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Department of Natural Resources and Parks
**Wastewater Treatment Division**
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July 26, 2022

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**RE: King County 2021 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 2022. The 2021 Annual Report addresses the County's CSO control project and compliance activities from January through December 2021.

Under King County's National Pollutant Elimination Discharge System (NPDES) permit WA-002918-1 S18.B.2. and Washington Administrative Code (WAC) 173-245-090(1)(a)-(c), the County also submits a CSO control program annual report to the Washington State Department of Ecology. This report documents CSO control program activities for calendar year 2021. 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 2021 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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7/26/2022

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

Date

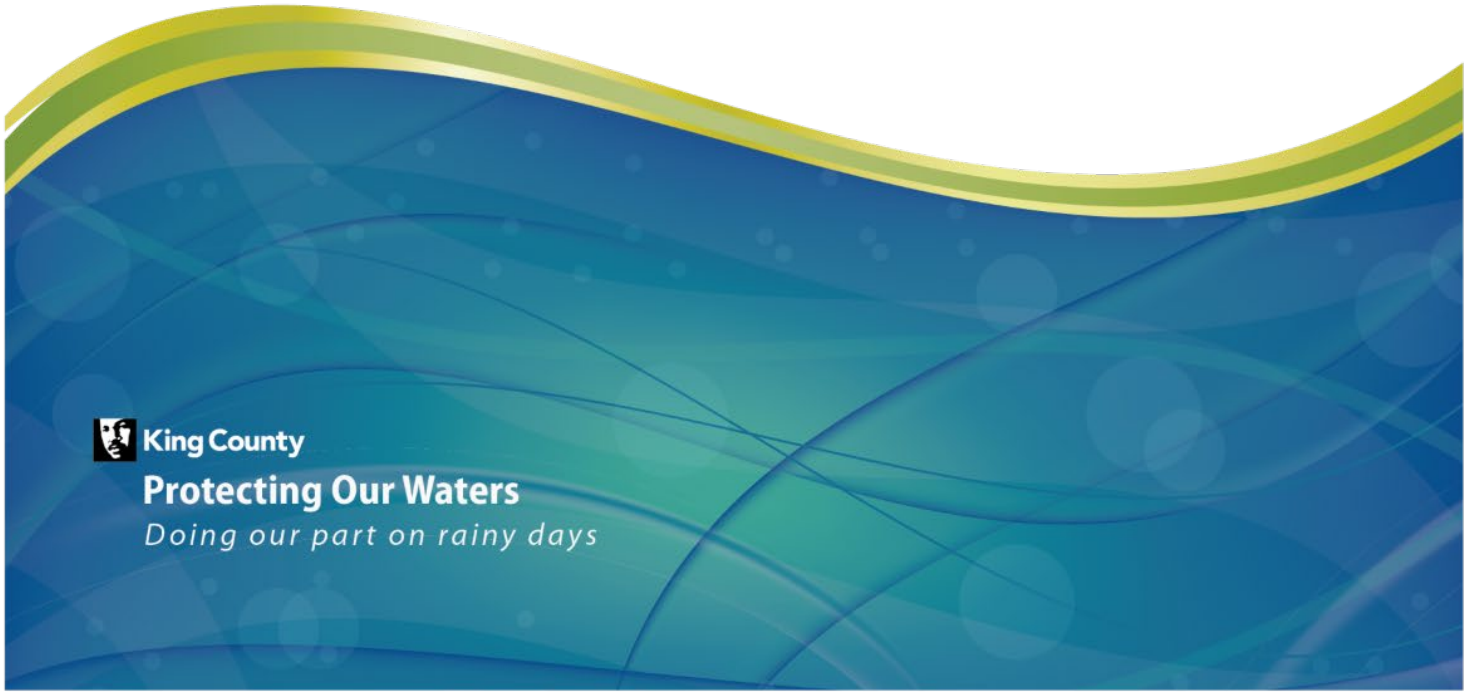
Enclosure

cc: Verna Bromley, Senior Deputy Prosecuting Attorney, King County Prosecuting Attorney's Office
Jeff Lafer, NDPES 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

# 2021 Annual CSO and Consent Decree Report

July 2022



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## List of Abbreviations and Acronyms

| | |
|---|---|
| BMPs | best management practices |
| CD | consent decree |
| Seattle | City of Seattle |
| County | King County |
| CSO | combined sewer overflow |
| DNRP | Department of Natural Resources and Parks |
| DOJ | Department of Justice |
| DSN | discharge serial number |
| DWO | dry weather overflow |
| EIS | Environmental Impact Statement |
| EPA | Environmental Protection Agency |
| ERTS | Environmental Report Tracking System |
| FOG | fats, oils, and grease |
| ft | foot/feet |
| GSI | green stormwater infrastructure |
| HLKK | Hanford/Lander/King/Kingdome |
| in. | inch(es) |
| hr | hour |
| HWMP | Local Hazardous Waste Management Program |
| JOIST | Joint Operations Information Sharing Team |
| JOSOP | Joint Operations and System Optimization Plan |
| JPA | joint project agreement |
| KCIW | King County Industrial Waste Program |
| L | liter |

| | |
|---|---|
| LTCP | long-term control plan |
| Metro | Municipality of Metropolitan Seattle |
| µg/L | micrograms per liter |
| MG | million gallons |
| MGD | million gallons per day |
| ml | milliliter |
| MLK | Martin Luther King |
| MOA | memorandum of agreement |
| WQA/MS | water quality assessment/monitoring study |
| NPDES | National Pollutant Discharge Elimination System |
| NTP | notice to proceed |
| O&M | operations and maintenance |
| PCMP | Post-Construction Monitoring Plan |
| PS | pump station |
| RS | Regulator station |
| RWSP | Regional Wastewater Services Plan |
| SBS | sodium bisulfite |
| SCADA | supervisory control and data acquisition |
| SDOT | Seattle Department of Transportation |
| Ship Canal | Lake Washington Ship Canal |
| SPU | Seattle Public Utilities |
| SS | settleable solids |
| SSO | sanitary sewer overflow |
| SSOP | Sewer System Operations Plan |

| | |
|---|---|
| SCIP | Source Control Implementation Plan |
| SMS | Sediment Management Standards |
| South Plant | South Treatment Plant in Renton |
| TRC | total residual chlorine |
| TSS | total suspended solids |
| TEPS | Tunnel Effluent Pump Station |
| WAC | Washington Administrative Code |
| West Point | West Point Treatment Plant |
| WTD | Wastewater Treatment Division |
| WWTS | wet weather treatment station |
| VFD | variable frequency drive |

# 1 Introduction

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

The NPDES permit for West Point Treatment Plant (West Point) was renewed on December 19, 2014 and became effective on February 1, 2015. 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's CSO Control Program and CD implementation activities and information for the 2021 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 (JOSOP) between WTD and Seattle Public Utilities (SPU)

- Coordination between WTD and SPU on CSO control programs and projects
- NPDES permit compliance for the King County wet weather treatment stations (WWTSs)
- Coordination with SPU on implementation of source control 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 34 constituent agencies in the greater Seattle metro area, including 18 cities, 15 local sewer utilities, and one tribal government. King County's wastewater service area includes more than 1.9 million residents of King, Pierce, and Snohomish counties.

The newer parts of WTD's service area use separate pipes to (a) convey wastewater to WTD's system and (b) convey 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 greater than 1,000 acres and conveyed the sewage to WTD's system. WTD conveys most of the flow from Seattle (including most of the combined sewage flows) to West Point in Discovery Park. A small amount of sewage from Seattle is treated at WTD's South Treatment Plant in Renton (South Plant).

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.

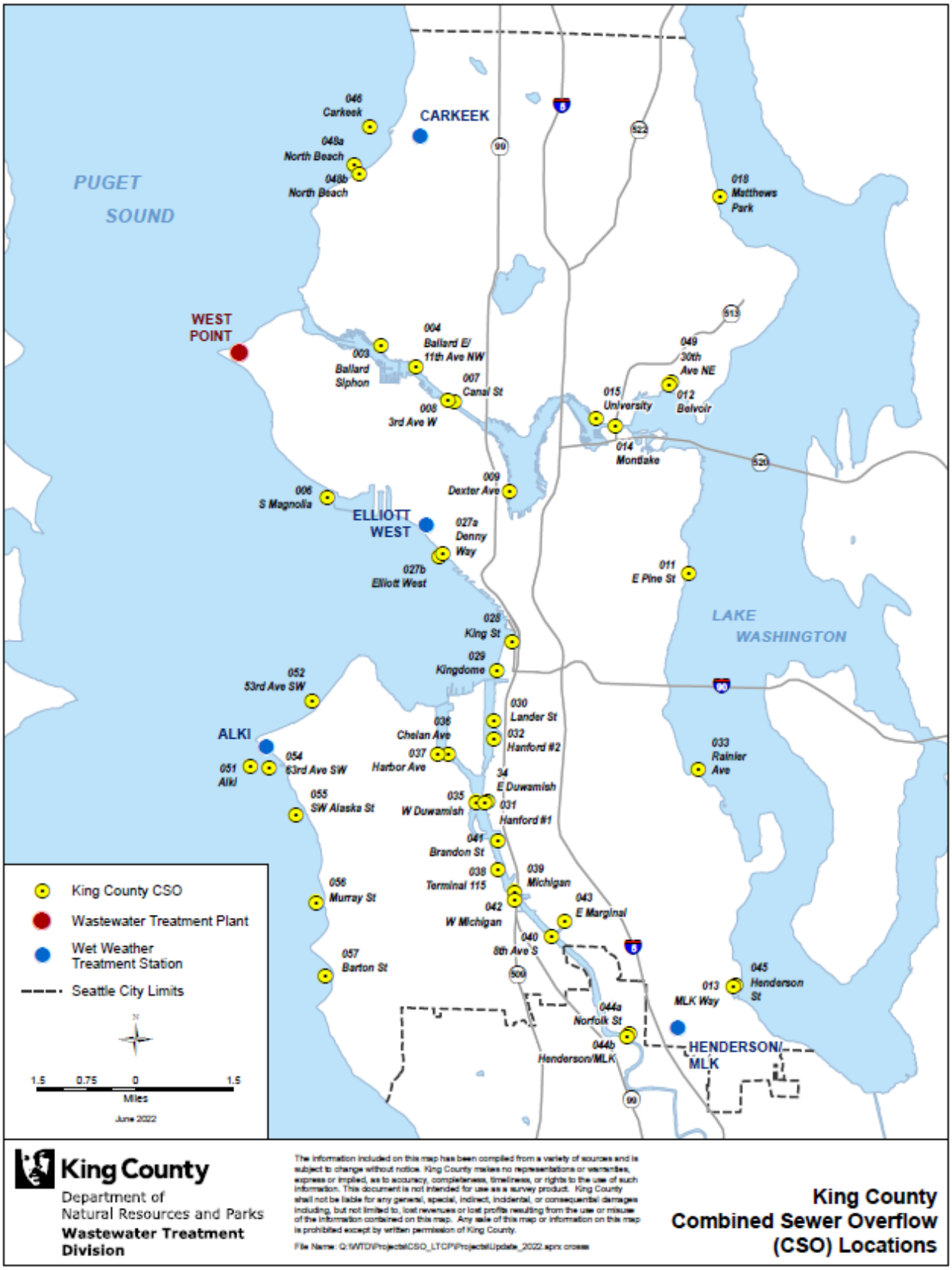


Figure 1. King County CSO Locations

## 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. Before 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, 1968–2012

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 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; outlined 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 (LTCP) Amendment (2012 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. Amendments 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 Control 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.

From 2019 to 2021, WTD continued CSO control planning and worked to identify opportunities for further project refinement, facility optimization, and new water quality projects. The 2019 to 2021 CSO planning work also quantified the potential water quality benefits and costs of these opportunities.

### 1.2.3 Clean Water Plan

In 2018, concurrent with LTCP implementation, King County WTD began working on a wastewater comprehensive plan, called the Clean Water Plan. The purpose of the Clean Water Plan effort is to assess all the demands on the regional wastewater utility, including CSOs, and plan a future direction for the regional system that makes the right investments at the right time. The Clean Water Plan would be an amendment to the RWSP.

In 2021, the Clean Water Plan provided information to the public on the actions (i.e., specific programs or sets of projects) being explored through the Clean Water Plan. In addition, initial work was conducted to begin to combine actions into work-in-progress strategies (i.e., complete investment approaches to the County's wastewater and water quality challenges, which consider the timing, sequencing, and interrelationships of actions). Both actions and strategies explored the potential for better water quality outcomes through CSO investments.

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 continued in 2021 through in-person engagement and online activities, consistent with COVID-19 guidelines.

At the end of 2021, King County decided to pause the Clean Water Plan process to fully consider external feedback received and to develop adjustments that respond to that feedback. In addition, the County also recognized that two major regulatory efforts underway have significant financial and policy effects on the Clean Water Plan and have complicated the Clean Water Plan process: Ecology's Puget Sound Nutrient General Permit and negotiations with Ecology and EPA regarding CSOs. The County believes a pause in the Clean Water Plan process will allow for more regulatory clarity, which will give the County the opportunity to be responsive, adjust the planning process, and move forward more effectively.

## 1.3 Consent Decree

After King County Council approved 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 to 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 SSOP and JOSOP (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 (HLKK) Wet Weather Station, 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 align the Chelan CSO control project with the HLKK milestones, the County also requested to initiate negotiations to modify the CD to accommodate changed conditions from 2013 when the CD was filed. The changed conditions include climate change that has increased the size of CSO control projects necessary to achieve compliance, additional wastewater system asset management needs, rising costs and other regional financial factors, and additional regulatory compliance obligations. The County, EPA, and Ecology (in coordination with the City of Seattle) were engaged throughout 2021 in developing the proposal to modify the CSO Control Program, schedule, and CD to address these changed conditions. In association with the changed conditions, the County acknowledged in a March 4, 2022, letter to EPA, Ecology, and DOJ that it anticipates delays in meeting CD milestones for CSO control projects in the HLKK, University, and Montlake basins.

## 1.4 Sediment Sampling and Analysis

In 1999, King County prepared a sediment management plan to address contaminated sediment at County CSO locations. The plan was updated, and the resulting 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 to meet permit obligations as well as provide information needed to plan for required or anticipated future cleanup actions. The SMP update also describes all of the King County CSO discharge locations, summarizes ongoing and previously performed sediment cleanup work, summarizes the results of CSO discharge modeling, and provides the status of existing sediment quality. As part of the update process, a predictive sediment contamination model for CSO discharges was developed. Supplemental sediment sampling data at CSO outfall locations was collected in 2012 (10 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 Inlet Overflow (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

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

- Report on implementation of EPA's Nine Minimum Controls (Section 2)
- Table showing the 20-year average frequency of untreated CSO events (Table 3)
- Status of CSO control projects in design or construction (Section 4)
- Discussion of 2021 rainfall and untreated and treated CSO events (Section 5)
- Detailed individual event-based table for unpermitted overflows in 2021 (Table 6)
- Summary of CD violations in 2021 (Section 6)
- Description of post-construction monitoring (Section 7)
- Detailed individual event-based tables for untreated CSOs in 2021 (Appendix A)
- Detailed individual event-based tables for treated CSOs in 2021 (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 WWTS, and Henderson/MLK Jr. Way WWTS (Appendices C through F)

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

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

| Consent Decree Section | Content | Annual Report Location |
|---|---|---|
| VIII.43.a | (i) the status of all CD compliance measures, including Currently Underway and Early Action CSO Control Measures, the implementation of all CSO Control Measures in Appendix B, PCMP, SSOP, and Information Sharing/Coordination Program Plan Between County and the City of Seattle.<br>(ii) any problems anticipated or encountered, along with the proposed or implemented solutions.<br>(iii) any anticipated or ongoing operation and maintenance activities relating to all CSO Control Measures.<br>(iv) remedial activities that will be performed in the upcoming year to comply with the requirements of this CD. | (i) 4.1 Project Summaries<br>4.2.1 Sewer System Operations Plan<br>4.2.2 JOSOP<br>4.2.3 WTD Coordination with SPU on CSO Control Projects<br>7.0 Post-construction monitoring<br>(ii) Included in sections above, 5.4, and Appendices C–F for WWTSs<br>(iii) 2.1 Reducing CSOs Through Operations and Maintenance<br>Appendices C–F for WWTSs<br>(iv) All of the above |
| VIII.43.b | A description of any noncompliance with the requirements of this CD 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. | 2.1 Reducing CSOs Through Operations and Maintenance<br>Appendices C–F for WWTSs<br>6.0 Summary of CD Violations |

| 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.<br>The report shall indicate whether a CSO site or group of sites has increased over the baseline annual condition. | 5.0 Summary of Rainfall and CSO Events<br>3.0 Control Status of CSO locations<br>Appendix A Untreated CSO Events<br>Appendix B Treated CSO Events<br>Appendices C–F for WWTSs |
| WAC 173-245-090(1)(b) | Explains the previous year's CSO reduction accomplishments. | 4.1 Project Summaries |
| WAC 173-245-090(1)(c) | Lists the projects planned for the next year. | 4.1 Project Summaries |

| NPDES Permit WA0029181 | Content | Annual Report Location |
|---|---|---|
| S11.C.2 | The CSO Annual Report must include the following information:<br>a. A summary of the number and volume of untreated discharge events per outfall for that year.<br>b. A summary of the 20-year moving average number of untreated discharge events per outfall, calculated once annually.<br>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.<br>d. An explanation of the previous year's CSO reduction accomplishments.<br>e. A list of CSO reduction projects planned for the next year. | 3.1 Twenty-Year Moving Average of Event Frequencies<br><br>Electronic Template submitted electronically with annual report; hardcopy of content in Appendices A and B |

| | | |
|---|---|---|
| | 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.<br>The Permittee must submit paper and electronic copies of the report, and Excel spreadsheet copies of significant spreadsheets. | |
| 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. | 3.1 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 2021.

## 2.1 Control 1 – Reducing CSOs through Operations and Maintenance

***Implement proper operations 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 its 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 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. In 2021, Conveyance Inspection staff inspected about 37,400 linear feet of sewers in the combined system. Maintenance schedules and records of visits are available for inspection upon request.

## 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 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. Figure 2 shows the sizing of the largest in-line tunnels.

Maximizing storage in the conveyance system works in concert with maximizing conveyance to West Point to minimize overflows and obtain high-quality treatment for service area flows. The system has been built to operate as much as possible based on gravity flow and levels in the interceptors and trunks, with little operator intervention.

When levels reach pre-determined set points, programmable logic controllers automatically adjust gates and pumps to manage the flows. These set points have been determined over the years by operational experience, hydraulic analysis, and modeling to balance conveyance to the treatment plant while maximizing storage in the pipelines and 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, including 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.***

The King County Industrial Waste Program (KCIW) issues permits and discharge approvals that set pollutant limits on industrial discharges to protect worker safety, local and regional sewer infrastructure, treatment plants, recycled products, and water quality. The program includes the following activities: permitting, inspecting, sampling, monitoring, enforcement actions, and technical assistance to businesses on appropriate waste pretreatment and disposal techniques. KCIW has a cost recovery program to recoup program costs as well as an awards program for companies and other entities who demonstrate excellent compliance. For permit issuance, King County works with Ecology and local sewer agencies during the permit approval and renewal process to allow for review and comment. 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 previous calendar year, as well as an evaluation of influent, effluent, and biosolids focusing on loading and removal rates.

Influent and effluent quality at West Point is 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 2021 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 its 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 onsite 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 2020 activities was submitted to Ecology in

November 2021. The Source Control Annual Report for 2021 activities will be submitted in 2022.

KCIW and the Sediment Management Program (as well as King County Stormwater Services and the King County 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 (i.e., 80 percent instead of 85 percent removal during the wet season months of November through April) in total suspended solids (TSS) percent removal requirements.

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

Where captured CSOs cannot be conveyed to secondary treatment plants because of conveyance system limitations, flows are conveyed to WWTSs, where the flows receive primary treatment and disinfection before being 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; 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 2021 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

KCIW, along with the County's HWMP, implements activities to provide source control within the combined sewer system. Industrial facilities throughout Seattle that are permitted by KCIW 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. KCIW also manages construction dewatering permits within Seattle that propose to discharge wastewater to the sanitary sewer system.

KCIW established local discharge limits in public rule for various pollutants of concern, including 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 KCIW 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 KCIW'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 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 2020 activities report was prepared in 2021 and submitted to Ecology in November 2021. The 2021 source control activities associated with this second five-year Plan will be summarized in a report developed in 2022.

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 KCIW 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 2013. 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, 2021, WTD has rebated 1,018 projects in King County CSO basins. These projects capture runoff from over 1.26 million square feet of roof area on private property, controlling an estimated 12.58 million gallons (MG) of stormwater per year.

WTD funds and administers the WaterWorks Grant Program to help nonprofit organizations, local agencies, schools, and community groups implement small-scale projects to improve 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 local waterways. 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.

In 2021, 68 new projects were awarded $5 million in grant funding. That brings the total number of projects since 2010 to 244 and total funding to $17.3 million. The projects will be implemented in the 2022 to 2025 timeframe and are expected to protect water quality, control pollution, and build healthy communities. The projects include a variety of approaches, including restoring stream and riverbanks, installing rain gardens, educating students and teachers, training youth in water quality job skills, monitoring water quality, and research. Twenty previously funded projects were also completed in 2021.

## 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 of Seattle'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 the reporting of illegal dumping. The County routes reports to the appropriate jurisdictional entity for cleanup of sites.

Seattle Municipal Code, Chapters 22.800 through 22.808, contains the City of Seattle'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 citywide 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 of Seattle'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 citywide pollution prevention program and performs 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 provide 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 in areas of the city served by DNRP CSO facilities. SPU provides pollution prevention actions in DNRP's CSO basins, as follows, but is not responsible for DNRP's NPDES permit compliance.

- 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.
- Additionally, SPU's on-call spill response coordinators are dispatched through the SPU Operations Response center as they are received to assist with spill cleanup activities.
- Finally, SPU coordinated with the Seattle Department of Transportation (SDOT) to conduct street sweeping on arterials in Seattle using high-efficiency regenerative air sweepers.

## 2.8 Control 8 – Notifying the Public

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

King County operates a CSO Notification and Posting Program as a joint project with the City of Seattle and Public Health–Seattle & King County. This program includes signs at publicly accessible CSO locations, an information phone line, websites, and other public outreach activities. In 2017, SPU and DNRP developed a new CSO outfall sign design with more languages, a link to the CSO overflow website, and a new phone number that is staffed 24 hours a day. DNRP fabricated and installed the new signs in 2019. Installation of the signs at SPU's CSO outfalls was partially completed in 2021 due to O&M staffing reductions resulting from the COVID-19 pandemic and will be completed as staff availability allows.

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 allows users to zoom in and out to get more details. This upgrade "redesigned" the site from a set of five pages (an overview map and four submaps) to a single-page map.

In 2021, the CSO Status Webpages had 6,668 page views (representing 5,631 unique page views, with 81 percent of users viewing and then leaving the page [bounce rate]). This represented an 18 percent increase in page views from 2018, during which there were 5,697 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 LTCP. These 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 waterbodies.
- Water quality data for receiving waterbodies.

- 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 report 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 also Chapter 7 for additional information.) The King County PCMP was submitted to Ecology in July 2010 and was approved on September 28, 2012. It can be found at:
http://your.kingcounty.gov/dnrp/library/wastewater/cso/docs/ProgramReview/2012/AppH_CSO_PostConstructionMonitoringPlan,Sept2012.pdf.

The post-construction monitoring results for several overflows per the approved quality assurance project plan was 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 2021.

# 3 Control Status of CSO Locations

## 3.1 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 3 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 discharge serial number (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, 048b (North Beach PS Inlet)
16. North Beach Pump Station Wet Well Overflow, 048a (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, 039 (S Michigan St. RS)
11. Terminal 115 Overflow, 038
12. University Regulator Station Overflow, 015 (University RS)
13. West Michigan Street Regulator Station Overflow, 042 (W Michigan St. RS)

The following five CSOs, with the corresponding DSN, were identified as needing 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)

Table 2 and Figure 3 further demonstrate the control status of all King County CSOs. The table and figure are broken down by control status category and differentiate uncontrolled CSOs that have projects currently underway, CSOs that have drifted out of control due to operational changes and climate change and projects that will be controlled after 2027.

## 3.2 Belvoir and 63rd

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 of 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. WTD is working to bring this outfall into compliance by December 31, 2030.

**Table 2. Outfall Control Status by Category**

| Outfall Status | Number of Outfalls |
|---|---|
| Controlled | 19 |
| Uncontrolled, but project underway[a] | 6 |
| Uncontrolled – under supplemental compliance[b] | 5 |
| Uncontrolled – trended out of control[c] | 2 |
| Uncontrolled – control anticipated after 2027 | 7 |

[a] Projects are expected to be completed within 5 years
[b] Supplemental Compliance Projects are a requirement of the CD and are only applicable to the projects contained within.
[c] These projects were considered controlled at the time the CD was signed and have since trended out of control.

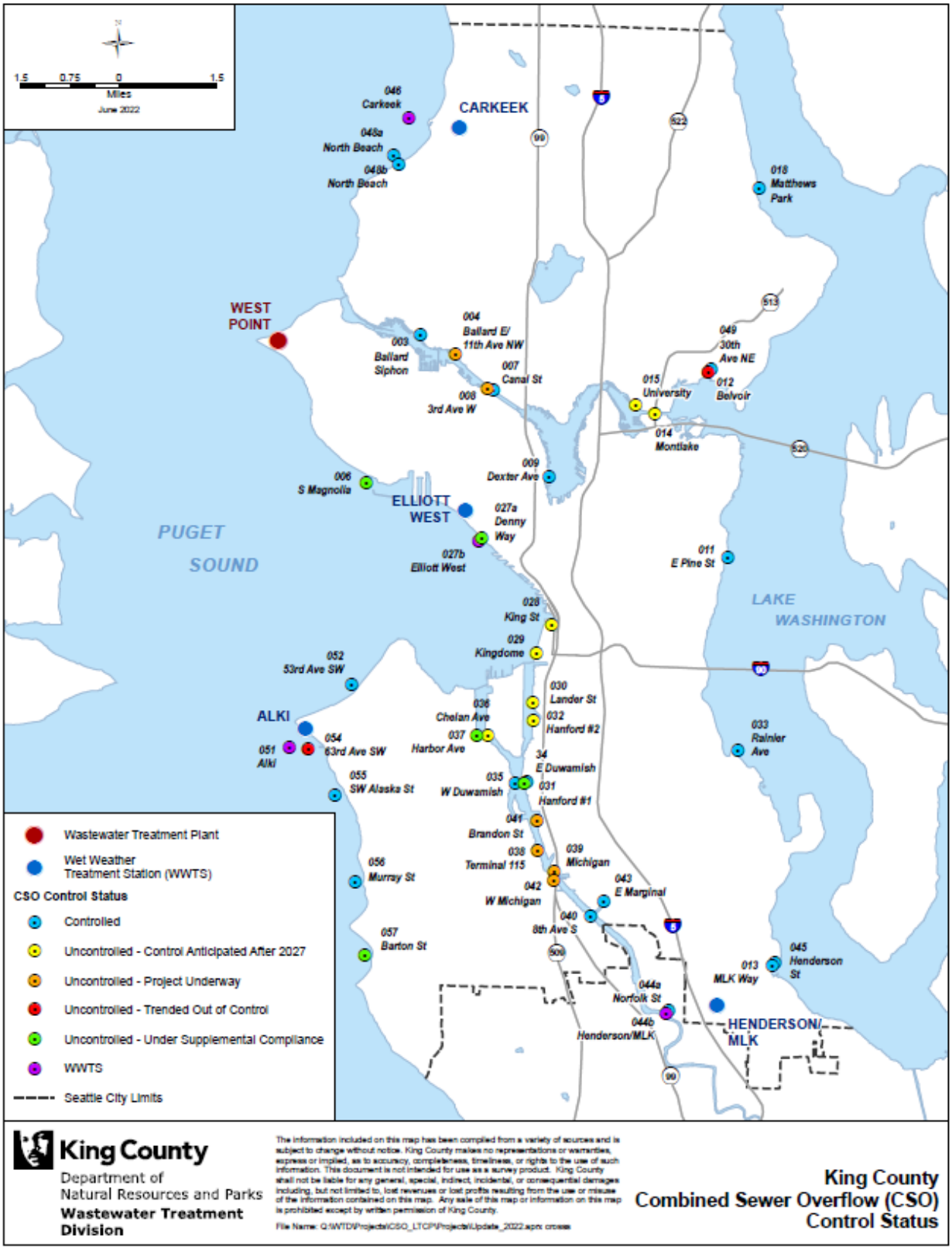


Figure 3. Outfall Control Status by Category

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## Table 3. King County Untreated CSO Events, Averages, and Baselines, 2002–2021

| Overflow Name | DSN | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 20-Year Average[1] | 1983 Baseline |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ballard Siphon | 003 | ***0*** | ***0*** | ***0*** | ***1*** | ***0*** | ***0*** | ***0*** | ***0*** | ***0*** | ***1*** | ***0*** | ***0*** | 2 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | **0.3** | 13 |
| 11th Ave. NW[2] | 004 | 8 | 8 | 6 | 11 | 22 | 10 | 7 | 16 | 19 | 16 | 20 | 12 | 25 | 17 | 22 | 21 | 13 | 10 | 18 | 20 | **15.1** | 16 |
| S Magnolia | 006 | ***0*** | ***2*** | ***1*** | ***0*** | ***0*** | ***1*** | ***0*** | ***1*** | ***2*** | ***2*** | ***1*** | ***3*** | ***1*** | ***4*** | ***1*** | ***0*** | ***0*** | 2 | 3 | 2 | **1.3** | 25 |
| Canal St. | 007 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | **0.5** | 1 |
| 3rd Ave. W[3] | 008 | 4 | 6 | 4 | 5 | 13 | 6 | 3 | 9 | 8 | 7 | 13 | 5 | 12 | 7 | 5 | 6 | 7 | 2 | 9 | 6 | **6.9** | 17 |
| Dexter Ave. RS | 009 | ***0*** | ***0*** | ***1*** | ***0*** | ***1*** | ***1*** | ***0*** | ***0*** | ***0*** | ***0*** | ***0*** | ***0*** | ***1*** | ***1*** | 0 | 0 | 0 | 0 | 1 | 0 | **0.4** | 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 | 4 | 0 | 0 | 1 | 1 | 0 | 5 | 1 | 2 | 2 | 2 | 2 | 5 | 2 | 2 | 1 | 1 | 1 | 2 | **1.7** | 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 | 5 | 11 | 5 | 6 | NM | 0 | 1 | 3 | 10 | 8 | 18 | 7 | 20 | 15 | 16 | 12 | 7 | 6 | 11 | 9 | **8.9** | 6 |
| University RS | 015 | 4 | 4 | 4 | 3 | 12 | 5 | 3 | 9 | 8 | 6 | 13 | 4 | 14 | 11 | 9 | 7 | 7 | 2 | 7 | 4 | **6.8** | 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 | ***0*** | ***1*** | ***1*** | ***0*** | ***2*** | ***2*** | ***0*** | ***1*** | ***2*** | ***1*** | ***1*** | ***1*** | ***2*** | ***4*** | ***2*** | ***1*** | ***0*** | 0 | 1 | 1 | **1.2** | 32 |
| King St. RS | 028 | 12 | 16 | 15 | 20 | 27 | 7 | 3 | 15 | 18 | 15 | 13 | 2 | 23 | 19 | 14 | 3 | 4 | 3 | 6 | 7 | **12.1** | 16 |
| Kingdome RS | 029 | 0 | 0 | 2 | 5 | 4 | 5 | 1 | 8 | 6 | 2 | 11 | 6 | 22 | 17 | 12 | 16 | 15 | 5 | 16 | 7 | **8.0** | 29 |
| Lander St. RS | 030 | 10 | 12 | 9 | 8 | 28 | 8 | 6 | 19 | 17 | 15 | 25 | 8 | 29 | 17 | 25 | 21 | 19 | 9 | 28 | 22 | **16.8** | 26 |
| Hanford #1[2] | 031a | ***1*** | ***2*** | ***0*** | ***0*** | ***4*** | ***1*** | ***0*** | ***3*** | ***2*** | ***2*** | ***2*** | ***3*** | ***3*** | ***3*** | ***2*** | ***3*** | ***1*** | 2 | 7 | 4 | **2.3** | 30 |
| Hanford #2 RS | 032 | 10 | 12 | 16 | 15 | 26 | 12 | 8 | 17 | 17 | 15 | 23 | 9 | 27 | 16 | 24 | 18 | 17 | 9 | 28 | 23 | **17.1** | 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 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | **0.3** | 1 |
| W Duwamish[2,5] | 035 | NM | NM | NM | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | **0.5** | 1 |
| Chelan Ave. RS | 036 | 2 | 3 | 1 | 2 | 5 | 2 | 0 | 0 | 3 | 4 | 13 | 4 | 13 | 13 | 9 | 10 | 8 | 2 | 5 | 4 | **5.2** | 7 |

## Control Status of CSO Locations

| Overflow Name | DSN | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 20-Year Average[1] | 1983 Baseline |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Harbor Ave. RS | 037 | ***2*** | ***2*** | ***0*** | ***1*** | ***1*** | ***2*** | ***0*** | ***1*** | ***2*** | ***1*** | ***1*** | ***0*** | ***1*** | ***3*** | ***1*** | ***2*** | ***0*** | 1 | 1 | 0 | **1.1** | 30 |
| Terminal 115[2,6] | 038 | NM | 2 | 0 | 2 | 7 | 4 | 0 | 3 | 3 | 0 | 1 | 1 | 0 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | **1.6** | 4 |
| S Michigan St. RS[n] | 039 | 8 | 9 | 6 | 5 | 13 | 5 | 3 | 10 | 12 | 14 | 16 | 8 | 26 | 17 | 16 | 13 | 17 | 6 | 14 | 13 | **11.6** | 34 |
| 8th Ave. S | 040 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 2 | **0.3** | 6 |
| Brandon St. RS[7] | 041 | 21 | 28 | 21 | 27 | 11 | NM | 3 | 16 | 11 | 7 | 12 | 7 | 16 | 14 | 12 | 6 | 3 | 2 | 6 | 0 | **11.7** | 36 |
| W Michigan St. RS | 042 | 5 | 4 | 1 | 3 | 8 | 4 | 0 | 8 | 9 | 3 | 5 | 2 | 3 | 6 | 9 | 6 | 4 | 1 | 3 | 4 | **4.4** | 5 |
| 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 | 1 | 0 | 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 Inlet[2] | 048b | ***0*** | ***0*** | ***0*** | ***0*** | ***0*** | ***0*** | ***0*** | ***0*** | ***0*** | ***0*** | ***0*** | ***0*** | ***0*** | ***0*** | 0 | 1 | 1 | 1 | 1 | 1 | **0.3** | 18 |
| North Beach PS Wet Well | 048a | ***0*** | ***2*** | ***0*** | ***0*** | ***0*** | ***1*** | ***0*** | ***0*** | ***1*** | ***2*** | ***1*** | ***1*** | ***1*** | ***2*** | 1 | 3 | 1 | 1 | 1 | 2 | **1.0** | 18 |
| 30th Ave. NE[2] | 049 | *0* | *0* | *0* | *0* | *0* | *0* | *0* | 5 | 0 | 3 | 1 | 1 | 2 | 3 | 1 | 0 | 1 | 0 | 1 | 2 | **1.0** | 1 |
| 53rd Ave. SW PS | 052 | 0 | 0 | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 2 | 2 | **0.5** | <1 |
| 63rd Ave. SW | 054 | 0 | 2 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 3 | 2 | 2 | 4 | 5 | 4 | 1 | 1 | 2 | 2 | **1.6** | 2 |
| SW Alaska St.[2] | 055 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | **0.4** | 1 |
| Murray PS | 056 | ***0*** | ***2*** | ***1*** | ***0*** | ***1*** | ***2*** | ***1*** | ***0*** | ***1*** | ***0*** | ***1*** | ***2*** | ***1*** | ***2*** | ***0*** | 1 | 1 | 1 | 1 | 0 | **0.9** | 5 |
| Barton St. PS | 057 | ***0*** | ***0*** | ***0*** | ***2*** | ***1*** | ***3*** | ***2*** | ***2*** | ***0*** | ***0*** | ***1*** | ***3*** | ***1*** | ***2*** | ***0*** | ***0*** | ***1*** | 2 | 2 | 1 | **1.2** | 9 |

**Notes:** Modeled numbers are shown in *italics* with a blue background. NM = Not Monitored

[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. Black 20-year averages are for uncontrolled basins.

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

[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

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

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

[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.

# 4 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 2021, planned activities for 2022, 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 4 summarizes the CD milestone statuses through 2021. Figure 3 shows the locations of the CSOs and the status of the related project(s).

**Table 4. Summary of King County Consent Decree Milestones through 2021**

| CSO Name (Project Name) | DSN | Current CD Commitment | Current Status |
|---|---|---|---|
| Barton St. PS (Barton St. Roadside Raingardens and Barton St. PS Upgrades) | 057 | Supplemental Compliance Plan submitted to Ecology April 23, 2018. Control status to be reported in Annual Reports | Monitoring for achievement of performance standard |
| Ballard Siphon Regulator (Ballard Siphon Project) | 003 | CSO outfall controlled by December 31, 2014 | Outfall Controlled December 2014 |
| Chelan Ave. RS (Chelan Ave. CSO Project)[i] | 036 | Completion of bidding by December 31, 2020 | Request to modify milestones submitted to regulators 10/25/2019 and reiterated in a 3/25/2021 letter |
| Brandon St. RS/S. Michigan St. Regulator Station (Georgetown Wet Weather Treatment Station)[i] | 039, 041 | Construction completion by December 31, 2022 | Construction continued in 2021 to meet the CD commitment |
| Hanford #2 RS/Lander St. RS/King St. RS/Kingdome RS (Mouth of Duwamish)[i] | 032<br>030<br>028<br>029 | Submit Facility Plan by December 31, 2024 | Project planning underway. Request to modify CD submitted on October 28, 2019. Request included combining Chelan milestones with HLKK and extending completion beyond 2030 |

| CSO Name (Project Name) | DSN | Current CD Commitment | Current Status |
|---|---|---|---|
| Montlake RS (Project Name TBD)[i] | 014 | Submit Facility Plan by December 31, 2023 | Uncontrolled – future project. Request to modify CD submitted on October 28, 2019. Request including extending completion beyond 2030. |
| Murray Street Pump Station (Murray St. Wet Weather Storage Project) | 056 | CSO controlled by December 31, 2017 | Outfall Controlled December 2017 |
| North Beach Pump Station (North Beach Wet Weather Storage Project) | 048a, 048b | CSO outfall controlled by December 31, 2016 | Outfall Controlled December 2016 |
| Hanford #1 (Rainier Valley Wet Weather Storage Project)[i] | 031 | Did not meet control performance standard; Supplemental Compliance Plan submitted August 28, 2020; progress reported annually; control status to be determined in July 2024 | Corrective actions being performed per Supplemental Compliance Plan |
| 11th Ave. NW/3rd Ave W (Ship Canal Water Quality Project)[ii] | 004, 008 | (For King County) construction completion by December 31, 2025 | Project construction underway |
| 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 2019 Annual Report | Corrective action completed December 2018, and project operational. See Section 3.1 for more updates |
| University RS (Project Name TBD)[i] | 015 | Submit Facility Plan by December 31, 2023 | Uncontrolled – future project. Request to modify CD submitted on October 28, 2019 |

| CSO Name (Project Name) | DSN | Current CD Commitment | Current Status |
|---|---|---|---|
| West Michigan St. Regulator/Terminal 115 (West Duwamish CSO Control Project)[i] | 038, 042 | Completion of bidding by December 31, 2022 | Project design underway. Site in Ecology cleanup order, with anticipated delay to milestones notified in force majeure submittals in 2021. |
| Dexter Ave. RS (Dexter Ave. Supplemental Compliance Plan) | 009 | Supplemental Compliance Plan submitted August 2013; control status to be reported in 2016 Annual Report | Outfall controlled July 2016 |
| Denny Way RS (Denny Way Supplemental Compliance Plan) | 027a | Supplemental Compliance Plan submitted to Ecology August 2, 2013. Revised Supplemental Compliance Plan submitted August 31, 2016; Completion of modifications by December 2018 and control status to be reported in Annual Reports. | Monitoring for achievement of performance standard |
| Harbor Ave. RS (Harbor Ave. Supplemental Compliance Plan) | 037 | Supplemental Compliance Plan submitted to Ecology July 3, 2013. Revised Plan submitted August 31, 2016; Completion of modification by December 2018, and control status to be reported in Annual Reports. | Monitoring for achievement of performance standard |

[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 (aka 11th Ave. NW) and 3rd Ave. W and Ewing St. (aka. 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 collaborative project in the nonmaterial CD modification.

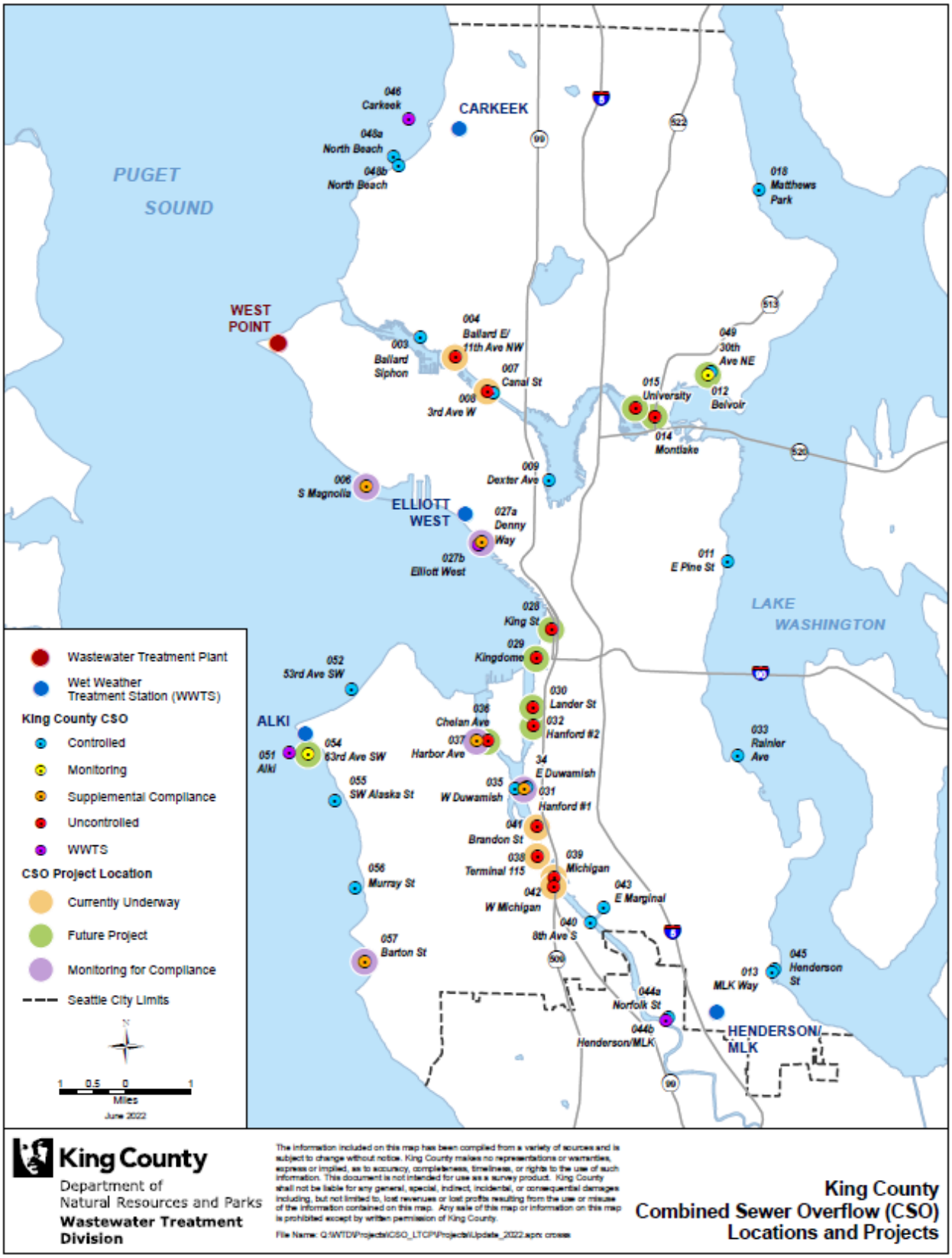


Figure 4. King County CSO Projects

# Project Summaries

A summary project status page for 2021 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. RS Overflow) and DSN 039 (S. Michigan St. Overflow)

**Project Description:** Construct a WWTS, associated conveyance, and marine outfall. For more information, see: https://kingcounty.gov/depts/dnrp/wtd/capital-projects/active/georgetown.aspx

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

**2021 Accomplishments:**

- Completed construction of the conveyance pipeline in 2021.
- Continued construction of the treatment station and equalization basin.

**2021 Challenges and Corrections:**

- Treatment station construction contract – Various changes to the contract were executed in 2021 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 2021 to account for design changes/clarifications, differing site conditions, and impacts resulting from the COVID-19 pandemic.

**2022 Activities in Progress or Expected:**

- Issue Substantial Completion on the Treatment Station construction contract.
- Issue Final Acceptance of the conveyance construction contract.
- Continue construction of treatment station structures and buildings.
- Continue 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 003 (11th Ave. NW Outfall)

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

SPU is the lead agency for design and construction, and will own, operate, and maintain the tunnel and its related structures. (WTD will continue to own its two outfall structures.) WTD is coordinating with SPU on the project through a Joint Project Agreement (JPA) approved by the Seattle and County Councils in July 2016. The JPA guides implementation, operation, and cost-sharing of the Ship Canal Project. The County is providing funding and technical expertise and participates in the JPA-mandated Joint Oversight and Project Review and Change Management Committees.

This project is in both King County and the City of Seattle's CDs. For more information, see: http://www.seattle.gov/utilities/neighborhood-projects/ship-canal

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 SPUs 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.

**2021 Accomplishments**

- Construction of the Storage Tunnel work package continued. All five drop shafts were constructed, and the team launched two tunnel boring machines: the 18-foot (ft), 10-inch (in.)-diameter storage tunnel and the 8-ft-diameter conveyance tunnel under the Ship Canal. Excavation began for several below-grade diversion structures and mechanical/electrical vaults.
- The Tunnel Effluent Pump Station (TEPS) work package team completed 90 percent design as a joint deliverable with the Ballard Conveyance work package. The 90 percent design was submitted to Ecology and EPA for review as the draft plans and specifications. The Ship Canal Project team 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 90 percent TEPS design received final approval from the Seattle Design Commission.
- The Wallingford Conveyance work package team completed 100 percent design. The 100 percent design was submitted to Ecology and EPA for review as the final plans and specifications. This work package will be advertised for bids in 2022, with construction scheduled to begin later in 2022.
- The Ship Canal Project completed hydraulic modeling of the North Queen Anne system to confirm that the project will not unacceptably impact the hydraulics of the system.
- The Ship Canal Project completed a 60 percent O&M manual deliverable for the overall facility.
- The overall Ship Canal Project received notice that it had achieved an Envision platinum award for sustainable infrastructure.
- Finally, SPU executed a $66 million State Revolving Fund (SRF) loan with Ecology for the Ship Canal Project and was informed that it has been selected for a separate SRF loan to be executed in 2022.

**2021 Challenges and Corrections:**

- Quality issues were discovered in the microtunnel pipe for the 8-ft-diameter conveyance tunnel. Tunneling has been paused, and SPU is evaluating corrective action proposals from the contractor. It is anticipated that the 8-ft- diameter tunnel will be completed successfully in 2022.
- Mining progress for the 18-ft, 10-in.-diameter storage tunnel has been slower than planned, in part due to impacts from COVID-19. SPU is working with the contractor to evaluate corrective actions and fully understand the impacts. It is anticipated that completion of the storage tunnel will delay the planned start of TEPS/Ballard Conveyance and the critical path to complete the Ship Canal Project facility; however, the Ship Canal Project team still forecasts to complete the project before the CD milestone date.

**2022 Anticipated Activities**

- Continue construction activities for Storage Tunnel work package.
- Conduct outreach to contractors ahead of bid advertisement for Wallingford Conveyance and TEPS/Ballard Conveyance.
- Deliver project briefings at organizations, boards and/or associations focused on potential project impacts to trees, bicycles, pedestrians, residents, and industry.
- Continue to deliver listserv updates, notices, and mailers along the tunnel alignment, as appropriate and necessary.
- Continue stakeholder briefings and attend community meetings.
- Provide project information via fact sheets, website, listserv, and other materials.

# 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://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) | | | | | | | | | | | |

**2021 Accomplishments:**

- Completed the updated draft Facility Plan, reflecting larger tank size, and submitted for review on 10/22/2021.
- Continued Preliminary Design – Baseline Design process.
- Continued land acquisition negotiations with the Port of Seattle.
- Developed a voluntary monitoring plan for sampling and analysis of soil and groundwater for certain key contaminants
- RainWise Program activities continued in South Park and Highland Park basins (see Section 3.2.3).

**2021 Challenges and Corrections:**

- King County identified that a larger tank size is required to account for the effects of climate change. The draft Facility Plan was updated, and the 30 percent engineering drawings were revised accordingly.
- Land acquisition has been delayed due to an administrative order applied to the preferred parcel. Efforts to negotiate purchase and sale have been negatively affected. The County submitted a force majeure claim on June 9, 2021 (with additional information on October 22, 2021) to notify that the property-related

issues are anticipated to result in delays to contracting/construction milestones of up to 24 months.

**2022 Activities in Progress or Expected:**

- Baseline Design, Cost, and Schedule
- 60 percent design package
- State Environmental Policy Act checklist, comment period, and responses
- Continue acquisition of proposed storage tank property
- Sampling and analysis of soil and groundwater
- Amend engineering consultant contract through final design phase
- Continue community briefings through project website and mailings
- Evaluate schedule to incorporate 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 RS Overflow)

**Project Description:** Construct GSI to minimize the gray infrastructure demands needed to achieve full CSO control. The timeline below corresponds to the CD's timeline for complete control of the University RS Overflow.

For more information, see: https://kingcounty.gov/depts/dnrp/wtd/capital-projects/active/university-gsi.aspx

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

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

**2021 Accomplishments:**

- RainWise Program activities continued in the University basin (see Section 3.2.3).
- Completed update of the GSI BMP modeling tool and associated materials developed during alternatives analysis.

**2021 Challenges and Corrections:**

- None

**2022 Activities in Progress or Expected:**

- No further basin-scale GSI activities.
- RainWise activities will continue in the University basin.

# CD/CSO Report Project Status

## Chelan Avenue CSO Control Project

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

**Project Description:** This project will control the Chelan Avenue 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 generation, flow diversion, and discharge.

For more information, see: https://kingcounty.gov/depts/dnrp/wtd/capital-projects/active/chelan-cso-control.aspx

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

**2021 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 delay of two interim milestone dates associated with the Chelan Avenue CSO to match the milestones in the CD for HLKK Wet Weather Station.
- Continued communication with regulators regarding request for milestone date change.

**2021 Challenges and Corrections:**

- The Completion of Bidding milestone deadline of December 31, 2020 was missed. Official notification was sent to EPA and Ecology.

**2022 Activities in Progress or Expected:**

- Planning effort to re-evaluate CSO control for Chelan and HLKK as a consolidated project (CHLKK) has continued into 2022. The CHLKK Control Plan Re-evaluation effort is identifying and assessing options to control the CHLKK outfalls while assessing benefits to other pressing sewer system needs.
- A public engagement plan for the re-evaluation effort is being developed and public engagement is expected to begin in 2022.
- WTD will continue to coordinate with SPU throughout the CHLKK Control Plan Re-evaluation.
- Continue discussion regarding potential CD modification.

## 4.1 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 5 ("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 the 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 5. Summary of King County Supplemental Compliance Plans**

| CSO Name (Project Name) | DSN | Supplemental Compliance Plan Background | Outfall Status |
|---|---|---|---|
| Barton St. PS (Barton Street Roadside Raingardens and Barton St. PS Upgrades) | 057 | Supplemental Compliance Plan submitted to Ecology April 23, 2018. Control status to be reported in Annual Reports. | Monitoring for achievement of performance standard. |
| South Magnolia (South Magnolia Wet Weather Storage Project) | 006 | Supplemental Compliance Plan submitted to Ecology January 30, 2017. Addendum submitted on April 24, 2018; Completion of corrective action by December 2018 and control status to be reported in Annual Reports. | Monitoring for achievement of performance standard. |
| Dexter Ave. RS (Dexter Ave. Supplemental Compliance Plan) | 009 | Supplemental Compliance Plan submitted August 2013; control status to be reported in Annual Reports. | Outfall controlled in 2016. |
| Denny Way RS (Denny Way Supplemental Compliance Plan) | 027a | Supplemental Compliance Plan submitted to Ecology August 2, 2013. Revised Supplemental Compliance Plan submitted August 31, 2016; Completion of modifications by December 2018 and control status to be reported in Annual Reports. | Monitoring for achievement of performance standard. |
| Hanford #1 CSO (Rainier Valley Wet Weather Storage) | 031 | Supplemental Compliance Plan submitted to Ecology August 28, 2020. Work detailed in the Supplemental Compliance Plan is continuing. | Initial remedial actions are underway; performance of the outfall will continue to be monitored. |

| | | | |
|---|---|---|---|
| Harbor Ave. RS (Harbor Ave. Supplemental Compliance Plan) | 037 | Supplemental Compliance Plan submitted to Ecology July 3, 2013. Revised Plan submitted August 31, 2016; Completion of modification by December 2018, and control status to be reported in Annual Reports. | Monitoring for achievement of performance standard |

# CD/CSO Report Supplemental Compliance Plan

## Barton St. Roadside Raingardens

**CSO(s):** DSN 057 (Barton St. PS Overflow)

**Project Description:** Construct GSI (bioretention swales and associated drainage structures) and underground injection control 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. Modeling and monitoring indicate that this outfall is close to compliance. The County is planning to investigate additional GSI throughout the Barton basin to further reduce overflows and will continue monitoring to confirm achievement of the performance standard.

For more information, see:
https://kingcounty.gov/~/media/depts/dnrp/wtd/capital-projects/COMPLETED/PDF/Barton-street-pump-station-upgrade-2015.ashx

**2021 Accomplishments:**

- Completed modeling using updated performance data to assess pump performance needed to reach control.
- Monitored for achievement of performance standard.

**2021 Challenges and Corrections:**

- Determined that operational adjustments performed in 2020 did not bring the facility into control.

**2022 Activities in Progress or Expected:**

- An amendment to the Supplemental Compliance Plan will be submitted detailing additional actions.
- Continue monitoring for achievement of performance standard.
- Identify additional GSI opportunities throughout the Barton basin to reduce control volume.

# CD/CSO Report Supplemental Compliance Plan Status

## Denny Way Regulator Station Overflow

**CSO(s):** DSN 027a (Denny Way RS Overflow)

**Project Description:** Adjust facilities built in 2005 to achieve final control per the Supplemental Compliance Plan included in the 2011 TM 970 and updated to Ecology and EPA in 2012. Investigation suggested that two of the inputs—Denny Local and Denny Lake Union—were overflowing more than intended. The investigation recommended removal of the lower Denny local weir and modification of the Elliott West pump ramp-up strategy to drop the lead pump start set point by 2.25 ft 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. This outfall is on the path to compliance based on long-term modeling runs using baseline climate simulations, which show an average of 0.8 events per year. Seven of the last 10 years have been significantly wetter than average, which has impacted the control status. Additional monitoring is needed to confirm achievement of the performance standard.

**2021 Activities:**

- Completed additional model updates and calibrations
- Monitored compliance at Denny Way RS.

**2021 Challenges and Corrections:**

- More monitoring information is needed to gain certainty and confirm achievement of the performance standard.

**2022 Activities in Progress or Expected:**

- An amendment to the Supplemental Compliance Plan will be submitted detailing additional actions
- Continue monitoring for achievement of performance standard.
- Additional modeling is planned to confirm the model is calibrated and validated as well as 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://kingcounty.gov/~/media/depts/dnrp/wtd/capital-projects/COMPLETED/PDF/Rainier-valley-wet-weather-storage-2018.ashx

**2021 Accomplishments:**

- Conducted field surveys and updated base maps for the following structures: Bayview North, Bayview South, and Hanford @ Rainier. Collected flow data for the Bayview Tunnel.
- Completed model updates using survey and flow data.
- Installed meter to check weir coefficient. Collected data from two storms since installation.

**2021 Challenges and Corrections:**

- The project is in early phases of its Supplemental Compliance Plan and will assess its status as remedial actions are completed.

**2022 Activities in Progress or Expected:**

- Expand collection of flow data to locations further upstream and downstream of Bayview structures.
- Continue modeling activities using additional flow data.
- Assess potential operational improvements.
- Inspect Bayview Tunnel for potential obstructions.

# 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. This outfall is on the path to compliance based on long term modeling runs utilizing baseline climate simulations which show an average of 0.95 events per year. Seven of the last 10 years have been significantly wetter than average, which has impacted the control status. Additional monitoring is needed in order to confirm achievement of the performance standard.

**2021 Activities:**

- Monitored for achievement of performance standard.
- Additional monitors installed upstream to confirm reflect inflow conditions
- The Delridge Trunk downstream of the Harbor Regulator Station was inspected via CCTV and sediment build-up was found.

**2021 Challenges and Corrections:**

- Modeled and monitored results indicate that the outfall is not yet in control.

**2022 Activities in Progress or Expected**

- An amendment to the Supplemental Compliance Plan will be submitted detailing additional actions
- Procure contractor to clean the sediment build-up downstream.
- The model of the facility will be updated to reflect the inflow conditions. 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:** Investigate solution to pipe break in the CSO conveyance pipe that was first discovered in fall 2016. A Supplemental Compliance Plan was submitted in January 2017 to comply with the CD deadline for notifications. King County completed all commitments in the Revised Supplemental Compliance Plan. The outfall is currently close to achieving compliance based on long term modeling runs utilizing baseline climate simulations which show an average of 0.8 events per year. Seven of the last 10 years have been significantly wetter than average, which has impacted the control status. Additional monitoring is needed in order to determine achievement of the performance standard

For more information see:
https://kingcounty.gov/depts/dnrp/wtd/capital-projects/completed/magnolia-wet-weather-storage-facility.aspx

**2021 Accomplishments:**

- Monitored for compliance at South Magnolia.
- Additional monitoring was conducted to verify if the storage tank is being fully used before overflows occur.

**2021 Challenges and Corrections:**

- More monitoring information is needed to gain certainty and confirm achievement of the performance standard.
- 2021 rainfall exceeded the 20-year average.
- Flow rate through the low flow gate in the upper diversion structure is assumed to be higher than anticipated during design and shown in the model.

**2022 Activities in Progress or Expected:**

- An amendment to the Supplemental Compliance Plan will be submitted detailing additional actions
- Continue monitoring for achievement of performance standard.
- Additional modeling is planned to confirm the model is calibrated and validated. Additional updates may be made to reflect operational strategy adjustments and observed conditions.

## 4.2 Program Plan Summaries

The CD required development and implementation of two plans: the SSOP and the JOSOP with the City of Seattle.

### 4.2.1 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.

### 4.2.2 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 JOSOP and to review it every three years and update it as necessary. In developing the original JOSOP (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 JOSOP Update submitted to EPA and Ecology in January 2019.

In 2021, joint operational activities were partially curtailed due to restrictions enacted in response to the COVID-19 pandemic. The following list describes each commitment and the progress made in 2021:

- 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 2021/2022 wet season, a meeting was held in September 2021 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 three meetings during which SPU and DNRP staff shared information on the operation of existing facilities, progress of capital projects, and coordination of Joint Plan commitments.

- 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 workshop in the spring to confirm the scope and schedule of the upgraded real-time data-sharing platform. SPU and DNRP are in process of updating the agreement before implementing the recommended upgrades to the data-sharing platform, which is anticipated in 2022.
- 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 2021 to review modeling results and coordinate model developments between each agency. In 2021, DNRP completed hydraulic evaluation of the proposed Ship Canal Water Quality Project 3rd Ave. W diversion design. The North Interceptor/Ship Canal model was updated per the 90 percent drawings for TEPS and Ballard and per the 100 percent drawings for Wallingford. The model was updated with the proposed controls for TEPS, as described in the project process control descriptions. In addition, SPU and DNRP shared modeling results from the Henderson CSO basin. SPU updated the Henderson North CSO model to represent the recent facility improvements while DNRP identified regional impacts to their system from recent SPU projects and began evaluating potential impacts from proposed SPU retrofits in the South Henderson CSO basins. The DNRP System Model was updated to include the recent SPU Central Waterfront project, the Georgetown WWTS, and an improved Interbay PS control algorithm. 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 2021, SPU commissioned the East Montlake (Basin 20) sewer system improvements and Wastewater Pump Station 118 (Northgate) and provided an overview to DNRP during a JOIST meeting.
- The Real-Time CSO Notification commitment includes revising both agencies' onsite signs and website information to improve notification of CSO events and communication with customers.
- The Reduce Saltwater Intrusion commitment involves continuing to work together on studies, data, and solutions for reducing intrusion. In November 2021, DNRP and SPU held a coordination meeting to review saltwater intrusion monitoring conducted in 2021, discuss work planned for 2022, and identify strategies for reducing saltwater intrusion.
- WTD and SPU kicked off the effort to complete the second update of the JOSOP, focusing on the progress made to each of the areas depicted above. The second update of the JOSOP was submitted to EPA and Ecology on February 28, 2022.

### 4.2.3 WTD and SPU Coordination on CSO Control Projects

WTD and SPU have been working together for many years to identify collaborative project and operational opportunities to improve each agency's efforts and to better protect public health and the environment. The two agencies have agreed to guiding principles to ensure that neither agency will adversely impact the compliance of the other. Given that SPU's combined sewers are upstream of King County's system, new or improved SPU CSO control facilities have the potential to affect flows in King County's regional system. For this reason, SPU and WTD coordinate before and after construction of capital projects. Below is a list of projects constructed by SPU in recent years:

- 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 began modeling the changes and impacts to the downstream system in 2021. Modeling will continue in 2022.
- SPU Pump Station 22 (SPU Basin 60) was upgraded from 0.86 MGD to 4 MGD in 2020.
- SPU Pump Station 20 in Portage Bay was upgraded from 1.1 MGD to 1.5 MGD in 2020.
- SPU Pump Station 13 in East Montlake (SPU Basin 20) was upgraded from 0.9 MGD to 2.8 MGD in 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 manage urban runoff by using nature-based processes to slow, detain or retain stormwater. The goals of our GSI work are to reduce polluted runoff entering the CSO system and/or nearby

waterways while also delivering a range of risk reduction and community co-benefits. GSI bioretention facilities in the right-of-way also are referred to as “natural drainage systems”. GSI can also be a component of low impact development. Collaborative work between WTD and SPU in 2021 included:

- Adding the updated GSI Manuals to the joint www.700milliongallons.org website to make them more accessible to a broader audience of users.
- Identifying training needs for GSI and developing and delivering two trainings.
- Evaluating and drafting updated presettling guidance, including identifying presettling technologies to test on specific projects.
- 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.

In 2022, planned collaborative work includes:

- Evaluating and updating (if appropriate) current design standards for inlets and orifice control.
- Updating the GSI Design Manual to incorporate lessons learned and any new or updated guidance, such as for presettling.
- Continued 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 its status is described in Section 4 of this report.

# 5 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 2021. Additional information can be found in the appendices of this report.

## 5.1 Annual Rainfall

Rainfall data are reported for each CSO event as measured by the nearest King County-owned rain gauge. Rainfall data for 2021 are included in Appendices A and B. The annual rainfall for 2021, as an average over local rain gauges, was 24.54 in. The annual rainfall at Sea-Tac Airport was 43.33 in., which is above the 20-year Sea-Tac Airport annual average of 41.90 in. Long-term, WTD will be looking at how storms over the last 20 years may compare to storms of the next 60 years. WTD is funding work by the University of Washington Climate Impacts Group to analyze impacts on precipitation over the next century.

## 5.2 Unpermitted Overflows

Overflows can occur from CSO structures and outfalls, broken pipelines, and maintenance holes. The County characterizes three types of unpermitted overflows: 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 by the County as “SSOs.” Additionally, the CD defines any overflow other than a DWO or exacerbated CSO 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 6 shows that, in January 2021, there were several sewer backups at residences upstream from the 8th Ave. S RS, including one home connected to a WTD trunk sewer and others connected to SPU sewer lines. Sewer backups retained in buildings are not

considered overflows, but WTD strives to avoid and alleviate conditions that may result in backups. WTD initiated several efforts in 2021 to reduce the potential backups, including reducing the set point elevation at which the regulator gate opens to lower trunk sewer water levels during storm events and increasing the size of a pipe at one location that may have restricted flow. Two SSOs occurred, including a small leak in the Interbay PS force main and one at the East Pine PS due to power disturbances and interruption of telemetry during a large storm.

Two bypasses of untreated wastewater occurred at West Point, including an event caused by storm-related power disturbance and a second brief event caused by the failure of a device associated with the backup power supply system. Ecology issued an administrative order to King County on February 2, 2021, requiring planning and implementation for near- and long-term actions to improve electrical systems and power supply reliability at West Point to minimize unauthorized bypasses and secondary diversions. King County Executive Dow Constantine issued an emergency declaration, and the King County Council approved a $65 million supplemental budget appropriation to fund near-term power-related improvements. WTD began planning for construction of a new battery backup system in 2021 to be operational in 2024 and submitted a Strategic Master Plan to Ecology in December 2021.

**Table 6. Summary of Unpermitted Overflows in 2021**

| Date of Event | Facility | Description of Violation(s) |
|---|---|---|
| 1/3/21 | South Park upstream of 8th Ave. S Regulator | Sewer Backup: During a peak rainfall event, while the regulator was operating as designed, a sewer backup occurred at a residence in the South Park area with direct connection to a WTD trunk sewer. WTD assisted the resident with cleanup activities. |
| 1/13/21 | West Point | Emergency Bypass Overflow: Power interruption caused the shutdown of effluent and intermediate pumps, resulting in an 11 MG overflow to Puget Sound over about 2 hours. |
| 1/13/21 | East Pine Pump Station | SSO: Power sags that were too brief to start generators caused pumps to trip offline, resulting in 2.2 MG overflow. Loss of telemetry prevented operators from knowing status. |
| 2/11/21 | Interbay Pump Station | SSO: Small, 1.5-in. hole in force main #1 caused leakage to ground estimated at 2,700 gallons over about 22 hours. |
| 4/29/21 | West Point | Emergency Bypass Overflow: During routine testing, an emergency power supply unit failed, resulting in systems responding as if a real power outage occurred, causing the emergency bypass gates to open and resulting in an overflow of about 900,000 gallons over 26 minutes. |

## 5.3 Annual Untreated CSO Events

West Point's SCADA system monitors the volume and frequency of CSOs at regulator and pump stations. Portable flow meters are deployed at 12 CSO locations not currently monitored by SCADA or to supplement SCADA monitoring: 11th Ave. NW Overflow, 3rd Ave. W and Ewing Street Overflow, 30th Ave. NE Overflow, Southwest Alaska Street Overflow (SW Alaska St. Overflow), Bayview North Overflow (Bayview N Overflow), Bayview South Overflow (Bayview S Overflow), East Duwamish Pump Station Overflow (E Duwamish PS Overflow), W Duwamish Overflow, Hanford @ Rainier Overflow, S Magnolia Overflow, North Beach PS Inlet Overflow, and Terminal 115 Overflow.

Hydraulic modeling predicts that King County CSOs will discharge 800 MG of untreated CSO in an average year of rainfall. In 2021, there were 25 storm events resulting in untreated CSO discharges. Some storm events spanned multiple days, and, at times, there were multiple discharges on the same day. Conditions in 2021 resulted in 144 untreated CSO events discharging about 1,226 MG. Rainfall in 2021 was higher than normal, resulting in a total discharge volume that was higher than predicted in an average year. The highest precipitation occurred in November (10.26 in.) and resulted in 36 untreated events totaling 192 MG. The second highest precipitation occurred in January (8.75 in.), resulting in 52 untreated events and an overflow volume of 738 MG.

Appendix A lists the untreated events from County CSOs during 2021. These data are also provided Ecology in electronic form alongside this report.

## 5.4 CSO Treatment

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

The following sections summarize performance and compliance at each facility during 2021. Appendix B of this report provides more detail on volumes and events. Appendices C through F contain the annual reports for each WWTS.

### 5.4.1 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 impacts to local water bodies. West Point had 21 wet weather treatment events during 2021, 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 186.15 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 2021, 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 is discharged to Puget Sound.

### 5.4.2 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 2021, there were four filling events and four discharge events. The Alki WWTS received 74.5 MG of influent flow and discharged 63.7 MG.

Overall, TSS removal was 36.0 percent for 2021, which did not meet the annual average 50 percent TSS removal limit. The TSS removal was the only permit requirement not met at Alki WWTS during the year. The annual average settleable solids (SS) was 0.10 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 minimum pH of less than 6.0 as well as the instantaneous maximum pH of over 9.0. 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 8 discharge days. Alki WWTS met the monthly fecal coliform geomean permit limit of 400 counts per 100 mL during the 2 months of discharge at Alki WWTS. Appendix C contains more details on the Alki WWTS.

### 5.4.3 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 2021, Carkeek WWTS had 14 filling events and four discharge events. The Carkeek WWTS received 20.4 MG and discharged 18.4 MG. The influent

volume should exceed the effluent volume by approximately 0.6 MG. King County staff are currently evaluating the flow metering. There are several possible explanations for the flow difference These include, for example, site drainage going back into the station's process tanks and level sensor instrumentation differences contributing to weir flow calculations. Carkeek WWTS performed well in 2021.

Overall, TSS percent removal was 73.3 percent in 2021, thereby meeting the NPDES permit limit of 50 percent for annual average removal. Carkeek WWTS met its annual average SS limit with the average measuring 0.12 ml/L/hr (with the NPDES permit limit being 0.3 ml/L/hr). The Carkeek WWTS complied with the instantaneous minimum pH of less than 6.0 as well as the instantaneous maximum pH of over 9.0 during each of the 11 discharge days. The daily maximum average TRC exceeded the permitted level of 490 µg/L on 2 of 11 discharge days; it reached as high as 3139 µg/L. All remaining NPDES permit limits were met at Carkeek WWTS. Appendix D contains more details on Carkeek WWTS.

### 5.4.4 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 2021, there were 36 inflow events totaling 283.8 MG and seven discharge events totaling 91.4 MG that were treated and discharged through the Elliott West Outfall at the Denny Way RS.

Overall, TSS removal averaged 58.3 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 3.83 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 2 of 10 discharge days; it reached as high as 467 µg/L. Effluent pH dropped below the permitted minimum limit of pH 6.0 on 4 of the 10 discharge days; it reached as low as pH 5.6 during any event. Effluent fecal coliform geomean was greater than 400 cfu/100 mL on 1 of the 4 discharge months, with a maximum value of 330,000 cfu/100 mL. There was one fecal sample that was invalid due to a laboratory error. All other required samples were collected, and all required measurements were completed in 2021. Appendix E contains more details on Elliott West WWTS.

### 5.4.5 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 four filling event and two discharge events during 2021. The first discharge event of the year was the result of 2.42 in. of rain that fell from January 1 to January 2. The Henderson/MLK Jr. Way WWTS received a total inflow of 19.13 MG and discharged 10.49 MG of treated water through the Norfolk Street Overflow to the Duwamish Waterway.

Overall, TSS removal was 64 percent for the year, thereby meeting the NPDES 50 percent annual average TSS removal limit. The annual average effluent settleable solids was below the permit limit of 0.3 ml/L/hr.

There were no violations to the minimum pH limit, the maximum daily TRC limit, nor the monthly fecal coliform bacteria. Improvement projects have been in progress to increase the consistency in meeting NPDES permit requirements. Appendix F contains more details on the Henderson/MLK Jr. Way WWTS.

# 6 Summary of Consent Decree and NPDES Violations in 2021

Section VIII. 43 of the CD requires the listing of any violations of the CD in the annual report. Table 7 identifies CD violations in 2021 and related exceedances of NPDES wet weather permit requirements for the CSO system. Appendices C through F contain details on the causes and corrective actions taken. All notifications to Ecology were made in a timely manner.

**Table 7. Summary of Effluent Limitation* and Consent Decree Violations in 2021**

| Date of Event | Facility | Description of Violation(s) |
|---|---|---|
| 1/4/21 | Elliott West WWTS | Total chlorine residual |
| 1/4/21 | Elliott West WWTS | pH |
| 1/11/21 | Elliott West WWTS | Total chlorine residual |
| 1/11/21 | Elliott West WWTS | pH |
| 1/12/21 | Elliott West WWTS | pH |
| 10/28/21 | Carkeek WWTS | Total chlorine residual |
| 10/28921 | Carkeek WWTS | Total chlorine residual |
| 11/12/21 | Elliott West WWTS | pH |
| November | Elliott West WWTS | Fecal coliform bacteria |
| 2021 annual | Alki WWTS | Annual average TSS removal |
| 2021 annual | Elliott West 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.

# 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. Sediment characterization data completed in this reporting period are summarized below.

No post-construction monitoring was required in 2021.

A post-construction monitoring report required under NPDES permit condition S11.F(d) was submitted 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 2021

Appendix B: Treated CSO Events, January-December 2021

Appendix C: Alki Wet Weather Treatment Station 2021 Annual Report

Appendix D: Carkeek Wet Weather Treatment Station 2021 Annual Report

Appendix E: Elliott West Wet Weather Treatment Station 2021 Annual Report

Appendix F: Henderson/MLK Jr. Way Wet Weather Treatment Station 2021 Annual Report

# Appendix A
# Untreated CSO Events

## January–December 2021

| DSN # | Overflow Name | Receiving Water | Event Starting Date/Time | Event Ending Date/Time | Duration (hours) | Volume (gallons) | Precipitation (inches) | Storm Duration (hours) | Note if DWO |
|---|---|---|---|---|---|---|---|---|---|
| 004 | East Ballard (aka 11th Ave. NW) | Lake Washington Ship Canal | 1/1/21 2:59 PM | 1/1/21 3:19 PM | 0.33 | 71,470 | 1.04 | 69.30 | |
| 004 | East Ballard (aka 11th Ave. NW) | Lake Washington Ship Canal | 1/2/21 6:12 PM | 1/3/21 12:02 AM | 5.83 | 1,834,032 | 2.71 | 101.97 | |
| 004 | East Ballard (aka 11th Ave NW) | Lake Washington Ship Canal | 1/5/21 8:41 PM | 1/5/21 11:00 PM | 2.32 | 112,732 | 0.76 | 11.13 | |
| 004 | East Ballard (aka 11th Ave. NW) | Lake Washington Ship Canal | 1/11/21 11:11 AM | 1/13/21 12:47 AM | 37.60 | 3,020,329 | 3.24 | 40.42 | |
| 004 | East Ballard (aka 11th Ave. NW) | Lake Washington Ship Canal | 2/1/21 10:01 PM | 2/1/21 11:26 PM | 1.42 | 44,221 | 1.65 | 74.10 | |
| 004 | East Ballard (aka 11th Ave. NW) | Lake Washington Ship Canal | 3/25/21 2:39 AM | 3/25/21 3:02 AM | 0.38 | 71,536 | 0.27 | 9.97 | |
| 004 | East Ballard (aka 11th Ave. NW) | Lake Washington Ship Canal | 6/11/2021 23:25 | 6/11/2021 23:37 | 0.20 | 9,989 | 0.13 | 10.97 | |
| 004 | East Ballard (aka 11th Ave. NW) | Lake Washington Ship Canal | 10/21/21 9:05 PM | 10/21/21 9:21 PM | 0.27 | 1,562 | 0.26 | 1.78 | |
| 004 | East Ballard (aka 11th Ave. NW) | Lake Washington Ship Canal | 10/28/21 8:49 PM | 10/29/21 12:27 AM | 3.63 | 136,077 | 1.83 | 29.7 | |
| 004 | East Ballard (aka 11th Ave. NW) | Lake Washington Ship Canal | 11/4/21 9:10 AM | 11/4/21 10:53 AM | 1.72 | 221,372 | 1.1 | 18.85 | |
| 004 | East Ballard (aka 11th Ave. NW) | Lake Washington Ship Canal | 11/6/21 6:30 PM | 11/6/21 7:09 PM | 0.65 | 175,488 | 0.41 | 11.33 | |
| 004 | East Ballard (aka 11th Ave. NW) | Lake Washington Ship Canal | 11/11/21 1:45 PM | 11/12/21 1:35 AM | 11.83 | 317,256 | 0.98 | 26.75 | |
| 004 | East Ballard (aka 11th Ave. NW) | Lake Washington Ship Canal | 11/13/21 6:59 PM | 11/13/21 7:16 PM | 0.28 | 5,668 | 0.24 | 2.5 | |
| 004 | East Ballard (aka 11th Ave. NW) | Lake Washington Ship Canal | 11/15/21 11:00 AM | 11/15/21 12:18 PM | 1.30 | 52,079 | 1.41 | 43.52 | |
| 004 | East Ballard (aka 11th Ave. NW) | Lake Washington Ship Canal | 11/23/21 5:37 AM | 11/23/21 6:02 AM | 0.42 | 30,968 | 0.52 | 12.65 | |
| 004 | East Ballard (aka 11th Ave. NW) | Lake Washington Ship Canal | 12/11/21 1:43 AM | 12/11/21 2:39 AM | 0.93 | 111,740 | 0.57 | 11.35 | |

| DSN # | Overflow Name | Receiving Water | Event Starting Date/Time | Event Ending Date/Time | Duration (hours) | Volume (gallons) | Precipitation (inches) | Storm Duration (hours) | Note if DWO |
|---|---|---|---|---|---|---|---|---|---|
| 004 | East Ballard (aka 11th Ave. NW) | Lake Washington Ship Canal | 12/22/21 2:45 PM | 12/23/21 12:18 AM | 9.55 | 317,256 | 0.88 | 26.38 | |
| 004 | East Ballard (aka 11th Ave. NW) | Lake Washington Ship Canal | 12/24/21 11:18 PM | 12/24/21 11:45 PM | 0.45 | 43,081 | 0.45 | 21.67 | |
| 006 | Magnolia Overflow | Elliot Bay/Puget Sound | 1/2/21 7:45 PM | 1/3/21 4:15 AM | 8.50 | 23,904 | 1.67 | 50.88 | |
| 006 | Magnolia Overflow | Elliot Bay/Puget Sound | 1/12/21 1:40 AM | 1/13/21 11:00 AM | 33.33 | 126,136 | 2.62 | 40.45 | |
| 007 | Canal Street Overflow | Lake Washington Ship Canal | 1/12/21 11:57 PM | 1/13/21 12:16 AM | 0.32 | 37,842 | 3.23 | 40.23 | |
| 008 | 3rd Ave. W and Ewing St. | Lake Washington Ship Canal | 1/2/21 6:30 PM | 1/3/21 1:14 AM | 6.73 | 6,237,715 | 2.74 | 102.87 | |
| 008 | 3rd Ave. W and Ewing St. | Lake Washington Ship Canal | 1/5/21 10:08 PM | 1/6/21 1:16 AM | 3.13 | 1,067,962 | 0.86 | 13.30 | |
| 008 | 3rd Ave. W and Ewing St. | Lake Washington Ship Canal | 1/11/21 8:08 PM | 1/13/21 2:19 AM | 30.18 | 10,975,571 | 3.24 | 40.42 | |
| 008 | 3rd Ave. W and Ewing St. | Lake Washington Ship Canal | 10/28/21 8:49 PM | 10/29/21 2:19 AM | 5.50 | 5,040,868 | 2.02 | 31.35 | |
| 008 | 3rd Ave. W and Ewing St. | Lake Washington Ship Canal | 11/4/21 10:27 AM | 11/4/21 10:58 AM | 0.52 | 25,691 | 1.10 | 18.85 | |
| 008 | 3rd Ave. W and Ewing St. | Lake Washington Ship Canal | 12/11/21 2:07 AM | 12/11/21 3:16 AM | 1.15 | 348,780 | 0.58 | 11.57 | |
| 011 | E Pine St. Pump Station Emergency Overflow | Lake Washington | 1/13/21 12:07 AM | 1/13/21 9:08 AM | 9.02 | 2,200,000 | | | SSO |
| 012 | Belvoir Pump Station Emergency Overflow | Lake Washington | 1/2/21 10:01 PM | 1/3/21 12:17 AM | 2.27 | 185,553 | 2.19 | 102.35 | |
| 012 | Belvoir Pump Station Emergency Overflow | Lake Washington | 1/12/21 2:29 AM | 1/12/21 5:03 AM | 2.57 | 191,252 | 1.48 | 51.53 | |
| 014 | Montlake Overflow | Lake Washington Ship Canal | 1/1/21 3:19 PM | 1/1/21 3:35 PM | 0.27 | 287,391 | 0.94 | 69.77 | |
| 014 | Montlake Overflow | Lake Washington Ship Canal | 1/2/21 6:11 PM | 1/3/21 12:39 AM | 6.47 | 8,927,206 | 2.21 | 102.80 | |
| 014 | Montlake Overflow | Lake Washington Ship Canal | 1/5/21 10:34 PM | 1/5/21 11:26 PM | 0.87 | 933,838 | 0.62 | 11.40 | |
| 014 | Montlake Overflow | Lake Washington Ship Canal | 1/12/21 1:42 AM | 1/13/21 12:57 AM | 23.25 | 12,419,521 | 2.57 | 71.32 | |
| 014 | Montlake Overflow | Lake Washington Ship Canal | 10/28/21 3:12 PM | 10/29/21 1:29 AM | 10.28 | 2,648,093 | 1.78 | 29.87 | |

| DSN # | Overflow Name | Receiving Water | Event Starting Date/Time | Event Ending Date/Time | Duration (hours) | Volume (gallons) | Precipitation (inches) | Storm Duration (hours) | Note if DWO |
|---|---|---|---|---|---|---|---|---|---|
| 014 | Montlake Overflow | Lake Washington Ship Canal | 11/4/21 9:50 AM | 11/4/21 10:49 AM | 0.98 | 926,368 | 0.96 | 68.43 | |
| 014 | Montlake Overflow | Lake Washington Ship Canal | 11/6/21 7:33 PM | 11/6/21 7:47 PM | 0.23 | 13,985 | 0.33 | 10.8 | |
| 014 | Montlake Overflow | Lake Washington Ship Canal | 11/11/21 5:31 PM | 11/11/21 6:17 PM | 0.77 | 1,527,850 | 0.75 | 21.6 | |
| 015 | University Regulator | Lake Washington Ship Canal | 1/5/21 11:12 PM | 1/5/21 11:35 PM | 0.38 | 281,598 | 0.62 | 11.40 | |
| 015 | University Regulator | Lake Washington Ship Canal | 10/28/21 9:32 PM | 10/29/21 2:53 AM | 5.35 | 5,648,506 | 2.17 | 32.27 | |
| 015 | University Regulator | Lake Washington Ship Canal | 11/4/21 10:17 AM | 11/4/21 10:49 AM | 0.53 | 910,180 | 0.97 | 18.13 | |
| 015 | University Regulator | Lake Washington Ship Canal | 11/11/21 5:52 PM | 11/11/21 6:14 PM | 0.37 | 638,113 | 0.75 | 21.6 | |
| 027a | Denny Way Regulator | Elliott Bay | 1/13/21 12:05 AM | 1/13/21 12:09 AM | 0.07 | 3,421 | 2.61 | 40.13 | |
| 028 | King Street Regulator | Elliott Bay | 1/2/21 4:17 PM | 1/3/21 1:54 AM | 9.62 | 3,145,207 | 1.55 | 47.45 | |
| 028 | King Street Regulator | Elliott Bay | 1/5/21 10:13 PM | 1/6/21 3:58 AM | 5.75 | 1,121,683 | 0.48 | 15.82 | |
| 028 | King Street Regulator | Elliott Bay | 1/11/21 8:45 PM | 1/13/21 12:23 AM | 27.63 | 3,880,753 | 1.18 | 39.17 | |
| 028 | King Street Regulator | Elliott Bay | 2/1/21 10:23 PM | 2/1/21 10:29 PM | 0.10 | 16,653 | 1.09 | 89.22 | |
| 028 | King Street Regulator | Elliott Bay | 10/28/21 3:03 PM | 10/29/21 5:20 AM | 14.28 | 2,907,351 | 1.97 | 34.85 | |
| 028 | King Street Regulator | Elliott Bay | 12/11/21 3:30 AM | 12/11/21 4:44 AM | 1.23 | 59,315 | 0.58 | 12.83 | |
| 028 | King Street Regulator | Elliott Bay | 12/22/21 5:10 PM | 12/22/21 5:15 PM | 0.08 | 11,350 | 0.35 | 3.00 | |
| 029 | Connecticut St. Regulator (aka Kingdome) | Elliott Bay | 1/2/21 3:40 PM | 1/3/21 3:57 AM | 12.28 | 7,743,591 | 1.55 | 47.45 | |
| 029 | Connecticut St. Regulator (aka Kingdome) | Elliott Bay | 1/4/21 8:48 AM | 1/4/21 12:48 PM | 4.00 | 1,855,883 | 2.22 | 81.50 | |

| DSN # | Overflow Name | Receiving Water | Event Starting Date/Time | Event Ending Date/Time | Duration (hours) | Volume (gallons) | Precipitation (inches) | Storm Duration (hours) | Note if DWO |
|---|---|---|---|---|---|---|---|---|---|
| 029 | Connecticut St. Regulator (aka Kingdome) | Elliott Bay | 1/5/21 3:02 PM | 1/6/21 4:51 AM | 13.82 | 3,433,831 | 0.48 | 15.82 | |
| 029 | Connecticut St. Regulator (aka Kingdome) | Elliott Bay | 1/11/21 7:55 PM | 1/13/21 5:40 AM | 33.75 | 14,195,361 | 1.18 | 39.17 | |
| 029 | Connecticut St. Regulator (aka Kingdome) | Elliott Bay | 2/1/21 11:05 PM | 2/2/21 12:42 AM | 1.62 | 452,735 | 1.19 | 90.63 | |
| 029 | Connecticut St. Regulator (aka Kingdome) | Elliott Bay | 2/15/21 1:50 PM | 2/15/21 7:55 PM | 6.08 | 1,723,775 | 1.13 | 26.57 | |
| 029 | Connecticut St. Regulator (aka Kingdome) | Elliott Bay | 9/18/21 1:25 AM | 9/18/21 2:43 AM | 1.30 | 191,674 | 0.12 | 9.55 | |
| 030 | Lander St. Regulator | Elliott Bay | 1/2/21 12:35 PM | 1/6/21 12:49 PM | 96.23 | 115,502,302 | 3.35 | 102.35 | |
| 030 | Lander St. Regulator | Elliott Bay | 1/11/21 12:17 PM | 1/13/21 9:15 AM | 44.97 | 155,401,113 | 2.66 | 40.65 | |
| 030 | Lander St. Regulator | Elliott Bay | 2/1/21 10:31 PM | 2/2/21 4:50 PM | 18.32 | 10,245,356 | 1.67 | 105.87 | |
| 030 | Lander St. Regulator | Elliott Bay | 2/15/21 12:03 PM | 2/15/21 9:00 PM | 8.95 | 14,161,723 | 0.86 | 23.80 | |
| 030 | Lander St. Regulator | Elliott Bay | 3/25/21 3:54 AM | 3/25/21 5:25 AM | 1.52 | 2,139,365 | 0.69 | 12.58 | |
| 030 | Lander St. Regulator | Elliott Bay | 3/28/21 3:33 PM | 3/28/21 5:32 PM | 1.98 | 1,303,809 | 0.34 | 4.02 | |
| 030 | Lander St. Regulator | Elliott Bay | 6/7/21 12:47 AM | 6/7/21 1:22 AM | 0.58 | 539,643 | 0.6 | 6.57 | |
| 030 | Lander St. Regulator | Elliott Bay | 6/13/21 6:20 PM | 6/13/21 9:41 PM | 3.35 | 4,903,751 | 0.62 | 56.1 | |
| 030 | Lander St. Regulator | Elliott Bay | 9/18/21 1:23 AM | 9/18/21 2:36 AM | 1.22 | 1,442,537 | 0.13 | 16.95 | |
| 030 | Lander St. Regulator | Elliott Bay | 9/26/21 8:25 PM | 9/26/21 8:28 PM | 0.05 | 49 | 0.5 | 5.52 | |
| 030 | Lander St. Regulator | Elliott Bay | 10/21/21 11:19 PM | 10/22/21 12:21 AM | 1.03 | 699,207 | 0.48 | 5.00 | |
| 030 | Lander St. Regulator | Elliott Bay | 10/28/2021 14:22:00 | 10/29/2021 6:49:00 | 16.45 | 23,799,468 | 2.24 | 35.57 | |

| DSN # | Overflow Name | Receiving Water | Event Starting Date/Time | Event Ending Date/Time | Duration (hours) | Volume (gallons) | Precipitation (inches) | Storm Duration (hours) | Note if DWO |
|---|---|---|---|---|---|---|---|---|---|
| 030 | Lander St. Regulator | Elliott Bay | 11/3/21 11:53 PM | 11/4/21 11:35 AM | 11.70 | 2,470,291 | 1.29 | 69.33 | |
| 030 | Lander St. Regulator | Elliott Bay | 11/6/21 8:28 PM | 11/6/21 8:56 PM | 0.47 | 127,546 | 0.56 | 11.28 | |
| 030 | Lander St. Regulator | Elliott Bay | 11/9/21 5:46 PM | 11/9/21 6:22 PM | 0.60 | 284,799 | 0.58 | 17.27 | |
| 030 | Lander St. Regulator | Elliott Bay | 11/11/21 3:09 PM | 11/12/21 3:07 PM | 23.97 | 25,625,795 | 1.41 | 43.18 | |
| 030 | Lander St. Regulator | Elliott Bay | 11/13/21 8:31 PM | 11/15/21 1:18 PM | 40.78 | 20,940,442 | 1.61 | 43.95 | |
| 030 | Lander St. Regulator | Elliott Bay | 11/23/21 7:25 AM | 11/23/21 9:53 AM | 2.47 | 5,302,474 | 0.41 | 15.53 | |
| 030 | Lander St. Regulator | Elliott Bay | 11/25/21 7:27 PM | 11/25/21 8:38 PM | 1.18 | 1,060,637 | 0.56 | 22.68 | |
| 030 | Lander St. Regulator | Elliott Bay | 11/27/21 8:38 PM | 11/27/21 9:09 PM | 0.52 | 9,185 | 0.45 | 11.35 | |
| 030 | Lander St. Regulator | Elliott Bay | 12/11/21 1:05 AM | 12/11/21 3:56 AM | 2.85 | 5,238,740 | 0.69 | 13.03 | |
| 030 | Lander St. Regulator | Elliott Bay | 12/18/21 7:24 AM | 12/18/21 4:40 PM | 9.27 | 8,192,041 | 0.79 | 21.45 | |
| 030 | Lander St. Regulator | Elliott Bay | 12/22/21 3:44 PM | 12/23/21 2:12 AM | 10.47 | 2,652,490 | 0.84 | 28.08 | |
| 031 | Hanford #1 | Duwamish River via Diagonal Storm Drain | 11/11/21 5:42 PM | 11/11/21 6:12 PM | 0.50 | 9,653,640 | 0.78 | 21.97 | |
| 031 | Hanford #1 | Duwamish River via Diagonal Storm Drain | 1/2/21 4:58 PM | 1/3/21 4:27 AM | 11.48 | 8,815,774 | 1.70 | 48.42 | |
| 031 | Hanford #1 | Duwamish River via Diagonal Storm Drain | 1/5/21 10:56 PM | 1/6/21 1:59 AM | 3.05 | 124,461 | 0.84 | 13.98 | |
| 031 | Hanford #1 | Duwamish River via Diagonal Storm Drain | 11/11/21 5:42 PM | 11/11/21 6:12 PM | 0.50 | 230,078 | 0.78 | 21.97 | |
| 031a | Hanford #1 (Hanford @ Rainier) | Duwamish River via Diagonal Storm Drain | 1/2/21 4:58 PM | 1/3/21 4:27 AM | 11.48 | 8,815,774 | 1.70 | 48.42 | |
| 031a | Hanford #1 (Hanford @ Rainier) | Duwamish River via Diagonal Storm Drain | 1/5/21 10:56 PM | 1/6/21 1:59 AM | 3.05 | 124,461 | 0.84 | 13.98 | |
| 031a | Hanford #1 (Hanford @ Rainier) | Duwamish River via Diagonal Storm Drain | 1/12/21 1:58 AM | 1/13/21 5:45 AM | 27.78 | 9,423,562 | 2.66 | 40.65 | |
| 031b | Hanford #1 (Bayview S.) | Duwamish River via Diagonal Storm Drain | 1/2/21 11:15 PM | 1/2/21 11:45 PM | 0.50 | 6,566 | 1.66 | 46.88 | |

| DSN # | Overflow Name | Receiving Water | Event Starting Date/Time | Event Ending Date/Time | Duration (hours) | Volume (gallons) | Precipitation (inches) | Storm Duration (hours) | Note if DWO |
|---|---|---|---|---|---|---|---|---|---|
| 032 | Hanford #2 Regulator | Duwamish River - East Waterway | 1/2/21 12:31 PM | 1/6/21 1:31 PM | 97.00 | 164,789,337 | 3.35 | 102.35 | |
| 032 | Hanford #2 Regulator | Duwamish River - East Waterway | 1/11/21 12:16 PM | 1/13/21 5:55 PM | 53.65 | 103,500,907 | 2.66 | 40.65 | |
| 032 | Hanford #2 Regulator | Duwamish River - East Waterway | 2/1/21 3:08 PM | 2/2/21 10:46 PM | 31.63 | 27,346,978 | 1.75 | 110.87 | |
| 032 | Hanford #2 Regulator | Duwamish River - East Waterway | 2/15/21 5:40 PM | 2/16/21 1:07 AM | 7.45 | 704,061 | 0.89 | 28.05 | |
| 032 | Hanford #2 Regulator | Duwamish River - East Waterway | 3/24/21 8:03 PM | 3/25/21 7:24 AM | 11.35 | 23,708,711 | 0.76 | 14.7 | |
| 032 | Hanford #2 Regulator | Duwamish River - East Waterway | 3/28/21 3:29 PM | 3/28/21 5:15 PM | 1.77 | 7,016,254 | 0.34 | 4.02 | |
| 032 | Hanford #2 Regulator | Duwamish River - East Waterway | 6/7/21 12:49 AM | 6/7/21 1:56 AM | 1.12 | 8,165,176 | 0.61 | 7.42 | |
| 032 | Hanford #2 Regulator | Duwamish River - East Waterway | 6/13/21 6:17 PM | 6/13/21 8:26 PM | 2.15 | 3,636,277 | 1.09 | 56.10 | |
| 032 | Hanford #2 Regulator | Duwamish River - East Waterway | 9/18/21 1:26 AM | 9/18/21 3:52 AM | 2.43 | 5,409,213 | 0.65 | 17.22 | |
| 032 | Hanford #2 Regulator | Duwamish River - East Waterway | 9/26/21 8:16 PM | 9/26/21 9:37 PM | 1.35 | 1,668,965 | 0.5 | 5.52 | |
| 032 | Hanford #2 Regulator | Duwamish River - East Waterway | 10/21/2021 23:17:00 | 10/22/2021 2:17:00 | 3.00 | 5,525,210 | 0.57 | 6.72 | |
| 032 | Hanford #2 Regulator | Duwamish River - East Waterway | 10/28/2021 14:28:00 | 10/29/2021 11:08:00 | 20.67 | 67,274,444 | 2.36 | 39.57 | |
| 032 | Hanford #2 Regulator | Duwamish River - East Waterway | 11/3/2021 23:50:00 | 11/4/2021 14:13:00 | 14.38 | 17,170,973 | 1.33 | 72.00 | |
| 032 | Hanford #2 Regulator | Duwamish River - East Waterway | 11/6/2021 20:25:00 | 11/6/2021 22:26:00 | 2.02 | 3,770,621 | 0.58 | 12.45 | |
| 032 | Hanford #2 Regulator | Duwamish River - East Waterway | 11/9/2021 17:44:00 | 11/9/2021 20:11:00 | 2.45 | 4,931,648 | 0.58 | 17.27 | |
| 032 | Hanford #2 Regulator | Duwamish River - East Waterway | 11/11/2021 15:06:00 | 11/12/2021 17:21:00 | 26.25 | 42,744,961 | 1.41 | 43.18 | |
| 032 | Hanford #2 Regulator | Duwamish River - East Waterway | 11/13/2021 20:32:00 | 11/15/2021 17:06:00 | 44.57 | 49,176,126 | 1.61 | 43.95 | |
| 032 | Hanford #2 Regulator | Duwamish River - East Waterway | 11/23/2021 8:39:00 | 11/23/2021 9:57:00 | 1.30 | 31,394 | 0.41 | 15.53 | |
| 032 | Hanford #2 Regulator | Duwamish River - East Waterway | 11/25/2021 19:27:00 | 11/25/2021 21:47:00 | 2.33 | 5,922,726 | 0.56 | 22.68 | |

| DSN # | Overflow Name | Receiving Water | Event Starting Date/Time | Event Ending Date/Time | Duration (hours) | Volume (gallons) | Precipitation (inches) | Storm Duration (hours) | Note if DWO |
|---|---|---|---|---|---|---|---|---|---|
| 032 | Hanford #2 Regulator | Duwamish River - East Waterway | 11/27/2021 19:47:00 | 11/27/2021 23:30:00 | 3.72 | 6,435,494 | 0.48 | 12.20 | |
| 032 | Hanford #2 Regulator | Duwamish River - East Waterway | 12/11/21 1:08 AM | 12/11/21 7:18 AM | 6.17 | 18,286,066 | 0.78 | 15.93 | |
| 032 | Hanford #2 Regulator | Duwamish River - East Waterway | 12/18/21 7:34 AM | 12/18/21 5:27 PM | 9.88 | 15,752,555 | 0.79 | 21.45 | |
| 032 | Hanford #2 Regulator | Duwamish River - East Waterway | 12/22/21 3:46 PM | 12/23/21 3:11 AM | 11.42 | 13,435,122 | 0.64 | 18.87 | |
| 034 | East Duwamish | Duwamish River | 1/13/21 12:06 AM | 1/13/21 2:10 AM | 2.07 | 1,031,624 | 2.66 | 40.65 | |
| 035 | West Duwamish | Duwamish River | 1/13/21 12:14 AM | 1/13/21 2:15 AM | 2.02 | 148,364 | 2.66 | 40.65 | |
| 036 | Chelan Ave. Regulator | West Waterway of Duwamish River | 1/13/21 5:35 AM | 1/13/21 5:48 AM | 0.22 | 105 | 2.66 | 40.65 | |
| 036 | Chelan Ave. Regulator | West Waterway of Duwamish River | 10/29/21 2:31 AM | 10/29/21 3:12 AM | 0.68 | 17,931 | 2.66 | 33.00 | |
| 036 | Chelan Ave. Regulator | West Waterway of Duwamish River | 11/11/21 6:12 PM | 11/11/21 6:56 PM | 0.73 | 60,063 | 0.79 | 23.05 | |
| 036 | Chelan Ave. Regulator | West Waterway of Duwamish River | 11/13/21 11:37 PM | 11/14/21 12:01 AM | 0.40 | 4,720 | 0.66 | 7.12 | |
| 038 | Terminal 115 Overflow | Duwamish River | 1/13/21 12:30 AM | 1/13/21 2:30 AM | 2.00 | 251,559 | 2.81 | 40.10 | |
| 039 | Michigan Regulator (aka S Michigan Regulator) | Duwamish River | 1/5/2021 20:48:00 | 1/6/2021 0:31:00 | 3.72 | 2,299,002 | 0.78 | 12.87 | |
| 039 | Michigan Regulator (aka S Michigan Regulator) | Duwamish River | 1/11/2021 20:08:00 | 1/13/2021 3:21:00 | 31.22 | 10,488,957 | 2.81 | 40.10 | |
| 039 | Michigan Regulator (aka S Michigan Regulator) | Duwamish River | 2/2/21 3:53 PM | 2/2/21 4:03 PM | 0.17 | 196 | 1.91 | 106.82 | |
| 039 | Michigan Regulator (aka S Michigan Regulator) | Duwamish River | 2/15/21 2:26 PM | 2/15/21 4:01 PM | 1.58 | 36,149 | 0.91 | 28.28 | |
| 039 | Michigan Regulator (aka S Michigan Regulator) | Duwamish River | 3/28/21 2:02 PM | 3/28/21 3:13 PM | 1.18 | 195,391 | 0.41 | 4.15 | |

| DSN # | Overflow Name | Receiving Water | Event Starting Date/Time | Event Ending Date/Time | Duration (hours) | Volume (gallons) | Precipitation (inches) | Storm Duration (hours) | Note if DWO |
|---|---|---|---|---|---|---|---|---|---|
| 039 | Michigan Regulator (aka S Michigan Regulator) | Duwamish River | 9/17/21 10:49 PM | 9/17/21 11:17 PM | 0.47 | 135,269 | 0.3 | 14.28 | |
| 039 | Michigan Regulator (aka S Michigan Regulator) | Duwamish River | 9/27/21 3:25 PM | 9/27/21 3:54 PM | 0.48 | 44,234 | 0.35 | 25.02 | |
| 039 | Michigan Regulator (aka S Michigan Regulator) | Duwamish River | 10/28/21 3:01 PM | 10/29/21 3:17 AM | 12.27 | 829,975 | 1.80 | 33.38 | |
| 039 | Michigan Regulator (aka S Michigan Regulator) | Duwamish River | 11/4/21 9:41 AM | 11/4/21 10:57 AM | 1.27 | 494,936 | 1.26 | 68.13 | |
| 039 | Michigan Regulator (aka S Michigan Regulator) | Duwamish River | 11/6/21 7:27 PM | 11/6/21 8:23 PM | 0.93 | 186,509 | 0.68 | 16.93 | |
| 039 | Michigan Regulator (aka S Michigan Regulator) | Duwamish River | 11/9/21 5:11 PM | 11/9/21 5:44 PM | 0.55 | 43,532 | 0.72 | 16.87 | |
| 039 | Michigan Regulator (aka S Michigan Regulator) | Duwamish River | 11/13/21 8:25 PM | 11/14/21 12:30 AM | 4.08 | 534,070 | 0.75 | 7.52 | |
| 039 | Michigan Regulator (aka S Michigan Regulator) | Duwamish River | 12/22/21 3:26 PM | 12/22/21 4:58 PM | 1.53 | 618,792 | 0.79 | 20.1 | |
| 040 | 8th Ave. South Regulator (aka W. Marginal Way Pump Station) | Duwamish River | 1/2/21 11:17 PM | 1/3/21 12:09 AM | 0.87 | 89,420 | 1.67 | 47.02 | |
| 040 | 8th Ave. South Regulator (aka W. Marginal Way Pump Station) | Duwamish River | 1/12/21 11:30 PM | 1/13/21 12:55 AM | 1.42 | 172,306 | 2.81 | 40.10 | |
| 042 | West Michigan (AKA SW Michigan St. Regulator) | Duwamish River | 1/2/21 5:51 PM | 1/3/21 2:12 AM | 8.35 | 912,682 | 1.70 | 48.42 | |
| 042 | West Michigan (aka SW Michigan St regulator) | Duwamish River | 1/5/21 10:57 PM | 1/5/21 11:53 PM | 0.93 | 87,660 | 0.73 | 12.12 | |
| 042 | West Michigan (aka SW Michigan St. Regulator) | Duwamish River | 1/12/21 2:16 AM | 1/13/21 4:08 AM | 25.87 | 2,089,725 | 2.81 | 40.10 | |

| DSN # | Overflow Name | Receiving Water | Event Starting Date/Time | Event Ending Date/Time | Duration (hours) | Volume (gallons) | Precipitation (inches) | Storm Duration (hours) | Note if DWO |
|---|---|---|---|---|---|---|---|---|---|
| 042 | West Michigan (aka SW Michigan St. Regulator) | Duwamish River | 11/11/21 6:01 PM | 11/11/21 6:48 PM | 0.78 | 41,556 | 0.84 | 19.78 | |
| 048a | North Beach Pump Station (Wet Well) | Puget Sound | 1/2/21 8:58 PM | 1/3/21 1:41 AM | 4.73 | 541,055 | 2.89 | 80.93 | |
| 048a | North Beach Pump Station (Wet Well) | Puget Sound | 1/12/21 2:11 AM | 1/13/21 2:25 AM | 24.23 | 1,092,691 | 3.39 | 70.86 | |
| 049 | 30th Avenue NE Pump Station | Lake Washington | 1/2/21 9:40 PM | 1/3/21 1:00 AM | 3.33 | 6,367 | 2.23 | 103.05 | |
| 049 | 30th Avenue NE Pump Station | Lake Washington | 1/12/21 5:05 AM | 1/13/21 12:35 AM | 19.50 | 65,003 | 2.56 | 70.68 | |
| 052 | 53rd Avenue SW Pump Station | Puget Sound | 1/2/21 8:34 PM | 1/3/21 12:31 AM | 3.95 | 134,044 | 1.68 | 47.33 | |
| 052 | 53rd Avenue SW Pump Station | Puget Sound | 1/12/21 2:31 AM | 1/13/21 12:49 AM | 22.30 | 401,418 | 2.66 | 40.65 | |
| 054 | 63rd Avenue SW Pump Station | Puget Sound | 1/2/21 6:38 PM | 1/3/21 1:03 AM | 6.42 | 19,109,545 | 2.61 | 51.17 | |
| 054 | 63rd Avenue SW Pump Station | Puget Sound | 1/12/21 1:51 AM | 1/13/21 1:42 AM | 23.85 | 58,933,204 | 2.66 | 40.65 | |
| 057 | Barton Street Pump Station | Puget Sound | 1/13/21 12:00 AM | 1/13/21 12:17 AM | 0.28 | 69,034 | 2.87 | 40.07 | |

# Appendix B
# Treated CSO Events
## January–December 2021

| Outfall # | Overflow Name | Receiving Water | Event Ending Date/Time | Event Starting Date/Time | Duration (hours) | Volume (million gallons) | Precipitation (inches) | Storm Duration (hours) | Note if DWO |
|---|---|---|---|---|---|---|---|---|---|
| 051b | Alki WWTS | Puget Sound | 1/1/00 12:00 AM | 1/2/21 6:35 PM | 19.29 | 18.47 | 2.36 | 96.00 | |
| 051b | Alki WWTS | Puget Sound | 1/6/21 5:53 AM | 1/5/21 11:10 PM | 7.32 | 4.98 | 1.04 | 20.35 | |
| 051b | Alki WWTS | Puget Sound | 1/13/21 11:13 AM | 1/12/21 1:06 AM | 40.05 | 38.65 | 2.65 | 40.65 | |
| 051b | Alki WWTS | Puget Sound | 10/29/21 5:25 AM | 10/29/21 2:16 AM | 2.83 | 1.57 | 2.19 | 35.27 | |
| 046b | Carkeek WWTS | Puget Sound | 1/6/21 1:35 PM | 1/2/21 8:11 PM | 52.22 | 7.20 | 3.82 | 95.65 | |
| 046b | Carkeek WWTS | Puget Sound | 1/13/21 7:34 PM | 1/12/21 1:32 AM | 34.15 | 10.88 | 3.24 | 40.41 | |
| 046b | Carkeek WWTS | Puget Sound | 9/26/21 9:32 PM | 9/26/21 8:27 PM | 1.08 | 0.13 | 0.92 | 7.23 | |
| 046b | Carkeek WWTS | Puget Sound | 10/29/21 9:10 AM | 10/29/21 1:00 AM | 3.62 | 0.21 | 1.91 | 34.62 | |
| 027b | Elliott West WWTS | Puget Sound | 1/3/21 2:27 AM | 1/2/21 6:41 PM | 7.72 | 17.75 | 1.39 | 41.97 | |
| 027b | Elliott West WWTS | Puget Sound | 1/4/21 3:23 PM | 1/4/21 3:04 PM | 0.32 | 0.13 | 0.85 | 31.22 | |
| 027b | Elliott West WWTS | Puget Sound | 1/5/21 3:50 AM | 1/5/21 11:42 PM | 4.12 | 2.65 | 0.92 | 15.68 | |
| 027b | Elliott West WWTS | Puget Sound | 1/13/21 2:14 AM | 1/11/21 9:02 PM | 20.08 | 38.95 | 2.62 | 40.45 | |
| 027b | Elliott West WWTS | Puget Sound | 9/27/21 2:22 AM | 9/26/21 7:37 PM | 6.75 | 11.85 | 1.12 | 12.18 | |
| 027b | Elliott West WWTS | Puget Sound | 10/29/21 10:23 AM | 10/28/21 8:06 PM | 12.00 | 18.83 | 2.12 | 38.97 | |

| Outfall # | Overflow Name | Receiving Water | Event Ending Date/Time | Event Starting Date/Time | Duration (hours) | Volume (million gallons) | Precipitation (inches) | Storm Duration (hours) | Note if DWO |
|---|---|---|---|---|---|---|---|---|---|
| 027b | Elliott West WWTS | Puget Sound | 11/12/21 2:39 PM | 11/12/21 3:08 AM | 2.75 | 1.24 | 1.37 | 42.57 | |
| 044b | MLK/ Henderson CSO Treatment Facility Outfall | Duwamish River | 1/3/22 6:25 AM | 1/2/22 10:38 PM | 7.78 | 4.45 | 2.47 | 43.50 | |
| 044b | MLK/ Henderson CSO Treatment Facility Outfall | Duwamish River | 1/13/22 5:34 AM | 1/12/22 6:34 PM | 11.00 | 6.04 | 3.01 | 40.00 | |
| 1 | West Point[1] | Puget Sound | 1/6/21 5:04 AM | 1/2/21 3:13 PM | 39.43 | 52.52 | 3.39 | 177.65 | |
| 1 | West Point[2] | Puget Sound | 1/9/21 9:05 AM | 1/9/21 8:41 AM | 0.03 | 0.024 | 0.00 | 11.23 | |
| 1 | West Point[1] | Puget Sound | 1/13/21 6:19 AM | 1/11/21 11:29 AM | 33.08 | 66.40 | 3.38 | 117.25 | |
| 1 | West Point[1] | Puget Sound | 2/2/21 1:51 AM | 2/1/21 10:58 PM | 1.03 | 0.95 | 0.88 | 74.10 | |
| 1 | West Point[3] | Puget Sound | 2/2/21 11:31 AM | 2/2/21 10:51 AM | 0.67 | 3.65 | 0.61 | 85.20 | |
| 1 | West Point[1] | Puget Sound | 2/15/21 8:47 PM | 2/15/21 12:47 PM | 2.08 | 8.30 | 0.41 | 53.15 | |
| 1 | West Point[1,4] | Puget Sound | 3/11/21 3:25 AM | 3/10/21 2:13 PM | 13.20 | 0.35 | 0.00 | 0.0 | |
| 1 | West Point[1] | Puget Sound | 3/25/21 5:51 AM | 3/25/21 3:38 AM | 2.08 | 1.29 | 0.55 | 12.82 | |
| 1 | West Point[1] | Puget Sound | 3/28/21 4:59 PM | 3/28/21 3:56 PM | 0.52 | 0.02 | 0.33 | 2.93 | |
| 1 | West Point[1] | Puget Sound | 6/13/21 9:18 PM | 6/13/21 5:11 PM | 4.13 | 3.03 | 0.81 | 21.50 | |
| 1 | West Point[1] | Puget Sound | 9/18/21 4:09 AM | 9/18/21 1:25 AM | 2.73 | 2.43 | 1.14 | 17.33 | |
| 1 | West Point[1] | Puget Sound | 10/22/21 12:58 AM | 10/21/21 11:43 PM | 1.23 | 1.03 | 0.69 | 43.82 | |

| Outfall # | Overflow Name | Receiving Water | Event Ending Date/Time | Event Starting Date/Time | Duration (hours) | Volume (million gallons) | Precipitation (inches) | Storm Duration (hours) | Note if DWO |
|---|---|---|---|---|---|---|---|---|---|
| 1 | West Point[1] | Puget Sound | 10/29/21 7:14 AM | 10/28/21 3:58 PM | 13.16 | 21.03 | 1.94 | 36.35 | |
| 1 | West Point[1] | Puget Sound | 11/4/21 1:17 PM | 11/3/21 11:04 PM | 4.55 | 5.17 | 1.15 | 18.85 | |
| 1 | West Point[1] | Puget Sound | 11/12/21 2:35 PM | 11/11/21 3:06 PM | 4.97 | 2.92 | 1.47 | 38.95 | |
| 1 | West Point[1] | Puget Sound | 11/15/21 2:49 PM | 11/13/21 8:24 PM | 6.75 | 5.96 | 1.45 | 109.80 | |
| 1 | West Point[1] | Puget Sound | 11/23/21 8:49 AM | 11/23/21 6:22 AM | 2.45 | 2.45 | 0.48 | 13.52 | |
| 1 | West Point[1] | Puget Sound | 11/25/21 9:21 PM | 11/25/21 7:07 PM | 1.30 | 0.13 | 0.55 | 23.28 | |
| 1 | West Point[1] | Puget Sound | 12/11/21 5:06 AM | 12/11/21 1:07 AM | 3.98 | 6.54 | 0.57 | 13.32 | |
| 1 | West Point[1] | Puget Sound | 12/18/21 5:03 PM | 12/18/21 12:38 PM | 2.52 | 0.45 | 0.70 | 20.83 | |
| 1 | West Point[1] | Puget Sound | 12/23/21 2:54 AM | 12/22/21 4:19 PM | 3.75 | 1.51 | 0.88 | 27.78 | |
| **Total Volume** | | | | | | **370.13** | | | |

Notes:

[1] Flow at West Point exceeded 300 MGD.

[2] Secondary diversion caused by power outage at West Point.

[3] Secondary diversion caused by Interbay PS pump failure at West Point.

[4] This event is part of a 2-day-long storm and CSO event.

# Appendix C
# Alki Wet Weather Treatment Station
# Annual Report

## January–December 2021

## Executive Summary

This 2021 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).

The year 2021 was slightly wetter than normal, producing four filling events and four discharge events at Alki WWTS. The four discharge events occurred over eight reporting days and two months. The Alki WWTS received a total of 74.5 million gallons (MG) and discharged 63.7 MG. A total of 44.66 in. of rain fell in 2021 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 2019 to report Alki WWTS rainfall data. The 2021 annual rainfall at Sea-Tac was 43.33 in.; the 20-year average of annual total rainfall at Sea-Tac was 39.76 in.

Table C-1 summarizes the performance of Alki WWTS in 2021. This station complied with all permit conditions except the annual total suspended solids (TSS) removal. The annual removal for 2021 was 36.0 percent which did not meet the annual average 50 percent TSS removal limit. Effluent settleable solids (SS) averaged 0.10 milliliters/liter/hour (mL/L/hr), which met the annual average permit limit of 0.3 ml/L/hr. The effluent total residual chlorine (TRC) averaged no greater than 231 micrograms per liter (µg/L) on any discharge day. The effluent fecal coliform geomeans were no greater than 3.5 counts per 100 mL during any discharge month. The effluent pH was between the permit limits of pH 6.0 to pH 9.0 for all discharge events.

**Table C-1. Alki WWTS Permit Performance in 2021**

| Parameter | Performance | Permit Conditions |
|---|---|---|
| Discharge events (number)[a] | **4** | **29** |
| Discharge volume million gallons (MG)[a] | **63.7** | **108** |
| Annual average SS (mL/L/hr) | **0.10** | **0.3** |
| Annual average TSS removal – including all discharge events percent | **36.0** | **50** |
| Instantaneous minimum effluent pH, frequency of discharge days with pH < 6.0 | **0 out of 8 discharge days** | **≥ 6.0** |
| Instantaneous maximum effluent pH, frequency of discharge days with pH > 9.0 | **0 out of 8 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 8 discharge days** | **≤ ≤ 234 µg/L** |
| Monthly fecal coliform geomean, frequency of months with monthly geomean >400/100mL | **0 out of 2 discharge months** | **400/ 100 mL** |

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

### Suspended and Settleable Solids

TSS removal averaged 36.0 percent in 2021, which includes all discharge events. This did not meet the annual average TSS removal permit level of 50 percent The annual event average SS was 0.10 mL/L/hr, thus 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 the sedimentation tanks and thus allow more solids to settle and be removed by the sludge removal system. In early 2021, 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 2021 met the fecal coliform monthly geomean limit of 400 counts per 100 mL; the results were 3.5 counts per 100 mL in January 2021 and 1 count per 100 mL in October 2021. All fecal coliform samples collected during these months were valid.

### Total Residual Chlorine

All eight discharge days at the Alki WWTS met the daily average TRC permit limit of 234 mg/L. The 2021 annual effluent TRC average was 6.5 µg/L, with the maximum daily average of 231 µg/L during the October 28, 2021, discharge event.

### Instantaneous Minimum and Maximum Effluent pH

Alki WWTP complied with the instantaneous pH permit limits throughout 2021. This is an improvement from previous years when the minimal allowable pH of 6.0 was violated during multiple events. This may be due to modifications that were made to the sampling pump stilling well.

### Operation and Maintenance

Major upgrades to the Alki WWTS were completed in recent years; staff evaluated and made adjustments as needed in 2021. Highlights of O&M activities during 2021 include:

- Conducted annual CSO refresher training for the operators in September 2021.
- Quarterly/monthly testing of hypochlorite and bisulfite solution strength; set point changes made to chemical feed pumps based on solution strength; shipments of full-strength solutions ordered as necessary.
- Continued to conduct debriefings with O&M staff after discharge events to review and discuss the discharge and treatment performance and make any needed operational adjustments for subsequent events.
- Periodically cleaned 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 preventive 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 two force mains 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.

### Alki Digester Tank and Process Evaluation to Improvement Solids/TSS Removal Project

A project was started in early 2021 to evaluate if the abandoned digester tanks could be used as solids holding tanks during discharge events. This project has included a structural inspection and evaluation of the digester tanks and evaluation of potential treatment process changes to improve the solids removal at Alki. The preliminary findings indicate that the digester

tanks are structurally sound for holding solids. Further evaluations of treatment performance were also recommended, including installation of online solids monitoring and additional sampling to perform more robust solids mass balances. The follow-up phase would be data analysis and recommendations, if any, for potential treatment process changes. These discussions are ongoing into 2022.

### Near Future Operation

As with all WWTSs, 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 operations and maintenance. 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 strategies to improve TSS removal at Alki WWTS.

## Table C-2. Alki WWTS 2021 Annual Event Data Summary

| Month | Day | Alki Inflow Event Number | Alki Inflow Volume (MG) | Alki Discharge Event Number | Alki Discharge Volume (MG) | Total Influent TSS (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 | 2 | 1 | 15.65 | 1 | 13.98 | 1,958 | 1,783 | | 0.0 | | 1/1 | 10 | 6.3/6.8 |
| | 3 | 1 | 4.07 | 1 | 1.29 | 1,392 | 188 | | | | | 3 | 6.5/6.8 |
| | 4 | 1 | 3.36 | 1 | 3.20 | 1,597 | 644 | | 0.1 | 0.1 | 1,100 | 3 | 6.5/6.9 |
| | 5 | 2 | 6.68 | 2 | 4.98 | 2,117 | 2,342 | | 0.2 | 0.2 | 1/1 | 7 | 6.4/6.8 |
| | 11 | 3 | 12.46 | 3 | 10.66 | 5,923 | 4,337 | | 0.1 | | 1/1 | 56 | 6.4/6.9 |
| | 12 | 3 | 26.07 | 3 | 26.07 | 10,871 | 6,523 | | 0.1 | | 68 | 10 | 6.5/7.0 |
| | 13 | 3 | 3.09 | 3 | 1.92 | 1,005 | 341 | | 0 | 0.1 | 1 | 3 | 6.7/6.9 |
| | Instant. Min/Max pH | | | | | | | | | | | | **6.3/6.8** |
| | Event/Daily Max | | | | | | | | | **0.1** | | **56** | |
| | Monthly Total/Avg/GeoMean | **3** | **71.4** | **3** | **62.1** | **24,863** | **16,158** | **35.0%** | | | **3.5** | | |
| February | 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** | | |
| 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 | 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** | | |
| 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** | | |
| September | 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 | 28 | 1 | 3.13 | 1 | 1.57 | 1,018 | 414 | | 0.1 | 0.1 | 1/1 | 231 | 6.6/7.2 |
| | 29 | 1 | 0.02 | | | | | | | | | | |
| | Instant. Min/Max pH | | | | | | | | | | | | **6.6/7.2** |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Event/Daily Max | | | | | | | | | 0.1 | | 231 | |
| | Monthly Total/Avg/GeoMean | 1 | 3.2 | 1 | 1.6 | 1,018 | 414 | 59.4% | | | 1.0 | | |
| November | 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 | | |
| December | 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 | | |
| **Total** | | 4 | 74.53 | 4 | 63.67 | 25,881 | 16,571 | | | | | | |
| **Inst. pH Min/Max** | | | | | | | | | | | | | |
| **Max (GEM, SS, TRC)** | | | | | | | | | | | 3.5 | 231 | |
| **Annual Average** | | | | | | | by mass: | 36.0% | | 0.10 | 2.3 | 6.5 | |

**Notes:**
ND = No Discharge
Red = NPDES permit exceedance
%NS = No sample collected
^ED = End of discharge; fecal coliform samples were collected before next grab sample was required.

# Appendix D
# Carkeek Wet Weather Treatment Station
# Annual Report

### January–December 2021

## Executive Summary

This 2021 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.

The year 2021 was slightly wetter than normal for the region, producing 14 filling events and four discharge events at Carkeek WWTS. The four discharge events occurred over 11 reporting days and three months. Carkeek WWTS received a total of 20.4 million gallons (MG) and discharged 18.4 MG. Rainfall at the Ballard Station rain gauge, the gauge used for Carkeek WWTS reporting, totaled 40.73 inches (in.) in 2021. By comparison, 2021 annual rainfall at Sea-Tac was 43.33 in.; the 20-year average of annual total rainfall at Sea-Tac is 39.76 in.

Table D-1 summarizes the performance of Carkeek WWTS in 2021. Carkeek WWTS complied with all permit conditions except for the daily average total residual chlorine (TRC) requirement on 2 of 11 discharge days. On these two days, the station exceeded the permitted level of a daily average of 490 micrograms per liter (µg/L); it reached as high as 3139 µg/L. Carkeek WWTS met its annual average suspended solids (SS) limit with the average measuring 0.12 ml/L/hr; the NPDES permit limit is 0.3 ml/L/hr. Total suspended solids (TSS) removal averaged 73.3 percent which met the annual average 50 percent TSS removal limit. The effluent fecal coliform geomeans were no greater than 4.3 counts per 100 mL during 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 2021**

| Parameter | Performance | Permit Conditions |
|---|---|---|
| Discharge events (number)[a] | **4** | **10** |
| Discharge volume million gallons (MG)[a] | **18.4** | **46** |
| Annual average SS (mL/L/hr) | **0.12** | **0.3** |
| Annual average TSS removal - including all discharge events (%) | **73.3** | **50** |
| Instantaneous minimum effluent pH, frequency of discharge days with pH < 6.0 | **0 out of 11 discharge days** | **≥ 6.0** |
| Instantaneous maximum effluent pH, frequency of discharge days with pH> 9.0 | **0 out of 11 discharge days** | **≤ 9.0** |
| Total residual chlorine (TRC), maximum of daily averages (µg/L), frequency of discharge days with TRC >490 µg/L | **2 out of 11 discharge days** | **≤ 490 µg/L** |
| Monthly fecal coliform geomean, frequency of months with monthly geomean >400/100mL | **0 out of 3 discharge months** | **400/100 mL** |

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

## Suspended and Settleable Solids

Total suspended solids (TSS) removal averaged 73.3 percent thereby meeting the annual average TSS removal NPDES permit limit of 50 percent. The annual settleable solids (SS) for the year averaged 0.12 ml/L/hr., meeting the NPDES Permit limit annual average of 0.3 ml/L/hr.

## Fecal Coliform Bacteria

Carkeek met the fecal coliform monthly geomean permit limit of 400 counts per 100 mL for each of the 3 discharge months in 2021. The annual average of the monthly geomeans was 4.3 counts/100 ml. All fecal coliform samples collected during these months were valid.

## Instantaneous Minimum/Maximum pH

The instantaneous minimum and maximum pH during the 2021 reporting period was 6.1 and 8.1 respectively, thereby meeting the NPDES permit limits of pH 6.0 and pH 9.0.

## Total Residual Chlorine

Carkeek did not meet the daily maximum average total residual chlorine (TRC) on 2 of 11 discharge days during 2021. The maximum daily average effluent TRC during the 2021 reporting year was 3139 µg/L, thereby not meeting the NPDES permit limit of 490 µg/L. The two TRC exceedances occurred during the same discharge event on October 28th – 29th. The discharge event on October 28th lasted for only 3.4 hours and 0.21 MG discharge volume, after which the discharge stopped, and resumed again on October 29th, lasting less than 20 minutes and 0.002 MG total discharge volume. This event resulted in a TRC of 3139 µg/L on October 28th and 1145 µg/L on October 29th. Both exceedances were a result of the short event – operators were unable to tune-in the chemical feed to prevent permit exceedances before the

event ended. There is a project underway to assess and modify the sodium bisulfite (SBS) storage and feed system. The purpose of this project is to address chemical feed and dechlorination issues to avoid violating the permitted TRC limit. Construction of the new SBS system is expected to be completed in early 2023.

## Operation and Maintenance

Highlights of O&M activities during 2021 include:

- Conducted annual CSO refresher training for the operators in October 2021.
- Received shipments of both sodium hypochlorite and sodium bisulfite treatment chemicals.
- Continued to conduct debriefings with O&M staff after each discharge event 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.
- Installation of data loggers for continuous data collection during instances of telemetry loss.

## 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 few 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. 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 2021 Annual Event Data Summary

| Month | Day | Carkeek Inflow Event Number | Carkeek Inflow Volume (MG) | Carkeek Discharge Event Number | Carkeek Discharge Volume (MG) | Total Influent TSS (lbs) | Total Effluent TSS Discharged @ Carkeek + WP (lbs) | % removal | Carkeek Effl. Daily Settl Solids (ml/l/hr) | Carkeek Effl. Settl Solids Event avg (ml/l/hr) | Carkeek Avg daily Effl. Fecal Coliforms (#/100 ml) | Carkeek Effl. Residual Chlorine Daily Average (µg/l) | Daily Min/Max pH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| January | 2 | 1 | 3.28 | 1 | 2.98 | 1,614 | 533 | | 0 | | 1-Jan | 168 | 6.4/7.6 |
| | 3 | 1 | 0.57 | 1 | 0.62 | 471 | 122 | | 0.1 | | 1 | 381 | 6.5/6.8 |
| | 4 | 1 | 1.63 | 1 | 1.92 | 775 | 356 | | 0.1 | | 1 | 113 | 6.4/6.6 |
| | 5 | 1 | 1.55 | 1 | 1.39 | 672 | 173 | | 0 | | 1 | 131 | 6.5/6.7 |
| | 6 | 1 | 0.256 | 1 | 0.288 | NM | NM | | NM | **0.1** | 1 | 225 | 6.5/6.5 |
| | 11 | 2 | 2.77 | 2 | 2.189 | 2,818 | 472 | | 0 | | Jan-45 | 25 | 6.1/7.3 |
| | 12 | 2 | 7.37 | 2 | 7.55 | 2,827 | 1,220 | | 0.1 | | 78 | 6 | 6.3/6.6 |
| | 13 | 2 | 1.02 | 2 | 1.14 | 519 | 158 | | 0 | **0** | 610 | 6 | 6.4/6.6 |
| | Instant. Min/Max pH | | | | | | | | | | | | **6.1/7.6** |
| | Event/Daily Max | | | | | | | | | **0.1** | | **381** | |
| | Monthly Total/Avg/GeoMean | **2** | **18.45** | **2** | **18.08** | **9,696** | **3,034** | **68.70%** | | | **4.3** | | |
| February | 1 | 1 | 0.1 | ND | ND | 86 | 8 | | | | | | |
| | Instant. Min/Max pH | | | | | | | | | | | | **ND** |
| | Event/Daily Max | | | | | | | | | **ND** | | **ND** | |
| | Monthly Total/Avg/GeoMean | **1** | **0.07** | **ND** | **0** | **86** | **8** | **90.30%** | | | **ND** | | |
| March | No Inflow/No Disch. | | | | | | | | | | | | |
| | Instant. Min/Max pH | | | | | | | | | | | | **ND** |
| | Event/Daily Max | | | | | | | | | **ND** | | **ND** | |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Monthly Total/Avg/GeoMean | **0** | **0** | **ND** | **0** | **-** | **-** | **-** | | | **ND** | | |
| April | No Inflow/No Disch. | | | | | | | | | | | | |
| | Instant. Min/Max pH | | | | | | | | | | | | **ND** |
| | Event/Daily Max | | | | | | | | | **ND** | | **ND** | |
| | Monthly Total/Avg/GeoMean | **0** | **0** | **ND** | **0** | **-** | **-** | **-** | | | **ND** | | |
| May | No Inflow/No Disch. | | | | | | | | | | | | |
| | Instant. Min/Max pH | | | | | | | | | | | | **ND** |
| | Event/Daily Max | | | | | | | | | **ND** | | **ND** | |
| | Monthly Total/Avg/GeoMean | **0** | **0** | **ND** | **0** | **-** | **-** | **-** | | | **ND** | | |
| June | No Inflow/No Disch. | | | | | | | | | | | | |
| | Instant. Min/Max pH | | | | | | | | | | | | **ND** |
| | Event/Daily Max | | | | | | | | | **ND** | | **ND** | |
| | Monthly Total/Avg/GeoMean | **0** | **0** | **ND** | **0** | **-** | **-** | **-** | | | **ND** | | |
| July | No Inflow/No Disch. | | | | | | | | | | | | |
| | Instant. Min/Max pH | | | | | | | | | | | | **ND** |
| | Event/Daily Max | | | | | | | | | **ND** | | **ND** | |
| | Monthly Total/Avg/GeoMean | **0** | **0** | **ND** | **0** | **-** | **-** | **-** | | | **ND** | | |
| August | No Inflow/No Disch. | | | | | | | | | | | | |
| | Instant. Min/Max pH | | | | | | | | | | | | **ND** |
| | Event/Daily Max | | | | | | | | | **ND** | | **ND** | |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Monthly Total/Avg/GeoMean | **0** | **0** | **ND** | **0** | **-** | **-** | **-** | | | **ND** | | |
| September | 17 | 1 | 0.01 | | | 323 | 10 | | | | | | |
| | 19 | 2 | 0.04 | | | 44 | 4 | | | | | | |
| | 26 | 3 | 0.47 | 1 | 0.13 | 1614 | 170 | | 0.4 | 0.4 | 20 | 440 | 7.1/7.2 |
| | 27 | 3 | 0.03 | | | NM | NM | | | | | | |
| | Instant. Min/Max pH | | | | | | | | | | | | **7.1/7.2** |
| | Event/Daily Max | | | | | | | | | **0.4** | | **440** | |
| | Monthly Total/Avg/GeoMean | **3** | **0.55** | **1** | **0.13** | **1,981** | **184** | **90.70%** | | | **20** | | |
| October | 28 | 1 | 0.72 | 1 | 0.21 | 389 | 110 | | 0 | | 1 | 3139 | 6.6/8.1 |
| | 29 | 1 | 0.01 | 1 | 0.002 | NS | 0.2 | | 0 | 0 | 1 | 1140 | 6.7/6.7 |
| | Instant. Min/Max pH | | | | | | | | | | | | **6.6/8.1** |
| | Event/Daily Max | | | | | | | | | **0** | | **3139** | |
| | Monthly Total/Avg/GeoMean | **1** | **0.73** | **1** | **0.21** | **389** | **110** | **71.70%** | | | **1** | | |
| November | 4 | 1 | 0.12 | | | 113 | 14 | | | | | | |
| | 11 | 2 | 0.05 | | | 61 | 5 | | | | | | |
| | 12 | 2 | 0.003 | | | 2 | 0.2 | | | | | | |
| | 15 | 3 | 0.28 | | | 348 | 24 | | | | | | |
| | Instant. Min/Max pH | | | | | | | | | | | | **ND** |
| | Event/Daily Max | | | | | | | | | **ND** | | **ND** | |
| | Monthly Total/Avg/GeoMean | **3** | **0.44** | **0** | **0** | **523** | **44** | **91.60%** | | | **ND** | | |
| December | 10 | 1 | 0.06 | | | 50 | 3 | | | | | | |
| | 18 | 2 | 0.07 | | | 56 | 39 | | | | | | |
| | 22 | 3 | 0.04 | | | 38 | 8 | | | | | | |
| | 24 | 4 | 0.04 | | | 28 | 3 | | | | | | |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Instant. Min/Max pH<br>Event/Daily Max<br>Monthly Total/Avg/GeoMean | 4 | 0.2 | 0 | 0 | 173 | 54 | 68.90% | | ND | ND | ND | ND |
| **Total** | | **14** | **20.43** | **4** | **18.41** | **12,848** | **3,434** | | | | | | |
| **Inst. pH Min/Max** | | | | | | | | | | | | | **6.1/8.1** |
| **Max (GEM, SS, TRC)** | | | | | | | | | | | **20** | **3139** | |
| **Annual Average** | | | | | | | by mass: | **73.30%** | | **0.12** | **4.3** | **525** | |

**Notes:**
ND = No Discharge
Red = NPDES permit exceedance
%NS = No sample collected
^ED = End of discharge; fecal coliform samples were collected discharge ended before next grab sample was required.

# Appendix E
# Elliott West Wet Weather Treatment Station
# Annual Report

## January–December 2021

### Executive Summary

This 2021 annual report summarizes the performance of the Elliott West Wet Weather Treatment Station (EW 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.

2021 was a slightly wetter than normal year, resulting in 36 inflow events and seven discharge events at EW WWTS. The seven discharge events occurred over ten reporting days and four reporting months. EW WWTS influent totaled 283.8 million gallons (MG) and 91.4 MG were discharged in 2021. Total rainfall in 2021 was 34.99 inches as measured at the Denny Way rain gauge (3165 Alaskan Way in Seattle). The annual total at Denny Way is considerably lower than the 2021 annual rainfall total of 43.33 inches at Seattle Tacoma International Airport (SeaTac). The 20-year average of annual rainfall at Sea-Tac is 39.76 inches.

The performance of EW WWTS in 2021 has been summarized below in Table E-1. EW WWTS did not comply with eight of a possible 36 permit conditions in 2021. EW WWTS fully complied with the permit limits for annual average total suspended solids (TSS) removal of 50 percent, and instantaneous effluent maximum pH 9.0. EW WWTS had permit violations for fecal coliform monthly geomean, maximum daily average total residual chlorine (TRC) of 109 µg/L, and daily instantaneous minimum pH of lower than 6.0 in 2021. TSS removal averaged 58.3 percent over the year, which accounts for all inflow and discharge events. The station did not meet the fecal coliform permit limit of 400 counts per 100 mL monthly geomean once out of the four discharge months. EW WWTS did not comply with the annual average settleable solids (SS) limit of 0.3 milliliters/liter/hour (mL/L/hr.); effluent SS averaged 3.83 mL/L/hr in 2021. Daily average total residual chlorine (TRC) exceeded the permitted level of 109 µg/L on two of ten discharge days; it reached as high as 467 µg/L. Effluent pH dropped below the permitted minimum limit of pH 6.0 on four of the ten discharge days; it reached as low as pH 5.6 during one event.

All required samples were collected, and all required measurements were completed in 2021 except for the three- to eight-hour fecal sample for the October 28, 2021, event. This value was reported as “Not Measured/ Not Reported” in the October 2021 DMR. The non-reported value was due to a laboratory error which led to an invalid result.

**Table E-1. Elliott West WWTS Permit Performance in 2021**

| Parameter | Performance | Permit Conditions |
|---|---|---|
| Discharge events (number) | **7** | **NA** |
| Discharge volume million gallons (MG) | **91.4** | **NA** |
| Annual average SS (mL/L/hr) | **3.83** | **0.3** |
| Annual average TSS removal - including all discharge events (%) | **58.3** | **50** |
| Instantaneous minimum effluent pH, frequency of discharge days with pH < 6.0 | **4 out of 10 discharge days** | **≥ 6.0** |
| Instantaneous maximum effluent pH, frequency of discharge days with pH > 9.0 | **0 out of 10 discharge days** | **≤ 9.0** |
| Total residual chlorine (TRC), maximum of daily averages (µg/L), frequency of discharge days with TRC >109 µg/L | **2 out of 10 discharge days** | **109 µg/L** |
| Monthly fecal coliform geomean, frequency of months with monthly geomean >400/100mL | **1 out of 4 discharge months** | **400/100 mL** |

Numbers in red indicate a permit exceedance.

## Suspended and Settleable Solids

In 2021, EW WWTS met the permit annual average total suspended solids (TSS) removal limit of 50 percent with an average of 58.3 percent. EW WWTS did not meet the permit annual settleable solids (SS) average limit of 0.3 ml/L/hr. The annual SS concentration for 2021 averaged 3.83 mL/L/hr with a maximum event SS value of 15.0 mL/L/hr on January 4, 2021.

In August 2020, King County hired a contractor to clean out the EW WWTS wet well of the accumulated solids. The expectation was that 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 noncompliance of SS permit limits. The contractor was able to remove approximately 32 tons of material from the wet well. Unfortunately, the wet well clean-out in August 2020 did not improve the settleable solids removal in 2021. 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. Discussions are ongoing to decide if wet well clean-out should be a re-occurring activity. Along with the wet well cleaning, King County started a project in 2020 to model particle deposition and resuspension in the EW 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 re-occurring preventive maintenance plan.

With the ongoing challenges of meeting the NPDES permit limits at EW 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. The final project report is completed and available.

### Fecal Coliform Bacteria

In 2021, Elliott West WWTS did not meet the fecal coliform NPDES permit limit of 400 counts per 100 mL monthly geomean during one out of the four discharge months. The maximum monthly geomean for fecal coliform bacteria was calculated as 330,000 counts per 100 mL occurred in the month of November. The annual average of the monthly geomeans was 82,550 counts per 100 mL. The single event that had the high fecal coliform count and resulted in geomean greater than the permit limit occurred on November 11, 2021. That event was a very short duration with less than three hours of discharge. During the event, the sodium hypochlorite dose was high, averaging over 40 mg/L and the pre-dechlorination total residual chlorine (TRC) was very low. Although the chlorine residual analyzer should serve as a verification of the high dosage, the hypochlorite strength and analyzer's calibration were also checked. A fresh batch of hypochlorite was received on October 30, 2021, and the TRC analyzers are checked and calibrated weekly. Based on the high sodium hypochlorite dosage, there should have been sufficient disinfection for the event. It is unknown as to the cause of high fecal coliform numbers from the single sample collected.

On October 28, 2021 there was an invalid three to eight-hour fecal coliform sample that resulted in non-reported result. The laboratory procedure for the analysis of fecal coliform requires that the sample culture rack be transferred to a water bath after three hours in a dry incubator, but the transfer was not completed within the required timeframe. This caused the results to be reported as invalid. In response, the West Point process laboratory and West Point operations staff have reviewed the procedure for transferring lab samples after-hours and have conducted additional training.

The hypochlorite dosing set point has been increased in response to high fecal coliform values during past events, and further increases in hypochlorite dose set point may be applied during future 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 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 2021, there were two out of ten 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 100 µg/L. The maximum daily average TRC of 467 µg/L occurred on January 4, 2021. This was a very short discharge lasting only 19 minutes. The KC operations staff was unable to tune-in the chemical feed for sodium bisulfite solution (SBS) before the event ended. Efforts are ongoing to address the dechlorination system at EW WWTS. The EW 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 2021 exceeded the minimum permit limit of pH <6.0 on four out of ten total discharge days. The instantaneous maximum pH limit of <9.0 was met for each of the discharge days in 2021.

The effluent pH reached as low as pH 5.6 on January 12, 2021; this was the lowest effluent pH of the year. The January 11 to 12, 2021, discharge event followed consecutive rainstorms in the region. The low alkalinity CSO flows, along with potential for over-dosing the acidic SBS during high discharge flows and high pre-dechlorinated 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, e.g., 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 to 225 mg/L $CaCO_3$ on dry weather days. Further analysis of the data trends of discharge events is ongoing. 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.

### Operation and Maintenance

Highlights of O&M activities at EWCSO during 2021:

- Conducted annual CSO refresher training for the operators in September 2021.
- 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 to remove additional solids, which takes advantage of the turbulence and re-suspension of solids in the wet well caused by the larger main pumps and increases the amount of solids in the return flows to the West Point Treatment Plant.
- Continued to conduct debriefings with O&M staff after discharge events to review and

discuss the discharge and treatment performance and make any needed operational adjustments for subsequent events.

- Continued with additional procedures to the post-discharge event routines including equipment testing, cleaning and de-ragging within the dechlorination and final effluent vaults/structures. Equipment includes both pre-dechlorination 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 EW WWTS to dilute the 38 percent SBS to 20 percent solution.
- Implemented a “semi-auto” mode for SBS feed control which would disable the input from the pre-dechlorination chlorine analyzer to the SBS feed program during times when the analyzer is not working properly.

### Improvement Projects at Elliott West Wet Weather Station

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 minimizes freezing and crystallization of SBS in the transfer line and aids in SBS dispersion at the dechlorination vault located at Denny Station.

### Near Future Operation

During the fifteen years of operation, opportunities to operate and then to optimize EW WWTS have been very limited. Challenges may be identified during an event in the wet season, but any major projects to address the challenge likely have to occur during the following dry season. Then, after the completion of these projects, the opportunities to test the improvements 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 EW WWTS CSO effluent drop structure drain gate (aka wet well drain gate) failed to close. This drain gate is normally closed during discharge events, but automatically opens 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 frame of the gate was seriously corroded and damaged and in need of repair or replacement. The repair and replacement of the gate, and the corroded frame, are scheduled for summer 2022. Currently the gate is operated manually after each event. The gate is opened once the wet well level is low enough for the hydraulic grade line to allow the remaining treated CSO in the final effluent pipe to drain back to the wet well where it is pumped back to West Point via the Elliott Bay Interceptor.

A project started in 2021 to evaluate various options to improve solids removal from the EW 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 EW WWTS is difficult to clean and remove accumulated solids. This project developed particle settling and resuspension models in 2021. 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 to incorporate these improvement projects with the discussions on alternative treatment technologies. The more comprehensive project is underway to review alternative treatment technologies at EW WWTS that could be considered a long-term improvement to fully comply with the NPDES permit. Footprint size in a limited space, treatment capacity and type of disinfection are some of the constrains that must be considered in this technology review. A draft alternatives analysis report was prepared in December 2021, and refinements for the alternatives analysis are ongoing 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 discussions to annually schedule a contractor to clean out the wet well as preventative maintenance.

## Table E-2. Elliott West WWTS 2021 Annual Event Data Summary

| Month | Day | EWCSO Inflow Event Number | EWCSO Inflow Volume (MG) | EWCSO Discharge Event Number | EWCSO Discharge Volume (MG) | Total Influent TSS (lbs) | Total Effluent TSS Discharged @ EW + WP (lbs) | % removal | EWCSO Effl. Daily Settl Solids (ml/l/hr) | EWCSO Effl. Settl Solids Event Average (ml/l/hr) | EWCSO Effl. Fecal Coliforms (#/100 ml) | EWCSO Effl. Residual Chlorine Daily Average (ug/l) | Daily Min/Max pH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| January | 1 | 1 | 5.47 | ND | ND | 507 | 35 | | | | | | |
| | 2 | 1 | 21.45 | 1 | 18 | 4300 | 3426 | | 0.1 | 0.1 | Jan-45 | 77 | 6.0/7.2 |
| | 3 | 1 | 4.4 | ND | ND | 440 | 59 | | | | | | |
| | 4 | 1 | 7.39 | 2 | 0 | 2244 | 949 | | 15 | 15 | 45 | 467 | 5.7/6.7 |
| | 5 | 1 | 5.29 | 3 | 3 | 1214 | 680 | | 0.3 | 0.3 | 20/1 | 68 | 6.0/6.7 |
| | 6 | 1 | 6.46 | ND | ND | 940 | 85 | | | | | | |
| | 7 | 1 | 1.15 | ND | ND | 1009 | 29 | | | | | | |
| | 11 | 2 | 21.94 | 4 | 19 | 8600 | 7915 | | 0.7 | | 20/20 | 152 | 5.9/7.9 |
| | 12 | 2 | 22.86 | 4 | 20 | 5155 | 4325 | | 0.1 | 0.4 | Jan-45 | 106 | 5.6/7.3 |
| | 13 | 2 | 6.45 | ND | ND | 1341 | 224 | | | | | | |
| | 14 | 2 | 1.46 | ND | ND | 413 | 26 | | | | | | |
| | 28 | 3 | 0.53 | ND | ND | 299 | 9 | | | | | | |
| | 31 | 4 | 0.08 | ND | ND | 21 | 1 | | | | | | |
| | Instant. Min/Max pH | | | | | | | | | | | | **5.6/7.9** |
| | Event/Daily Max | | | | | | | | | **15** | | **467** | |
| | Monthly Total/Avg/GeoMean | **4** | **104.94** | **4** | **59.48** | **26,483** | **17,763** | **32.90%** | | | **9.7** | | |
| February | 0 | 1 | 3.49 | ND | ND | 1,444 | 140 | | | | | | |
| | 2 | 1 | 3.04 | ND | ND | 734 | 62 | | | | | | |
| | 14 | 2 | 0.3 | ND | ND | 108 | 4 | | | | | | |
| | 15 | 2 | 3.14 | ND | ND | 30,191 | 4,010 | | | | | | |
| | 16 | 2 | 4.49 | ND | ND | 647 | 61 | | | | | | |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 22 | 3 | 0.55 | ND | ND | 338 | 14 | | | | | | |
| | Instant. Min/Max pH | | | | | | | | | | | | ND |
| | Event/Daily Max | | | | | | | | | ND | | ND | |
| | Monthly Total/Avg/GeoMean | **3** | **15.01** | **ND** | **0** | **33,462** | **4291** | **87.20%** | | | **ND** | | |
| March | 4 | 1 | 1.18 | ND | ND | 2,109 | 282 | | | | | | |
| | 7 | 2 | 0.23 | ND | ND | 133 | 8 | | | | | | |
| | 18 | 3 | 0.47 | ND | ND | 114 | 3 | | | | | | |
| | 20 | 4 | 0.72 | ND | ND | 193 | 12 | | | | | | |
| | 22 | 5 | 0.51 | ND | ND | 97 | 5 | | | | | | |
| | 24 | 6 | 2.04 | ND | ND | 446 | 19 | | | | | | |
| | 25 | 6 | 2.02 | ND | ND | 270 | 22 | | | | | | |
| | 28 | 7 | 2.24 | ND | ND | 410 | 24 | | | | | | |
| | Instant. Min/Max pH | | | | | | | | | | | | ND |
| | Event/Daily Max | | | | | | | | | ND | | ND | |
| | Monthly Total/Avg/GeoMean | **7** | **9.42** | **ND** | **0** | **3,772** | **376** | **90.00%** | | | **ND** | | |
| April | 25 | 1 | 0.4 | ND | ND | 787 | 29 | | | | | | |
| | Instant. Min/Max pH | | | | | | | | | | | | ND |
| | Event/Daily Max | | | | | | | | | ND | | ND | |
| | Monthly Total/Avg/GeoMean | **1** | **0.4** | **ND** | **0** | **787** | **29** | **96.30%** | | | **ND** | | |
| May | 3 | 1 | 0.56 | ND | ND | 1,092 | 54 | | | | | | |
| | Instant. Min/Max pH | | | | | | | | | | | | ND |
| | Event/Daily Max | | | | | | | | | ND | | ND | |
| | Monthly Total/Avg/GeoMean | **1** | **0.56** | **ND** | **0** | **1,092** | **54** | **95.10%** | | | **ND** | | |
| June | 6 | 1 | 2.48 | ND | ND | 358 | 8 | | | | | | |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 7 | 1 | 2.55 | ND | ND | 378 | 16 | | | | | |
| | 11 | 2 | 0.87 | ND | ND | 929 | 22 | | | | | |
| | 13 | 3 | 2.83 | ND | ND | 630 | 67 | | | | | |
| | 14 | 3 | 1.15 | ND | ND | 7,924 | 267 | | | | | |
| | Instant. Min/Max pH | | | | | | | | | | | **ND** |
| | Event/Daily Max | | | | | | | | **ND** | | **ND** | |
| | Monthly Total/Avg/GeoMean | **3** | **9.88** | **ND** | **0** | **10,218** | **380** | **96.30%** | | **ND** | | |
| July | No Inflow/No Disch. | | | | | | | | | | | |
| | Instant. Min/Max pH | | | | | | | | | | | **ND** |
| | Event/Daily Max | | | | | | | | **ND** | | **ND** | |
| | Monthly Total/Avg/GeoMean | **0** | **0** | **ND** | **0** | **-** | **-** | **-** | | **ND** | | |
| August | No Inflow/No Disch. | | | | | | | | | | | |
| | Instant. Min/Max pH | | | | | | | | | | | **ND** |
| | Event/Daily Max | | | | | | | | **ND** | | **ND** | |
| | Monthly Total/Avg/GeoMean | **0** | **0** | **ND** | **0** | **-** | **-** | **-** | | **ND** | | |
| September | 17 | 1 | 2.83 | ND | ND | 1,939 | 62 | | | | | |
| | 18 | 1 | 4.52 | ND | ND | 1,040 | 226 | | | | | |
| | 19 | 1 | 1.37 | ND | ND | 468 | 41 | | | | | |
| | 26 | 2 | 17.81 | 1 | 11.85 | 50,578 | 43,651 | | 10.5 | 9,200/1 | 53 | 6.1/7.1 |
| | 27 | 2 | 8.45 | ND | ND | 2,009 | 214 | | | | | |
| | 28 | 2 | 1.32 | ND | ND | 329 | 11 | | | | | |
| | 29 | 2 | 0.33 | ND | ND | 236 | 6 | | | | | |
| | 30 | 2 | 2.09 | ND | ND | 662 | 26 | | | | | |
| | Instant. Min/Max pH | | | | | | | | | | | **6.1/7.1** |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Event/Daily Max | | | | | | | | **10.5** | | **53** | |
| | Monthly Total/Avg/GeoMean | **2** | **38.72** | **1** | **11.85** | **57,262** | **44,238** | **22.70%** | | **96** | | |
| October | 5 | 1 | 0.56 | ND | ND | 2066 | 58 | | | | | |
| | 10 | 2 | 0.13 | ND | ND | ND | ND | | | | | |
| | 11 | 2 | 0.43 | ND | ND | 582 | 19 | | | | | |
| | 20 | 3 | 0.11 | ND | ND | 145 | 4 | | | | | |
| | 21 | 4 | 3.09 | ND | ND | 2571 | 99 | | | | | |
| | 22 | 4 | 1.28 | ND | ND | 171 | 16 | | | | | |
| | 24 | 5 | 1.7 | ND | ND | 4170 | 222 | | | | | |
| | 25 | 5 | 0.06 | ND | ND | 369 | 11 | | | | | |
| | 26 | 6 | 0.07 | ND | ND | 31 | 1 | | | | | |
| | 27 | 6 | 0.1 | ND | ND | ND | ND | | | | | |
| | 28 | 6 | 21.29 | 1 | 18.36 | 15269 | 13967 | | | 130/68 | 57 | 6.2/7.5 |
| | 29 | 6 | 8.58 | 1 | 0.47 | 1033 | 302 | | 0.4 | %NR | 21 | 6.0/6.7 |
| | 30 | 6 | 0.56 | ND | ND | 727 | 25 | | | | | |
| | Instant. Min/Max pH | | | | | | | | | | | **6.2/7.5** |
| | Event/Daily Max | | | | | | | | **0.4** | | **57** | |
| | Monthly Total/Avg/GeoMean | **6** | **37.96** | **1** | **18.83** | **27,134** | **14,725** | **45.70%** | | **94** | | |
| November | 3 | 1 | 2.53 | ND | ND | 739 | 22 | | | | | |
| | 4 | 1 | 7.2 | ND | ND | 1508 | 192 | | | | | |
| | 5 | 1 | 1.02 | ND | ND | 2514 | 127 | | | | | |
| | 6 | 1 | 2.13 | ND | ND | 10468 | 1035 | | | | | |
| | 7 | 1 | 0.87 | ND | ND | 554 | 45 | | | | | |
| | 8 | 1 | 0.45 | ND | ND | 429 | 19 | | | | | |
| | 9 | 1 | 3.18 | ND | ND | 664 | 52 | | | | | |
| | 10 | 1 | 0.29 | ND | ND | 462 | 23 | | | | | |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 11 | 1 | 2.93 | 1 | 0.27 | 984 | 130 | | | 330000 | 0 | 6.2/7.1 |
| | 12 | 1 | 8.59 | 1 | 0.97 | 1542 | 572 | | 0.1 | | 0 | 5.9/6.6 |
| | 13 | 1 | 5.14 | ND | ND | 725 | 50 | | | | | |
| | 14 | 1 | 3.82 | ND | ND | 639 | 86 | | | | | |
| | 15 | 1 | 4.35 | ND | ND | 683 | 48 | | | | | |
| | 18 | 2 | 0.79 | ND | ND | 15220 | 491 | | | | | |
| | 22 | 3 | 0.39 | ND | ND | 478 | 15 | | | | | |
| | 23 | 3 | 3.14 | ND | ND | 690 | 50 | | | | | |
| | 25 | 4 | 1.84 | ND | ND | 264 | 24 | | | | | |
| | 26 | 4 | 0.76 | ND | ND | 370 | 20 | | | | | |
| | 27 | 4 | 1.14 | ND | ND | 3491 | 240 | | | | | |
| | Instant. Min/Max pH | | | | | | | | | | | **5.9/7.1** |
| | Event/Daily Max | | | | | | | | **0.1** | | **0** | |
| | Monthly Total/Avg/GeoMean | **4** | **50.58** | **1** | **1.24** | **42,423** | **3,240** | **92.40%** | | **330000** | | |
| December | 2 | 1 | 0.54 | ND | ND | 617 | 41 | | | | | |
| | 4 | 2 | 0.43 | ND | ND | ND | ND | | | | | |
| | 10 | 3 | 1.3 | ND | ND | 745 | 52 | | | | | |
| | 11 | 3 | 6.24 | ND | ND | 1947 | 825 | | | | | |
| | 12 | 3 | 0.28 | ND | ND | 42 | 4 | | | | | |
| | 18 | 4 | 1.7 | ND | ND | 525 | 366 | | | | | |
| | 21 | 5 | 0.46 | ND | ND | 472 | 18 | | | | | |
| | 22 | 5 | 4.23 | ND | ND | 611 | 123 | | | | | |
| | 23 | 5 | 1.17 | ND | ND | 166 | 31 | | | | | |
| | Instant. Min/Max pH | | | | | | | | | | | **ND** |
| | Event/Daily Max | | | | | | | | **ND** | | **ND** | |
| | Monthly Total/Avg/GeoMean | **5** | **16.34** | **ND** | **0** | **5,124** | **1,460** | **71.50%** | | **ND** | | |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Total** | **36** | **283.81** | **7** | **91.4** | **207,758** | **86,555** | | | | | |
| **Inst. pH Min/Max** | | | | | | | | | | | **5.6/7.9** |
| **Max (GEM, SS, TRC)** | | | | | | | | **10.5** | **330000** | **467** | |
| **Annual Average** | | | | | | by mass: | **58.30%** | **3.83** | **82550** | **100** | |

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

## January–December 2021

### Executive Summary

This 2021 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 four filling events and two discharge events at the Henderson/MLK Jr. Way WWTS in 2021. The treatment facility received 19.13 million gallons (MG) of combined sewer wastewater and discharged 10.49 MG of treated water to the Duwamish Waterway. The Henderson/MLK Jr. Way WWTS complied with all permit effluent and performance limits in 2021.

The first discharge event of the year was the result of 2.42-inches of rain that fell from January 1 to January 2 (as measured by the Henderson Pump Station rain gauge). Total inflow was 8.13 million gallons (MG), and 4.45-MG of treated water was discharged to the Duwamish Waterway.

The second discharge event of the year was the result of 3.01-inches that fell on January 11 and January 12 (as measured by the Henderson Pump Station rain gauge). Total inflow was 9.72 million gallons (MG), and 6.04-MG of treated water was discharged to the Duwamish Waterway.

2021 was wetter than the average year with a rainfall total of 43.3-inches (SeaTac); the annual average for the past 20 years is 39.2-inches. Rainfall was heavy in January and November but otherwise it reflected historical rates. 35.5-inches of rain fell in 2021, as measured at the Henderson Street Pump Station. A rain gage nearby at Hamm Creek reported 44.72 inches of rainfall in 2021.

**Table F-1. Henderson/MLK Jr. Way WWTS Permit Performance in 2021**

| Parameter | Performance | Permit Conditions |
|---|---|---|
| Annual average effluent settleable solids (ml/L/hr) | <0.1 | 0.3 |
| Annual average total suspended solids removal (%) - all events | 64% | 50 |
| Instantaneous minimum effluent pH: number of days with pH <6.0 | 0 exceedances on 2 discharge days | ≥ 6.0 |
| Instantaneous maximum effluent pH: number of days with pH >9.0 | 0 exceedances on 2 discharge days | ≤ 9.0 |
| Daily average total residual chlorine (TRC, µg/L): number of days with TRC >39 µg/L | 0 exceedances on 2 discharge days | 39 |
| Monthly geomean fecal coliform (cfu/100 ml): number of months with >400 cfu/100-mL | 0 exceedances on 1 discharge month | 400 |

### Annual Suspended Solids Removal and Settleable Solids

The 2021 annual average total suspended solids (TSS) removal was 64 percent and met the annual average permit limit of 50 percent. The annual average effluent settleable solids of <0.1 milliliters/liter/hour (ml/L/hr) met the annual average permit limit of 0.3 ml/L/hr.

### Monthly Fecal Coliform Bacteria and Daily Total Residual Chlorine

There were no exceptions to the monthly geometric mean fecal coliform limit of 400 colony forming units (cfu)/100 ml and the daily average total residual chlorine (TRC) limit of 39 µg/L. The maximum monthly effluent fecal coliform concentration in 2021 was 27-cfu/100 ml. The maximum daily effluent TRC in 2021 was 1.6-ug/L.

### Instantaneous Minimum/Maximum pH

There were no exceptions to the minimum and maximum pH limits. The lowest and highest effluent pH measured in 2021 was pH 6.1 and pH 7.5, respectively.

### Operation and Maintenance

Routine operation 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.

### 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. Improvements continued to be made in 2021 and will continue to be made as various issues arise during the infrequent operations that occur.

<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 hypochlorite and SBS chemical dosing lines.
- Improved venting of the chemical supply lines.

2019 improvements

- New hypochlorite 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.

2021 Improvements

- Improved local data logging and additional data available remotely.

Planned Improvements

The sample pump that provides effluent to online analyzers is prone to getting airbound 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 were only two events in 2021. 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 2021

| Month | Day | Inflow Event Number | Inflow Volume (MG) | Discharge Event Number | Discharge Volume (MG) | Total Influent TSS (lbs) | Total Effluent TSS Discharged @ MLK + WP (lbs) | % 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 | 2 | 1 | 8.13 | 1 | 4.45 | 4950 | 1838 | 63% | <0.1 | <0.1 | 739 | 1.6 | 6.6/7.5 |
| | 5 | 2 | 0.93 | | | 186 | 19 | 90% | ND | ND | ND | ND | ND |
| | 11 | 3 | 2.24 | | | 1065 | 97 | 91% | ND | ND | ND | ND | ND |
| | 12 | 3 | 7.48 | 2 | 6.04 | 2932 | 1312 | 55% | <0.1 | <0.1 | <1 | 1.4 | 6.1/7.1 |
| | Instant. Min/Max pH Event/Daily Max | **3** | | | | | | | | **<0.1** | | **1.6** | **6.1/7.5** |
| | Monthly Total/Avg/GeoMean | | **18.78** | **2** | **10.49** | **9,133** | **3,265** | **64%** | | | **27** | | |
| February | No Inflow/No Disch. | | | | | | | | | | | | |
| | Instant. Min/Max pH Event/Daily Max | | | | | | | | | **ND** | | **ND** | **ND** |
| | Monthly Total/Avg/GeoMean | **0** | **0.0** | **0** | **0.0** | **-** | **-** | **-** | | | **ND** | | |
| March | No Inflow/No Disch. | | | | | | | | | | | | |
| | Instant. Min/Max pH Event/Daily Max | | | | | | | | | **ND** | | **ND** | **ND** |
| | Monthly Total/Avg/GeoMean | **0** | **0.0** | **0** | **0.0** | **-** | **-** | **-** | | | **ND** | | |
| April | No Inflow/No Disch. | | | | | | | | | | | | |
| | Instant. Min/Max pH Event/Daily Max | | | | | | | | | **ND** | | **ND** | **ND** |
| | Monthly Total/Avg/GeoMean | **0** | **0.0** | **0** | **0.0** | **-** | **-** | **-** | | | **ND** | | |
| May | No Inflow/No Disch. | | | | | | | | | | | | |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Instant. Min/Max pH<br>Event/Daily Max<br>Monthly<br>Total/Avg/GeoMean | **0** | **0.0** | **0** | **0.0** | **-** | **-** | **-** | | **ND** | **ND** | **ND** | **ND** |
| June | No Inflow/No Disch. | | | | | | | | | | | | |
| | Instant. Min/Max pH<br>Event/Daily Max<br>Monthly<br>Total/Avg/GeoMean | **0** | **0.0** | **0** | **0.0** | **-** | **-** | **-** | | **ND** | **ND** | **ND** | **ND** |
| July | No Inflow/No Disch. | | | | | | | | | | | | |
| | Instant. Min/Max pH<br>Event/Daily Max<br>Monthly<br>Total/Avg/GeoMean | **0** | **0.0** | **0** | **0.0** | **-** | **-** | **-** | | **ND** | **ND** | **ND** | **ND** |
| August | No Inflow/No Disch. | | | | | | | | | | | | |
| | Instant. Min/Max pH<br>Event/Daily Max<br>Monthly<br>Total/Avg/GeoMean | **0** | **0.0** | **0** | **0.0** | **-** | **-** | **-** | | **ND** | **ND** | **ND** | **ND** |
| September | No Inflow/No Disch. | | | | | | | | | | | | |
| | Instant. Min/Max pH<br>Event/Daily Max<br>Monthly<br>Total/Avg/GeoMean | **0** | **0.0** | **0** | **0.0** | **-** | **-** | **-** | | **ND** | **ND** | **ND** | **ND** |
| October | 28 | 1 | 0.35 | 0 | 0.0 | 117 | 30 | 74% | | | | | |
| | Instant. Min/Max pH<br>Event/Daily Max<br>Monthly<br>Total/Avg/GeoMean | **1** | **0.35** | **0** | **0.0** | **-** | **-** | **-** | | **ND** | **ND** | **ND** | **ND** |
| November | No Inflow/No Disch. | | | | | | | | | | | | |
| | Instant. Min/Max pH<br>Event/Daily Max<br>Monthly<br>Total/Avg/GeoMean | **0** | **0.0** | **0** | **0.0** | **-** | **-** | **-** | | **ND** | **ND** | **ND** | **ND** |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| December | No Inflow/No Disch. | | | | | | | | | | | | |
| | Instant. Min/Max pH<br>Event/Daily Max<br><br>Monthly Total/Avg/GeoMean | **0** | **0.0** | **0** | **0.0** | **-** | **-** | **-** | | **ND** | **ND** | **ND** | **ND** |
| **Total** | | **4** | **19.13** | **2** | **10.49** | **9,249** | **3,295** | | | | | | |
| **Inst. pH Min/Max** | | | | | | | | | | | | | **6.1/7.5** |
| **Max (GEM, SS, TRC)** | | | | | | | | | | | **27** | **1.6** | |
| **Annual Average** | | | | | | | by mass: | **64%** | | **<0.1** | **27** | **1.5** | |