Seattle Public Utilities

Protecting Seattle's Waterways

Wastewater Collection System: 2018 Annual Report

March 26, 2019

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List of Abbreviations

Term	Definition
BMP	Best Management Practice
CMOM	Capacity, Management, Operations, and Maintenance
CSO	Combined Sewer Overflow
DOJ	U.S. Department of Justice
DNRP	King County Department of Natural Resources and Parks
DWO	Dry Weather Overflow
Ecology	Washington State Department of Ecology
EBI	King County Elliott Bay Interceptor
EPA	U.S. Environmental Protection Agency
FSE	Food Service Establishment
GSI	Green Stormwater Infrastructure (see also NDS, LID)
LID	Low Impact Development (see also NDS, GSI)
LTCP	Long-Term Control Plan
MG	million gallons
MGD	million gallons per day
NDS	Natural Drainage Systems (see also GSI, LID)
NPDES	National Pollutant Discharge Elimination System
PACP	Pipeline Assessment and Certification Program
Public Health	Public Health - Seattle & King County
RCM	Reliability Centered Maintenance
SCADA	Supervisory Control and Data Acquisition
SDOT	Seattle Department of Transportation
SOP	Standard Operating Procedure
SPU	Seattle Public Utilities
SSO	Sewer Overflow

SECTION 1

Introduction

This annual report was prepared to share information with the public on activities Seattle Public Utilities (SPU) is undertaking to improve its wastewater collection system and to meet state and federal regulatory requirements. The report provides updates on the Combined Sewer Overflow (CSO) Reduction Program and the Capacity, Management, Operations and Maintenance (CMOM) Program. The report is organized as follows:

- Section 1: Introduction
- Section 2: Planning Activities
- Section 3: Operation and Maintenance Activities
- Section 4: Capital Activities
- Section 5: Monitoring Programs and Results

Additional information is available at www.seattle.gov/cso.

1.1 The Wastewater Collection System

The City of Seattle's (City's) wastewater collection system is one of the largest in Washington State. It includes sanitary, combined, and partially separated combined sewers, as shown in Figure 1-1. In areas of the City served by sanitary sewers, stormwater runoff flows to a storm drainage system, and sewage is conveyed through City sewers to larger pipelines and treatment facilities owned and operated by King County Department of Natural Resources and Parks (DNRP). In areas of the City with combined sewers, stormwater runoff and sewage flow into the sewers and are conveyed to the DNRP facilities. In areas of the City served by partially separated combined sewers, storm drain separation projects were built during the 1960s and 1970s to divert street runoff to the storm drainage system; rooftop and other private property drainage continue to flow into the combined sewers.

During storm events, the amount of stormwater in the combined sewers sometimes exceeds the collection system's capacity. When this happens, the collection system overflows through structures designed for this purpose. These wet weather overflows are called Combined Sewer Overflows (CSOs), and the structures where these overflows can occur are called CSO outfalls. There are currently 85 CSO outfalls in SPU's wastewater collection system. As shown in Figure 1-2, they are located along Lake Washington, the Ship Canal, Puget Sound, Elliott Bay, the Duwamish River, and Longfellow Creek. The goal of the CSO Reduction Program is to reduce the number of CSOs to an average of no more than one per outfall per year based on a 20-year moving average.

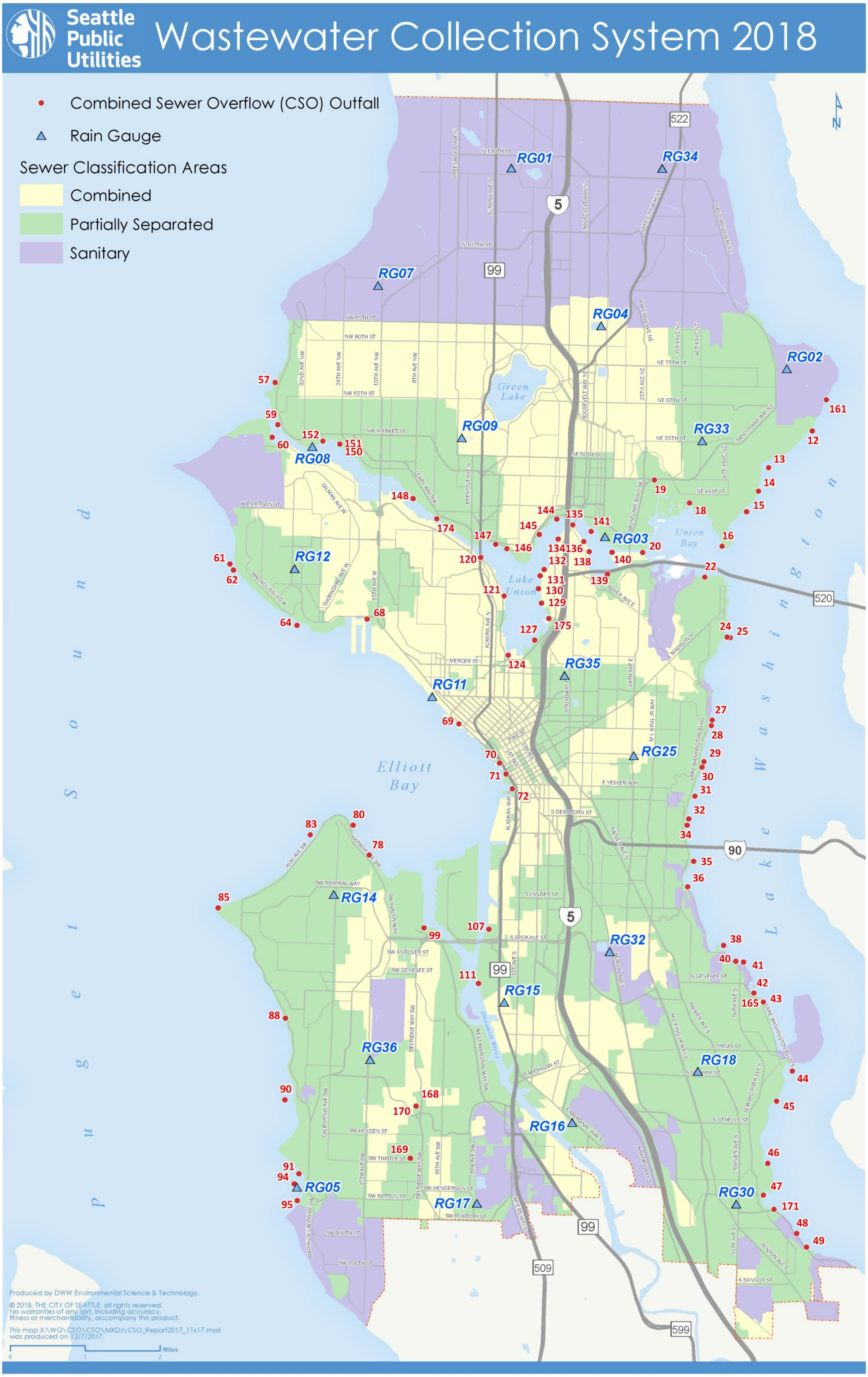


Figure 1-1. 2018 Combined Sewer Outfalls

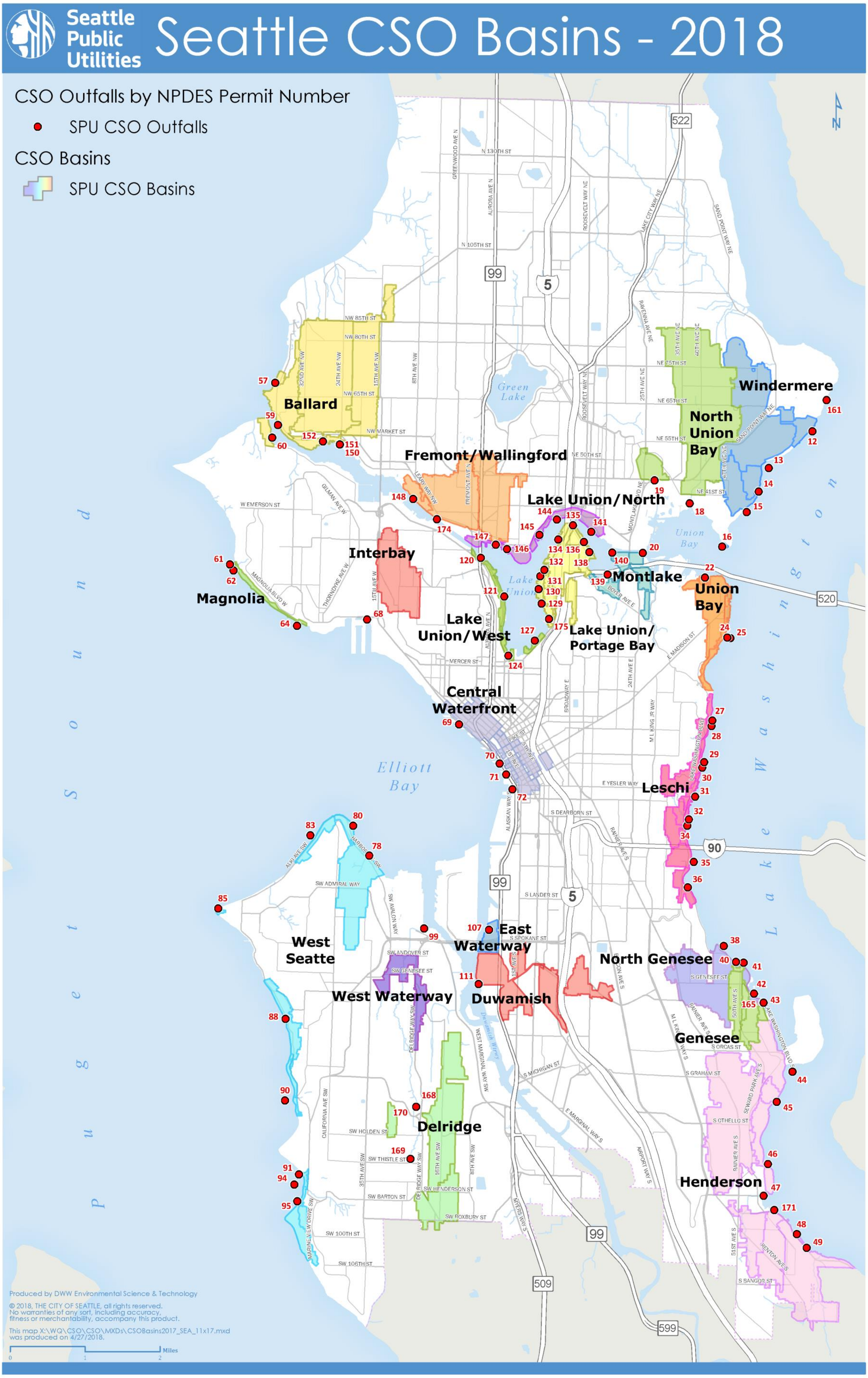


Figure 1-2. 2018 CSO Basins

1.2 Collection System NPDES Permit

The City's wastewater collection system is regulated by the Washington State Department of Ecology (Ecology), through a National Pollutant Discharge Elimination System (NPDES) Permit. Ecology first issued the City an NPDES Permit for CSO discharges in 1975. The permit has been reissued periodically (generally every 5 years), most recently as NPDES Permit WA0031682 issued on March 30, 2016, with an effective date of May 1, 2016. The permit was modified on September 28, 2017 and expires on April 30, 2021.

The NPDES Permit:

- Authorizes CSOs at the 85 outfalls shown in Figures 1-1 and 1-2. Outfall 33, which formerly served the Leschi area and is not shown in these figures, was removed from CSO service on July 22, 2016;
- Requires that SPU limit the number of CSOs from each "controlled" outfall to an average of no more than one per outfall per year, based on a twenty-year moving average;
- Includes a compliance schedule for CSO control projects and other activities that must be completed by the permit expiration date;
- Prohibits overflows from the CSO outfalls during dry weather. Regardless of their cause (mechanical failure, blockage, power outage, and/or human error), such overflows are called dry weather overflows (DWOs). Based on guidance from Ecology, if the volume of a wet weather overflow is increased because of a mechanical failure, blockage, power outage, and/or human error, the event is called an exacerbated CSO;
- Requires SPU to report sewer overflows (SSOs) within specific timeframes; and
- Requires SPU to apply for permit renewal six months before the permit expires.

1.3 Collection System Consent Decree

The City also must meet the requirements of a Consent Decree with the United States Department of Justice (DOJ), United States Environmental Protection Agency (EPA), and Ecology (Civil Action No. 2:13-cv-678; July 3, 2013). The Consent Decree achieves the following:

- Resolves EPA's and Ecology's complaints that the City had violated the Clean Water Act and its collection system NPDES Permit;
- Sets a schedule for the City to come into compliance with state and federal requirements for controlling CSOs;
- Requires the City to implement a performance based adaptive management approach to system operation and maintenance (O&M), to prevent DWOs and reduce the number of SSOs and exacerbated CSOs;
- Requires the City to report annually on Consent Decree required activities; and
- Establishes penalties for non-compliance.

1.4 Collection System Reporting Requirements

SPU's NPDES Permit requires submittal of the following types of reports:

- Monthly discharge monitoring reports. These document the volume, duration, precipitation, and storm duration for each CSO event and are due by the 28th of the following month.
- Reports of SSOs and DWOs. SPU must report any DWOs and certain types of SSOs (those that reach surface waters, the municipal storm system, or other areas with public access) immediately, by phone, to Ecology and Public Health – Seattle & King County (Public Health). Other SSOs must be reported to Ecology online or by phone within 24 hours. SPU must also file a written follow-up report within five days of each DWO or SSO, except those SSOs that are contained within buildings. SSOs that are contained within buildings are summarized quarterly in a spreadsheet.
- Engineering reports, plans, specifications, construction quality assurance plans, and post-construction monitoring plan reports. These are required for specific CSO reduction projects. Many of the due dates are specified in the permit.

Each of the 2018 monthly discharge monitoring reports was completed and submitted on time. All required engineering reports, plans, specifications, and construction quality assurance plans were submitted by their respective deadlines, and most were submitted in advance of deadlines. There were no DWOs. Almost all SSOs were reported by their respective deadlines, and all of the written follow-up reports were submitted on time.

In addition, both the NPDES Permit and the Consent Decree include annual reporting requirements. This report meets these annual reporting requirements. Table 1-1 lists the requirements and identifies where the information is provided.

Table 1-1. 2018 Annual Reporting Requirements		
Source	**Requirement**	**Report Location**
NPDES Permit		
S4.B	Detail the past year's frequency and volume of combined sewage discharged from each CSO outfall	Table 5-4
S4.B	For each CSO outfall, indicate whether the number and volume of overflows has increased over the baseline condition and, if so, propose a project and schedule to reduce the number and volume of overflows to baseline or below	Table 5-5, Section 5.3
S4.B	Explain the previous year's CSO reduction accomplishments	Section 4
S4.B	List the CSO reduction projects planned for the next year	Table 4-1, Section 4
S4.B	Document compliance with the Nine Minimum Controls	Section 3.1
S4.B	Include a summary of the number and volume of untreated discharge events per outfall	Table 5-6
S4.B	Determine and list which outfalls are controlled (no more than one overflow per year on average), using up to 20 years of past and present data, modeling, and/or other reasonable methods	Table 5-8
S4.B	Summarize all event-based reporting for all CSO discharges for the year	Tables 5-4, 5-6, 5-7
Consent Decree		
V.C.26	Report the metrics regarding sewer overflow (SSO) performance included in Appendix D, Paragraph E (1-7): a. SSO performance; b. Number of miles of sewer that were cleaned, inspected, and repaired/replaced/rehabilitated; c. Number of pump station inspections and the capacity of each pump station; d. Number of maintenance holes and force mains inspected and repaired/replaced/rehabilitated; e. Number and type of CSO regulators inspected; f. Summaries of inspections and cleanings of each CSO control structure; and g. Summaries of Fats Oil and Grease (FOG) inspections and enforcement actions taken the preceding year.	 a. Tables 3-3, 3-4, A-1 b. Table 3-1 c. Tables 3-1, A-2, A-3 d. Table 3-1 e. Table 3-1 f. Section 3.1.1 g. Section 3.3
V.D.28	Submit summaries of FOG inspections and enforcement actions taken during the previous year.	Section 3.3
VII.43.a.i	Describe the status of any work plan or report development	Section 2
VII.43.a.ii	Describe the status of any design and construction activities	Section 4

Table 1-1. 2018 Annual Reporting Requirements		
VII.43.a.iii	Describe the status of all Consent Decree compliance measures and specific reporting requirements for each program plan, including: a. The CSO control measures for the Early Action CSO Control Program (Henderson Basins 44, 45, 46, and 47/171); b. The Long-Term Control Plan; c. The Post-Construction Monitoring Program Plan; e. The CMOM Performance Program Plan; e. The FOG Control Program Plan; and f. The Joint Operations and System Optimization Plan between the City of Seattle and King County	a. Sections 4.2 and 4.7 b. No changes c. Sections 5.4 and 5.5 d. Section 3.2 e. Section 3.3 f. Section 2.1
VII.43.a.iv	Provide the project costs incurred during the reporting period	Table 4-1
VII.43.a.v	Describe any problems anticipated or encountered, along with the proposed or implemented solutions	Sections 3.1.5, 4.1.2, 4.1.3, 4.1.6, 4.3, 4.4.1, 4.5, 4.6, 4.7, 4.8, 4.10, 4.12, 5.3 and 5.4
VII.43.a.vi	Describe the status of any wastewater collection system permit applications	Section 1.2
VII.43.a.vii	Describe any wastewater collection system reports submitted to state or local agencies	Section 1.4
VII.43.a.viii	Describe any anticipated or ongoing collection system O&M activities	Section 3
VII.43.a.ix	Describe any remedial activities that will be performed in the upcoming year to comply with the Consent Decree	Sections 4.5, 4.6, 4.7, 4.8, and 5.3
VII.43.b	Describe any non-compliance with the requirements of the Consent Decree and include an explanation of the likely cause, the duration of the violation, and any remedial steps taken (or to be taken) to prevent or minimize the violation	Potential non-compliance: Sections 4.1.3, 4.1.6, 4.4.1, and 5.3. Supplemental Compliance Plans: Sections 4.5, 4.6, 4.7, 4.8, and 5.4
Appendix D, Paragraph E	Include the listed CMOM performance metrics.	Tables 3-1, 3-3, 3-4, A-1, A-2, and A-3, and Sections 3.1 and 3.3

SECTION 2

Planning Activities

In 2018, SPU continued planning efforts to help ensure SPU meets Clean Water Act, NPDES Permit, and consent decree requirements in a way that is cost-effective, community centered, and provides the most value to our customers.

2.1 Joint City of Seattle/King County Operations and System Optimization Plan

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

- The Joint System Debrief Committee commitment is to evaluate performance of the SPU and DNRP systems, identify interconnections to improve operations, and share information after major storm events. To coordinate for the 2018/2019 wet season, a meeting was held in October 2018 to discuss pre-season maintenance activities, system changes, meteorological information, and emergency communication protocols.
- The Data Sharing commitment is supported by four activities: the formation of the Joint Operations Information Sharing Team (JOIST), implementation of a pilot project for sharing real-time SCADA data, development of data sharing protocols, and the improvement of regional ability to forecast storms and rainfall intensities.
    - JOIST held four meetings during which SPU and DNRP staff conducted tours of both SPU and DNRP facilities and shared information on the operation of existing facilities, progress of capital projects, and coordination of Joint Plan commitments.
    - The SPU and DNRP data sharing committee established standard operating procedures for sharing information and to facilitate data transfer as requested. An annual data review workshop was held in June to review flow monitoring data collected by each agency and provide recommendations for future monitoring. Additionally, a mapping tool was developed to display SPU's and DNRP's flow monitoring locations in the system.

  - A Real-Time Data Sharing Pilot established a framework for real-time data sharing and resulted in development of a secure connection between DNRP's and SPU's Supervisory Control and Data Acquisition (SCADA) systems for the Windermere/ University basin where both DNRP and SPU have pump stations and CSO control facilities. A joint project team completed an options analysis of a permanent data sharing platform. SPU and DNRP are coordinating to complete the analysis in 2019 and begin implementing the recommendations to support future data sharing between other portions of SPU's and DNRP's SCADA systems.
  - Improved Rainfall Data for Forecasting with additional gauges. DNRP and SPU exchanged internal operational weather forecasts and impacts information. Both agencies worked together to incorporate climate change model output, including new projections of changing heavy precipitation, to better understand future impacts of intense rainfall on the wastewater systems. SPU and DNRP continued to engage the research community and co-develop predictive tools to enable operational adjustments to mitigate CSO and flooding events.

- The Joint Modeling Coordination Committee commitment is to share modeling tools and increase understanding of modeling analyses and system operation while developing stronger working relationships between DNRP and SPU modeling staff and improving efficiencies through better coordination efforts. Members of the Joint Modeling Coordination Committee held meetings in 2018 to review modeling results and coordinate model developments between each agency. Work activity continued to focus on development and application of the MIKE URBAN model of the North Interceptor system incorporating the proposed joint Ship Canal Water Quality Project Facility. A joint modeling work plan was developed by the Joint Modeling Coordination Committee in 2018. This plan is intended to provide a framework for coordination and communication for upcoming modeling work.
- The Coordination during Startup and Commissioning of CSO Control Facilities commitment is to conduct document review, attend commissioning meetings, and implement data sharing for SPU and DNRP CSO control facilities. In 2018, SPU staff toured the DNRP Rainier Valley Wet Weather Facility that was commissioned this year.
- The Real Time CSO Notification commitment is to improve both onsite signs and website information to improve notification of CSO events and communication with customers. In 2018, SPU and DNRP finished an updated design for signs identifying CSO outfalls. The design includes the website address to obtain CSO status, multiple languages, a larger size for visibility, and a new phone number directed to SPU's Operations Response Center, which will serve as a single point of contact for both SPU and DNRP CSO outfalls located in the City of Seattle. Sign fabrication and installation is expected to begin in 2019.
- The Reduce Saltwater Intrusion commitment is continuing to work together on studies, data and solutions for reducing intrusion. In 2018, DNRP installed two continuous saltwater monitors in their system and plans to share the data with SPU. DNRP will continue to monitor saltwater in the conveyance system to monitor progress and identify any new sources of saltwater intrusion.

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

2.2 Integrated System Planning

The purpose of SPU's the Drainage and Wastewater (DWW) Integrated System Planning effort is to plan future infrastructure investments that improve water quality while providing the greatest community value. The effort will integrate planning across drainage and wastewater systems, emphasize engagement, and focus on leveraging effective partnerships to meet Seattle's infrastructure and receiving water body challenges.

The Integrated System Planning effort is made up of four interrelated program elements:

- ***Data Collection and Analysis:*** The data collection and analysis projects are identifying drainage and wastewater system and receiving water body challenges and opportunities and prioritizing the challenges based on risk. Two major comprehensive analysis projects are the Wastewater System Analysis and Drainage System Analysis. These two projects were launched in 2017 and will be substantially complete in 2019.
- ***Drainage and Wastewater Vision Plan:*** The Vision Plan will set the vision, goals, objectives, and measures of success for SPU's Drainage and Wastewater lines of business that will be used to guide the Integrated System Plan. The Vision Plan will be developed through collaboration with our community, City departments, and partner agencies and organizations. SPU will use innovative approaches to engagement and emphasize two-way communication and relationship building to achieve meaningful participation with these diverse stakeholders. SPU is launching the Vision Plan in 2019 and anticipates substantial completion in 2020.
- ***Integrated System Plan:*** The Integrated System Plan (ISP) will direct near- and long-term investment in the partnerships, programs and projects that will improve receiving water quality and the performance and resilience of our drainage and wastewater systems while optimizing social and environmental benefits for the City. SPU is also launching the ISP in 2019 and anticipates substantial completion in 2022.
- ***Focus Area Planning:*** The Focus Area Planning will develop focused and integrated solutions in specific geographic areas of Seattle. These plans will yield pilot projects that demonstrate how integrated planning concepts can result in projects that provide community benefits. Focus Area Planning is ongoing and will continue beyond 2022.

Additional Information can be found in the DWW Planning Fact Sheets, available here: https://www.seattle.gov/util/cs/groups/public/@spu/@drainsew/documents/webcontent/1_070762.pdf.

SECTION 3

Operation & Maintenance Activities

This section describes the operation and maintenance (O&M) activities SPU undertakes to reduce the number and volume of sewer overflows, dry weather overflows (DWOs), and combined system overflows (CSOs).

3.1 Nine Minimum Control Activities

The Federal CSO Control Policy requires municipalities with combined sewer systems to implement nine measures that help reduce the number and volume of sewage overflows without extensive engineering studies or significant construction costs. The following paragraphs describe the work that was performed in 2018 on each of these nine control measures.

3.1.1 Control 1: Provide System Operations & Maintenance (O&M)

Reduce the magnitude, frequency, and duration of CSOs through proper operation and maintenance (O&M) of the combined sewer system.

Each year SPU performs extensive system O&M activities to reduce the frequency and volume of preventable overflows. Routine maintenance activities include sewer inspections, cleaning, and non-emergency point repairs; catch basin inspection, cleaning, and repairs; control structure and storage structure cleaning; valve and flap gate inspection, cleaning, lubricating, and servicing; and pump station electrical, mechanical, and facilities inspection and servicing.

SPU uses the National Association of Sewer Service Companies (NASSCO) Pipeline Assessment and Certification Program (PACP) defect coding system to identify and prioritize pipes to be scheduled for maintenance or rehabilitation. Once a sewer has been identified as having a maintenance-related problem, the sewer is placed on a routine cleaning schedule to prevent future overflows. The initial cleaning frequency is based on the cause of the initial overflow, and the cleaning frequency is increased or decreased over time as appropriate. Corrective activities include:

- Jetting, for light to medium debris;
- Hydrocutting, for roots and/or grease;
- Rodding, for pipes with an active blockage; and
- Chemical root treatment, when roots are present and no grease.

SPU's preventive sewer maintenance frequencies range from once a month to once every ten years. The challenge for sewer utilities is to clean sewers as frequently as necessary to maintain system capacity but no more than necessary, as cleaning sewers shortens the sewer's functional life span.

SPU inspects each of its 85 CSO control structures one to four times per year. During these inspections, crews make observations about flow, water level, sediment, debris, signs of infiltration, structural integrity, and whether the structure is operating as intended. Those observations lead to recommendations for cleaning, repair, and rehabilitation. The crews also perform any needed cleaning and make any necessary repairs. The 2018 inspections showed that the structures were generally in good working condition and did not require any extensive repair.

Pump station electrical and mechanical components are replaced as necessary during pump station maintenance. Since 2008 SPU has used Reliability Centered Maintenance (RCM) at its wastewater pump stations. The objective of RCM is to help ensure the right maintenance is performed at the right intervals, which in turn optimizes life cycle costs while increasing system reliability. In addition, RCM helps ensure the right data is collected and evaluated, adding discipline to decision-making around operations, spare parts inventory, maintenance strategies, and data collection. SPU continues to use, evaluate, and adjust its RCM-based strategies.

SPU's 2018 O&M accomplishments are summarized in Table 3-1.

3.1.2 Control 2: Maximize Storage of Flows

Maximize the use of the collection system for wastewater storage, in order to reduce the magnitude, frequency, and duration of CSOs.

SPU maximizes storage in its collection system through a multi-faceted approach that includes:

- Regular collection system maintenance, so that existing capacity is available during storm events;
- Modification of storage facilities whose existing capacity is not fully utilized;
- Increasing the height of overflow weirs, when doing so increases collection system storage capacity without creating backups; and
- Eliminating excessive inflow and infiltration.

In 2018, SPU continued to design and construct sewer system improvements to better utilize existing sewer system capacity. Work on these improvements is described in Section 4.1 of this report. SPU is also working to optimize the operation of recently constructed storage facilities, as described in Sections 4.2, 4.5, 4.6 and 4.7.

Table 3-1. 2018 O&M Accomplishments	
Activity	**Quantity**
Miles of mainline pipe cleaned	376
Miles of mainline pipe inspected via CCTV	217
Miles of mainline pipe repaired/replaced/rehabilitated	12.0
Number of pump station inspections [1]	1,780
Number of maintenance holes inspected	494
Number of force mains inspected	61
Number of force mains repaired/replaced/rehabilitated	2
Number of CSO structure inspections	242
Number of CSO structure cleanings	162
Number of CSO HydroBrake inspections	204
Number of CSO HydroBrake cleanings	30
Linear feet of pipe receiving chemical treatment to inhibit root growth	127,556
Number of catch basins inspected	13,904
Number of catch basins cleaned	2,806
Number of catch basins repaired	14
Number of catch basins replaced	0
Number of catch basin traps replaced	140

1. See Tables A-2 and A-3 for pump station capacity and inspection details.

3.1.3 Control 3: Control Nondomestic Sources

Implement selected CSO controls to minimize CSO impacts resulting from nondomestic discharges.

Two important programs are implemented to help control nondomestic discharges into the Seattle sewer system: the Fats, Oils, and Grease (FOG) Control Program and the Industrial Pretreatment Program.

SPU administers the City's FOG Control Program. This program enforces Seattle Municipal Code requirements to pretreat FOG-laden wastewater before discharge to the City sewer system. FOG has a deleterious effect on the sewer system as it chemically reacts with calcium in the wastewater to form hardened deposits similar to soap. These deposits adhere to the inside of sewers and decrease capacity, which can lead to sewer overflows. SPU enforces this code on nondomestic sources through a regulatory education, inspection, and enforcement program regulating commercial and institutional kitchen facilities. FOG Control inspection and enforcement activities conducted in 2018 are summarized in Section 3.3.

The Industrial Pretreatment Program is administered by King County Wastewater Treatment Division – Industrial Waste Program (KCIW). KCIW issues industrial waste pretreatment permits that include appropriate discharge limits and conducts regular site inspections and periodic permit reviews. SPU reviews CCTV tapes of lines to which these industries discharge to assess the impact to the local system. SPU and KCIW work together if permittees are found to have a negative impact on the sewer system.

Figure 3-1. FOG Control Program Educational Materials

3.1.4 Control 4: Deliver Flows to the Treatment Plant

Operate the collection system to maximize flows to the treatment plant, within the treatment plant's capacity.

SPU maximizes flow to the treatment plant by implementing the measures described in Controls 1 and 2 and by providing ongoing system performance monitoring and analysis.

SPU's Control Center is staffed 24 hours a day and receives real-time Supervisory Control & Data Acquisition (SCADA) information. Control Center staff respond to any alarms at the pump stations that indicate a drop in performance or other problem. In addition, SPU monitors pump station, overflow structure, and outfall flow data as it is collected and uses the data to detect maintenance issues that may be affecting system performance.

In 2018, several projects completed stabilization including an upgraded pump station in Madison Park (Pump Station 50 in Basin 22), Delridge Area sewer system improvement projects (Basins 168 and 169), a Windermere Area storage project (Basin 13) and North Union Bay improvements (Basin 18). Stabilization continues for the Genesee Area storage projects (Basins 40, 41, and 43), South Henderson Area projects (Basins 47/171), and North Henderson Area projects (Basins 44 and 45). Stabilization includes monitoring and analysis to help ensure a facility is functioning as intended.

In 2019, SPU will finish upgrading Wastewater Pump Station 2 in the Leschi Area (Basin 34) and repairing a broken force main at Wastewater Pump Station 43 (Basin 59).

In addition, SPU has remodeled the Control Center to allow for easier monitoring of the wastewater system.

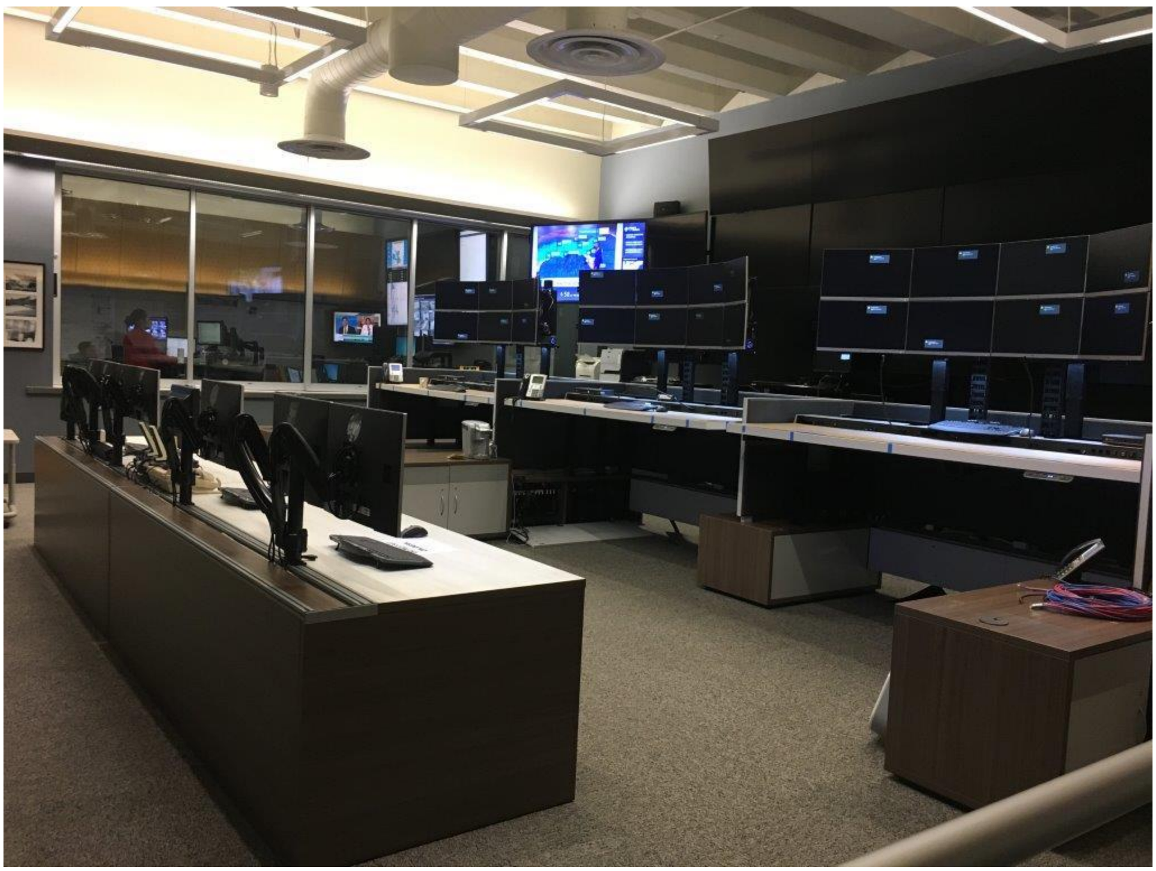


Figure 3-2. New Wastewater Control Center

3.1.5 Control 5: Prevent Dry Weather Overflows

Prevent dry weather overflows; they are not authorized. Report any dry weather overflows within 24 hours and take prompt corrective action.

To help prevent DWOs and exacerbated CSOs, each combined sewer system overflow location is configured with an alarm that is triggered if there is a likely overflow condition. The alarm alerts analysts and/or field crews to assess the situation and take corrective action if possible. In addition, whenever SPU experiences a DWO or exacerbated CSO, SPU investigates to identify the cause and takes action to reduce the possibility of recurrence.

There were no DWOs in 2018, but SPU experienced four exacerbated CSOs. Three of these occurred in January, and the fourth occurred in April. All four were at Outfall 59. During normal operations, Wastewater Pump Station (WWPS) 43 pumps flows from Basin 59 through a 12-inch diameter force main located under Shilshole Bay. However, the force main has failed and, until it is replaced, SPU is bypassing flows around WWPS 43. Because of unavoidable downstream bypass system constraints, exacerbated CSOs occur each time there is a large rain event. SPU anticipates that force main replacement will be complete in June 2019.

A summary of the DWOs and exacerbated CSOs from 2007-2018 is included in Table 3-2.

Table 3-2. Dry Weather Overflows (DWOs) and Combined Sewer Overflows (CSOs) Exacerbated by System Maintenance Issues 2007 – 2018

Year	DWOs		CSOs Exacerbated by System Maintenance Issues[1]	
	No. of Overflows	Volume (gallons)	No. of Overflows	Volume (gallons)
2007	7	499,264	--	--
2008	1	148,282	8	470,444
2009	1	3,509	3	156,153
2010	0	0	13	12,320,400
2011	0	0	10	2,317,068
2012	0	0	11	5,846,647
2013	3[2]	123,670	5	12,894
2014	1	4,767	16	9,349,549
2015	3[3]	77,598	3	10,825
2016	2	113,349	6	2,061,875
2017	0	0	8	465,938
2018	0	0	4	591,114

[1] CSOs exacerbated by system maintenance issues were not reported prior to 2008. The 'exacerbated CSOs' listed in this table are listed as CSO discharges in Table 5-4 and are included in the discharges summarized in Tables 5-5, 5-6, 5-7, and 5-8.

[2] None of these DWOs were caused by SPU or any other City entity.

[3] One of these DWOs was caused by a non-City entity.

3.1.6 Control 6: Control Solids and Floatable Materials

Implement measures to control solid and floatable materials in CSOs.

SPU implements several measures to control floatables:

Catch basins are designed to prevent floatables from entering the system. Specifically, SPU's catch basins are designed to overflow only when the water level in the catch basin is well above the overflow pipe opening. Because floatables remain on the water surface, they are trapped in the catch basins. Catch basins are inspected and cleaned regularly to remove debris and potential floatables. Catch basin inspection, cleaning, and rehabilitation metrics are included in Table 3-1.

SPU continued its Make It a Straight Flush pilot outreach campaign to educate customers that only toilet paper and human waste should be flushed down the toilet. This campaign focuses on areas where SPU's crews perform extra maintenance because of flushed trash. SPU also piloted a Community Based Social Marketing campaign to promote flushing only toilet paper. SPU did initial research to look at potential audiences including college-age women, childcare providers, gastroenterology clinics, and retirement facilities/communities. Research identified the college-age population as the audience with the most potential for behavior change. A 2019 targeted outreach pilot campaign will focus on UW students.

Figure 3-3. Flushables Outreach Campaign Poster

In addition, the City of Seattle runs several solid waste and city cleanup programs to prevent and reduce the amount of street litter, including:

- Street sweeping, including increased efforts for Fall leaf pickup,
- Spring clean,
- Storm drain stenciling,
- Event recycling,
- Public litter and recycling cans,
- Waste free holidays,
- Product bans, and
- Illegal dumping investigation and response.

3.1.7 Control 7: Prevent Pollution

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

Description of the Source Control Pollution Prevention Program

SPU has a fully developed source control program that has been in place since the early 2000's. The program is authorized by the City of Seattle Stormwater Code and Side Sewer Code. The program implements the following source control actions in the City's combined sewer basins:

- Spill Response: SPU performs spill response activities city-wide using a 24 hour per day, 7 day per week call out system. SPU Spill Responders respond to the site, assess the impact and procure resources to mitigate or clean up the spill.
- Water Quality Complaint Investigations: SPU responds to water quality complaints city wide. This program provides outreach and education on proper Best Management Practices (BMPs) to residents and businesses within the City.
- Business Inspections: SPU conducts business inspections to assess how businesses are implementing proper BMPs based on their onsite activities. SPU conducts these inspections in combined sewer basins as resources allow.
- Stormwater Facility Inspections: SPU conducts maintenance inspections of privately-owned stormwater facilities to assess how property owners are maintaining their drainage system. SPU conducts these inspections in combined sewer basins as resources allow.

In addition, SPU conducts the following pollution prevention activities:

- Public Education Programs: SPU supports a variety of public education programs that help prevent pollution, including Spring Clean, Green Cleaning, Adopt-a-Street, Adopt-a-Drain, Storm Drain Stenciling, Surface Water Pollution Report Line, Pet Waste Disposal, Natural Yard Care, Car Tips (to decrease leaks from automobiles), event recycling, and Reduce, Reuse, and Recycle tips.
- Street Sweeping: The Seattle Department of Transportation (SDOT) performs street sweeping, including street sweeping downtown streets every night and cleaning alleys three nights per week. In 2018, SDOT street sweeping crews swept 5,685 miles in the SPU combined sewer system area.
- Illegal Dumping: The City has made it easier for anyone to report illegal dumping and other issues via the Find It, Fix it app available for mobile phones. In 2018, SPU received 22,487 illegal dumping complaints from customers. More than 2,341,680 pounds of debris were removed from Seattle's public property. 100 percent of complaints were removed in 10 days or less. Thanks to new ways of using technology, customer engagement, and process improvements SPU reduced the average time for removing illegal dumping from 21 days in 2015 to under 10 days in 2018.
- Other Pollution Prevention Programs: SPU conducts multiple pollution prevention programs to keep contaminants from entering the sewer system. Pollution prevention programs performed by SPU in 2018 include: solid waste collection and recycling, product ban/substitution, control of product use such as cleaning and yard care recommendations, illegal dumping response, bulk refuse disposal, hazardous waste collection, and commercial/industrial pollution prevention.

Legal Authority and Administrative Procedures Used for Program Implementation

The following City of Seattle codes provide authority to implement the pollution prevention program in the City's combined sewer overflow basins:

- The Side Sewer Code (SMC 21.16) regulates side sewers and, for example, prohibits discharge of certain materials; requires repair of inoperative or inadequate sewers, drains, or natural watercourses; and regulates the construction, alteration, repair, and connection of side sewers and service drains. The Side Sewer Code was last substantially amended in 2010, signed by the Mayor on December 20, 2010, and effective on January 5, 2011.
- Legal authority enabling the City to address discharges to the combined sewer system owned and operated by Seattle Public Utilities is established by Seattle Municipal Code (SMC), Stormwater Code (for example, SMC 22.800.030. C) effective January 1, 2016, including revisions.

Appropriate BMPs

BMPs to be used at businesses and properties are described in the City of Seattle Stormwater Manual, Volume 4: Source Control. The Manual details BMPs that the Stormwater Code requires city-wide and that are appropriate pollution prevention steps in combined sewer basins. The following BMPs from the City of Seattle Directors' Rules SDCI 17-2017/DWW200, Volume 4: Source Control are appropriate for preventing pollution in combined sewer overflow basins:

- BMP1: Eliminate Illicit Connections. - All properties are required to examine their systems and obtain permits and eliminate illicit connections if found.
- BMP2: Perform Routine Maintenance - All properties are required to conduct annual inspections of all conveyance, catch basin, detention and treatment systems and maintain per thresholds described in Appendix G of the Directors' Rule. Solids and polluted water removed from these systems must be properly disposed.
- BMP 3: Dispose of Fluids and Wastes Properly - All properties must properly dispose of solid and liquid wastes and contaminated stormwater and sediment.
- BMP 4: Proper Storage of Solid Wastes - All properties are required to implement proper solid waste storage and disposal practices.
- BMP 5: 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, and includes notification procedures for spills to the drainage and sewer systems.
- BMP 6: Provide Oversight and Training for Staff - Businesses and public entities that have activities requiring BMPs are required to have trained personnel for their implementation.
- BMP 7: 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 practices include inspections, avoidance measures (containment, covering, or locating activities away from drainage systems), and sweeping and cleaning procedures.

Future Actions

- Revisions to the Stormwater Code: SPU has determined that the City's legal authority and administrative procedures are already sufficient to implement the pollution prevention program. As part of continuous improvement, SPU intends to evaluate possible revisions to SMC 22.800.040.A.4 to require installation of source control BMPs during site development, if the site discharges to a combined sewer in one of the City's combined sewer basins.
- Coordination with DNRP: To meet its own NPDES Permit obligations, DNRP relies upon SPU to implement pollution prevention actions (e.g., spill response, water quality complaint response and street sweeping) in areas of the City served by DNRP CSO facilities. SPU currently provides these pollution prevention actions in areas served by DNRP CSO facilities but is not responsible for DNRP's NPDES Permit compliance. At DRNP's request, SPU tracks and reports to DNRP on the limited set of BMPs that are implemented each year, so that DNRP can report to EPA and Ecology in DRNP's annual report. SPU and DNRP will explore whether to continue this arrangement and, if so, how to document costs and responsibilities.

3.1.8 Control 8: Notify the Public

Implement a public notification process to inform the citizens of when and where CSOs occur.

SPU, together with Public Health - Seattle & King County, maintains a sewage overflow notification and posting program for Seattle's CSO outfalls. Signs at each outfall identify the outfall and warn of possible combined sewage overflows. The signs include the phone number for the CSO Hotline, staffed and managed by Public Health. Public Health also provides a website with detailed information about CSOs, potential public health hazards, and precautions the public may take to protect themselves. In addition, if sewer overflows occur into waterways, SPU posts additional warning signs at impacted waterways until the problem is resolved.

In 2018 SPU and DNRP developed a new CSO outfall sign design with more languages, a link to the CSO overflow website, and a new phone number that is staffed 24 hours a day. SPU and DNRP intend to fabricate and install the new signs beginning in 2019. Figure 3-3 shows the existing and new outfall signs.

Figure 3-4. Outfall Signage: Existing (Left) and New (Right)

In addition, King County DNRP has hosted an overflow website since December 2007, providing a map of recent and current DNRP CSO overflows. In 2009, SPU and DNRP worked together to incorporate SPU information on the DNRP website. In 2015, SPU and DNRP worked together as part of their Joint Operations and System Optimization Plan activities to make the map more user-friendly and interactive and to increase the map information refresh rate. Now the community is able to access near real-time information to assist them in making choices about use of local waters. The screen shots that comprise Figure 3-4 show the simplified website language and the zoomable map the public sees when they access the website.

3.1.9 Control 9: Monitor CSOs

Monitor CSO outfalls to characterize CSOs and the effectiveness of CSO controls.

SPU monitors each of its CSO outfalls to detect sewage overflows. SPU also tracks the performance of its flow monitors to help ensure consistent, high quality measurements. The flow, precipitation, and flow monitor performance monitoring programs and results are summarized in Section 5 of this report.

Home » Services » Environment » Wastewater services » Combined sewer overflow status

Combined sewer overflow status

Check the map below to see if a combined sewer overflow, or CSO, is occurring before going swimming, wading, fishing, or boating near a CSO warning sign. These overflows take place within the City of Seattle.

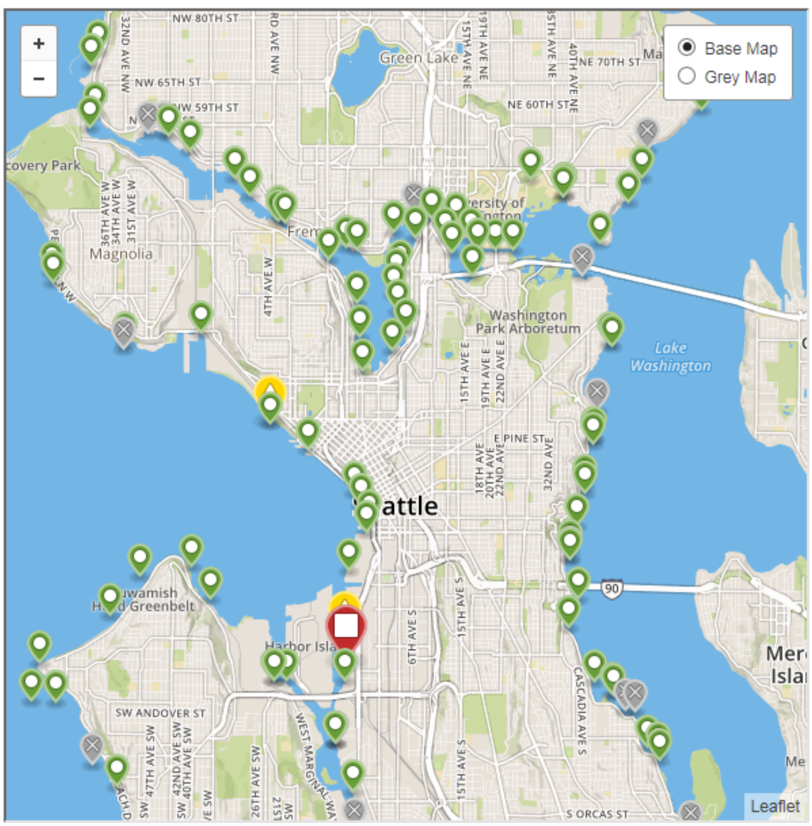
Warning

Stay out of the water for 48 hours after a combined sewer overflow; contact with polluted water can make you sick.

Learn more
Más información
進一步瞭解
Hãy tìm hiểu thêm

Example of a posted warning sign

Click on each CSO outfall symbol to learn more. Click on the [+] or [-] symbols to zoom in or out.



Legend

- Overflowing now
- Overflowed in the last 48 hrs
- No recent overflow
- Data not available

Health Questions?

Public Health Seattle & King County answers questions about CSOs

206-205-1151

Frequently asked questions about public health and CSOs

Figure 3-5. DNRP/SPU Real-Time Overflow Website Screen Shots

3.2 CMOM Performance Program Activities

The CMOM Performance Program Plan included a 2011-2016 CMOM Roadmap and an SSO Performance Threshold. The 2011-2016 CMOM Roadmap committed SPU to completing performance, productivity, and efficiency initiatives in each of the following program areas:

- Planning and scheduling;
- Sewer cleaning;
- FOG control;
- Repair, rehabilitation, and replacement;
- Condition assessment; and
- SSO response.

These initiatives were completed in 2016. Beginning in 2017, SPU began working on initiatives from the updated 2016-2020 CMOM Roadmap and will report here on progress made on those initiatives in the following program areas:

- Sewer cleaning;
- Sewer condition assessment; and
- Sewer rehabilitation.

3.2.1 Sewer Cleaning Initiatives

The purpose of the sewer cleaning initiatives is to improve the quality and efficiency of sewer cleaning by standardizing the procedures, providing ongoing crew training, measuring and tracking the quality of cleaning efforts, providing feedback to the crews, and using technology to help identify where changes in cleaning frequency should be considered. Work completed in 2018 and planned for 2019 includes:

- Increased Sewer Cleaning – In 2017, SPU increased its annual sewer system cleaning production goal from 300 to 450 miles of pipe. That increased level of cleaning was continued in 2018. SPU plans to continue this level of cleaning into 2019, focusing on areas of the system that have not recently received maintenance
- Chemical Root Control – In 2018, SPU increased the annual application of chemical root control agents from 17 to 24.7 miles of sewer pipe with known intrusion issues. The same investment in chemical root control measures is planned for 2019 and SPU plans to review the pipes selected for treatment to ensure treatment occurs in the highest risk locations.
- Sewer Cleaning Preventive Maintenance – In 2018, SPU continued reviewing current planning and scheduling processes and existing preventive maintenance schedules to help ensure maximum efficiency and effectiveness of our cleaning activities. Sixty percent of the existing preventive maintenance schedules were reviewed and validated or adjusted. This effort will continue throughout 2019.

3.2.2 Sewer Condition Assessment Initiatives

The purpose of the condition assessment initiatives is to reduce the risk of sewer overflows through greater understanding of the wastewater collection system condition, leading to more efficient and effective decisions about the maintenance and rehabilitation of its components. Work completed in 2018 and planned for 2019 includes:

- Increased Condition Assessment via CCTV – In 2017, SPU increased its annual goal for wastewater collection system condition assessment via CCTV from 190 to 240 miles of pipe, prioritizing areas with a higher risk of failure (based on likelihood and consequence of failure) and where no CCTV data currently exists. SPU continued at this increased level in 2018 and plans to maintain this level of condition assessment activity in 2019.
- Condition Assessment Strategy – In 2017, SPU completed a comprehensive wastewater collection system Condition Assessment Strategy that documents the goals, approach, processes, and measurements of success for SPU's condition assessment activities. Implementation of the Condition Assessment Strategy began in 2018 and will continue throughout 2019.
- Management Areas – In 2017, an approach was developed to enable SPU to conduct inspections and condition assessment of its entire wastewater collection system in a systematic manner. The system was divided into 100 Management Areas according to the hydraulics of the wastewater collection system, the design and flow of the system, and discharge points to the DNRP system. SPU then developed and applied prioritization criteria and adjusted for practical implementation factors. SPU will continue implementing the Management Areas approach in 2019 and plans to inspect its entire wastewater collection system in a priority-driven, proactive manner by 2023.

3.2.3 Sewer Renewal Initiatives

The purpose of the rehabilitation initiatives is to prioritize and complete sewer rehabilitation in a timely, efficient, and cost-effective manner. Work completed in 2018 and planned for 2019 includes:

- Increased Budget for Rehabilitation Projects – Continuing into 2018, SPU increased spending on sewer rehabilitation projects. Increased investment levels are planned to continue through 2019.
- Rehabilitation Strategy – In 2017, SPU began developing a comprehensive wastewater collection system Rehabilitation Strategy that documents SPU's priorities, our approach to making system rehabilitation investments, and process improvements to improve efficiency. As a part of this effort, SPU identified the need to replace enterprise technology tools that support the Rehabilitation Program. Implementation of the new software began in 2018 and will continue into 2019. Strategy development is expected to be completed in 2019 with implementation beginning in 2020.

3.2.4 SSO Performance

There were 20 sewer overflows in 2018, and they are summarized by cause in Table 3-3. The greatest number of sewer overflows were caused by structural failures of sewer pipes (6 overflows).

Table 3-3. 2018 Sewer Overflows by Category

Category	Primary Cause of Sewer Overflows	Number of 2018 Sewer Overflows
1	Roots	0
2	FOG	2
3	Debris	2
4	Structural Failure – Gravity	6
5	Structural Failure – Force Main	0
6	Capacity – Gravity	0
7	Pump Station – Mechanical	0
8	Pump Station - Capacity	0
9	Power Outage	1
10	Operator Error	0
11	Maintenance Error	1
12	Pressure Release	0
13	City Construction	2
14	New Facility Startup	0
15	Private Side Sewer Issue	0
16	Capacity – King County	0
17	Private Construction	3
18	Other Agency Construction	0
19	Vandalism	3
20	Extreme Weather Event (≥25year)	0
	Total for Categories 1 – 20	20
	Total for Categories 1 – 15	14

SSO performance for the years 2013 through 2018 is summarized in Table 3-4. SSO performance measures the effectiveness of SPU's CMOM Program and helps ensure SPU is focusing its efforts on activities that help prevent sewer overflows. For these reasons, the SSO performance calculation excludes sewer overflows that are beyond SPU's ability to control, including sewer overflows caused by extreme weather events (for example, rainfall with a recurrence interval of 25 years or more), other agency construction, private construction, King County capacity and vandalism. This table shows that SPU is continuing to meet the performance target of no more than 4 SSOs per 100 miles of sewer per year, based on a two-year moving average.

Table 3-4. 2013-2018 SSO Performance

Year	Number of SSOs[1]	SSOs/100 Miles of Sewer[2]	2-Year Average SSOs/ 100 Miles of Sewer
2013	40	2.8	3.3
2014	36	2.5	2.7
2015	72	5.1	3.8
2016	38	2.7	3.8
2017	41	2.9	2.8
2018	14	1.0	1.9

1. *Numbers in this column include only the sewer overflows included in the SSO performance calculation and exclude sewer overflows caused by extreme weather events, other agency construction, private construction, King County capacity constraints, and vandalism.*
2. *SPU has 1,422 miles of sewers.*

To remain in the high-performing utility band and continue reducing the annual number of SSOs, SPU analyzes each SSO and identifies appropriate follow-up actions, including system modifications and/or increased maintenance where appropriate. SPU also reviews SSO data on an ongoing basis, looking for any patterns or trends that can be addressed through adaptive management of the CMOM Program. Nearly half of the SSOs in 2018 were caused by the structural condition of the pipe, so in 2019 we are continuing to focus on understanding the condition of our wastewater system through increased CCTV inspection and increased investment and planning in our Rehabilitation Program.

3.3 FOG Control Program Activities

The purpose of the Fats, Oils, and Grease (FOG) Control Program is to reduce the number of FOG-related sewer overflows (SSOs) by developing and implementing a FOG Control Plan. FOG Control Plan activities include standardizing procedures, training FOG inspectors, providing outreach and education to FOG-generating dischargers, and utilizing risk-based assessments to help prioritize inspections of food service establishments (FSE), FOG-related sewer cleaning, and FOG-related enforcement. Work completed in 2018 and planned for 2019 is described in the following sections.

3.3.1 FSE Risk Assessments and Regulatory Compliance Inspections

In 2018, FOG Control Program staff completed 1,236 FSE FOG discharge risk assessments and regulatory compliance inspections. This number included 748 “High Priority facility” inspections and 488 initial assessments. Inspections include FOG education, data collection, an evaluation of FOG discharge risk, and an assessment of compliance with Seattle Municipal Code. Completed risk assessments allow program staff to assign each FSE an overall priority, which is then used to designate an inspection frequency based on the FSE’s FOG production rate and the collection system condition.

The risk assessment and inspection frequency criteria are summarized in Table 3-5 below. As depicted in the table, inspections are scheduled based on the overall priority assigned to each individual FSE. SPU uses a matrix system which combines the “FOG Hotspot” mainline data based on our mainline CCTV, assessment and maintenance data and combines this with a grease production assessment from each FSE. This allows SPU to focus more energy and resources on the highest grease producers connected to the most highly impacted mainlines. For example, a heavy grease producing restaurant connected to a Category 1 hotspot mainline is considered a Priority 1 FSE and inspected two times per year while a minimally producing FSE on the same Category 1 line would be classified as a Priority 4 and receive only biannual inspections.

Table 3-5. FOG Risk Assessment and Inspection Frequency Criteria

Hotspot/Discharge Risk Assessment Matrix				
	FOG Discharge Risk			
Hotspot Risk	High	Medium	Low	Minimal
Category 1	1	2	3	4
Category 2	2	3	4	5
Category 3	3	4	5	6
Category 4, 5, 6	4	5	6	7

Inspection Frequencies		
Map Category	Inspection Frequency Code	Years
Priority 1	Semiannual	2/year
Priority 2	Annual	1 year
Priority 3	Annual	1 year
Priority 4	Biennial	2 years
Priority 5	Triennial	3 years
Priority 6	Quadrennial	4 years
Priority 7	Quinquennial	5 years

In accordance with the risk-based strategy in the approved FOG Control Program Plan, in 2018 SPU conducted a minimum of one regulatory compliance inspection at all Priority 1, 2, and 3 facilities. 2019 efforts will include the following activities:

- Conduct regulatory compliance inspections on a minimum of 90% of all 599 Priority 1, 2, and 3 facilities as described in Table 3-5 above.
- Conduct regulatory compliance inspections on all previously assessed facilities scheduled in 2018 per the periodicity outlined in Table 3-5 above.
- Continue initial risk assessments for facilities connected to Category 3, 4, 5 and 6 mainlines.

- Conduct a reassessment of facilities that discharge to high priority sewer mainlines annotated during initial assessment as "no" or "inadequate" pretreatment and conduct Notice of Violation enforcement to achieve code compliance.

3.3.2 FOG Outreach

In 2018, SPU conducted both commercial and residential outreach. Specific outreach activities included the following:

Commercial

- Conducted 1,236 FSE site visits with an outreach component;
- Delivered FOG messaging to 83 facilities and delivered free spill kits to 58 facilities, as part of a Seattle Green Business Program multi-faceted conservation, pollution prevention, and recycling campaign;
- Attended 2018 events in Seattle including the Heart of Seattle Awards, GoGreen Seattle Conference, and the Food Business Roadshow; and
- Maintained and updated a commercial FOG messaging website: http://www.seattle.gov/util/ForBusinesses/DrainageSewerBusinesses/FatsOilsGreaseDisposal/index.htm.

Residential

- Attended and distributed FOG reduction outreach materials at multiple community events including the Trends – Rental Property Management conference and Tradeshow, which was attended by over 1,300 rental property owners and managers;
- Through our customer service web portal and individual inquires, distributed 5,202 FOG educational brochures (primarily to multi-family property owners and managers);
- As a member of the Seattle Multi-Family Conservation Initiative team, distributed conservation and environmental messaging associated with several SPU programs;
- Continued pilot outreach project to improve residential awareness, update outreach materials, and motivate behavior change. Key activities associated with this were:
  - Analyzed information gathered from focus groups and customer awareness surveys;
  - Developed new outreach and educational materials based on analysis and feedback provided by customers (see Figure 3-6 below);
  - Concept tested new materials with more than 50 customers from 10 different user groups, including speakers of five other languages;
  - Initiated a pilot program to field test and evaluate new outreach and education materials and FOG reduction incentives with more than 350 customers in seven neighborhoods; and
  - Maintained and updated residential FOG messaging website: www.seattle.gov/cookingoil.

Figure 3-6. Updated Residential Outreach Messaging

2019 outreach efforts will include the completion of the pilot outreach program and implementation of an updated residential outreach program based on the findings of the pilot program evaluation.

3.3.3 FOG Planning and Program Management

SPU staff review the FOG Control Program Plan each year and update it as appropriate to continue focusing efforts on areas most heavily impacted by FOG discharges. The 2018 annual review did not result in any plan revisions.

The FSE Inventory Management Plan describes SPU's approach for collecting, using, and managing FSE data. In 2018, SPU updated the FSE database periodically by uploading an updated listing of FSEs permitted through Public Health - Seattle & King County (Public Health). An ongoing and automated quarterly report is obtained via the Public Health database to help ensure FSE information in the FOG database remains current.

In 2019, SPU plans to continue to initiate modification of existing City side sewer regulation through the development of a Director's Rule and maintenance reporting program.

SPU reviewed all FOG Standard Operating Procedures (SOPs) in 2018. As a result of this review, the Linko Database SOP was updated to reflect minor procedural changes. This annual review process:

- Helps ensure field staff are familiar with and are utilizing SOPs;
- Helps ensure SOPs accurately reflect actual field activity processes; and
- Empowers and expand the capabilities, ownership and buy-in of field inspectors by providing them with a voice in the program process development.

FOG Inspector training in 2018 included the following:

- In-house FOG inspector training included informal discussions concerning procedural changes brought about by technology improvement projects and program improvements. These sessions occur weekly during FOG Team meetings;
- Monthly online webinar training sessions were offered by the FOG program software provider, Linko Technologies, and attended by FOG inspectors as appropriate;
- In April, FOG Team members attended and presented at the Western States Alliance FOG Forum Workshop in Hood River, Oregon; and
- FOG Team members actively participated in quarterly meetings of the APWA PREFOG Sub-Committee in May and October.

3.3.4 Inter-Agency/Stakeholder Coordination

SPU Staff coordinated with external agencies and groups who impact FOG Pretreatment installations, conduct plumbing plan review, and enforce public health regulations relating to restaurant kitchens. The partners involved include UA Local 32 Plumbers and Pipefitters Union, King County Plumbing Department, Public Health, and the NW Chapter of the International Association of Plumbing and Mechanical Officials (IAPMO). These collaborations have proved to be highly beneficial and have led to improvements in FOG pretreatment installations in SPU's service area.

Specific collaborations in 2018 included:

- UA Local 32 Seattle Area Plumbers and Pipe Fitters Training Center: SPU provided six 1-hour training sessions to apprentice plumbers during their initial training phase and journeymen plumbers for continuing education credits. This training will help plumbers understand the necessity and requirements for properly installing FOG pretreatment.
- NW Chapter IAPMO: SPU provided two 1-hour presentations to plumbing industry leaders in the Seattle area.
- Discussions with Public Health Plumbing Inspectors have increased their awareness of the issues related to and sources of FOG-laden discharges from FSEs. This increased awareness has led to an expansion of their plan review process to include all FSE kitchen plan submissions whereas in the past only new facilities were reviewed. This effort will help ensure installations for restaurants meet expectations and will greatly reduce the need to enforce retrofits to existing restaurants.

These collaborative efforts will continue in 2019.

3.4 Annual Review of Operations and Maintenance Manuals

In 2015, SPU submitted O&M manuals to Ecology and EPA for the new operable CSO storage facilities at Windermere and Genesee. In 2016, SPU reviewed and updated the O&M Manuals for Windermere and Genesee. The updates mainly consisted of modifications to control logic made to the facilities operations during the stabilization phase. In 2018, SPU submitted an O&M Manual for the Henderson North CSO storage facility.

SECTION 4

Capital Activities

This section describes activities SPU is undertaking to reduce the number and volume of sewage overflows and implement the Plan to Protect Seattle's Waterways. Included is a summary of progress made in 2018 and work that SPU plans to complete in 2019. During 2018, SPU continued to proactively monitor and control scope, schedule, and budget on each of its major projects. In addition, SPU applied considerable attention to applying lessons learned across capital projects. 2018 project spending is summarized in Table 4-1.

Table 4-1. 2018 Plan Implementation Spending

Project Name	Amount Spent
Ship Canal Water Quality Project	$18,062,773
North Henderson CSO Reduction Project	285,251
Central Waterfront CSO Reduction Projects	902,335
Delridge 168/169 CSO Control	270,291
South Henderson 49 CSO Reduction Project	182,872
Sewer System Improvement Projects (Retrofits)	3,142,039
Pump Station Rehabilitation	3,127,856
Outfall Rehabilitation	1,107,320
Sewer Renewal	23,443,174
Windermere Supplemental Compliance	275,000
Genesee Supplemental Compliance	156,000
South Henderson 47/171 Supplemental Compliance	98,000
Magnolia 62 Supplemental Compliance	52,000
Roadside Raingardens	226,424
RainWise	1,522,300
NDS Partnering	2,070,360
South Park Water Quality Facility	232,616
Expanded Street Arterial Sweeping	1,783,175
Total	$56,939,786

4.1 Sewer System Improvement Projects

SPU made significant progress on a variety of combined sewer system improvement projects in 2018, as summarized in the following paragraphs.

4.1.1 Delridge (Basin 99) HydroBrake Retrofit Project

A 2016 options analysis of the Delridge Basin 99 sewer system recommended replacement of the existing HydroBrake flow restriction device with an automated sluice gate. This replacement will allow SPU to use the existing offline storage pipe more effectively and will allow SPU to achieve a consistent discharge flowrate to the DNRP regional sewer system. SPU completed detailed design of the sluice gate retrofit in 2018 and advertised the bid package on November 7, 2018. SPU expects to start construction in the second quarter of 2019 and complete construction by September 30, 2019. Following construction, SPU will monitor the facility and make operational improvements to ensure the facility achieves its design intent.

4.1.2 Delridge (Basins 168, 169) HydroBrake Retrofit Project

Delridge CSO Basins 168 and 169 are located in the residential area of the Delridge neighborhood in southwest Seattle. Any CSOs from these basins flow into Longfellow Creek, Seattle's only creek that receives combined sewage.

In 2015, SPU replaced the existing HydroBrakes at CSO Facilities 2 and 3 (in Basins 168 and 169, respectively) with actively controlled valves and added upstream flow diversion structures to more optimally use the existing storage facilities. These improvements reduced the frequency of surcharging in the downstream sewer system, reduced CSOs at Outfalls 168 and 169, and have nearly eliminated unscheduled maintenance due to debris issues at the facilities.

Since construction, SPU has fine-tuned the operation of the valves to meet design intent and mitigate the effects of hydraulic jumps near operational monitoring points. SPU also has monitored the facilities and, in 2018, used the monitoring data to update the area hydraulic model and perform a long-term simulation to identify the 20-year average CSO frequency of the two outfalls. The monitoring and modeling results are included in Table 5-8 and show that neither basin is controlled to the CSO performance standard. Therefore, in 2018 SPU initiated a consultant hiring process for a team to identify and analyze additional options for controlling each basin. This options analysis is expected to take two years to complete and is expected to begin in March 2019.

4.1.3 Leschi (Basins 26 – 36)

The Leschi area is in east Seattle bordering Lake Washington and comprises Basins 26 through 36. Over a dozen individual sewer system improvements were implemented in this area. The improvements were divided into two phases: Phase 1, which was completed in 2015, and Phase 2, which was completed in 2016. Phase 1 improvements were described in the 2014 Annual Report. Phase 2 improvements were detailed in the 2016 Annual Report. As part of the improvements, Outfalls 26 and 33 were sealed and removed from service.

An additional sewer system adjustment was completed on February 15, 2017, when SPU lowered the CSO weir at Outfall 34 to prevent flooding of the Pump Station 2 drywell due to the elevated hydraulic grade line defined by the high CSO weir elevation. This modification represents the last physical change to the Leschi sewer system. Due to the hydraulic connectivity of the outfalls in the Leschi sewer system, this date is used as the demarcation point between the use of model data and observed data for all outfalls in the Leschi Area when assessing long-term CSO frequency.

Based on flow monitoring data, it is apparent that the constructed sewer improvements changed the flow characteristics of the Leschi Area. As a result of the changed flow characteristics, together with recent changes in precipitation patterns, the constructed improvements did not reduce CSOs as much as expected in most of the Leschi Basins. Modeling conducted in 2018 confirmed that Outfalls 27, 28, 29, 32, 34, 35, and 36 meet the CSO performance standard and Outfalls 30 and 31 are not controlled to the CSO standard.

Because one of the uncontrolled basins was not identified in the "if needed" Leschi CSO Control Project (Basin 30), SPU believes it is prudent to look again at the options for controlling the Leschi Area rather than immediately moving forward with the originally identified off-line storage pipes. As part of this re-look, SPU will be working with DNRP to determine whether the most cost-effective and technically sound control measure involves partnering on DNRP's Montlake (DSN 014) CSO control project. This analysis will be completed as part of DNRP's future LTCP update work effort, and DNRP and SPU will know the results in 2020.

On June 14, 2018, SPU submitted a Notification of Potential Milestone Violation notifying Ecology and EPA of the possibility that SPU may not meet the Leschi CSO Control Project Engineering Report submittal milestones. Working with DNRP, SPU will identify the preferred control measure(s) as soon as possible.

4.1.4 Duwamish (Basin 111) Weir Raising Project

The Duwamish Basin (111) is located in industrial south Seattle in the Duwamish River valley. The sewer system improvement project for this basin consisted of raising the overflow weirs at Overflow Structures 111B and 111C. Post-project performance monitoring indicates that the improvements are performing as expected. In 2018, the hydraulic model was updated to reflect the system changes, in support of a long-term simulation to assess the basin's 20-year CSO frequency. The results are included in Table 5-8. Modeling indicates that raising the weirs at Overflow Structures 111B and 111C decreased the frequency of CSOs at Outfall 111 from 1.9 to 1.2 times per year on average.

4.1.5 Madison Park (Basin 22) Pump Station 50 Rehabilitation Project

Basin 22 is located in the Madison Park area. Combined sewage from the basin flows by gravity to Pump Station 50, located at the north end of 39th Avenue East. Pump Station 50 was an airlift-type pump station that in recent years underperformed and had recurring reliability and maintenance issues resulting in SSOs and CSOs. In 2016, the air lift pump station was upgraded to include larger capacity submersible pumps, new piping, valves, and new electrical and SCADA equipment. The project also included upgrades to the overflow structure and new valve vaults. Construction was completed in December 2016. In 2018, the Basin 22 model was updated to support a long-term simulation to determine the basin's 20-year CSO frequency. The results are included in Table 5-8 and show that the outfall meets the CSO standard.

4.1.6 Magnolia (Basin 60) Pump Station 22 Rehabilitation Project

Basin 60 is located in the Lawtonwood neighborhood of Magnolia, on the west side of Seattle. The sewer system improvement for this basin includes increasing the pumping capacity of Pump Station 22, rehabilitating other station assets, and replacing the aging force main with a larger diameter main.

During 2018, SPU completed 60% design and issued a State Environmental Policy Act (SEPA) Checklist and Determination of Non-Significance (DNS). An adjacent property owner appealed the DNS to Seattle's Office of the Hearing Examiner. Given the length of time that would have been required to hear and resolve the appeal, SPU notified Ecology of a Potential Force Majeure event on July 19, 2018. SPU worked with the appellant to negotiate a settlement agreement, which was approved on December 21, 2018.

In 2019, SPU will complete design and solicit bids for construction. Construction will begin in late 2019 and be completed in 2020. Following construction, SPU will monitor the facility to assess its performance against the design intent.

4.1.7 Montlake (Basin 20) Pump Station 13 Rehabilitation Project

Montlake Basin 20 is located in central Seattle, just south of the Ship Canal cut. The sewer system improvement for this basin, similar to the project in Magnolia Basin 60, includes increasing the pumping capacity of Pump Station 13, rehabilitating other assets of the station, and replacing the aging force main with a larger diameter main. SPU began designing the project in 2018 and reached 60% design in January 2019. Additional tasks to be completed in 2019 include complying with SEPA environmental review requirements, finalizing the design, and soliciting bids for construction. Construction will begin in late 2019 with completion expected in 2020. Following construction, SPU will monitor the facility to assess its performance against the design intent.

4.1.8 East Waterway (Basin 107) Flap Gate Rehabilitation

East Waterway Basin 107 is a small combined system in Seattle's industrial south. In 2017, SPU installed a new backwater valve at the outlet of the basin's sewer system to prevent flows in DNRP's Elliot Bay Interceptor from exacerbating SPU's overflow volumes and frequencies.

SPU conducted flow monitoring within Basin 107 to assess the performance of the valve and to support a long-term model simulation to assess the basin's 20-year CSO frequency. Flow monitoring data indicates that CSO volumes have decreased considerably, with events occurring after the valve's installation being two to three orders of magnitude less in volume than events prior to valve installation. The results are included in Table 5-8 and show that the frequency of overflows has decreased from 5.5 to 4.9 per year on average. However, the overflow volumes are considerably lower in magnitude as a function of the new backwater valve. In 2019 SPU will continue to monitor the performance of the new valve.

4.1.9 Portage Bay (Basin 138) HydroBrake Retrofit Project

In 2016, SPU conducted an analysis of Basin 138 to identify an appropriate sewer system improvement. The recommended option includes removal of the HydroBrake at the existing offline storage tank and replacement with an automated sluice gate. This improvement will optimize the use of the existing offline storage, allowing the storage tanks to discharge at a rate that matches the firm pumping capacity of Pump Station 20.

In 2018, SPU decided to slightly increase the peak pumping capacity of the pump station from 1.1 MGD to 1.5 MGD. This increased peak pumping rate will allow the new automated sluice gate to discharge at a higher rate than previously anticipated. Hydraulic modeling of the Portage Bay system indicates that this improvement will likely control Basin 138, and the downstream basins (Basins 129, 130, 131, 134, 135, 136, and 175) will remain controlled.

In 2019, SPU will comply with SEPA environmental review requirements, complete project design, and advertise for bids. Construction will occur in 2020. Following construction, SPU will monitor the basin to assess its performance against the design intent.

4.1.10 Montlake (Basin 140) Sewer System Improvement Project

The 2017 Annual Report indicated that SPU would raise the Outfall 140 CSO weir to better utilize the existing offline storage tank. In 2018, SPU recalibrated the hydraulic model for the basin to better replicate the observed overflow frequencies and volumes. SPU will use the updated model to identify an optimal increased weir height and will adjust the weir height in late 2019.

4.2 North Henderson Storage Project (Basins 44, 45)

The North Henderson CSO Reduction Project will reduce the number and volume of combined sewage overflows from Outfalls 44 and 45. The project includes a new 2.65 MG storage facility in Seward Park and more modest improvements adjacent to Martha Washington Park. The storage facility includes diversion structures with motor-operated gates to control flow into the storage tank, a mechanical and electrical facility vault, and a pump and force main system to return stored flow back into the sewer system.

Figure 4-1. Completed North Henderson CSO Storage Facility

The new facilities were placed in operation in May 2017 and were in SPU's "stabilization" phase during 2018. Stabilization consists of monitoring and adjusting operations to optimize performance of the newly constructed facilities. At the end of 2018, SPU submitted a notification that construction is complete and the facilities are in regular operation. Hydraulic modeling will be performed in 2019 to determine if Outfalls 44 and 45 are controlled.

4.3 Ship Canal Water Quality Project

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

On July 27, 2016, the City of Seattle and King County signed a Joint Project Agreement (JPA) to guide implementation, operation, and cost-sharing of the Ship Canal Project. SPU is the lead for construction and implementation of the tunnel, and will own, operate, and maintain the tunnel and its related structures. (DNRP will continue to own its two outfall structures.) SPU and DNRP have also chartered Joint Oversight and Project Review and Change Management Committees to provide policy guidance and senior level management oversight, support and direction to the project.

A Draft Facility Plan was prepared for the Ship Canal Project and was submitted to EPA and Ecology for review in January 2016. As the lead agency, SPU issued a draft Ship Canal Project Supplemental EIS for public comment on September 22, 2016 and completed the SEPA process when it issued a Final Supplemental EIS in 2017 and received no appeals.

The Final Facility Plan for the Ship Canal Project was submitted in March 2017 and was approved by EPA and Ecology in June 2017. The approval letter noted that SPU and DNRP were continuing to update the hydrologic and hydraulic model used to size the project and required that SPU and DNRP submit a Facility Plan Addendum to document any design revisions resulting from the updated model.

SPU and DNRP initially completed an integrated hydraulic model in 2017. The integrated model provided a common platform for both agencies to evaluate design and operation of CSO control facilities in the north end of Seattle. SPU and DNRP worked together to develop and calibrate common standardized "MIKE URBAN" models for both agencies' CSO Basins and facilities tributary to the Ship Canal Water Quality Project and the West Point Treatment Plant. The component models were integrated into a single model used to simulate the North Interceptor, define operational strategies, and evaluate the predicted performance of the Ship Canal Project.

SPU and DNRP then prepared a Facility Plan Addendum to document the completed model and any resulting design changes. The storage tunnel diameter was increased from 14 feet to 18 feet 10 inches to provide the storage volume identified in the integrated hydraulic model, address upstream and downstream operational variabilities, address the uncertainties of climate change, and help ensure long-term compliance with the CSO standard. The Facility Plan Addendum was submitted to Ecology and EPA in February 2018. Later in 2018, deficiencies in the completed hydraulic model were discovered and corrected, resulting in changes to DNRP's 3rd Avenue West (DSN 008) basin. SPU and DNRP drafted a Revised Facility Plan Addendum and submitted it to Ecology and EPA in March 2019.

In 2018, the project team made significant progress in the design of project construction packages:

- The project completed 90 percent design of the storage tunnel and conveyance packages (3rd Ave, 11th Ave NW and Fremont) in 2018 and are on schedule to complete 100 percent design in early 2019.
- A public works bidding process was completed for the Ballard Early Work Package, and construction began in 2018. This construction package includes site remediation near the western tunnel portal, replacement of the pedestrian pier and CSO Outfall 151 at the 24th Ave NW street end, and temporary power and utility relocations at the Ballard site. Reconstruction of the 24th Ave NW pier will enable barging of tunneling spoils. Construction accomplishments in 2018 included demolition of the existing pier, partial construction of the replacement pier and outfall, and utility relocations.

Figure 4-2. Ballard Early Work Construction – Pier Replacement

- SPU completed a site plan for the property SPU owns in Ballard where the Tunnel Effluent Pump Station (TEPS) will be located. The site plan informs the design of the pump station, which is currently nearing 60 percent complete.
- The project completed 100 percent design of the Shilshole Pipe project in 2018. This package included the design of two conveyance pipelines to convey TEPS flows to the King County Ballard Siphon. A subsequent evaluation of operational alternatives identified a more cost-effective way of draining the storage tunnel, so Shilshole Pipe was removed from the Ship Canal Project.

SPU is working to obtain necessary property easements along the tunnel alignment. SPU expects to acquire the remaining underground easements in early 2019. The pier adjacent to the 24th Ave NW pier has also been leased to facilitate reconstruction of the 24th Ave NW pier and tunnel barging operations.

SPU continued with community outreach for the Ship Canal Project during 2018, as summarized below:

- Staffed information booths at the Fremont Fair and Ballard Seafood Fest, in June and July, resulting in approximately 741 contacts and 21 listserv signups.
- Delivered project briefings at advisory boards (Seattle Pedestrian Advisory Board; Urban Forestry Commission; Creeks, Drainage & Wastewater Advisory Committee; Burke Gilman Missing Link Design Advisory Committee; SPU's Customer Review Panel), community councils and associations (Wallingford, Fremont, Queen Anne, Ballard District Council, Central Ballard Residents Association), and business groups (Wallingford Chamber, Fremont Chambers and North Seattle Industrial Association).

- Delivered presentations to Seattle City Council, the King County Regional Water Quality Committee, and the Metropolitan Water Pollution Abatement Advisory Committee.
- Held public drop-ins (2) for stakeholders in Ballard and Fremont.
- Conducted numerous stakeholder briefings with property owners and businesses along the proposed project sites and tunnel alignment.
- Contacted businesses and residents with flyers and phone calls about noise monitoring, soil investigations and utility location work.
- Conducted preconstruction public open house and delivered two rounds of preconstruction flyers for the Ballard Early Work Project.
- Sent eight program and project updates to approximately 650 residents and business owners through the Ship Canal Project listserv.

SPU's planned 2019 outreach activities include:

- Staff information booths at the Fremont Fair and Ballard Seafood Fest.
- Deliver project briefings at organizations, boards and/or associations focused on trees, bicycles, pedestrians, and industry.
- Deliver notices and mailers along the tunnel alignment, as necessary.
- Continue stakeholder briefings and attending community meetings.
- Provide project information via fact sheets, website, listserv and other materials.
- Conduct preconstruction community outreach prior to the start of tunnel construction.
- Conduct site design outreach with parties interested in the Ballard project site and the Wallingford project site.

4.4 Central Waterfront CSO Reduction Projects

4.4.1 South Central Waterfront (Basins 70, 71, 72)

To control combined sewer overflows from the south end of the Central Waterfront, SPU is planning to install approximately 2,000 linear feet of new 24 to 36-inch diameter sewer; and connect combined sewer basins 70, 71, and 72. The completed project will be designed to limit CSOs from outfalls 70 (University Street Outfall), 71 (Madison Street Outfall) and 72 (Washington Street Outfall) to no more than one per year on average.

SPU and Seattle's Office of the Waterfront are coordinating the design and construction of the Central Waterfront sewer system modifications and the Waterfront Seattle Alaskan Way to Elliott Way - S King St to Battery St Project, because critical portions of both City projects are located under the existing Alaskan Way Viaduct and neither of these City projects can be completed until the Alaskan Way Viaduct is demolished. Attempting to complete the CSO control project prior to demolition of the Viaduct would result in significant additional cost, additional disruption to businesses and motorists, additional risk of failure of the currently compromised viaduct structure itself, and risk that the completed improvements would be damaged during subsequent demolition work. In addition, the Viaduct cannot be demolished until the new SR-99 tunnel is complete, or there would be major additional disruption to businesses and motorists. WSDOT is solely responsible for completing the new SR-99 tunnel and funding the Viaduct demolition; the City is not able to direct the activities of WSDOT or its tunneling contractor, Seattle Tunnel Partners (STP), and therefore is not able to accelerate WSDOT's schedule for completing SR-99 and demolishing the Viaduct.

In the Plan to Protect Seattle's Waterways, SPU indicated that construction of the Basin 70, 71, 72 CSO control project would be complete by the end of 2020. This completion date was based on construction beginning in 2017, which coincided with WSDOT's original schedule for completion of SR-99 and demolition of the Viaduct. On October 22, 2015, WSDOT and STP notified the Washington State Legislature's Joint Transportation Committee that resumption of the tunneling on SR-99 was delayed until December 23, 2015. This delay in tunneling resumption pushed the SR-99 completion and Viaduct demolition schedules beyond the point where the City can assure that the CSO control project will be completed by 2020. Consequently, SPU submitted notification of this force majeure event the same day. Unfortunately, the City cannot determine the full extent of the delay until WSDOT and its construction contractors have completed their work. In the meantime, SPU has completed the design of the Basin 70, 71, 72 CSO control project and it is being bid so that it is ready to construct after the Viaduct is demolished.

The WSDOT-caused delay is not expected to cause or contribute to endangerment of public health, welfare, or the environment. Outfalls 70 and 72 already discharge less than once per year on average, and the discharge from Outfall 71 is a relatively small portion of the City's CSO volume.

In 2018, SPU completed the design, included the design in the bid package for the Waterfront Seattle Alaskan Way to Elliott Way - S King St to Battery St Project, and has been implementing the necessary measures to mitigate customer impacts. In 2019, SPU intends to complete the final measures to mitigate customer impacts, work with the Office of the Waterfront to award the construction contract, establish a construction schedule for the CSO control portion of the overall Waterfront Project, and begin construction.

4.4.2 North Central Waterfront (Basin 69)

Basin 69 is the most northern CSO basin along the Central Waterfront. Basin 69 is approximately 150 acres in size and the wastewater collection system is fully combined. Combined sewage flows north from Basin 69 into DNRP's Elliot Bay Interceptor (EBI). Currently, the control volume for this basin is estimated at approximately 130,000 gallons.

In 2018 SPU hired a design consultant team to support the options analysis phase of the project. During the latter half of the year the project began modelling work for a possible partnership solution with DNRP (flow transfer option) and modelling work for in-basin storage solutions.

In 2019, SPU will continue the evaluation of alternatives, select a preferred alternative using triple bottom line analysis, and complete the options analysis phase. SPU is on schedule to deliver the draft engineering report for the preferred alternative by mid-2019 and the final engineering report for the preferred alternative by the end of 2019.

There are numerous other transportation projects planned to be constructed in Basin 69 as well as interests from community groups to create more open space and green corridors. SPU coordinated with these stakeholders in 2018 and this coordination will continue through 2019.

4.5 Windermere Supplemental Compliance Plan

In 2015 SPU completed the construction of a 2.05 million-gallon (MG) storage tank near Magnuson Park on the south side of NE 65th Street to reduce the number of overflows from Outfall 13. Hydraulic modeling to assess the performance of the facility was completed in Summer 2016. The modeling showed that, although the project significantly reduced the occurrence of overflows from Basin 13, the modelled 20-year average number of overflows was 1.6, which exceeds the State CSO performance standard. Therefore, on October 4, 2016, SPU submitted a Supplemental Compliance Plan to Ecology and EPA outlining the steps SPU plans to take to meet the CSO standard. Ecology and EPA approved the Plan on January 5, 2017.

Per the approved Plan, in 2017 SPU evaluated operational adjustments to the recently constructed control structures in the Windermere Area. SPU submitted a technical memorandum summarizing the findings of the evaluation on December 28, 2017. SPU found that the two main control gates in the Windermere Area needed to be reprogrammed and recalibrated to better respond to changes in flow. The evaluation also found that Basin 15 was barely exceeding the CSO standard (at 1.1 CSO per year based on modeling), so SPU submitted a Supplemental Compliance Plan for Basin 15 on April 17, 2018.

In 2018 SPU implemented the recommended gate programming changes. In 2019 and 2020, SPU will monitor their effectiveness and continue to work with DNRP to identify other short-term system operational improvements.

Figure 4-3. Completed Windermere CSO Storage Facility

4.6 Genesee Supplemental Compliance Plan

In 2015 SPU completed the construction of a 380,000-gallon storage tank and a 120,000-gallon storage tank to reduce overflows from Outfalls 40, 41, and 43. The project was constructed in two parking lots along Lake Washington Boulevard S at 49th Avenue S and at 53rd Avenue S. Each has a facility vault, diversion sewer, and a force main with motor-operated gates to control the flow of wastewater similar to the Windermere storage facility.

In February 2016, SPU found significant root intrusion in the Lake Line that conveys combined sewage from the two newly constructed CSO storage tanks to Wastewater Pump Station 5. This root intrusion had two detrimental effects on the operation of the Genesee CSO facilities:

- It caused the tanks to fill up prematurely during storms, and
- It caused the tanks to drain too slowly after each storm.

These issues prevented SPU from updating the hydraulic model and completing the modeling work needed to determine whether the Genesee Area was controlled to the Consent Decree performance standard. Consequently, SPU submitted a Supplemental Compliance Plan to Ecology and EPA on March 8, 2017, requesting more time to complete flow monitoring and hydraulic modeling. Ecology and EPA approved the SCP on May 30, 2017. SPU cleaned the Lake Line and, in 2017, monitored flows in the Genesee Area.

In June of 2018, SPU submitted a Revised Supplemental Compliance Plan to Ecology, noting that the storage tanks have significantly reduced overflows in the Genesee Area but four basins are still exceeding the 1 per year standard. The Basins are 40, 41, 42 and 43, and modeling indicates they have 1.7, 1.7, 1.1, and 2.75 overflows per year, respectively. Similar to the steps taken in the Windermere Area, SPU evaluated possible operational improvements in the Genesee Area, which led to the recommendation to revise the programming of two control gates and install a new gate controller on CSO Storage Facility 9. In 2019, SPU will implement these operational improvements and monitor their effectiveness.

Figure 4-4. Completed Genesee CSO Storage Facility 9A

Figure 4-5. Completed Genesee CSO Storage Facility 11A

4.7 South Henderson Supplemental Compliance Plan

In 2015-2016 SPU constructed the following improvements to the combined system in the South Henderson Area:

- The 52nd Ave S Conveyance Project (Basins 47B and 171) which included a new diversion system and a pipeline to convey peak flows to DNRP's Henderson Pump Station.
- Pump Station 9 Upgrade (Basin 46), which included pumping and mechanical upgrades to SPU's pump station to better handle peak flows coming down from the sewer lake line.
- Henderson 47C Retrofit (Basin 47C), which included installing a new higher weir in the 47C control structure to optimize upstream storage and improve overflow monitoring.

In late 2016, hydraulic modeling was used to assess the performance of these improvements. The modeling showed that Basin 46 is meeting the CSO performance standard and Basins 47 and 171 are not. Prior to construction of these improvements, Basin 47 averaged 15.7 CSOs per year and Basin 171 averaged 7.4 CSOs per year. Based on 2016 modeling, the completed projects decreased the average frequency to 4.1 CSOs per year from Basin 47 and 3.3 CSOs per year from Basin 171.

Figure 4-6. Completed 52nd Ave S Combined Sewage Conveyance Project

Because the two basins were not yet meeting the CSO performance standard, on March 22, 2017 SPU submitted a Supplemental Compliance Plan to Ecology and EPA describing the additional steps that will be taken to control CSOs from Basins 47 and 171. Ecology and EPA approved the Plan on May 19, 2017. In 2017, SPU evaluated these basins and identified operational adjustments to the recently constructed control structures. SPU submitted a Technical Memorandum summarizing the evaluation on September 29, 2017. The main recommendation was to remove an orifice plate in Sub-Basin 47B to achieve the desired design flowrate. Per the approved Plan, this adjustment was implemented by December 29, 2017. In 2018, SPU monitored flows and modeled the system with the orifice plate removed. Modeling indicated that orifice plate removal decreased the average frequency to 3.2 CSOs per year from Basin 47 and 2.5 CSOs per year from Basin 171. In 2019, per the Supplemental Compliance Plan, SPU will submit a technical memorandum summarizing the monitoring and modeling results and will initiate planning activities to identify potential capital options for controlling these basins.

4.8 Magnolia 62 Supplemental Compliance Plan

In the 2016 Annual Report, SPU noted that the 20-year CSO frequency at Magnolia Outfall 62 had increased in recent years to an average of 1 per year (1997 – 2016). On March 21, 2018 SPU verbally notified Ecology and EPA that the frequency of CSOs from Outfall 62 had increased to a 20-year average of 1.1 per year (1998 – 2017) and that Outfall 62 no longer met the CSO performance standard. On April 3, 2018, SPU submitted a Supplemental Compliance Plan to Ecology and EPA, describing the remedial measures SPU will pursue to control the outfall. Following receipt of comments from Ecology and EPA on April 19, 2019, and a site visit with Ecology during Summer 2018, SPU submitted a revised Supplemental Compliance Plan on September 6, 2018.

The revised Supplemental Compliance Plan was approved on October 24, 2018. SPU committed to raise the Basin 62 CSO weir by December 31, 2018, and report on its functionality by March 31, 2019. On August 27, 2018, SPU installed a metal weir plate on the existing concrete weir wall, raising the weir 6.4 inches. Preliminary monitoring data shows that this new weir plate is likely already preventing overflows. SPU has also begun to evaluate how to inspect and clean (if required) the beach line (gravity conveyance from Basin 61 to Basin 64) as this line may be partially occluded with sediment. SPU will submit a technical memorandum to Ecology by June 28, 2019 summarizing the inspection and cleaning approach. If there is no feasible approach, SPU will submit a technical memorandum summarizing an alternative approach.

4.9 Outfall Rehabilitation Projects

In 2018, SPU replaced the deteriorating trash rack at Outfall 99 in the Delridge Area. See Figure 4-7.

Figure 4-7. CSO Outfall 99 Trash Rack: Before and After Replacement

Per the 2015 Outfall Rehabilitation Plan, SPU is also rehabilitating the bulkhead at Outfall 171 in the Genesee Area. Work is expected to be complete by the end of 2019.

In 2016, SPU completed the design for the replacement of Outfall 151 as part of the work on the Ship Canal Water Quality Project (see Section 4.3). Construction of Outfall 151 began in 2018 and will be completed in early 2019.

In 2019, SPU will initiate new underwater assessment of other CSO outfalls to begin identifying the next group of outfalls to rehabilitate.

4.10 South Park Water Quality Facility

The South Park Water Quality Facility is one of the stormwater improvement projects included in the approved Plan to Protect Seattle's Waterways. The intent of the facility is to treat stormwater runoff from the existing 7th Avenue South drainage basin, a highly industrial basin in the City's South Park neighborhood, and discharge treated water to the Lower Duwamish Waterway. The South Park Water Quality Facility would work in conjunction with the proposed South Park Pump Station, which would enable the existing stormwater collection system and outfall to function during all tidal conditions in the Lower Duwamish Waterway.

In 2018, SPU determined that the South Park Pump Station will require full use of the site previously slated for both the Pump Station and the Water Quality Facility. SPU began evaluating other potential Water Quality Facility sites in the industrial area of the South Park neighborhood. Much of the technical work on the Water Quality Facility is on hold pending property acquisition. The size of the property available to the project will dictate what treatment technologies should be evaluated. In 2019, SPU plans to complete the siting evaluation and hopes to confirm which property will be acquired.

4.11 Green Stormwater Infrastructure

The term green stormwater infrastructure (GSI) describes a variety of measures that use soil to absorb stormwater or slow the rate of stormwater entering the sewer system. Green solutions control the sources of pollution by slowing, detaining, or retaining stormwater so that it does not carry runoff into nearby waterways. This reduces the volume and timing of flows into the system. GSI facilities also are referred to as natural drainage systems (NDS) and they are a type of low impact development (LID). Examples of GSI include:

- RainWise – A program that provides homeowners with rebates for installing rain gardens and cisterns on their own property.
- Roadside bioretention – Deep-rooted native plants and grasses planted in a shallow depression in the public right-of-way, such as the planting strip adjacent to homes.

SPU's general goal is to use green solutions to reduce CSOs.

SPU and DNRP continue to work together to help ensure GSI projects in the City of Seattle use a consistent approach. Collaborative work in 2018 included:

- Improving user access to RainWise materials on the joint www.700milliongallons.org website. The platform has become more mobile friendly and sections of the site that are for contractor use have been made more difficult to access by the general public.
- Finalizing Volume III (Design Phase), issuing a draft final of Volume V (Operations & Maintenance) that addressed issues identified during finalization of Volume III, and initiating the update of Volume II (Options Analysis) of the joint SPU/DNRP Green Stormwater Infrastructure (GSI) Manuals.

In 2019, planned collaborative work includes:

- Updating Volume II (Options Analysis) of the joint GSI Manual to include lessons learned from past projects.
- Developing a new volume of the GSI Manual (Construction and Commissioning) to document the procedures and practices in construction and commissioning to help ensure the quality of projects, building on lessons learned from recent projects.
- Developing standard guidelines for underground injection control (UIC) well design and maintenance.

4.11.1 RainWise Program

Since 2010, RainWise has offered rebates to property owners in the combined sewer areas of Seattle. Eligible property owners are alerted about the program through regular mailings, public meetings, and media events. By visiting the RainWise website at www.700milliongallons.org, property owners are able to learn about green stormwater technologies and are presented with solutions appropriate for their property. Through this site, they are also able to find trained contractors.

Over 700 contractors, landscape designers and similar professionals have been trained in the program since 2009. Each year, the program offers two training opportunities for interested contractors. There are currently 70 active contractors listed on the RainWise website that are available to bid and install systems for RainWise customers. In addition, there are several contractors with RainWise training who choose not to be on the RainWise list because they consider RainWise as part of much larger installations.

In 2018, contractor fairs were offered to connect interested participants with participating contractors. Additionally, SPU and its community partners held several information workshops for potential RainWise customers to learn about the program, talk with satisfied participants, and meet contractors.

Upon completion, installations are inspected by a RainWise inspector and property owners apply for the rebate. RainWise rebates for rain gardens are currently four dollars per square foot of roof area controlled. Rebates for cisterns equal 69 percent or more of the rain garden rate, depending on the size of the cistern and contributing area. The average 2018 installation now controls the runoff from nearly 1,400 square feet of roof area.

Typical RainWise installations are shown in Figure 4-9.

Figure 4-8. Raingarden (left) and Cistern (right)

In 2018, the RainWise Program completed 120 projects in the Ballard, North Union Bay, Delridge, Fremont, Genesee, Henderson, Leschi, Montlake, and Windermere basins. Since program inception, 890 installations have been completed. These installations control approximately 27.9 acres of impervious roof area and an estimated 13.6 million gallons (MG) per year of stormwater, and they provide an estimated 224,516 gallons of CSO control volume.

In an effort to reach historically underserved communities, SPU continues to undertake equity inclusion initiatives in the Delridge, Genesee, and Henderson basins to explore and implement best practices for involving these communities in RainWise. In 2018, the initiative provided outreach to Somali, Vietnamese, Filipino and Chinese homeowners. Additionally, two Vietnamese contractors were recruited and trained.

The RainWise Program continues to operate under a memorandum of agreement with DNRP to make RainWise rebates available to customers whose properties are located in the City of Seattle and within CSO basins served by DNRP, in Ballard/West Phinney, Highland Park, Barton, and South Park. DNRP completed 102 installations in 2018, bringing their total installations since joining the program in 2013 to 790. DNRP's installations control approximate 21.5 acres of impervious roof area and approximately 12.0 MG per year of stormwater.

SPU will continue to offer its RainWise Program in 2019.

4.11.2 NDS Partnering

In 2015, the Natural Drainage System (NDS) Partnering Program developed the methodology, budget, and schedule required to achieve the NDS Partnering Program commitments in the approved Plan to Protect Seattle's Waterways. In 2018, the Program began construction of the 30th Ave NE Sidewalk and NDS Project, the first partnership project with SDOT, meeting the NDS Partnering regulatory milestone of issuing construction NTP by July 2019. Construction will be completed in early 2019.

Work in 2018 also included finalizing options analysis for the Longfellow and South Thornton Creek NDS Projects. This work included identifying potential project blocks, specifically where there was a potential partnership opportunity (such as with SDOT), conducting geotechnical analysis, developing concept plans, implementing the basin outreach plans and stategies for reaching underserved communities, incorporating community feedback into the concept plans, and finalizing the selection of preferred blocks for design. Options analysis for the Piper's Creek NDS Project also started in 2018.

In 2019, the NDS Partnering Program will begin design for the Longfellow and South Thornton Creek NDS Projects, finalize options analysis for the Piper's Creek NDS Project, and initiate options analysis for North Thornton Creek NDS Project.

Figure 4-9. Rendering of 30th Ave NE Sidewalk and NDS Project

4.12 Expanded Arterial Street Sweeping Program

This program expands the City's arterial street sweeping program, per commitments in the Plan to Protect Seattle's Waterways.

During 2018, the team continued implementing the expanded program. Key tasks completed included:

- Swept 16,100 broom-miles draining to waterways to capture 149 dry tons of total suspended solids (TSS) equivalent (22 percent positive variance from plan);
- Continued to utilize overtime to address difficulties maintaining a full crew due to a tight labor market and high turnover;
- Commissioned and utilized a new Ecology grant-funded regenerative air sweeper;
- Collected 48 post-construction monitoring plan (PCMP) samples; and
- Submitted the first PCMP report for review on March 26, 2018.

During 2019, the team will continue to implement the expanded program and adapt as needed to meet the regulatory targets. The key tasks planned for this year include:

- Continue sweeping established routes;
- Reduce sample collection to a quarterly basis;
- Replace sweepers in the fleet that have met the end of their useful life; and
- Improve process efficiency with a focus on onboard scale data collection.

The City is on schedule to meet the annual commitment of capturing 122 tons of total suspended solids (TSS) equivalent in 2019.

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SECTION 5

Monitoring Programs and Results

This section provides a brief overview of SPU's precipitation and flow monitoring programs and presents 2018 results, including CSO overflow details, 5-year average overflow frequencies, and a summary of the outfalls meeting the CSO control standard.

5.1 Precipitation Monitoring Program

SPU collects precipitation data from a network of 22 rain gauges located throughout the City of Seattle, as shown in Figure 1-1. SPU made no changes to the network of permanent rain gauges in 2018.

Two tables summarizing 2017 precipitation monitoring results are included in this report:

- Table 5-1 provides precipitation by gauge and by month; and
- Table 5-2 summarizes the last five years of precipitation monitoring results by year and by month.

For the first time in 5 years, Seattle experienced normal precipitation over a calendar year. That said, only four months were wetter than normal, which is the fewest recorded since 2008. The most abnormally dry period fell between mid-April and mid-September.

Annual rainfall across the city ranged from a maximum of 40.49 inches (RG01, North Seattle) to a minimum of 30.23 inches (RG05, Fauntleroy). Total rainfall averaged across the City of Seattle reached 35.35 inches, which is a fraction over the normal 34.94 inches.

For the third straight year, Seattle avoided extreme events (equal to or greater than a 25-year recurrence interval). The most intense rainfall of the year occurred on April 15th when three rain gages recorded 5-year, 6-hour events. Two-year recurrences (at one or more locations) were recorded three other times.

5.2 Flow Monitoring Program

During 2018, SPU's flow monitoring consultant operated and maintained 72 monitoring points. An additional 24 monitoring points were operated and maintained by SPU staff, for a total of 96 continuous monitoring sites.

Dedicated monitoring program staff review flow monitoring results on a regular basis and evaluate data quality and flow monitor performance. If emerging problems are identified during these reviews (such as data showing slow storage tank drainage or missing data), the issues are rapidly addressed by requesting field service from the monitoring consultant or from the SPU Drainage and Wastewater crews. The consultant and SPU staff also perform site-specific troubleshooting.

Each month, the consultant's lead data analyst and senior engineer and SPU monitoring staff review and analyze any apparent overflows that occurred the previous month, taking into consideration rainfall, knowledge of site hydraulics, and the best available monitoring data. When needed, SPU meets with consultant staff to make a final determination regarding whether an overflow occurred, and any necessary follow-up actions are documented.

5.3 Summary of 2018 Monitoring Results

Several tables summarizing 2018 flow monitoring and flow monitor performance are included in the following pages of this report:

- Table 5-3 show the 2018 flow monitor performance by outfall and month;
- Table 5-4 provides the details of all 2018 CSOs by outfall and date;
- Table 5-5 includes the most recent 5-year overflow frequency for each outfall and compares 2018 and baseline CSO conditions;
- Table 5-6 compares 2014-2018 CSOs by outfall;
- Table 5-7 compares 2014-2018 CSOs by receiving water body;
- Table 5-8 shows which outfalls met the performance standard for controlled outfalls in 2018.

Observations and conclusions from these tables include:

- All of the flow monitoring stations were in service, detecting and quantifying any CSOs, over 99% of the time.
- There were 163 CSOs in 2018, totaling 52.6 million gallons (MG). Over one-fourth of these CSOs occurred in each of January and April, and over one-third of the annual CSO volume was discharged in each of January and April.
- Over 43 percent of the 2018 CSO volume was discharged from Outfall 152 (Ballard), which serves the largest combined sewer area of any of the outfalls. Not surprisingly, the water body receiving the greatest CSO volume in 2018 was Salmon Bay (Ballard).
- The five outfalls that will be controlled by the Ship Canal WQ Project (Outfalls 147, 150, 151, 152, and 174) contributed two-thirds of the 2018 CSOs (110 of the 163 CSOs) and 85 percent of the 2018 CSO volume (44.5 of the 52.6 MG).

One outfall that was reported to be controlled in SPU's baseline report and has been uncontrolled in recent years is Outfall 139 in the Montlake Area. In July 2016 SPU increased the pumping capacity of Wastewater Pump Station 25 by approximately 20 percent to increase the rate of flow to DNRP. SPU will continue to monitor the performance of the pump station to refine the remaining control volume estimate ahead of possible partnership with DNRP on a Montlake area CSO storage project.

Two outfalls identified as controlled in SPU's NPDES Permit did not meet the State CSO performance standard in 2018 (Outfalls 59 and 62). SPU hereby notifies Ecology and EPA of the Outfall 59 noncompliance, which is due to the unexpected failure of a force main serving Wastewater Pump

Station (WWPS) 43. SPU is replacing the force main using emergency contracting procedures, is bypassing WWPS 43 in the meantime, expects to complete construction in June 2019, and expects Outfall 59 to return to controlled status at that time. Prior to the force main break, Outfall 59 averaged 0.4 CSOs/year. For the period 2001-2018, Outfall 59 averaged 1.1 CSOs/year. Additional information regarding the exacerbated CSOs at Outfall 59 is included in Section 3.1.5.

SPU notified Ecology and EPA of the Outfall 62 noncompliance last year and submitted a Supplemental Compliance Plan. For the period 2001-2018, Outfall 62 averaged 1.1 CSOs/year. A description of the issues and steps taken to date to address the Outfall 62 noncompliance is provided in Section 4.8.

5.4 CSO Control Post-Construction Monitoring

In May 2018, SPU submitted a Supplemental Compliance Plan to defer sediment sampling at Outfall 18 until the adjacent Belvoir Pump Station outfall is controlled. The Supplemental Compliance Plan was approved on May 3, 2018.

Also in May 2018, SPU submitted a Supplemental Compliance Plan to bring the Outfall 68 Post-Construction Monitoring schedule into sync with the Port of Seattle's cleanup site sampling schedule and in particular with the projected availability of the Port's Final Sampling Report. The Supplemental Compliance Plan was approved on May 3, 2018.

SPU planned to perform post-CSO visual water quality monitoring at Outfalls 68 and 95 during calendar year 2018 if a CSO occurred. Only one CSO event occurred at Outfall 68 during 2018, on April 7, 2018. Visual water quality observations were made by SPU staff less than four hours after this small, six-minute-long overflow event started. No signs of debris or aesthetic impairment associated with sanitary sewage were observed. No CSO events occurred at Outfall 95 during 2018, so visual monitoring will be performed at this outfall if it overflows during the 2018-19 wet season (by April 30, 2019).

PCMP sediment sampling was completed at Outfall 95 on September 13, 2018. The sampling was performed by King County DNRP staff, overseen by SPU. Seven sediment samples and one duplicate sample were collected in the vicinity of Outfall 95, in accordance with the approved QAPP/SAP. The analytical results of these samples will be reported in 2019.

In 2018, SPU prepared a QAPP for Outfall 44, which was submitted to Ecology for review on November 29, 2018. SPU plans to conduct sediment sampling in 2020.

5.5 Integrated Plan Post-Construction Monitoring

Volume 3 of the Plan to Protect Seattle Waterways included a commitment to monitor the individual performance of the three Integrated Plan projects as data is available and to monitor overall performance once data is available from all three Integrated Plan projects. Table 5-9 summarizes the Integrated Plan performance targets and the data that is available to date. As noted, overall performance is not assessed because performance data is not yet available on the South Park Water Quality Facility and NDS Partnering.

City staff completed the Expanded Arterial Street Sweeping Program post-construction monitoring sampling activities on December 20, 2018. Staff collected 24 samples from the Haller Lake yard sweepings bin and 24 samples from the Charles Street yard sweepings bin during the 2018 post-construction monitoring period.

Volume 3 of the Plan to Protect Seattle's Waterways (the Integrated Plan) proposed calculating the incremental benefit of the Expanded Arterial Street Sweeping Program by subtracting the total pollutant load removed in 2013 (prior to implementation of the expanded program) from the total pollutant load removed during each of 2017 and 2018. Analysis of the 2013 through 2018 data showed significant pollutant concentration differences by year, location, and season, suggesting that concentrations are highly variable from year to year and indicating that the 2013 data does not represent a true baseline year.

Therefore, SPU modified the method used to determine the incremental benefits from the expanded program. SPU's modification uses the methodology described in the Integrated Plan and the January 17, 2017 Quality Assurance Project Plan (QAPP) with one change. Rather than compare the 2017 or 2018 pollutant load to the 2013 pollutant load, SPU multiplied the incremental miles swept each year times that year's pollutant pickup rates. The pollutant pickup rate is the total mass of pollutant removed during the year divided by the total miles swept that year. Table 5.9, which includes the 2017 and 2018 post-construction monitoring results, reflects this method modification.

The 2018 report, which includes the 2017 and 2018 results, will be submitted in March 2019 and reflects this method modification.

Table 5-1. 2018 Precipitation by Gauge and by Month (inches)												
Rain Gauge	**January**	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**October**	**November**	**December**
RG01	8.98	3.80	2.71	5.64	0.51	1.83	0.04	0.15	1.68	3.75	4.97	6.43
RG02	8.38	3.37	2.51	5.75	0.21	1.78	0.01	0.24	1.33	3.45	4.36	5.82
RG03	8.27	3.13	2.29	5.62	0.17	1.39	0.01	0.26	0.96	3.46	4.60	5.62
RG04	8.49	3.11	2.24	5.66	0.22	1.67	0.02	0.28	1.15	3.78	4.47	6.21
RG05	7.30	1.45	1.46	4.54	0.08	0.89	0.00	0.14	1.36	2.78	4.77	5.46
RG07	8.60	3.20	2.30	5.19	0.53	1.37	0.02	0.13	1.20	3.45	4.43	5.97
RG08	7.21	2.56	1.79	4.64	0.21	1.18	0.01	0.14	1.00	3.46	4.59	6.03
RG09	8.49	2.89	2.10	5.41	0.23	1.34	0.02	0.17	1.27	3.82	4.92	6.24
RG11	7.81	2.30	1.81	5.02	0.37	1.06	0.00	0.31	0.77	3.04	4.77	5.48
RG12	8.17	2.55	1.73	5.18	0.11	1.12	0.02	0.31	1.16	3.42	4.65	6.35
RG14	8.26	2.62	1.85	4.84	0.31	1.33	0.00	0.15	0.77	3.30	5.08	6.47
RG15	8.22	2.75	2.07	5.44	0.21	1.45	0.00	0.11	1.29	3.12	5.05	6.33
RG16	7.64	2.56	2.10	5.18	0.03	0.80	0.00	0.09	1.44	3.22	4.63	5.98
RG17	7.64	2.25	2.02	4.96	0.06	0.84	0.01	0.14	1.22	3.17	4.99	6.31
RG18	8.01	2.67	2.38	5.84	0.08	1.02	0.00	0.23	1.29	3.66	4.58	5.83
RG25	8.05	2.76	2.34	5.83	0.14	1.47	0.00	0.48	1.00	3.36	4.63	5.82
RG30	8.38	2.76	2.33	6.07	0.10	0.90	0.01	0.17	1.20	3.82	4.78	6.07
Monthly Average	**8.11**	**2.75**	**2.12**	**5.34**	**0.21**	**1.26**	**0.01**	**0.21**	**1.18**	**3.42**	**4.72**	**6.02**

Table 5-2. 2014-2018 Average Precipitation by Month (inches)					
Month/Year	**2014**	**2015**	**2016**	**2017**	**2018**
January	4.05	2.63	7.53	4.00	8.11
February	5.67	4.51	4.42	8.61	2.75
March	8.62	4.61	5.57	6.80	2.12
April	3.12	1.60	1.46	4.09	5.34
May	2.57	0.58	1.18	2.55	0.21
June	0.88	0.17	1.50	1.16	1.26
July	0.93	0.25	0.59	0.01	0.01
August	1.35	2.88	0.09	0.09	0.21
September	2.73	1.46	1.17	0.93	1.18
October	6.73	3.67	10.57	3.39	3.42
November	4.61	6.83	7.44	8.39	4.72
December	5.50	10.41	3.91	4.80	6.02
Annual Total	**46.76**	**39.59**	**45.43**	**44.82**	**35.35**

Table 5-3. 2018 Flow Monitor Performance by Outfall and Month

Outfall Number	Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sept		Oct		Nov		Dec		2018 Cumulative	
	Downtime (hrs)	Uptime (%)	Downtime (hrs)	Uptime (%)	Downtime (hrs)	Uptime (%)	Downtime (hrs)	Uptime (%)	Downtime (hrs)	Uptime (%)	Downtime (hrs)	Uptime (%)	Downtime (hrs)	Uptime (%)	Downtime (hrs)	Uptime (%)	Downtime (hrs)	Uptime (%)	Downtime (hrs)	Uptime (%)	Downtime (hrs)	Uptime (%)	Downtime (hrs)	Uptime (%)	Downtime (hrs)	Uptime (%)
12	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0
13	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	1.0	99.9	0.0	100.0	1.0	100.0
14	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0
15	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0
16	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0
18	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0
19	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0
20	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0
22	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0
24	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0
25	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0
27	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0
28	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0
29	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0
30	33.9	95.4	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	33.9	99.6
31	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0
32	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0
33	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
34	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0
35	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0
36	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0

Outfall Number	Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sept		Oct		Nov		Dec		2018 Cumulative	
	Downtime (hrs)	Uptime (%)	Downtime (hrs)	Uptime (%)	Downtime (hrs)	Uptime (%)	Downtime (hrs)	Uptime (%)	Downtime (hrs)	Uptime (%)	Downtime (hrs)	Uptime (%)	Downtime (hrs)	Uptime (%)	Downtime (hrs)	Uptime (%)	Downtime (hrs)	Uptime (%)	Downtime (hrs)	Uptime (%)	Downtime (hrs)	Uptime (%)	Downtime (hrs)	Uptime (%)	Downtime (hrs)	Uptime (%)
38	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0
40	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0
41	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0
42	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0
43	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0
44	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	1.1	99.8	0.0	100.0	5.9	99.2	7.0	99.9
45	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0
46	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0
47	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	39.6	94.7	0.0	100.0	82.3	88.9	121.9	98.6
48	0.0	100.0	0.0	100.0	0.0	100.0	2.8	99.6	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	2.8	100.0
49	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0
57	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0
59	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0
60	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0
61	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0
62	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0
64	0.0	100.0	0.0	100.0	0.0	100.0	28.3	96.2	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	28.3	99.7
68	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0
69	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0
70	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	18.4	97.5	9.0	98.8	27.4	99.7
71	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0
72	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0
78	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0

Outfall Number	Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sept		Oct		Nov		Dec		2018 Cumulative	
	Downtime (hrs)	Uptime (%)	Downtime (hrs)	Uptime (%)	Downtime (hrs)	Uptime (%)	Downtime (hrs)	Uptime (%)	Downtime (hrs)	Uptime (%)	Downtime (hrs)	Uptime (%)	Downtime (hrs)	Uptime (%)	Downtime (hrs)	Uptime (%)	Downtime (hrs)	Uptime (%)	Downtime (hrs)	Uptime (%)	Downtime (hrs)	Uptime (%)	Downtime (hrs)	Uptime (%)	Downtime (hrs)	Uptime (%)
80	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0
83	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	1.0	99.9	0.0	100.0	1.0	100.0
85	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0
88	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0
90	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	1.0	99.9	0.0	100.0	0.0	100.0	1.0	100.0
91	0.0	100.0	0.0	100.0	0.0	100.0	5.3	99.3	0.0	100.0	4.1	99.4	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	9.4	99.9
94	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	1.2	99.8	0.0	100.0	0.0	100.0	1.2	100.0
95	0.0	100.0	46.2	93.8	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	39.8	94.7	86.0	99.0
99	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0
107	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0
111	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0
120	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0
121	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0
124	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0
127	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0
129	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0
130	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0
131	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0
132	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0
134	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	1.0	99.9	0.0	100.0	1.0	99.9	0.0	100.0	2.0	100.0
135	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0
136	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0
138	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0

Outfall Number	Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sept		Oct		Nov		Dec		2018 Cumulative	
	Downtime (hrs)	Uptime (%)	Downtime (hrs)	Uptime (%)	Downtime (hrs)	Uptime (%)	Downtime (hrs)	Uptime (%)	Downtime (hrs)	Uptime (%)	Downtime (hrs)	Uptime (%)	Downtime (hrs)	Uptime (%)	Downtime (hrs)	Uptime (%)	Downtime (hrs)	Uptime (%)	Downtime (hrs)	Uptime (%)	Downtime (hrs)	Uptime (%)	Downtime (hrs)	Uptime (%)	Downtime (hrs)	Uptime (%)
139	25.1	96.6	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	25.1	99.7
140	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0
141	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0
144	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	91.3	87.7	0.0	100.0	91.3	99.0
145	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	1.0	99.9	1.0	99.9	0.0	100.0	2.8	99.6	4.7	99.9
146	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0
147	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0
148	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0
150/151	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0
152	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	42.7	94.3	10.0	98.7	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	52.7	99.4
161	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0
165	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0
168	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	2.0	99.7	5.1	99.3	0.0	100.0	2.1	99.7	0.0	100.0	7.6	99.0	16.8	99.8
169	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	1.1	99.8	1.0	99.9	9.4	98.7	11.6	99.9
170	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.8	99.9	0.0	100.0	0.0	100.0	0.0	100.0	0.8	100.0
171	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	69.7	90.6	0.0	100.0	0.0	100.0	0.0	100.0	69.7	99.2
174	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0
175	0.0	100.0	69.7	90.6	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	99.2
TOTAL	59.0	99.9	115.9	99.8	0.0	100.0	36.3	99.9	0.0	100.0	4.1	100.0	44.7	99.9	15.1	100.0	72.5	99.9	47.0	99.9	113.6	99.8	156.8	99.7	665.0	99.9

Table 5-4. 2018 CSO Details by Outfall and Date								
Permit No	Outfall No	Facility Name	Receiving Water	CSO Events				
				Starting Date	Volume (gallons)	Duration (hours)	Storm Duration (hours)	Precipitation (inches)
WA0031682	**12**	City of Seattle	Lake Washington	*No combined sewer overflow during 2018*				
WA0031682	**13**	City of Seattle	Lake Washington	04/14/2018	360,187	4.17	113.10	3.11
				Total	360,187	4.17	113.10	3.11
				Average	360,187	4.17	113.10	3.11
WA0031682	**14**	City of Seattle	Lake Washington	*No combined sewer overflow during 2018*				
WA0031682	**15**	City of Seattle	Lake Washington	04/14/2018	19,206	1.80	109.45	2.79
				10/27/2018	81	0.17	5.85	0.93
				Total	19,287	1.97	115.30	3.72
				Average	9,644	0.99	57.65	1.86
WA0031682	**16**	City of Seattle	Union Bay	*No combined sewer overflows during 2018*				
WA0031682	**18**	City of Seattle	Union Bay	*No combined sewer overflows during 2018*				
WA0031682	**19**	City of Seattle	Union Bay	*No combined sewer overflows during 2018*				
WA0031682	**20**	City of Seattle	Union Bay	01/11/2018	75,007	2.50	163.40	2.89
				01/29/2018	83,722	2.93	154.08	3.08
				04/14/2018	371,462	9.37	116.28	3.22
				Total	530,191	14.80	433.77	9.19
				Average	176,730	4.93	144.59	3.06

Permit No	Outfall No	Facility Name	Receiving Water	CSO Events				
				Starting Date	Volume (gallons)	Duration (hours)	Storm Duration (hours)	Precipitation (inches)
WA0031682	**22**	City of Seattle	Union Bay	*No combined sewer overflows during 2018*				
WA0031682	**24**	City of Seattle	Lake Washington	*No combined sewer overflows during 2018*				
WA0031682	**25**	City of Seattle	Lake Washington	*No combined sewer overflows during 2018*				
WA0031682	**27**	City of Seattle	Lake Washington	*No combined sewer overflows during 2018*				
WA0031682	**28**	City of Seattle	Lake Washington	04/14/2018	6,611	1.87	107.88	2.55
				Total	6,611	1.87	107.88	2.55
				Average	6,611	1.87	107.88	2.55
WA0031682	**29**	City of Seattle	Lake Washington	*No combined sewer overflows during 2018*				
WA0031682	**30**	City of Seattle	Lake Washington	04/14/2018	14,492	3.12	109.17	2.75
				Total	14,492	3.12	109.17	2.75
				Average	14,492	3.12	109.17	2.75
WA0031682	**31**	City of Seattle	Lake Washington	1/11/2018	18,424	1.10	158.90	2.96
				1/29/2018	48,133	1.90	152.50	3.03
				04/14/2018	147,406	10.27	116.35	3.18
				Total	213,963	13.27	427.75	9.17
				Average	71,321	4.42	142.58	3.06

Permit No	Outfall No	Facility Name	Receiving Water	CSO Events				
				Starting Date	Volume (gallons)	Duration (hours)	Storm Duration (hours)	Precipitation (inches)
WA0031682	**32**	City of Seattle	Lake Washington	01/11/2018	380	0.23	158.63	2.96
				01/29/2018	4,569	0.83	152.43	3.02
				04/14/2018	49,383	2.73	109.55	2.80
				Total	54,332	3.80	420.62	8.78
				Average	18,111	1.27	140.21	2.93
WA0031682	**33**	City of Seattle	Lake Washington	*Sealed and removed on July 22, 2016*				
WA0031682	**34**	City of Seattle	Lake Washington	04/14/2018	347,045	6.90	114.05	3.14
				Total	347,045	6.90	114.05	3.14
				Average	347,045	6.90	114.05	3.14
WA0031682	**35**	City of Seattle	Lake Washington	*No combined sewer overflows during 2018*				
WA0031682	**36**	City of Seattle	Lake Washington	*No combined sewer overflows during 2018*				
WA0031682	**38**	City of Seattle	Lake Washington	04/14/2018	113,752	6.43	114.40	2.94
				Total	113,752	6.43	114.40	2.94
				Average	113,752	6.43	114.40	2.94
WA0031682	**40**	City of Seattle	Lake Washington	04/14/2018	232,494	15.42	125.45	2.98
				Total	232,494	15.42	125.45	2.98
				Average	232,494	15.42	125.45	2.98

Permit No	Outfall No	Facility Name	Receiving Water	CSO Events				
				Starting Date	Volume (gallons)	Duration (hours)	Storm Duration (hours)	Precipitation (inches)
WA0031682	**41**	City of Seattle	Lake Washington	04/14/2018	232,494	15.42	125.45	2.98
				Total	232,494	15.42	125.45	2.98
				Average	232,494	15.42	125.45	2.98
WA0031682	**42**	City of Seattle	Lake Washington	04/14/2018	199,773	9.10	117.03	2.97
				Total	199,773	9.10	117.03	2.97
				Average	199,773	9.10	117.03	2.97
WA0031682	**43**	City of Seattle	Lake Washington	1/11/2018	18,656	3.33	162.18	2.79
				1/29/2018	17,226	3.00	154.28	3.20
				4/14/2018	137,430	19.92	125.87	2.98
				Total	173,312	26.25	442.33	8.97
				Average	57,771	8.75	147.44	2.99
WA0031682	**44**	City of Seattle	Lake Washington	04/15/2018	566,412	13.75	129.95	2.99
				Total	566,412	13.75	129.95	2.99
				Average	566,412	13.75	129.95	2.99
WA0031682	**45**	City of Seattle	Lake Washington	*No combined sewer overflows during 2018*				
WA0031682	**46**	City of Seattle	Lake Washington	*No combined sewer overflows during 2018*				
WA0031682	**47**	City of Seattle	Lake Washington	04/14/2018	520,612	7.75	0.00	0.00
				Total	520,612	7.75	0.00	0.00
				Average	520,612	7.75	0.00	0.00

Permit No	Outfall No	Facility Name	Receiving Water	CSO Events				
				Starting Date	Volume (gallons)	Duration (hours)	Storm Duration (hours)	Precipitation (inches)
WA0031682	**48**	City of Seattle	Lake Washington	*No combined sewer overflows during 2018*				
WA0031682	**49**	City of Seattle	Lake Washington	01/11/2018	154,757	3.20	22.30	1.00
				01/29/2018	184,138	3.07	154.60	3.41
				04/14/2018	1,052,315	11.43	118.07	3.05
				Total	1,391,210	17.70	294.97	7.46
				Average	463,737	5.90	98.32	2.49
WA0031682	**57**	City of Seattle	Puget Sound - Central	*No combined sewer overflows during 2018*				
WA0031682	**59**	City of Seattle	Salmon Bay	01/11/2018	92,091	2.75	3.75	2.51
				01/23/2018	12,121	8.75	9.33	0.99
				01/29/2018	111,438	3.75	5.42	2.87
				04/14/2018	375,464	6.17	115.75	2.63
				Total	591,114	21.42	134.25	9.00
				Average	147,778	5.35	33.56	2.25
WA0031682	**60**	City of Seattle	Salmon Bay	*No combined sewer overflows during 2018*				
WA0031682	**61**	City of Seattle	Elliott Bay	*No combined sewer overflows during 2018*				
WA0031682	**62**	City of Seattle	Elliott Bay	*No combined sewer overflows during 2018*				
WA0031682	**64**	City of Seattle	Elliott Bay	*No combined sewer overflows during 2018*				

Permit No	Outfall No	Facility Name	Receiving Water	CSO Events				
				Starting Date	Volume (gallons)	Duration (hours)	Storm Duration (hours)	Precipitation (inches)
WA0031682	**68**	City of Seattle	Elliott Bay	04/07/2018	766	0.13	77.68	1.02
				Total	766	0.13	77.68	1.02
				Average	766	0.13	77.68	1.02
WA0031682	**69**	City of Seattle	Elliott Bay	*No combined sewer overflows during 2018*				
WA0031682	**70**	City of Seattle	Elliott Bay	*No combined sewer overflows during 2018*				
WA0031682	**71**	City of Seattle	Elliott Bay	01/29/2018	4	0.07	8.60	0.74
				04/14/2018	85,916	3.33	109.22	2.38
				Total	85,920	3.40	117.82	3.12
				Average	42,960	1.70	58.91	1.56
WA0031682	**72**	City of Seattle	Elliott Bay	*No combined sewer overflows during 2018*				
WA0031682	**78**	City of Seattle	Elliott Bay	*No combined sewer overflows during 2018*				
WA0031682	**80**	City of Seattle	Puget Sound	*No combined sewer overflows during 2018*				
WA0031682	**83**	City of Seattle	Puget Sound	*No combined sewer overflows during 2018*				
WA0031682	**85**	City of Seattle	Puget Sound	*No combined sewer overflows during 2018*				
WA0031682	**88**	City of Seattle	Puget Sound	*No combined sewer overflows during 2018*				
WA0031682	**90**	City of Seattle	Puget Sound	*No combined sewer overflows during 2018*				

Permit No	Outfall No	Facility Name	Receiving Water	CSO Events				
				Starting Date	Volume (gallons)	Duration (hours)	Storm Duration (hours)	Precipitation (inches)
WA0031682	**91**	City of Seattle	Puget Sound	*No combined sewer overflows during 2018*				
WA0031682	**94**	City of Seattle	Puget Sound	*No combined sewer overflows during 2018*				
WA0031682	**95**	City of Seattle	Puget Sound	*No combined sewer overflows during 2018*				
WA0031682	**99**	City of Seattle	West Waterway - Duwamish River	01/11/2018	44,716	1.23	162.60	2.75
				01/29/2018	161,289	2.60	153.05	3.35
				04/14/2018	877,826	9.47	116.95	2.88
				Total	1,083,831	13.30	432.60	8.98
				Average	361,277	4.43	144.20	2.99
WA0031682	**107**	City of Seattle	East Waterway - Duwamish River	01/29/2018	450	0.57	152.88	3.34
				04/14/2018	29,155	3.20	109.73	2.76
				Total	29,605	3.77	262.62	6.10
				Average	14,803	1.88	131.31	3.05
WA0031682	**111**	City of Seattle	Duwamish River	04/14/2018	56,370	2.77	111.83	2.92
				Total	56,370	2.77	111.83	2.92
				Average	56,370	2.77	111.83	2.92
WA0031682	**120**	City of Seattle	Lake Union	*No combined sewer overflows during 2018*				

Permit No	Outfall No	Facility Name	Receiving Water	CSO Events				
				Starting Date	Volume (gallons)	Duration (hours)	Storm Duration (hours)	Precipitation (inches)
WA0031682	**121**	City of Seattle	Lake Union	*No combined sewer overflows during 2018*				
WA0031682	**124**	City of Seattle	Lake Union	*No combined sewer overflows during 2018*				
WA0031682	**127**	City of Seattle	Lake Union	*No combined sewer overflows during 2018*				
WA0031682	**129**	City of Seattle	Lake Union	*No combined sewer overflows during 2018*				
WA0031682	**130**	City of Seattle	Lake Union	*No combined sewer overflows during 2018*				
WA0031682	**131**	City of Seattle	Lake Union	*No combined sewer overflows during 2018*				
WA0031682	**132**	City of Seattle	Lake Union	*No combined sewer overflows during 2018*				
WA0031682	**134**	City of Seattle	Lake Union	*No combined sewer overflows during 2018*				
WA0031682	**135**	City of Seattle	Lake Union	*No combined sewer overflows during 2018*				
WA0031682	**136**	City of Seattle	Lake Union	*No combined sewer overflows during 2018*				
WA0031682	**138**	City of Seattle	Portage Bay	04/14/2018	85,845	6.83	114.72	3.22
				Total	85,845	6.83	114.72	3.22
				Average	85,845	6.83	114.72	3.22

Permit No	Outfall No	Facility Name	Receiving Water	CSO Events				
				Starting Date	Volume (gallons)	Duration (hours)	Storm Duration (hours)	Precipitation (inches)
WA0031682	**139**	City of Seattle	Portage Bay	04/14/2018	45,599	1.63	109.25	2.78
				10/27/2018	288,712	2.40	6.35	0.96
				11/26/2018	109,012	8.50	28.22	1.88
				Total	443,323	12.53	143.82	5.62
				Average	147,774	4.18	47.94	1.87
WA0031682	**140**	City of Seattle	Portage Bay	01/18/2018	29	0.07	66.15	1.14
				04/14/2018	45,068	6.17	113.68	3.15
				10/27/2018	35,573	2.37	6.42	0.96
				11/27/2018	22,730	0.67	28.32	1.88
				Total	103,400	9.28	214.57	7.13
				Average	25,850	2.32	53.64	1.78
WA0031682	**141**	City of Seattle	Portage Bay	*No combined sewer overflows during 2018*				
WA0031682	**144**	City of Seattle	Lake Union	*No combined sewer overflows during 2018*				
WA0031682	**145**	City of Seattle	Lake Union	*No combined sewer overflows during 2018*				
WA0031682	**146**	City of Seattle	Lake Union	*No combined sewer overflows during 2018*				
WA0031682	**147**	City of Seattle	Lake Union	01/05/2018	90,455	17.67	31.78	0.63
				01/09/2018	291,493	20.92	121.12	2.04
				01/11/2018	1,658,743	7.33	162.95	2.93
				01/17/2018	1,054,236	28.92	72.03	1.77
				01/21/2018	33,642	14.42	45.78	0.41

Permit No	Outfall No	Facility Name	Receiving Water	CSO Events				
				Starting Date	Volume (gallons)	Duration (hours)	Storm Duration (hours)	Precipitation (inches)
				01/23/2018	551,920	32.50	34.63	1.32
				01/27/2018	380,587	8.67	97.97	2.11
				01/29/2018	1,309,455	12.17	155.30	3.15
				02/01/2018	84,969	3.92	8.98	0.46
				02/25/2018	930	0.17	33.87	0.16
				02/27/2018	110,082	22.00	29.93	0.67
				03/13/2018	71	0.08	4.50	0.15
				03/22/2018	26,318	45.25	58.10	1.08
				04/01/2018	27,185	0.25	11.95	0.13
				04/07/2018	598,873	6.33	79.42	1.23
				04/11/2018	3,757,670	77.25	116.80	2.89
				05/19/2018	74,113	0.42	0.70	0.15
				06/13/2018	16,639	12.83	13.13	0.45
				06/22/2018	8,476	0.17	1.27	0.12
				06/24/2018	50,066	0.33	0.67	0.13
				09/15/2018	47,202	19.50	20.17	0.49
				10/08/2018	5,485	0.25	36.63	0.48
				10/25/2018	52,466	3.50	17.48	0.66
				10/27/2018	955,572	24.25	26.38	1.63
				11/02/2018	22	0.08	32.30	0.30
				11/03/2018	178	0.25	60.47	0.49
				11/07/2018	3,784	0.25	24.38	0.21
				11/22/2018	141,041	14.92	44.07	0.96
				11/26/2018	1,310,221	47.75	71.85	2.35
				11/30/2018	30	0.17	134.18	2.71
				12/09/2018	933	0.42	6.50	0.43

Permit No	Outfall No	Facility Name	Receiving Water	CSO Events				
				Starting Date	Volume (gallons)	Duration (hours)	Storm Duration (hours)	Precipitation (inches)
				12/11/2018	1,036	0.08	55.17	1.06
				12/16/2018	672,330	62.75	67.52	2.07
				12/20/2018	123,468	6.25	109.10	2.56
				12/22/2018	638,988	14.08	14.77	0.85
				12/28/2018	79,959	1.83	53.27	0.55
				12/29/2018	873,283	12.17	90.07	1.18
				Total	15,031,921	520.08	1,945.18	40.96
				Average	406,268	14.06	52.57	1.11
WA0031682	**148**	City of Seattle	Lake Washington - Ship Canal	*No combined sewer overflows during 2018*				
WA0031682	**150/151**	City of Seattle	Salmon Bay	01/06/2018	128,781	0.30	36.58	0.56
				01/09/2018	17	0.07	125.82	1.69
				01/11/2018	111,560	4.00	165.78	2.51
				01/18/2018	57,313	19.97	72.08	1.27
				01/21/2018	5,853	14.27	26.92	0.33
				01/23/2018	10,682	13.10	14.98	0.92
				01/27/2018	2,626	0.43	89.65	1.65
				01/29/2018	865,849	29.40	172.15	2.94
				02/01/2018	16,750	0.10	5.32	0.18
				04/07/2018	124,768	0.40	78.33	0.88
				04/11/2018	8,677	0.37	42.67	0.92
				04/14/2018	49,566	1.60	109.07	2.20
				05/19/2018	235,062	0.47	0.75	0.14
				10/09/2018	76	0.03	37.53	0.37
				10/25/2018	10,891	2.67	17.22	0.59

Permit No	Outfall No	Facility Name	Receiving Water	CSO Events				
				Starting Date	Volume (gallons)	Duration (hours)	Storm Duration (hours)	Precipitation (inches)
				10/27/2018	782,339	15.90	25.22	1.40
				11/22/2018	4,676	0.47	17.50	0.39
				11/26/2018	128,249	4.13	22.65	2.05
				12/09/2018	7,388	0.47	6.35	0.45
				12/17/2018	26,022	19.07	63.78	1.80
				12/22/2018	338,394	13.03	33.48	0.86
				12/29/2018	467	11.90	90.03	1.00
				Total	2,916,004	152.14	1253.87	25.10
				Average	132,546	6.92	56.99	1.14
WA0031682	**152**	City of Seattle	Salmon Bay	01/05/2018	360,429	69.00	80.08	1.16
				01/08/2018	326,332	21.47	126.38	1.70
				01/11/2018	1,898,110	37.97	196.88	2.64
				01/16/2018	191	0.67	4.27	0.15
				01/17/2018	1,208,921	30.32	72.92	1.27
				01/21/2018	181,189	21.97	26.92	0.33
				01/23/2018	1,635,283	53.17	53.83	1.34
				01/26/2018	757,358	25.95	112.45	2.01
				01/29/2018	2,383,316	30.43	172.15	2.94
				02/01/2018	305,653	5.38	9.75	0.43
				02/03/2018	17,628	5.75	58.37	0.75
				02/13/2018	8,943	2.00	3.70	0.24
				02/17/2018	26,352	1.30	27.68	0.18
				02/25/2018	8,159	1.15	33.48	0.20
				02/27/2018	314,777	23.95	26.42	0.66
				03/08/2018	62,102	5.70	16.23	0.42

Permit No	Outfall No	Facility Name	Receiving Water	CSO Events				
				Starting Date	Volume (gallons)	Duration (hours)	Storm Duration (hours)	Precipitation (inches)
				03/22/2018	88,215	45.85	58.50	0.89
				04/01/2018	68,973	1.97	1.98	0.14
				04/05/2018	444	1.17	40.63	0.37
				04/07/2018	431,965	26.83	99.63	1.09
				04/10/2018	81,328	1.37	2.70	0.20
				04/11/2018	540,588	4.18	43.10	0.93
				04/13/2018	3,046,387	58.33	139.50	2.79
				04/28/2018	55,180	14.33	14.90	0.46
				05/19/2018	130,107	0.67	0.78	0.14
				06/10/2018	26,482	0.35	52.35	0.26
				06/13/2018	50,367	17.08	17.78	0.50
				06/24/2018	40,593	0.42	1.18	0.14
				09/14/2018	15,568	1.72	8.95	0.16
				09/15/2018	11,928	13.15	13.95	0.31
				10/08/2018	23,034	2.02	37.80	0.38
				10/25/2018	232,252	3.67	17.22	0.59
				10/27/2018	2,299,387	24.43	32.67	1.54
				11/02/2018	12,115	0.30	22.65	0.13
				11/03/2018	5,375	0.43	58.12	0.29
				11/22/2018	408,016	28.97	44.70	0.96
				11/26/2018	2,447,132	49.17	51.62	2.37
				11/30/2018	313,195	3.02	21.02	0.46
				12/02/2018	10,125	6.97	32.27	0.24
				12/09/2018	158,726	6.10	7.95	0.55
				12/11/2018	21,942	4.05	54.88	1.06
				12/16/2018	989,830	63.73	67.55	1.93

Permit No	Outfall No	Facility Name	Receiving Water	CSO Events				
				Starting Date	Volume (gallons)	Duration (hours)	Storm Duration (hours)	Precipitation (inches)
				12/20/2018	117,108	6.60	108.67	2.41
				12/22/2018	1,128,815	15.02	34.48	0.88
				12/28/2018	410,693	38.98	90.03	1.00
				Total	22,660,613	777.04	2199.08	39.59
				Average	503,569	17.27	48.87	0.88
WA0031682	**161**	City of Seattle	Lake Washington	*No combined sewer overflows during 2018*				
WA0031682	**165**	City of Seattle	Lake Washington	04/14/2018	732	0.73	109.30	2.53
				Total	732	0.73	109.30	2.53
				Average	732	0.73	109.30	2.53
WA0031682	**168**	City of Seattle	Lake Washington	04/15/2018	52,250	3.92	119.48	2.76
				Total	52,250	3.92	119.48	2.76
				Average	52,250	3.92	119.48	2.76
WA0031682	**169**	City of Seattle	Lake Washington	*No combined sewer overflows during 2018*				
WA0031682	**170**	City of Seattle	Lake Washington	*No combined sewer overflows during 2018*				
WA0031682	**171**	City of Seattle	Lake Washington	04/14/2018	266,958	3.77	110.73	2.76
				Total	266,958	3.77	110.73	2.76
				Average	266,958	3.77	110.73	2.76

Permit No	Outfall No	Facility Name	Receiving Water	CSO Events				
				Starting Date	Volume (gallons)	Duration (hours)	Storm Duration (hours)	Precipitation (inches)
WA0031682	**174**	City of Seattle	Lake Washington Canal	01/11/2018	757,967	4.25	162.03	2.93
				01/18/2018	366,058	3.08	54.52	1.25
				01/29/2018	772,514	4.17	154.38	3.15
				04/07/2018	2,215	0.25	78.33	1.19
				04/14/2018	1,847,976	9.42	115.55	2.88
				10/27/2018	476,026	2.17	6.47	1.13
				11/26/2018	394,936	8.00	44.68	2.08
				Total	4,617,692	31.34	615.97	14.61
				Average	659,670	4.48	88.00	2.09
WA0031682	**175**	City of Seattle	Lake Union	*No combined sewer overflows during 2018*				

Table 5-5. Comparison of 2018 and Baseline CSOs by Outfall

Outfall Number	2014 - 2018 Average CSO Frequency (No./year)	2018 CSO Discharge Events			Receiving Water	2010 Baseline CSO		2018 CSOs Compared to 2010 Baseline CSOs
		Frequency (No./year)	Duration (hours)	Volume (gallons)		Frequency (No./year)	Volume (MG/year)	
12	0.4	0	0.00	0	Lake Washington	0	0	Equals
13	5.8	1	4.17	360,187	Lake Washington	12	6.7	Below
14	0.6	0	0.00	0	Lake Washington	0	0	Below
15	3.6	2	1.97	19,287	Lake Washington	1.2	0.3	Frequency Above, Volume Below
16	0	0	0.00	0	Lake Washington	0	0	Equals
18	2.2	0	0.00	0	Union Bay	6.6	0.5	Below
19	0	0	0.00	0	Union Bay	0.2	0	Frequency Below, Volume Equals
20	5.2	3	14.80	530,191	Union Bay	2.6	0.1	Above
22	1.4	0	0.00	0	Union Bay	0.7	0.1	Below
24	0.4	0	0.00	0	Lake Washington	0.2	0	Frequency Below, Volume Equals
25	0.4	0	0.00	0	Lake Washington	2.8	1.6	Below
27	0	0	0.00	0	Lake Washington	0	0	Equals
28	4.2	1	1.87	6,611	Lake Washington	15	0.4	Below
29	6.4	1	3.40	53,616	Lake Washington	4.7	0.3	Below
30	3	1	3.12	14,492	Lake Washington	5.4	0.7	Below
31	6	3	3.00	213,963	Lake Washington	9.3	0.5	Below
32	2.6	3	3.80	54,332	Lake Washington	8.4	0.3	Below
33	0	0	0.00	0	Lake Washington	0.2	0	NA (Removed from service)
34	1	1	6.90	347,045	Lake Washington	1.4	0.5	Below
35	1.4	0	0.00	0	Lake Washington	2	0.3	Below
36	1.6	0	0.00	0	Lake Washington	2.7	0.1	Below
38	1.6	1	6.43	113,752	Lake Washington	0.7	0.4	Frequency Above, Volume Below
40	4.2	1	15.42	232,494	Lake Washington	6	0.8	Below
41	7.6	1	15.42	232,494	Lake Washington	7.5	0.9	Below
42	2.4	1	9.10	199,773	Lake Washington	0.6	0.02	Above
43	6.8	3	26.25	173,312	Lake Washington	7	0.7	Below
44	17.8	1	13.75	566,412	Lake Washington	13	9.3	Below
45	9.6	0	0.00	0	Lake Washington	5.9	1.1	Frequency Below, Volume Equal
46	1	0	0.00	0	Lake Washington	6.5	0.9	Below

Outfall Number	2014 - 2018 Average CSO Frequency (No./year)	2018 CSO Discharge Events			Receiving Water	2010 Baseline CSO		2018 CSOs Compared to 2010 Baseline CSOs
		Frequency (No./year)	Duration (hours)	Volume (gallons)		Frequency (No./year)	Volume (MG/year)	
47	4.8	1	7.77	520,612	Lake Washington	5.6	1.8	Below
48	0	0	0.00	0	Lake Washington	0	0	Equals
49	4.6	3	17.70	1,391,210	Lake Washington	1.6	0.8	Above
57	0	0	0.00	0	Puget Sound	0	0	Equals
59	2.6	4	21.42	591,114	Salmon Bay	0.2	0.4	Above
60	2.2	0	0.00	0	Salmon Bay	1.7	0.8	Below
61	0.4	0	0.00	0	Elliott Bay	0	0	Equals
62	2.2	0	0.00	0	Elliott Bay	0.7	0	Frequency Below, Volume Equals
64	0	0	0.00	0	Elliott Bay	0.1	0	Frequency Below, Volume Equals
68	2.2	1	0.13	766	Elliott Bay	1.4	1.3	Below
69	2.6	0	0.00	0	Elliott Bay	4.4	1.4	Below
70	0.2	0	0.00	0	Elliott Bay	0.9	0.2	Below
71	3.4	2	3.40	84,372	Elliott Bay	4.3	1.3	Below
72	0	0	0.00	0	Elliott Bay	1.2	0.3	Below
78	0	0	0.00	0	Elliott Bay	0.3	0.2	Below
80	0	0	0.00	0	Elliott Bay	0	0	Equals
83	0	0	0.00	0	Puget Sound	0	0	Equals
85	0	0	0.00	0	Puget Sound	0	0	Equals
88	0.2	0	0.00	0	Puget Sound	0.3	0.2	Below
90	0	0	0.00	0	Puget Sound	0.2	0	Frequency Below, Volume Equals
91	0	0	0.00	0	Puget Sound	0	0	Equals
94	0	0	0.00	0	Puget Sound	0.1	0	Frequency Below, Volume Equals
95	0.4	0	0.00	0	Puget Sound	3	0.4	Below
99	4.6	3	13.30	1,083,831	W Waterway - Duwamish River	0.5	2.8	Frequency Above, Volume Below
107	5.6	2	3.77	29,605	E Waterway - Duwamish River	3.8	1.9	Below
111	1.8	1	2.77	56,370	Duwamish River	3	7.9	Below
120	0	0	0.00	0	Lake Union	0	0	Equals
121	0	0	0.00	0	Lake Union	0.1	0	Frequency Below, Volume Equals
124	0	0	0.00	0	Lake Union	0	0	Equals

Outfall Number	2014 - 2018 Average CSO Frequency (No./year)	2018 CSO Discharge Events			Receiving Water	2010 Baseline CSO		2018 CSOs Compared to 2010 Baseline CSOs
		Frequency (No./year)	Duration (hours)	Volume (gallons)		Frequency (No./year)	Volume (MG/year)	
127	0.2	0	0.00	0	Lake Union	0.7	0.1	Below
129	0	0	0.00	0	Lake Union	0.1	0	Frequency Below, Volume Equals
130	0.6	0	0.00	0	Lake Union	0	0	Equals
131	0	0	0.00	0	Lake Union	0.1	0	Frequency Below, Volume Equals
132	0.6	0	0.00	0	Lake Union	0.7	0	Frequency Below, Volume Equals
134	0	0	0.00	0	Lake Union	0	0	Equals
135	0.4	0	0.00	0	Lake Union	0.3	0	Frequency Below, Volume Equals
136	0	0	0.00	0	Lake Union	0	0	Equals
138	3.4	1	6.83	65,996	Portage Bay	2.3	2	Below
139	2.8	3	12.53	443,323	Portage Bay	0.7	1.4	Frequency Above, Volume Below
140	8.8	4	9.28	103,400	Portage Bay	4.1	0.3	Below
141	0	0	0.00	0	Portage Bay	0.1	0	Frequency Below, Volume Equals
144	0	0	0.00	0	Lake Union	0.1	0.2	Below
145	0	0	0.00	0	Lake Union	0	0	Equals
146	0	0	0.00	0	Lake Union	0	0	Equals
147	43.6	37	520.08	15,031,921	Lake Union	33	19	Frequency Above, Volume Below
148	0.2	0	0.00	0	Lake Washington Ship Canal	0	0	Equals
150/151	28.8	22	152.14	2,916,004	Salmon Bay	15	2	Above
152	49	45	777.04	22,660,613	Salmon Bay	15	9.7	Above
161	0	0	0.00	0	Lake Washington	0	0	Equals
165	1.2	1	0.73	732	Lake Washington	1.1	0.02	Below
168	1.2	1	3.92	52,250	Longfellow Creek	3.9	1.6	Below
169	1.4	0	0.00	0	Longfellow Creek	2.2	49	Below
170	0.2	0	0.00	0	Longfellow Creek	0.4	0.1	Below
171	4.8	1	3.77	266,958	Lake Washington	4.1	0.75	Below
174	12	6	27.17	3,845,179	Lake Washington Ship Canal	11	5.9	Below
175	1	1	3.08	366,058	Lake Union	0.7	0	Above
Total	**295**	**163**	**1,713**	**52,618,123**		**252**	**140**	

Table 5-6. 2014-2018 Summary Comparison of CSOs by Outfall																
Outfall No.	Frequency (Number per Year)					Duration (Hours per Year)					Volume (Gallons per Year)					Receiving Water
	2014	2015	2016	2017	2018	2014	2015	2016	2017	2018	2014	2015	2016	2017	2018	
12	2	0	0	0	0	0.87	0.00	0.00	0.00	0.00	2,612	0	0	0	0	Lake Washington
13	15	7	2	4	1	139.42	80.15	22.93	35.90	4.17	12,376,374	10,406,831	389,145	4,106,126	360,187	Lake Washington
14	0	1	1	1	0	0.00	0.03	0.42	0.08	0.00	0	136	14	1	0	Lake Washington
15	2	7	3	4	2	6.41	5.69	5.30	5.00	1.97	66,045	130,433	43,665	135,288	19,287	Lake Washington
16	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	Lake Washington
18	5	2	3	1	0	38.75	12.53	79.17	1.47	0.00	3,350,103	2,821,975	1,703,725	44,582	0	Union Bay
19	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	Union Bay
20	5	8	4	6	3	18.60	28.73	18.50	68.47	14.80	562,408	939,125	277,377	1,693,470	530,191	Union Bay
22	3	3	1	0	0	4.02	6.75	0.73	0.00	0.00	16,765	10,825	1,002	0	0	Union Bay
24	0	0	1	1	0	0.00	0.00	0.67	6.50	0.00	0	0	39,762	877,185	0	Lake Washington
25	0	0	1	1	0	0.00	0.00	0.60	5.67	0.00	0	0	48,394	459,487	0	Lake Washington
27	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	Lake Washington
28	7	5	4	4	1	0.77	10.68	0.53	5.37	1.87	3,781	15,141	4,174	24,045	6,611	Lake Washington
29	7	9	10	5	1	23.68	79.00	13.43	75.60	3.40	134,427	163,604	23,379	297,430	53,616	Lake Washington
30	2	4	5	3	1	8.53	47.70	3.85	14.38	3.12	149,342	68,875	2,380	24,363	14,492	Lake Washington
31	5	5	10	7	3	28.69	108.95	63.26	86.10	3.00	152,897	1,292,158	689,411	1,271,673	213,963	Lake Washington
32	2	1	4	3	3	10.08	1.40	3.07	50.10	3.80	111,411	21,463	20,455	251,033	54,332	Lake Washington
33	0	0	0	NA	NA	0.00	0.00	0.00	NA	0.00	0	0	0	NA	NA	Lake Washington
34	2	1	0	1	1	4.97	1.70	0.00	4.23	6.90	79,864	36,871	0	98,569	347,045	Lake Washington
35	2	5	0	0	0	0.16	2.82	0.00	0.00	0.00	851	26,232	0	0	0	Lake Washington
36	2	4	2	0	0	8.40	92.02	2.70	0.00	0.00	26,931	129,992	8,215	0	0	Lake Washington
38	2	2	0	3	1	2.53	8.08	0.00	12.53	6.43	55,731	424,286	0	587,079	113,752	Lake Washington
40	11	5	1	3	1	97.27	133.60	67.22	73.92	15.42	2,502,735	2,079,022	455,337	2,052,156	232,494	Lake Washington
41	22	9	3	3	1	269.17	233.73	67.22	73.92	15.42	2,745,644	6,552,815	455,337	2,052,156	232,494	Lake Washington
42	6	3	0	2	1	46.80	10.67	0.00	12.20	9.10	489,133	161,845	0	250,946	199,773	Lake Washington

Outfall No.	Frequency (Number per Year)					Duration (Hours per Year)					Volume (Gallons per Year)					Receiving Water
	2014	2015	2016	2017	2018	2014	2015	2016	2017	2018	2014	2015	2016	2017	2018	
43	14	7	5	5	3	117.08	113.98	57.17	71.00	26.25	1,541,559	3,237,045	1,687,465	2,837,201	173,312	Lake Washington
44	25	18	34	11	1	319.81	419.69	452.47	302.23	13.75	11,257,313	17,584,437	9,129,326	16,067,339	566,412	Lake Washington
45	21	10	12	5	0	95.72	188.83	68.85	85.27	0.00	520,482	1,047,926	322,189	1,131,582	0	Lake Washington
46	4	1	0	0	0	27.88	1.33	0.00	0.00	0.00	51,982	16,053	0	0	0	Lake Washington
47	15	3	2	3	1	55.72	57.00	1.92	18.08	7.77	2,475,920	1,859,583	109,548	2,094,545	520,612	Lake Washington
48	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	Lake Washington
49	6	5	4	5	3	44.28	86.64	15.19	70.90	17.70	2,452,672	5,220,691	819,793	6,726,873	1,391,210	Lake Washington
57	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	Puget Sound
59	0	0	1	8	4	0.00	0.00	0.42	26.07	21.42	0	0	76,208	236,432	591,114	Salmon Bay
60	2	4	2	3	0	4.30	8.08	4.70	7.60	0.00	86,372	200,834	20,813	39,088	0	Salmon Bay
61	0	0	0	2	0	0.00	0.00	0.00	0.40	0.00	0	0	0	14,854	0	Elliott Bay
62	2	4	1	4	0	0.64	3.70	4.42	0.92	0.00	1,584	75,305	1,868	3,434	0	Elliott Bay
64	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	Elliott Bay
68	2	4	2	2	1	3.84	5.48	17.30	0.63	0.13	188,263	559,251	247,681	14,620	766	Elliott Bay
69	3	4	4	2	0	1.09	2.52	0.90	1.18	0.00	206,238	435,845	65,281	146,360	0	Elliott Bay
70	0	1	0	0	0	0.00	0.13	0.00	0.00	0.00	0	22,849	0	0	0	Elliott Bay
71	2	6	2	5	2	1.01	3.20	1.77	7.83	3.40	81,675	225,540	140,046	400,921	84,372	Elliott Bay
72	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	Elliott Bay
78	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	Elliott Bay
80	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	Elliott Bay
83	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	Puget Sound
85	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	Puget Sound
88	0	0	0	1	0	0.00	0.00	0.00	1.43	0.00	0	0	0	51,735	0	Puget Sound
90	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	Puget Sound
91	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	Puget Sound
94	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	Puget Sound
95	0	0	0	2	0	0.00	0.00	0.00	1.14	0.00	0	0	0	14,958	0	Puget Sound
99	6	4	5	5	3	72.67	74.23	23.00	74.23	13.30	3,827,730	4,855,651	1,053,542	4,548,780	1,083,831	W Waterway - Duwamish River

Outfall No.	Frequency (Number per Year)					Duration (Hours per Year)					Volume (Gallons per Year)					Receiving Water
	2014	2015	2016	2017	2018	2014	2015	2016	2017	2018	2014	2015	2016	2017	2018	
107	6	9	5	6	2	30.10	82.20	42.58	63.15	3.77	288,804	673,362	427,231	947,028	29,605	E Waterway - Duwamish River
111	3	3	0	2	1	16.59	6.57	0.00	5.93	2.77	146,654	357,532	0	317,148	56,370	Duwamish River
120	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	Lake Union
121	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	Lake Union
124	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	Lake Union
127	0	1	0	0	0	0.00	70.60	0.00	0.00	0.00	0	64,878	0	0	0	Lake Union
129	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	Lake Union
130	0	3	0	0	0	0.00	0.82	0.00	0.00	0.00	0	268,332	0	0	0	Lake Union
131	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	Lake Union
132	0	3	0	0	0	0.00	1.58	0.00	0.00	0.00	0	1,014,884	0	0	0	Lake Union
134	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	Lake Union
135	0	2	0	0	0	0.00	0.90	0.00	0.00	0.00	0	9,889	0	0	0	Lake Union
136	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	Lake Union
138	3	7	3	3	1	8.00	17.48	3.23	22.00	6.83	264,644	721,977	85,056	392,526	65,996	Portage Bay
139	2	6	0	3	3	3.33	16.38	0.00	10.50	12.53	47,515	1,171,445	0	389,283	443,323	Portage Bay
140	13	10	10	7	4	9.72	28.25	3.29	36.90	9.28	341,627	695,688	48,134	415,391	103,400	Portage Bay
141	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	Portage Bay
144	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	Lake Union
145	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	Lake Union
146	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	Lake Union
147	49	32	58	42	37	589.00	495.17	531.66	537.67	520.08	12,316,618	16,682,352	13,068,417	25,042,017	15,031,921	Lake Union
148	0	1	0	0	0	0.00	1.30	0.00	0.00	0.00	0	1,400	0	0	0	Lake Washington Ship Canal
150/151	34	28	31	29	22	268.14	387.00	249.07	159.87	152.14	3,543,723	2,539,871	2,226,176	4,695,385	2,916,004	Salmon Bay
152	53	34	63	50	45	900.65	713.68	1052.89	879.15	777.04	41,104,401	36,195,281	42,062,058	56,062,735	22,660,613	Salmon Bay
161	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0	Lake Washington
165	2	1	0	2	1	1.34	1.48	0.00	4.60	0.73	8,970	16,634	0	31,973	732	Lake Washington
168	1	2	0	2	1	13.73	84.33	0.00	30.33	3.92	1,092,208	7,718,986	0	3,932,249	52,250	Longfellow Creek
169	1	2	1	3	0	23.15	105.93	6.27	22.10	0.00	604,990	6,162,245	664,680	1,783,155	0	Longfellow Creek

Outfall No.	Frequency (Number per Year)					Duration (Hours per Year)					Volume (Gallons per Year)					Receiving Water
	2014	2015	2016	2017	2018	2014	2015	2016	2017	2018	2014	2015	2016	2017	2018	
170	0	0	0	1	0	0.00	0.00	0.00	3.53	0.00	0	0	0	15,194	0	Longfellow Creek
171	15	3	2	3	1	57.62	24.05	1.53	9.90	3.77	1,544,026	287,884	90,094	481,749	266,958	Lake Washington
174	20	15	12	7	6	89.35	113.37	83.34	50.67	27.17	8,763,659	13,555,680	9,106,686	4,176,148	3,845,179	Lake Washington Ship Canal
175	0	4	0	0	1	0.00	1.43	0.00	0.00	3.08	0	243,126	0	0	366,058	Lake Union
Total	**406**	**318**	**314**	**275**	**163**	**3,463.9**	**3,981.6**	**2,971.6**	**3,036.6**	**1,713.4**	**115,586,683**	**149,004,085**	**85,614,065**	**147,236,290**	**52,628,274**	

Table 5-7. 2014-2018 Summary Comparison of CSOs by Receiving Water

Receiving Water	Frequency (Number per Year)					Duration (Hours per Year)					Volume (Gallons per Year)				
	2014	2015	2016	2017	2018	2014	2015	2016	2017	2018	2014	2015	2016	2017	2018
Duwamish River	3	3	0	2	1	17	7	0	6	3	146,654	357,532	0	317,148	56,370
East Waterway	6	9	5	6	2	30	82	43	63	4	288,804	673,362	427,231	947,028	29,605
Elliott Bay	4	19	9	15	3	5	15	24	11	4	269,938	1,318,790	454,875	580,189	85,138
Lake Union	49	45	58	42	39	589	571	532	538	523	12,316,618	18,283,461	13,068,417	25,042,017	15,397,980
Lake Washington	191	116	106	79	27	1,367	1,709	848	1,023	155	38,750,702	50,779,955	14,338,085	41,858,799	4,767,281
Lake Washington - Ship Canal	20	16	12	7	6	89	115	83	51	27	8,763,659	13,557,080	9,106,686	4,176,148	3,845,179
Longfellow Creek	2	4	1	6	1	37	190	6	56	4	1,697,198	13,881,231	664,680	5,730,598	52,250
Portage Bay	18	23	13	13	8	21	62	7	69	29	653,786	2,589,110	133,190	1,197,199	612,719
Puget Sound	0	0	0	3	0	0	0	0	3	0	0	0	0	66,693	0
Salmon Bay	94	66	97	90	64	1,175	1,108	1,307	1,073	950	44,942,318	38,935,987	44,385,255	61,033,640	26,167,731
Union Bay	13	13	8	7	3	61	48	98	70	15	3,929,276	3,771,925	1,982,104	1,738,052	530,191
West Waterway	6	4	5	5	3	73	74	23	74	13	3,827,730	4,855,651	1,053,542	4,548,780	1,083,831
TOTAL:	**406**	**318**	**314**	**275**	**157**	**3,464**	**3,981**	**2,972**	**3,037**	**1,724**	**115,586,683**	**149,004,085**	**85,614,065**	**147,236,290**	**52,618,123**

Table 5-8. Outfalls Meeting Performance Standard for Controlled CSOs Based on Flow Monitoring Results and Modeling

Outfall Number	Number of Combined Sewer Overflows Per Year [1]																				Average Annual Overflow Frequency	Meets Performance Standard? [2]	Long-Term Simulation Source	Notes
	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018				
12			0	0	0	0	0	0	0	0	0	1	0	1	1	2	0	0	0	0	0.3	Yes	N/A	3
13	0	0	1	1	2	2	1	2	1	0	2	1	0	1	1	4	5	2	4	1	1.6	No	Mike URBAN results, March 2017	4
14									1	0	1	0	0	0	0	0	1	1	1	0	0.4	Yes	N/A	5
15	0	0	1	1	2	1	1	3	1	0	2	1	1	1	2	6	7	3	4	2	2.0	No	Mike URBAN results, March 2017	4
16			0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0.1	Yes	N/A	3
18	2	0	3	2	3	4	4	11	2	3	8	5	4	8	2	5	2	3	1	0	3.6	No	LTCP Long Term Simulation Results February 2013	6, 7
19			0	0	1	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0.2	Yes	N/A	3
20	1	0	0	0	2	1	0	3	1	0	3	3	3	2	2	5	8	4	6	3	2.4	No	LTCP Long Term Simulation Results February 2013	6
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0.1	Yes	EPA-SWMM results, February 2019	8
24	0	0	0	0	2	2	0	4	1	0	1	1	0	1	1	0	0	1	1	0	0.8	Yes	LTCP Long Term Simulation Results February 2013	6
25	0	0	0	0	2	1	0	3	1	1	2	1	0	1	1	0	0	1	1	0	0.8	Yes	LTCP Long Term Simulation Results February 2013	9
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	Yes	Mike URBAN results, January 2019	10
28	0	0	0	2	1	2	0	1	1	1	0	0	0	0	2	2	2	2	3	1	1.0	Yes	Mike URBAN results, January 2019	10
29	0	0	0	1	0	1	0	1	0	0	0	0	0	0	0	0	1	1	2	1	0.4	Yes	Mike URBAN results, January 2019	10
30	0	0	1	1	2	2	1	4	1	1	2	1	1	3	3	5	5	3	4	1	2.1	No	Mike URBAN results, January 2019	10
31	0	0	2	2	2	3	2	4	1	1	5	2	2	4	3	9	9	6	7	3	3.4	No	Mike URBAN results, January 2019	10
32	0	0	1	1	1	1	0	1	1	1	0	0	0	1	2	2	2	2	1	3	1.0	Yes	Mike URBAN results, January 2019	10
33																					NA	NA	NA	11
34	0	0	0	1	2	1	0	2	1	1	0	1	1	1	1	2	1	1	1	1	0.9	Yes	Mike URBAN results, January 2019	10
35	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0.1	Yes	Mike URBAN results, January 2019	10
36	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0.1	Yes	Mike URBAN results, January 2019	10

Outfall Number	Number of Combined Sewer Overflows Per Year [1]																				Average Annual Overflow Frequency	Meets Performance Standard? [2]	Long-Term Simulation Source	Notes
	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018				
38	0	0	1	1	0	0	0	2	1	0	1	1	1	1	1	0	0	0	3	1	0.7	Yes	Mike URBAN results, June 2018	12
40	0	0	3	2	2	1	1	5	1	0	3	1	2	2	1	2	3	1	3	1	1.7	No	Mike URBAN results, June 2018	12
41	0	0	3	2	2	1	1	5	1	0	3	1	2	2	1	2	3	1	3	1	1.7	No	Mike URBAN results, June 2018	12
42	0	0	3	0	2	0	0	3	1	1	1	1	1	1	1	0	3	0	2	1	1.1	No	Mike URBAN results, June 2018	12
43	1	0	3	3	2	1	2	6	1	1	5	3	2	5	2	4	5	4	5	3	2.9	No	Mike URBAN results, June 2018	12
44	12	8	14	10	18	16	13	29	9	12	16	16	17	22	11	25	18	34	11	1	15.6	No	InfoWorks V9.5 H&H Model - Extracted Data Set from Long Term Simulation Run.	6
45	10	6	16	11	18	22	17	21	19	5	11	10	11	14	7	20	10	12	5	0	12.3	No	InfoWorks V9.5 H&H Model - Extracted Data Set from Long Term Simulation Run.	6
46	0	0	2	0	3	1	0	1	1	0	3	1	1	2	0	1	2	0	0	0	0.9	Yes	InfoWorks results, December 2016	13
47	3	0	2	2	3	0	4	5	3	2	6	4	2	5	3	4	6	4	2	1	3.1	No	Mike URBAN results, December 2018	14
48										0	0	0	0	0	0	0	0	0	0	0	0.0	Yes	N/A	6
49	3	0	2	5	3	1	3	8	3	1	4	5	4	7	3	6	5	4	5	3	3.8	No	Mike URBAN results, February 2018	6
57			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	Yes	N/A	3
59			0	0	1	0	0	0	1	0	0	0	1	2	1	0	0	1	8	4	1.1	No	N/A	3, 15
60	4	1	2	0	2	1	4	4	3	0	3	4	2	6	1	2	4	2	3	0	2.4	No	LTCP Long Term Simulation Results February 2013	6
61	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	2	0	0.2	Yes	N/A	6
62	0	0	1	0	1	0	1	1	1	0	0	0	3	1	2	2	4	1	4	0	1.1	No	N/A	6
64	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	Yes	N/A	6
68	0	0	1	0	2	0	1	1	1	0	1	1	0	1	1	2	4	1	2	1	1.0	Yes	LTCP Long Term Simulation Results February 2013	6, 16
69	0	1	1	1	2	1	1	2	1	1	3	1	2	2	3	3	4	4	2	0	1.8	No	LTCP Long Term Simulation Results February 2013	6
70	0	0	1	0	0	1	0	1	1	0	1	0	0	0	1	0	1	0	0	0	0.4	Yes	AWVSRP Modeling Support Alternative Modeling Report May 2012, Appendix D	6
71	0	0	1	0	3	1	1	2	1	2	9	7	3	5	3	2	5	2	5	2	2.7	No	AWVSRP Modeling Support Alternative Modeling	6

Outfall Number	Number of Combined Sewer Overflows Per Year [1]																				Average Annual Overflow Frequency	Meets Performance Standard? [2]	Long-Term Simulation Source	Notes
	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018				
																							Report May 2012, Appendix D	
72	0	0	0	0	2	0	0	1	1	0	0	0	0	0	1	0	0	0	0	0	0.3	Yes	AWVSRP Modeling Support Alternative Modeling Report May 2012, Appendix D	6
78			0	0	2	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0.2	Yes	N/A	3
80			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	Yes	N/A	3
83			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	Yes	N/A	3
85			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	Yes	N/A	3
88			0	0	0	1	0	0	2	0	0	1	0	0	0	0	0	0	1	0	0.3	Yes	N/A	3
90			0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0.1	Yes	N/A	3
91			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	Yes	N/A	3
94			0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	Yes	N/A	3
95	1	0	0	0	1	0	0	2	1	1	2	1	0	1	1	0	0	0	2	0	0.7	Yes	EPA-SWMM results, February 2019	17
99	2	0	3	0	1	1	2	1	1	0	1	2	3	5	1	6	4	5	5	3	2.3	No	LTCP Long Term Simulation Results February 2013	6
107								9	3	1	9	11	4	4	2	4	5	5	5	2	4.9	No	EPA-SWMM results, February 2019	18
111	0	0	1	0	3	0	2	2	1	0	1	1	0	1	3	2	3	0	2	1	1.2	No	EPA-SWMM results, February 2019	19
120			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	Yes	N/A	3
121			0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	Yes	N/A	3
124			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	Yes	N/A	3
127			0	0	0	1	0	3	0	1	1	0	0	0	0	0	0	0	0	0	0.3	Yes	N/A	3
129			0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	Yes	N/A	3
130										0	0	0	0	0	0	0	3	0	0	0	0.3	Yes	N/A	5
131			0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0.1	Yes	N/A	3
132										0	0	0	1	0	2	0	3	0	0	0	0.5	Yes	N/A	5
134			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	Yes	N/A	3
135										0	1	0	0	0	0	0	2	0	0	0	0.3	Yes	N/A	5
136			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	Yes	N/A	3
138	0	0	1	0	2	3	0	3	1	1	2	1	3	2	2	3	7	3	3	1	1.9	No	LTCP Long Term Simulation Results February 2013	6
139	0	0	1	0	1	3	1	2	1	0	1	2	1	2	1	2	6	0	3	3	1.5	No	LTCP Long Term Simulation Results February 2013	6

Outfall Number	Number of Combined Sewer Overflows Per Year [1]																				Average Annual Overflow Frequency	Meets Performance Standard? [2]	Long-Term Simulation Source	Notes
	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018				
140	0	2	2	3	6	5	6	5	1	1	7	8	2	4	5	13	10	10	7	4	5.1	No	LTCP Long Term Simulation Results February 2013	6
141			0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0.1	Yes	N/A	3
144			0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0.1	Yes	N/A	3
145			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	Yes	N/A	3
146			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	Yes	N/A	3
147	32	27	26	29	31	29	37	45	35	50	45	63	40	47	27	49	32	58	42	37	39.1	No	LTCP Long Term Simulation Results February 2013	6
148			0	0	0	0	0	0	0	0	0	1	2	0	0	0	1	0	0	0	0.2	Yes	N/A	3
150/151	19	11	16	10	14	6	15	23	11	2	22	29	25	31	14	34	28	31	29	22	19.6	No	LTCP Long Term Simulation Results February 2013	6
152	49	57	47	39	53	44	46	42	43	11	29	63	48	57	44	53	34	63	50	45	45.9	No	LTCP Long Term Simulation Results February 2013	6
161			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0	Yes	N/A	3
165	0	0	0	0	2	0	0	1	2	0	0	2	1	2	2	0	2	0	2	1	0.9	Yes	Mike URBAN results, June 2018	12
168	4	0	3	1	2	1	2	5	2	0	1	1	0	2	0	2	2	0	2	1	1.6	No	EPA-SWMM results, February 2019	20
169	3	1	3	1	3	1	3	5	2	1	1	2	2	3	0	2	3	1	3	0	2.0	No	EPA-SWMM results, February 2019	20
170										0	2	1	0	1	0	0	0	0	1	0	0.5	Yes	N/A	6
171	2	0	1	1	2	0	3	5	2	1	6	4	2	4	2	4	6	3	1	1	2.5	No	Mike URBAN results, December 2018	14
174	6	1	8	3	5	6	10	21	6	6	14	13	10	17	7	20	15	12	7	6	9.7	No	LTCP Long Term Simulation Results February 2013	6
175										0	1	0	0	0	2	0	4	0	0	1	0.7	Yes	N/A	6

Notes:

1. Per Section S4.B of the NPDES Permit, the determination of whether an outfall is meeting the performance standard for controlled outfalls has been made based on up to 20 years of data and modeling. Numbers in the colorless cells were obtained from flow monitoring. Numbers in blue-shaded cells were obtained using precipitation data and basin-specific models and are used in the long-term average annual overflow calculation for years when flow monitoring data either is not available or the accuracy of the flow monitoring data cannot be confirmed.
2. Responses in this column are “Yes” if the calculated Average Annual Overflow Frequency is no more than 1 per year and “No” if the calculated Average Annual Overflow Frequency is more than 1 per year.
3. The flow monitoring configuration prior to 2001 cannot be confirmed and the pre-2001 data accuracy is questionable, so the calculated Average Annual Overflow Frequency uses data from flow monitoring conducted between 2001 and 2016.
4. The Basin 13 storage tank was operationally complete on July 21, 2015. Due to the hydraulic connectivity between Basin 13 and Basin 15 via the Lake Line, flow modeling data is used to estimate overflow events from both basins prior to this date.
5. The flow monitoring configuration prior to 2007 cannot be confirmed and the pre-2007 data accuracy is questionable, so the calculated Average Annual Overflow Frequency uses data from flow monitoring conducted between 2007 and 2016.

6. The flow monitoring configuration prior to 2008 cannot be confirmed and the pre-2008 data accuracy is questionable, so the calculated Average Annual Overflow Frequency uses data from flow monitoring conducted between 2008 and 2016.
7. SPU completed two separate retrofit projects in Basin 18 in 2012 and 2016, reducing the frequency of CSOs in subsequent years.
8. Several exacerbated CSOs occurred at Outfall 22 in recent years because of the deteriorating performance of WWPS 50. The pump station was rehabilitated and existing air-lift style pumps replaced with submersible pumps. WWPS 50 began pumping at its design rate on December 20, 2016. Flow modeling data is used prior to this date.
9. SPU raised the weir at Outfall 25 in early 2008, so the calculated Average Annual Overflow Frequency uses flow modeling through 2008 and flow monitoring for subsequent years.
10. The weir at Outfall 34 was lowered on February 15, 2017 to protect WWPS 2 from an elevated grade line. Due to the hydraulic connectivity of the Leschi basins along the Lake Line, flow modeling data is used for all Leschi outfalls prior to this date.
11. The CSO overflow pipe to Outfall 33 was sealed and the outfall was removed from CSO service on July 22, 2016.
12. The Lake Line connecting the Genesee CSO basins was jet cleaned on March 17, 2016, allowing for maximum hydraulic conveyance capacity. Due to the connectivity of the Genesee CSO basins along the Lake Line, flow modeling data is used for all Genesee outfalls prior to this date.
13. SPU completed the Pump Station 9 Rehabilitation Project in 2016 and subsequently updated the hydraulic model for Basin 46 to reflect the constructed facilities.
14. On July 19, 2013, SPU replaced a HydroBrake in South Henderson Basin 49 with an orifice plate. Flow modeling is used to predict Basin 49 CSOs prior to this date. SPU completed the South Henderson CSO Reduction Projects (weir retrofits and 52nd Ave Conveyance Project) in August 2015 and, on November 9, 2017, removed the orifice in the 52nd Avenue South flow control structure that was restricting flows. Flow modeling is used to predict Basin 47 and 171 flows prior to this date.
15. During repair of the WWPS 43 force main, flows are being temporarily bypassed around WWPS 43. Because of unavoidable bypass system constraints, there were six exacerbated CSOs at Outfall 59 in 2017 and four exacerbated CSOs at Outfall 59 in 2018.
16. Basin 68 CSOs in 2015 and 2016 were likely exacerbated by a partially clogged HydroBrake. Subsequent attention to inspection and maintenance seems to have reduced the frequency of CSOs.
17. The Basin 95 retrofit project was substantially completed on April 4, 2013. Flow modeling is used prior to this date.
18. Basin 107 overflows are induced by an elevated hydraulic grade line (HGL) in the Elliot Bay Interceptor. Reliable HGL data, necessary for flow modeling, is available from 2006 to present. The backwater valve retrofit was installed on August 19, 2017. Therefore, flow modeling data is used for January 1, 2006 through August 19, 2017, with flow monitoring data used thereafter.
19. The last hydraulic modification in Basin 111 was performed on December 1, 2014. Flow modeling data is used prior to this date.
20. SPU completed the valve retrofit on November 5, 2015. Flow modeling data is used prior to this date.

Table 5-9. Integrated Plan Performance Targets and Results								
Status	**Project Name**	**Average volume treated or removed (MG/year)**	**Fecal coliform (billion CFU/year)[1]**	**PCB (g/year)[1]**	**Total phosphorus (kg/year)[1]**	**Total copper (kg/year)[1]**	**TSS (kg/year)[1]**	**Total zinc (kg/year)[1]**
Target	NDS Partnering	32[1]	10,649	1.3	11	1.1	6,478	9.2
	South Park Water Quality Facility	67[1]	31,000	5.2	38	3.8	20,935	25
	Expanded Arterial Street Sweeping	1,477[1,2]	1,380	2.0	14	3.3	20,700	6.3
	Total	1,576	43,029	9	63	8.2	48,113	41
2017 Interim Results	Expanded Arterial Street Sweeping[3]	1,900	1,464	4.0	44	9.1	59,000	20
2018 Interim Results	Expanded Arterial Street Sweeping[3]	1,700	801	2.6	41	8.4	53,000	18

Notes:

1. These values represent the 95% lower confidence limits (LCL) from the Integrated Plan pollutant load model (PLM) results.
2. Volume of runoff from swept streets.
3. Data is only available for the Expanded Arterial Street Sweeping Program. Monitoring for NDS Partnering and South Park Water Quality Facility has not begun. Post-construction monitoring results will not be compared to the total performance monitoring targets until monitoring has been completed for all three stormwater projects because the goals are based on the total load reductions for the three projects combined.

Appendix A: Additional CMOM Information

Table A-1. 2018 Sewer Overflow (SSO) Details

2018 SSO Number	ERTS Number	Date	Address	SSO Volume (gallons)	Volume to Surface Water (gallons)	Surface Water	Primary Cause
18001	678339	1/10/18	5020 SW Dakota St	5			Debris
18002	678406	1/11/18	6333 1st Ave S	2000	10	Duwamish River	FOG
18003	678484	1/14/18	9853 Rainier Ave S (revised from ERTS report)	5,900	5,000	Lake Washington	Structural Failure-gravity
18004	678891	1/27/18	9549 1st Ave NW (revised from ERTS report)	1			Debris
18005	678967	1/30/18	219 2nd Ave S	1			Structural Failure-gravity
18006	679299	2/13/18	1331 Harbor Ave SW	5			Private Construction
18007	679349	2/18/18	9514 8th Ave NW	600			Structural Failure-gravity
18008	680218	3/29/18	660 S Andover St	2,000			Vandalism
18009	680411	4/8/18	42nd Ave S between S Snoqualmie St & S Conover Way	360	360	Lake Washington	Vandalism
18010	680628	4/14/18	5300 34th Ave NW	40			Maintenance Error
18011	682631	7/16/18	228 Fairview Ave N	1000			Private Construction
18012	683256	8/10/18	4552 SW Othello St	Unknown			Structural Failure-gravity
18013	683436	8/18/18	1507 Western Ave	50			Vandalism
18014	683603	8/25/18	937 N 102nd St	5			City Construction
18015	683702	8/29/18	3821 E Newton St	0.25			City Construction
18016	683808	9/5/18	Union St between 2nd and 3rd Ave	50			FOG
18017	684946	10/28/18	4002 Aikens Ave SW	25			Structural Failure-gravity
18018	685249	11/10/18	W Ewing St & 6th Ave W	14,400	14,400	Lake Washington Ship Canal	Power Outage
18019	685366	11/16/18	116 26th Ave E	60			Private Construction
18020	685827	12/9/18	3108 S Washington St	20			Structural Failure-gravity

Table A-2. Pump Station Location and Capacity								
Number	Name	Address	Type [1]	Basin Area (acres)	Average Inflow (gpm)	Number of Pumps and Rating	Static Head (feet)	Storage Time (hours)
1	Lawton Wood	5645 45th Ave West	WW/DW	31.8	36	2 at 350 gpm each	60.5	9.4
2	Charles Street	901 Lakeside Dr	WW/DW	108.1	262	2 at 450 gpm each	20	4+
4	South Director Street	5135 South Director St	Air Lift	3.1	4	2 at 150 gpm each	28.5	10.7
5	46th Avenue South	3800 Lake Washington Blvd	WW/DW	198.2	1147	2 at 1000 gpm each	13.9	4+
6	South Alaska Street	4645 Lake Washington Blvd	WW/DW	10.2	439	2 at 300 gpm each	14	4+
7	East Lee Street	4214 East Lee St	WW/DW	227	209	2 at 2800 gpm each	50	5.75
9	South Grattan Street	8400 55th Ave South	WW/DW	422.2	1293	2 at 2700 gpm each	13.9	2
10	South Holly Street	5711 South Holly St	WW/DW	188.4	1064	2 at 1000 gpm each	13.5	2
11	North Sand Point	63rd Ave NE and NE 78th St	Submersible		10	2 at 800 gpm each	23	1
13	Montlake	2160 East Shelby St	WW/DW	64.9		2 at 600 gpm each	29.7	4+
15	West Park Drive East	West Park Dr East and East Shelby St	Submersible		10	2 at 800 gpm each	12	1
17	Empire Way	42nd Ave South and South Norfolk St	WW/DW	395	1341	2 at 2000 gpm each	27.7	5
18	South 116th Place	6700 South 116th Pl	Submersible		18	2 at 800 gpm each	45	12+
19	Leroy Place South	9400 Leroy Pl South	Submersible		22	2 at 800 gpm each	45	12+
20	East Shelby Street	1205 East Shelby St	WW/DW	48.6	541	2 at 600 gpm each	45	4+
21	21st Avenue West	2557 21st Ave West	Submersible		19	2 at 800 gpm each	45	12+
22	West Cramer Street	5400 38th Ave West	WW/DW	26.9	444	2 at 750 gpm each	62	6.64
25	Calhoun Street	1812 East Calhoun St	WW/DW	52.2	371	2 at 850 gpm each	36	3.63
28	North Beach	9001 View Ave NW	Submersible	4.8	7	2 at 800 gpm each	40.7	4
30	Esplanade	3206 NW Esplanade St	Submersible	5.7	9	2 at 800 gpm each	63	11.88
31	11th Avenue NW	12007 11th Ave NW	Submersible	2	10	2 at 800 gpm each	20	12+
35	25th Avenue NE	2734 NE 45th St	WW/DW	71	436	3 at 850 gpm each	39.8	1
36	Maryland	1122 Harbor Ave SW	Air Lift	12.2	18	2 at 150 gpm each	10	10.25
37	Fairmont	1751 Harbor Ave SW	WW/DW	281.5	1491	2 at 3500 gpm each	12.8	2
38	Arkansas	1411 Alki Ave SW	Air Lift	46.5	188	2 at 150 gpm each	10	13.15

Number	Name	Address	Type [1]	Basin Area (acres)	Average Inflow (gpm)	Number of Pumps and Rating	Static Head (feet)	Storage Time (hours)
39	Dawson	5080 Beach Dr SW	WW/DW	55	622	2 at 1100 gpm each	36.7	4.6
42	Lincoln Park	8617 Fauntleroy Way SW	WW/DW	6.5	64	2 at 200 gpm each	55.5	12.4
43	Seaview No. 1	5635 Seaview Ave NW	WW/DW	177.4	1693	2 at 1500 gpm each	40.4	4.85
44	Boeing No. 1	6820 Perimeter Rd S	WW/DW	168.5	334	2 at 600 gpm each	19	1.68
45	Boeing No. 2	7609 Perimeter Rd S	WW/DW	133.5	293	2 at 300 gpm each	16.5	2.91
46	Seaview No. 2	6541 Seaview Ave NW	Air Lift	52.6	68	2 at 150 gpm each	14.6	2.45
47	Seaview No. 3	7242 Seaview Ave NW	Air Lift	11	14	2 at 150 gpm each	9.5	5.87
48	Brooklyn	3701 Brooklyn Ave NE	WW/DW	31.4	156	2 at 1000 gpm each	53.3	4.01
49	Latona	3750 Latona Ave NE	WW/DW	22.4	257	2 at 250 gpm each	33.3	4+
50	39th Avenue East	2534 39th Ave East	Submersible	10.6	14	2 at 100 gpm each	17	6
51	NE 60th Street	6670 NE 60th St	WW/DW	44.5	59	2 at 325 gpm each	126.3	1.71
53	SW Hinds Street	4951 SW Hinds St	WW/DW	10.6	41	2 at 150 gpm each	66	2
54	NW 41st Street	647 NW 41st St	WW/DW	24.5	169	2 at 350 gpm each	27	1.52
55	Webster Street	3021 West Laurelhurst NE	Air Lift	2.4	5	2 at 150 gpm each	31	2.15
56	Bedford Court	10334 Bedford Ct NW	Air Lift	1.6	3	2 at 150 gpm each	30.3	0.75
57	Sunnyside	3600 Sunnyside Ave North	WW/DW	16.3	57	2 at 300 gpm each	31.5	2.66
58	Woodlawn	1350 North Northlake Way	WW/DW	33.4	290	2 at 600 gpm each	30	3.5
59	Halliday	2590 Westlake Ave North	WW/DW	21.2	53	2 at 325 gpm each	17.7	9.7
60	Newton	2010 Westlake Ave North	WW/DW	57.6	77	2 at 250 gpm each	67.4	4.38
61	Aloha	912 Westlake Ave North	WW/DW	26.3	59	2 at 450 gpm each	19.1	4.9
62	Yale	1103 Fairview Ave North	WW/DW	12.2	211	2 at 350 gpm each	18.4	4.63
63	East Blaine	140 East Blaine St	WW/DW	33.1	251	2 at 600 gpm each	31	2.43
64	East Lynn Street No. 2	2390 Fairview Ave East	WW/DW	9.4	253	2 at 300 gpm each	16.2	7.05
65	East Allison Street	2955 Fairview Ave East	WW/DW	19.2	111	2 at 300 gpm each	47.2	3.96
66	Portage Bay No. 1	3190 Portage Bay Pl East	WW/DW	6.5	200	2 at 200 gpm each	12.2	18.6
67	Portage Bay No. 2	1209 East Shelby St	WW/DW	14.7	176	2 at 250 gpm each	17	9.08

Number	Name	Address	Type [1]	Basin Area (acres)	Average Inflow (gpm)	Number of Pumps and Rating	Static Head (feet)	Storage Time (hours)
69	Sand Point	6451 65th Ave NE	WW/DW	15.5	124	2 at 300 gpm each	79	2.03
70	Barton No. 2	4890 SW Barton St	WW/DW	73	136	2 at 290 gpm each	29	0.4
71	SW 98th Street	5190 SW 98th St	WW/DW	36.3	155	2 at 450 gpm each	16	6.79
72	SW Lander Street	2600 13th Ave SW	WW/DW	203.5	428	3 at 2000 gpm each	22.8	4+
73	SW Spokane St	1190 SW Spokane St	WW/DW	336.5	45	3 at 2500 gpm each	16.3	4+
74	26th Avenue SW	2799 26th Ave SW	Submersible	144		2 at 800 gpm each	30	3.21
75	Point Place SW	3200 Point Pl SW	Air Lift	4.9	9	2 at 150 gpm each	12.2	10
76	Lowman Park	7025 Beach Dr SW	WW/DW	20.4	27	2 at 100 gpm each	34	17.8
77	32nd Avenue West	1499 32nd Ave West	WW/DW	206.5	601	2 at 1400 gpm each	48	5.17
78	Airport Way South	8415 Airport Way South	Air Lift	18.4	41	2 at 150 gpm each	14.5	5.5
80	South Perry Street	9724 Rainier Ave South	Air Lift	4.6	5	2 at 150 gpm each	22	10
81	72nd Avenue South	10199 Rainier Avenue South	WW/DW	11	60	2 at 200 gpm each	53.3	24.3
82	Arroyo Beach Place	11013 Arroyo Beach Pl SW	Air Lift	6	8	2 at 150 gpm each	19.8	10
83	West Ewing Street	390 West Ewing St	Air Lift	6.1	39	2 at 150 gpm each	19	4.24
84	28th Avenue NW	5390 28th Ave NW	WW/DW	691.4	128	2 at 500 gpm each	24.4	3.43
114	35th Avenue NE	10701 36th Ave NE	Submersible	3.2	47	2 at 800 gpm each	5.6	2
118	Midvale Avenue North	1200 North 107th St	WW/DW	22.4	103	2 at 300 gpm each	11.5	3.5

1. *WW/DW = Wet Well/Dry Well*

Table A-3. 2018 Pump Station Work Order Summary			
WWPS Number	Inspection	Maintenance	Total Work Orders
WWPS001	18	2	20
WWPS002	30	11	41
WWPS004	32	9	41
WWPS005	48	14	62
WWPS006	24	13	37
WWPS007	27	16	43
WWPS009	23	8	31
WWPS010	33	20	53
WWPS011	30	17	47
WWPS013	22	11	33
WWPS017	36	72	108
WWPS018	17	14	31
WWPS019	33	127	160
WWPS020	18	8	26
WWPS021	30	27	57
WWPS022	21	12	33
WWPS025	28	11	39
WWPS028	23	14	37
WWPS030	46	32	78
WWPS031	18	9	27
WWPS035	35	81	116
WWPS036	35	8	43
WWPS037	22	15	37
WWPS038	39	21	60
WWPS039	19	11	30
WWPS042	20	10	30
WWPS043	39	23	62
WWPS044	24	15	39
WWPS045	36	14	50
WWPS046	35	11	46
WWPS047	24	8	32
WWPS048	21	41	62
WWPS049	28	73	101
WWPS050	17	6	23
WWPS051	27	60	87
WWPS053	17	6	23
WWPS054	28	10	38
WWPS055	24	15	39
WWPS056	43	9	52

WWPS Number	Inspection	Maintenance	Total Work Orders
WWPS057	17	64	81
WWPS058	17	20	37
WWPS059	21	21	42
WWPS060	26	20	46
WWPS061	19	4	23
WWPS062	26	71	97
WWPS063	23	13	36
WWPS064	18	12	30
WWPS065	25	11	36
WWPS066	20	5	25
WWPS067	18	5	23
WWPS069	32	21	53
WWPS070	16	1	17
WWPS071	18	12	30
WWPS072	22	5	27
WWPS073	19	3	22
WWPS074	27	21	48
WWPS075	19	9	28
WWPS076	24	67	91
WWPS077	22	15	37
WWPS078	24	6	30
WWPS080	29	8	37
WWPS081	19	3	22
WWPS082	24	11	35
WWPS083	27	18	45
WWPS084	26	14	40
WWPS114	27	20	47
WWPS118	32	20	52
Grand Total	**1,727**	**1,384**	**3,111**