**ND**	**ND**	**ND**	**ND**
December	21	1	5.40	1	1.72	10,583	2,599	75%	0.4	0.4	<1/<1	32	7.0/8.1
	Instant. Min/Max pH Event/Daily Max									**0.4**		**21**	**7.0/8.1**

	Monthly Total/Avg/Geo Mean	1	5.40	1	1.72	10,583	2,599	75%			<1		
Total		**6**	**10.62**	**1**	**1.72**	**13,449**	**2,910**						
Inst. pH Min/Max													**7.0/8.1**
Max (GEM, SS, TRC)											**<1**	**21**	
Annual Average							by mass:	**78%**		**0.4**	**<1**	**21**	

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