FY 2024

CITY OF PORTLAND | BUREAU OF ENVIRONMENTAL SERVICES

Annual CSO and CMOM Report

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Annual CSO and CMOM Report - FY 2024

September 2024

Report prepared for the
Oregon Department of Environmental Quality
Portland, Oregon

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CERTIFICATION

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

Amanda Haney
NPDES Duly Authorized Representative
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AGCA. Accelerated grease cleaning area

BES. Bureau of Environmental Services

BLM. The Biotic Ligand Model, used for the Oregon DEQ standard for copper criteria. The BLM is a metal bioavailability model that uses grab sample water characteristics to develop site-specific instantaneous water quality criteria.

BOD. Biochemical oxygen demand. Values in this report specifically pertain to the amount, in mg/L, of dissolved oxygen consumed by organic material under standard laboratory procedure (known as BOD_5).

CBWTP. Columbia Boulevard Wastewater Treatment Plant

CCC. Criterion continuous concentration, an estimate of the highest concentration of a material in ambient water to which an aquatic community can be exposed to indefinitely without resulting in an unacceptable adverse effect. This is the chronic criterion.

CCTV. Closed-circuit television

CEPT. Chemically Enhanced Primary Treatment

CIP. Capital Improvement Program

CIPP. Cured-in place pipe

CMC. Criterion maximum concentration, an estimate of the highest concentration of a material in ambient water to which an aquatic community can be exposed to briefly without resulting in an unacceptable adverse effect. This is the acute criterion.

CMMS. Computerized maintenance management system

CMOM. Capacity, Management, Operation, and Maintenance

CSO. Combined sewer overflow, especially as it pertains to discharge events. Note that during the CSO Program's implementation, CSOs were being captured into the new facilities such as the Willamette CSO Tunnels and the Columbia Slough Consolidation Conduit. Technically, CSOs are no longer being "captured" after the implementation was completed—rather, the water that used to produce those events is now controlled within the augmented combined sewer system, and the term "CSO" is limited once again to discharges from the combined system to receiving waters.

DEQ. Oregon Department of Environmental Quality

EMC. Event mean concentration

EWWPT. Enhanced wet weather primary treatment

FOG. Fats, oils, and grease

FY. Fiscal year (FY 2024 is July 1, 2023, through June 30, 2024)

I&I. Inflow and infiltration

Mg/d. Megagrams per day

MGD. Million gallons per day

MG. Million gallons

mg/L. Milligrams per liter

MPN. Most Probable Number

NPDES. National Pollutant Discharge Elimination System. This report addresses NPDES permit #101505.

O&M. Operations and Maintenance

RDII. Rainfall-derived (also, dependent) inflow and infiltration

SPCR. Spill Protection and Citizen Response

Summer season. Defined in NPDES permit #101505 as May 1 to October 31.

SWMM. *Stormwater Management Manual*

TSS. Total suspended solids

Winter season. Defined in NPDES permit #101505 as November 1 to April 30

WWTF. Wet Weather Treatment Facility

Section 1 Introduction

The *Annual CSO and CMOM Report* provides a comprehensive review of Portland's integrated combined sewer overflow (CSO) system and the Capacity, Management, Operation, and Maintenance (CMOM) Program during fiscal year 2024 (FY 2024: July 1, 2023, through June 30, 2024). This report provides updates to the previous FY 2023 report. The report was developed to comply with National Pollutant Discharge Elimination System (NPDES) permit #101505, Schedule D, Condition 3.b., as summarized in the Table 1.

Table 1 *Annual CSO and CMOM Report* NPDES Requirements

Reporting Requirement	Found In Report
Identify any combined sewer overflow (CSO) outfall not meeting CSO performance standards	Section 2.1 and 2.2
Summarize CSOs and assess reduction in CSOs	Section 2.2
Summarize wet weather treatment performance of Columbia Boulevard Wastewater Treatment Plant	Section 2.3.2 and 2.4
Summarize CSO monitoring for reporting period	Section 2.5
Summarize Capacity, Management, Operation, and Maintenance (CMOM) program activities, including: - Sewer inspections and cleaning - Sewer assessments and repairs - Grease management - Summary analysis of sanitary sewer overflows during reporting period	The following: - Section 3 - Section 3 - Section 3 - Section 4
Provide annual inflow and infiltration report	Section 7
Provide activities performed to implement the Environmental Protection Agency's Nine Minimum Controls: - Eliminate dry weather CSOs - Control solids and floatable material in CSOs - Maximize treatment - Monitor and characterize impacts and efficacy of O&M programs - Maximize storage - Public notification of CSOs - Pretreatment program review and updates - Pollution prevention programs	The following: - Section 2.2.2 - Sections 2.2.3 and 2.3 - Section 2.3 and 2.4 - Section 3 - Section 5 - Section 8 - Section 9 - Section 9

1.1 Major Changes from FY 2023 Report

There have been no major changes since the FY 2023 report.

1.2 Programs

CSO program. The City of Portland (City) completed its CSO long-term control plan implementation in 2011. The City is currently proceeding with implementing its *Post-2011 Combined Sewer Overflow Facilities Plan*, published in 2010. This plan looked at ways to cost-effectively exceed the level of control specified in the 1994 Amended Stipulation and Final Order agreement with Oregon's Environmental Quality Commission. This additional work is necessary to handle the pressure on the combined sewer system facilities' capabilities to control CSOs due to increased population and development.

CMOM program. The City of Portland has implemented a CMOM program to reduce the likelihood of sewer releases by improving the overall reliability of the sanitary and combined sewer collection systems. The *CMOM Program Report* submitted to the Oregon Department of Environmental Quality (DEQ) on June 28, 2013, explains the City of Portland Bureau of Environmental Service's (BES's) strategies and activities for the development, reinvestment, operation, and maintenance of the system.

The CMOM program specifically addresses proper operation and regular maintenance of the collection system. The City's wastewater collection system includes mainlines, trunklines, interceptors, pump stations, and force mains. The City is generally responsible for service laterals from the sewer main up to the curb line, while the building or private sewer laterals extending beyond the curb are the responsibility of the property owner. Portland's sewer collection system consists of a network of 2,662 miles of collection system piping (1,011 miles of sanitary sewer including force mains, 914 miles of combined sewer, and 737 miles of sewer laterals) and 41,647 sewer maintenance holes.

The system also includes two wastewater treatment plants and 98 pump stations. There are 95 City-owned and operated pump stations and three pump stations owned by other public agencies that are operated and maintained by the City under satellite or easement agreements. Ten privately-owned septic tank effluent pumping systems are maintained by the City under agreements with the property owners.

This annual update for FY 2024 provides a review of CMOM program actions and key performance indicators. It also provides an evaluation of the effectiveness of BES's risk-based asset management approach to collection system operation and maintenance.

Section 2 Integrated CSO System Performance for FY 2024

The integrated CSO system consists of the combined sewer collection system; the CSO collection, storage, and pumping system; and the Columbia Boulevard Wastewater Treatment Plant (CBWTP) treatment system. This section reports on the performance of the overall integrated CSO system during FY 2024.

2.1 Rainfall Patterns for the Past Fiscal Year

FY 2024 was an above-average rainfall year for the City of Portland. The area weighted average rainfall for the Willamette CSO area was 41.4 inches over the year; 112% of the average annual rainfall of 37 inches for Portland.

2.1.1 Summer Season Storms Review

During FY 2024, one summer (as defined in the permit) storm on October 9-11, 2023, was large enough to cause permittable CSOs to the Willamette River and Columbia Slough. This storm generated CSO discharge on October 10 (Table 2).

Table 2 FY 2024 Summer Season Storms

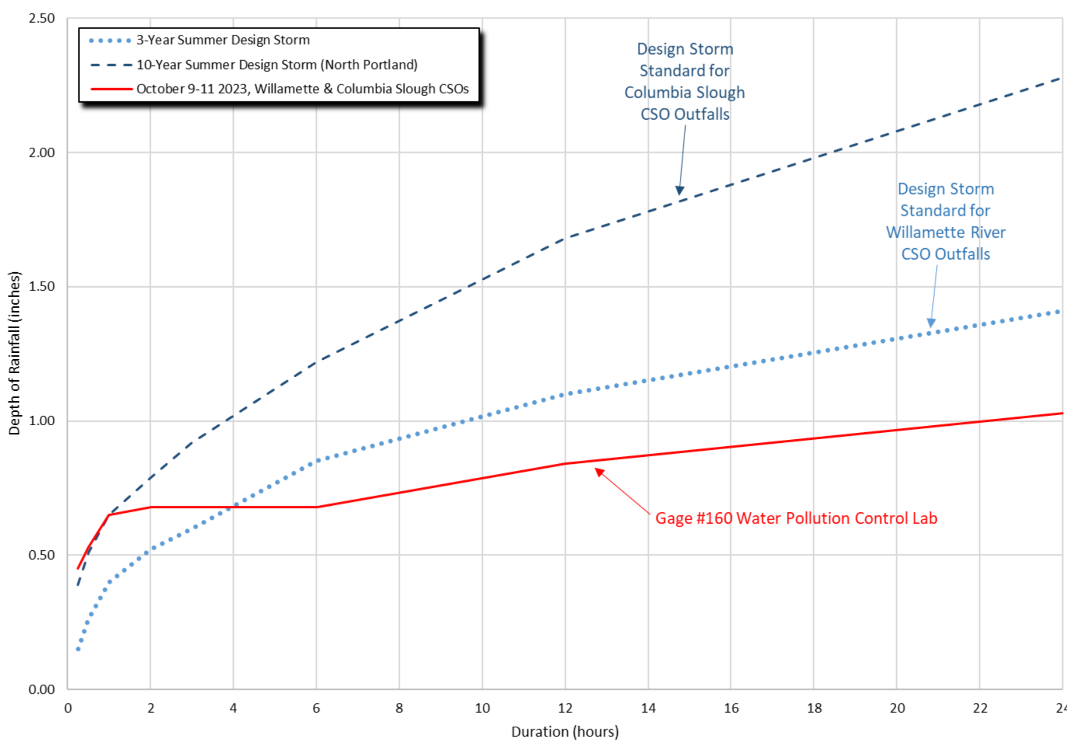
Storm	CSO?	Duration (min)		Duration (hours)					Notes	Storm Exceeds 3-Year Summer Design Storm[1]	Storm Exceeds 10-Year Summer Design Storm[2]
		15	30	1	3	6	12	24			
Willamette River Summer Design Storm (inches)											
3-Year Summer Design Storm		0.15	0.26	0.40	0.60	0.85	1.10	1.41			
Columbia Slough Summer Design Storm (inches)											
10-Year Summer Design Storm (North Portland)		0.39	0.51	0.65	0.92	1.22	1.68	2.28			
FY 2024 Summer Storms - Rainfall in St. Johns Area (inches)											
October 9-11, 2023	Yes	0.45	0.53	0.65	0.68	0.68	0.84	1.03	Gage #160 St. Johns	Yes	Yes

1. CSOs are permitted to the Willamette River when the storm exceeds performance criteria.
2. CSOs are permitted to the Columbia Slough when the storm exceeds performance criteria.

The summer storm of October 9-11, 2023, was caused by a narrow band of high-intensity rainfall over the St. Johns and Oswego combined sewer basins in North Portland and resulted in discharge from two Willamette River CSO outfalls and one Columbia Slough CSO outfall. The local rain gage (#160) recorded rainfall exceeding the 1-per-3-summer design storm for the 15-minute to 2-hour durations and meeting or exceeding the 1-per-10-summer design storm for the 15-minute to 1-hour durations.

The October 9-11, 2023, storm exceeded the 10-year summer NPDES permit design depths at the local rain gage, shown graphically in Figure 1, and resulted in a CSO. The graph is a "Depth-Duration" chart that displays the maximum depth of rainfall that occurred for the range of storm durations, from 15-minutes to 24-hours at the local gage. The observed rainfall event is compared to the 3-year and 10-year NPDES Summer Design Storms shown with a blue-tinted line.

Figure 1 FY 2024 CSO Summer Season Storms Compared to NPDES Summer Storms



2.1.2 Winter Season Storm Review

Nine winter season storms were large enough to have caused permittable CSOs to the Willamette River, and two of those storms resulted in a CSO discharge event (Table 3). Additional CSO discharge information is provided in Section 2.2.

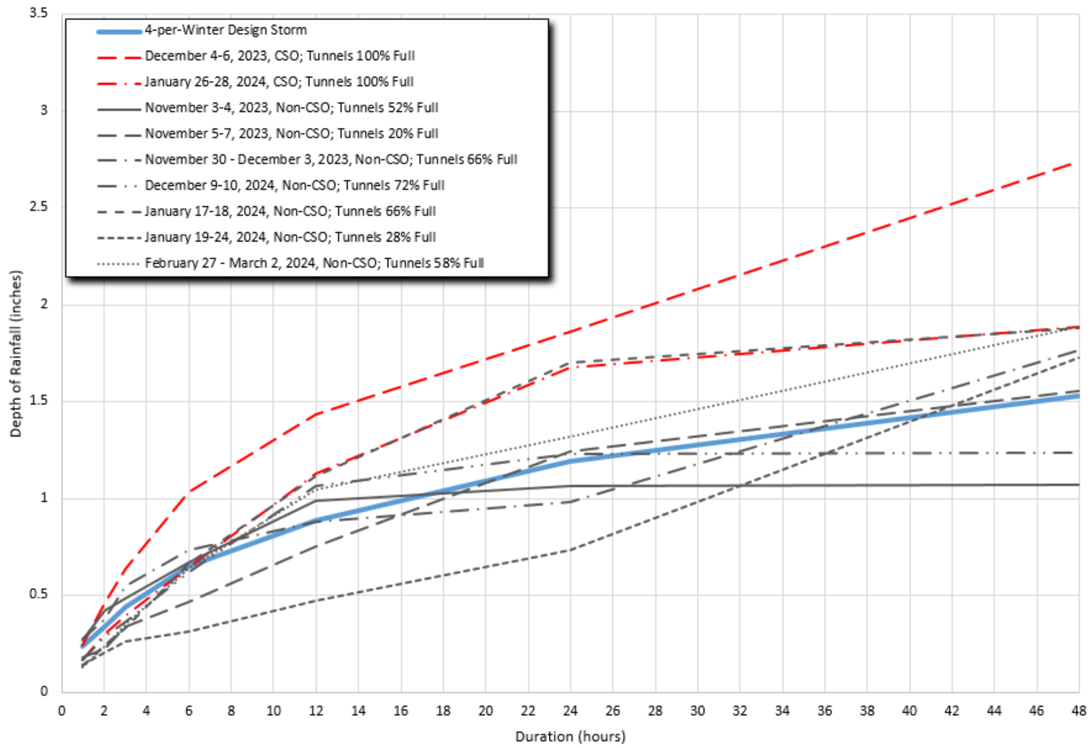
The nine storms that exceeded the 4-per-winter NPDES permit design depths over the CSO control area are shown graphically in Figure 2. This graph is a "Depth-Duration" chart that displays the maximum depth of rainfall that occurred for the range of storm durations, from 1 hour to 48 hours. The observed rainfall events are compared to the NPDES Winter Design Storm for the Willamette River (4 per winter) shown with a blue-tinted dashed line. The two storms that exceeded the 4-per-winter design storm for the Willamette CSO area and resulted in CSOs are shown in red. The seven storms that exceeded the 4-per-winter design storm but did not result in CSOs are shown in gray.

Table 3 FY 2024 Winter Season Storm Comparisons

Storm	CSO?	Duration (hours)						Storm Exceeds 4-per-Winter Design Storm[1]
		1	3	6	12	24	48	
Willamette River Winter Design Storm (inches)								
4-per-Winter Design Storm		0.24	0.44	0.65	0.89	1.19	1.53	
FY 2024 Winter Storms - Average Rainfall over Willamette CSO Basin (inches)								
November 3-4, 2023	No	0.27	0.49	0.67	0.99	1.07	1.08	Yes
November 5-7, 2023	No	0.18	0.34	0.47	0.76	1.24	1.55	Yes
November 30 - December 3, 2023	No	0.28	0.55	0.73	0.88	0.98	1.77	Yes
December 4-6, 2023	Yes	0.25	0.64	1.03	1.43	1.86	2.74	Yes
December 9-10, 2023	No	0.17	0.36	0.62	1.06	1.23	1.24	Yes
January 17-18, 2024	No	0.13	0.33	0.67	1.12	1.70	1.88	Yes
January 19-24, 2024	No	0.14	0.27	0.32	0.48	0.73	1.73	Yes
January 26-28, 2024	Yes	0.17	0.40	0.64	1.13	1.68	1.88	Yes
February 27 - March 2, 2024	No	0.13	0.35	0.64	1.04	1.32	1.89	Yes

1. CSOs are permitted to the Willamette River when the storm exceeds performance criteria.

Figure 2 FY 2024 CSO Winter Season Storms Compared to NPDES Winter Storms



2.2 CSO Discharges into the Willamette River and Columbia Slough

2.2.1 Discharge Events

In FY 2024, City of Portland's combined sewer system experienced one summer season and two winter season CSO discharge events to the Willamette River and one summer season discharge event to the Columbia Slough. Refer to the compliance letters submitted to DEQ for details on the circumstances and validation of these events as allowed by the NPDES permit for CBWTP.

- **October 10, 2023.** A total of 36,600 gallons were discharged over 15 minutes from two outfalls to the Willamette River and 10,400 gallons from one outfall to the Columbia Slough. A narrow band of short-duration, high-intensity rainfall moved over the St. Johns and Oswego combined sewer basins in North Portland. Rainfall exceeded the 1-per-3 summer storm criterion for discharges to the Willamette River and the 1-per-10 summer criterion for discharges to the Columbia Slough.
- **December 6, 2023.** Eighty-eight million gallons (MG) were discharged over 6 hours from eight Willamette River outfalls. A stalled atmospheric river that moved slowly over the Willamette CSO service area produced rainfall depths

surpassing the 4-per-winter criterion. Ten of the 24 rain gages recorded rainfall that exceeded the 5-year winter design storm.

- **January 27, 2024.** Sixty-eight MG discharged over 9.5 hours from six outfalls to the Willamette. An atmospheric river with peak intensities surpassing the 2-per-winter level in the northern half of Portland's combined sewer area caused the overflow.

The entire historical record of CSOs discharged from the City's CSO facilities is provided in Appendix A.

2.2.1.1 How Well Were CSO Events Controlled?

System rainfall was above average during the reporting period. Out of a total of 50 distinct storm events, the system experienced one summer season and two winter season overflows. Approximately 2,860 MG were stored in the CSO tunnels during these events.

Total CSO discharge for the year was 156 MG from the Willamette CSO system and 10,400 gallons (0.01 MG) from the Columbia Slough CSO system, which was less than 2.3% of the wet weather volume handled by the combined and sanitary collection systems. This equates to 97.7% volume control, exceeding the 94% level of control expected from the Willamette CSO system.

2.2.1.2 Were Wet Weather Flows Maximized to the Plant?

Flow was maximized to the treatment plant to the greatest extent possible while preserving plant processes.

2.2.1.3 Was System Storage Maximized?

In all events, the CSO system discharged after rainfall intensity exceeded permit levels and, in the applicable winter season events, after the tunnels were filled. For the CSO-sized events that the system managed without overflows, tunnel storage peaked at 72% capacity. For all non-CSO-sized storm events (less intense than 4-per-winter and 1-per-3 summers), tunnel storage levels did not exceed more than 41% capacity.

2.2.2 Dry Weather Overflow Events

No dry weather overflow events from the combined system outfalls were recorded in FY 2024.

2.2.3 Control of Floatables and Debris

City maintenance crews inspect and clean the bar screens of certain diversion structures, such as those leading to OF 07B (Sheridan) and OF 52 (Philadelphia and Burlington), after CSO discharge events when conditions allow. Table 4 provides information on CSO events requiring floatables control cleaning for FY 2024.

Table 4 CSO events with floatables control activity

CSO Event Date(s)	Maintenance Date	Location	Description of Maintenance
October 10, 2023	10/16/2023	St. Johns Bar Screens (AAE560 and AAE648)	Minimal material present. Cleaned screen of sticks, leaves, and other organic material.
December 6, 2023	12/15/2023	Sheridan Bar Screen (ANS918)	Cleaned screen of 15-20 gallons of organic material with some trash mixed in.
January 27, 2024	2/15/2024	Sheridan Bar Screen (ANS918)	Minimal material present. Cleaned screen of 0.5 cubic yards of sticks, leaves, and other organic material.

2.3 Wet Weather Performance

2.3.1 CSO Facilities Operations

The CSO system configuration experienced no significant changes for most of FY 2024. The system experienced an above-average year of rainfall, receiving 41.14 inches of total rainfall. This follows a below-average year of rainfall in FY 2023, during which the City of Portland received 35.6 inches of rainfall. Influent volumes to CBWTP increased by 5.4% from FY 2023, totaling almost 27 billion gallons (see Table 7).

The percentage treated by the secondary system decreased from 91% to 87%, which is still consistent with years that experienced above-average rainfall, most recently in FY 2022. The percentage of captured CSOs that underwent secondary treatment decreased from 59% in FY 2023 to 51% in FY 2024. The average percentage of captured CSOs that underwent secondary treatment is 60% since tracking began in 2012. Biochemical oxygen demand (BOD) removal increased from 91% in FY 2023 to 93% this year, and total suspended solids (TSS) removal efficiency also increased from 92% to 93%. These numbers indicate that the plant continues to exhibit satisfactory performance reliably year over year.

Table 5 shows the total volume pumped from the two major CSO pump stations in the system: Swan Island CSO Pump Station, which drains the Willamette River system, and the Influent Pump Station, which drains the Columbia Slough system. About 6,800 MG of captured CSOs reached the plant (see Table 3). About 8,300 MG of tunnel flow was pumped to CBWTP, representing 122% of that captured volume. The additional pumped flow is the net of CSO volume reaching CBWTP via the combined collection system and the volume diverted to the tunnels during repair work on the Ankeny Pump Station.

Table 5 Volume Pumped from CSO Tunnels

CSO Tunnel Pumping	Total Pumped Volume (MG)
Swan Island CSO Pump Station	
Force main 1 (Peninsular Dry Weather)	4,428
Force main 2 (Peninsular Wet Weather)	572
Force main 3 (Portsmouth Wet Weather)	2,123
Swan Island CSO Pump Station Subtotal	7,123
Influent Pump Station Total	1,212
Total Volume Pumped to CBWTP from Tunnels	8,335

2.3.2 Annual Treatment Performance for CBWTP

Key parameters for the treatment systems annual performance are derived from the NPDES permit for CBWTP, which specifies seasonal percent removal efficiencies at the plant.

2.3.2.1 Annual CSO Treatment Characteristics

Annual percent removal efficiencies for the wet weather system were based on Portland's 2009 No Feasible Alternative Analysis report. Table 6 summarizes the minimum efficiency limits for BOD and TSS that were met for the winter season (November 1 to April 30) and summer season (May 1 to October 31).

Table 6 Combined Outfalls OF001/003 Minimum Average 30-day Removal Efficiency

System	Season	Efficiency Limit	BOD Removal Efficiency	TSS Removal Efficiency
Combined Outfalls OF001/OF003	Summer	85% or more	88%	87%
	Winter	65% or more	85%	86%

Table 7 summarizes the main annual treatment performance measures for the CBWTP systems. This table compares the performance against the average year model and permit values. Key parameters for FY 2024 are in blue text.

- Average flow introduced to secondary treatment during enhanced wet weather primary treatment (EWWPT) events was maintained at 98 million gallons per day (MGD). This is the result of aeration basin maintenance and rehabilitation work. The operating setpoint was lowered to 80 MGD while the aeration basins were taken offline. Secondary effluent flows during EWWPT events met the 110 MGD required by the permit after FY 2014 during periods when the setpoint was established at 110 MGD. This is discussed in greater detail in Section 2.4.
- Fifty-one percent (51%) of wet weather volume was treated through secondary treatment, which did not meet the model target level of 54%. This is the result of additional volume diverted to the tunnels during scheduled repair work on Ankeny Pump Station.

When evaluating wet weather treatment, BES asks three questions (key parameters for FY 2024):

- **Were wet weather flows treated to a high quality?** Yes, the plant saw minimum BOD and TSS removal efficiencies of 88% and 87%, respectively, in May to June of FY 2024 (with expected efficiencies of both BOD and TSS to be at least 85%). Minimum BOD and TSS removal efficiencies were 85% and 86%, respectively, during the winter season (with expected efficiencies of both to be at least 65%).

- **Were flows to secondary treatment maximized?** Yes, flows were maximized according to regular protocol and established setpoints meeting the 110 MGD requirement. Average secondary effluent flows were 122 MGD during EWWPT events during periods when the setpoint was established at 110 MGD. See Section 2.2.1.2 and Section 2.4.

- **Were effluent limits for BOD and TSS achieved at Outfalls OF001 and OF003?** Effluent limits were achieved for the peak-week performances. The TSS effluent concentration exceeded the maximum 30-day performance during the summer season (35 milligrams per liter [mg/L] as calculated by a rolling-average achieved for a 30 mg/L limit) but satisfied performance requirements for the winter season. This is discussed further in Section 2.3.2.2. BOD effluent concentrations for the maximum 30-day period met the required treatment performance for both summer and winter seasons.

Examination of the annual results indicates that the CSO system operations strategy continues to sustain desired performance and can handle various conditions throughout the year, even with large changes in rainfall amounts year over year during normal conditions.

Operations also initiated a pilot last year using different chemicals in the Chemically Enhanced Primary Treatment (CEPT) system to avoid the depressed pH levels observed when ferric chloride and sodium bisulfite are used. The results of this assessment indicate that using aluminum-based coagulants for wet weather treatment provide equivalent or better treatment to ferric chloride, mitigate pH depression during wet weather events, and can be applied with the same distribution system as ferric chloride. Consequently, BES has elected to switch from ferric chloride to an aluminum-based coagulant.

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Table 7 CBWTP annual treatment performance data[1]

CBTWP Annual Treatment Performance and Characteristics Summary FY2023-2024	CEPT (yes/no)	Annual Rainfall Depth (inches/year)	Flows to CBWTP	Influent Volume (MG/Year)	Dry Weather Sanitary Volume (MG/Year)	Captured CSO Flow - Volume (MG/Year)	Total Volume Treated Through Secondary (MG)	% of Plant Flow Treated Through Secondary System	WWTF (EWWPT) Events	Flow Rate to DW/Secondary During EWWPT (MGD)	Number of Events/Year	WWTF Volume/Year	Amount of Captured CSO Treated via Secondary (%)	Duration of WWTF Events (hours)	Calendar Days of WWTF Discharges (days)	Blended Effluent (OF001 & OF003) Treatment	BOD Loading (lbs/year)	BOD Average Concentration (mg/L)	Total Plant BOD Removal Efficiency (%)	TSS Loading (lbs/year)	TSS Average Concentration (mg/L)	Total Plant TSS Removal Efficiency (%)
Trend Line																						
Average Year Model/Permit	-	-		28,300	22,100	6,200	25,443	90%		100	32	2,857	54%	919	-		2,510,000	27.0	-	2,440,000	27.0	-
FY2012	no	46.8		28,800	20,200	8,600	25,662	89%		120	29	3,138	64%	706	66		4,000,000	16.6	93%	5,050,000	21.0	92%
FY2013	yes	40.2		26,625	19,496	7,129	24,197	91%		126	22	2,429	66%	668	50		2,957,783	13.3	95%	3,585,748	16.1	94%
FY2014	yes	40.0		26,549	19,471	7,078	24,002	90%		112	27	2,546	64%	904	65		3,472,307	15.7	94%	4,055,479	18.3	93%
FY2015	yes	33.9		25,760	19,609	6,151	23,221	90%		112	27	2,540	59%	591	51		4,176,834	19.4	93%	4,413,412	20.5	92%
FY2016	yes	53.4		30,665	20,179	10,485	26,301	86%		117	39	4,363	58%	1,241	92		3,871,106	15.1	93%	4,910,264	19.2	92%
FY2017	yes	59.5		33,544	22,358	11,187	28,765	86%		119	41	4,779	57%	1,333	99		4,554,872	16.3	92%	5,248,619	18.8	92%
FY2018	yes	37.6		26,844	21,635	5,209	24,947	93%		117	37	1,897	64%	602	65		3,046,966	13.6	95%	3,738,873	16.7	94%
FY2019	yes	30.5		23,763	20,037	3,726	22,173	93%		118	35	1,590	57%	387	52		2,786,772	14.1	95%	3,237,714	16.3	95%
FY2020	yes	33.2		22,528	18,624	3,904	21,176	94%		111	37	1,352	65%	338	53		2,925,285	15.6	94%	2,962,541	15.8	94%
FY2021	yes	35.4		23,305	17,657	5,648	21,129	91%		111	35	2,175	61%	556	59		3,014,266	15.5	93%	3,276,139	16.9	93%
FY2022	yes	50.4		27,026	18,632	8,523	23,345	86%		110	44	3,681	57%	860	82		3,907,860	17.3	92%	4,493,102	19.9	91%
FY2023	yes	35.6		25,505	19,818	5,687	23,159	91%		109	33	2,346	59%	645	65		4,251,889	20.0	91%	4,306,550	20.2	92%
FY2024	yes	41.4		27,094	20,023	7,071	23,629	87%		98	33	3,465	51%	1,039	77		3,679,304	14.7	93%	3,679,304	16.3	93%

[1] The permit average for "Rate to DW/Secondary During EWWPT (MGD)" rose to 110 MGD from 100 MGD in 2014 (applicable for FY 2015 and onwards).

2.3.2.2 CBWTP Max-Month and Peak-Week Treatment Performance

Table 8 summarizes maximum 30-day treatment results for BOD and TSS for the winter season (November 2023 to April 2024). While the permit requires reporting of maximums on a calendar month basis, this evaluation uses a more stringent moving 30-day window analysis. Exceedances shown in the tables below do not reflect the concentrations shown in the monthly discharge monitoring reports. The maximum monthly average concentrations of BOD and TSS allowed by the permit are 30 mg/L for both summer and winter seasons.

For the winter season, maximum 30-day concentrations and loadings at both outfalls were below the permitted monthly limits for both BOD and TSS. The maximum 30-day period for the winter season ended on February 1st, 2024, for BOD and February 2nd, 2024, for TSS.

Table 8 FY 2024 CSO Max-Month (30-Days of Solids Loading) Treatment Performance - Winter Season

Parameters	Maximum Monthly (30-Day)									
	Avg Concentration During Maximum Month for Mass Loading				Mass Loading					
	Permit Monthly (mg/L)	Max 30-Day (mg/L)	30-Day Avg Flow (m^3/s)	30-Day Avg Flow (MGD)	Permit Monthly (Mg/d)	Permit Monthly (lbs/d)	Max 30-Day (lbs/d)	Max 30-Day (Mg/d)	Date of 30th Day	Notes
Columbia Boulevard WWTP – Outfalls 001 and 003 Effluent Quality										
BOD5	30	18	6.0	139	20.4	45,000	20,929	9.4	1-Feb-24	9.67 inches of rain in 30d
TSS	30	21	6.0	138	20.4	45,000	2,554	10.6	2-Feb-24	

Table 9 summarizes the results for the summer season (July to October 2023 and May to June 2024). For the summer season, monthly limits were exceeded for TSS producing a maximum concentration of 35 mg/L. This was calculated using a moving 30-day average. The monthly discharge monitoring report data summary shows that April met the maximum TSS concentration limit with an average of 29 mg/L, demonstrating the system was in compliance with the permit limit. The BOD concentrations for the maximum 30-day period in the summer season was 28 mg/L, below the monthly limit. The maximum 30-day period ended on May 4, 2024, for BOD and May 3, 2024, for TSS for the summer season.

Table 9 FY 2024 CSO Max-Month (30-Days of Solids Loading) Treatment Performance - Summer Season

Parameters	Maximum Monthly (30-Day)									
	Avg Concentration During Maximum Month for Mass Loading				Mass Loading					
	Permit Monthly (mg/L)	Max 30-Day (mg/L)	30-Day Avg Flow (m^3/s)	30-Day Avg Flow (MGD)	Permit Monthly (Mg/d)	Permit Monthly (lbs/d)	Max 30-Day (lbs/d)	Max 30-Day (Mg/d)	Date of 30th Day	Notes
Columbia Boulevard WWTP – Outfalls 001 and 003 Effluent Quality										
BOD5	30	30	2.7	64	20.4	45,000	15,734	9.4	3-May-24	2.35 inches of rain in 30d
TSS	30	35	2.7	64	20.4	45,000	18,704	10.6	3-May-24	

Table 10 summarizes peak 7-day treatment results for BOD and TSS in the winter season, and Table 11 summarizes peak 7-day treatment results for BOD and TSS in the summer season. The NPDES permit requires the reporting of peaks on a calendar week (Sunday to Saturday) basis. The following analysis uses a more stringent moving 7-day window.

Table 10 FY 2024 CSO Peak Week (7 Days of Solids Loading) Treatment Performance - Winter Season

Parameters	Peak Week (7-Day)									
	Avg Concentration During Maximum Month for Mass Loading				Mass Loading					
	Permit Weekly (mg/L)	Max 7-Day (mg/L)	7-Day Avg Flow (m^3/s)	7-Day Avg Flow (MG)	Permit Weekly (Mg/d)	Permit Weekly (lbs/d)	Max 7-Day (lbs/d)	Max 7-Day (Mg/d)	Date of 7th Day	Notes
Columbia Boulevard WWTP – Outfalls 001 and 003 Effluent Quality										
BOD5	45	24	8.9	207	53.5	118,800	20,235	9.1	27-Jan-24	4.31 inches of rain in 7d
TSS	45	26	8.9	207	53.5	118,800	45,747	20.6	27-Feb-24	

Table 11 FY 2024 CSO Peak Week (7 Days of Solids Loading) Treatment Performance - Summer Season

Parameters	Peak Week (7-Day)									
	Avg Concentration During Maximum Month for Mass Loading				Mass Loading					
	Permit Weekly (mg/L)	Max 7-Day (mg/L)	7-Day Avg Flow (m^3/s)	7-Day Avg Flow (MG)	Permit Weekly (Mg/d)	Permit Weekly (lbs/d)	Max 7-Day (lbs/d)	Max 7-Day (Mg/d)	Date of 7th Day	Notes
Columbia Boulevard WWTP – Outfalls 001 and 003 Effluent Quality										
BOD5	45	30	8.9	80	53.5	118,800	20,235	9.1	1--May-24	1.81 inches of rain in 7d
TSS	45	43	8.9	80	53.5	118,800	28,522	12.8	1-May-24	

Concentrations and loading for TSS and BOD for the maximum 7-day period during the winter season were below the permit's maximum weekly limit. This period ended on January 27, 2024, for both BOD and TSS.

Concentrations and loading for TSS and BOD for the maximum 7-day period during the summer season were below the permit's weekly limit. This 7-day period ended on May 1, 2024, for BOD and TSS.

2.4 Enhanced Wet Weather Primary Treatment Performance

Wet weather treatment performance is best evaluated by examining the events in which the Wet Weather Treatment Facility (WWTF) discharged treated effluent. These events are called EWWPT events to underscore that the wet weather flow diverted from the secondary system receives CEPT.

An EWWPT event begins when the WWTF starts discharging effluent and ends after either of the following:

- WWTF discharge has ended and the plant inflow remains below 80 MGD for 6 hours (transition to dry weather conditions has completed) or
- WWTF discharge has ended and no subsequent WWTF discharge occurs for 48 hours. This condition may occur when low-level rainfall maintains plant inflows, but the Operations team is able to send all inflows through secondary treatment.

Table 12 summarizes the WWTF events for FY 2024. The full detailed list of the events are available at the end of this section (see Table 13).

Table 12 Enhanced Wet Weather Primary Treatment Events Summary

		CBWTP Flows		WWTF Flows				WWTF Effluent			
	Events	Avg influent during EWWPT (MGD)	Avg secondary flow during EWWPT (MGD)	Avg WWTF flow (MGD)	WWTF discharge volume (MG)	Duration of WWTF discharge occurred	Calendar days WWTF discharge occurred	Event BOD load discharged (lbs)	Event TSS load discharged (lbs)	EMC BOD (mg/L)	EMC TSS (mg/L)
Total	**33**				**3,465**	**1,039**	**77**	**1,137,829**	**1,024,666**		
Average/Event		**179**	**98**	**71**	**105**	**31.5**	**2.3**	**34,80**	**31,050**	**54**	**37**

Key aspects WWTF performance for FY 2024 include:

- Volume of EWWPT events was around 3.5 billion gallons. This is about 12.8% of the total volume received at the CBWTP for the year (27 billion gallons; see Table 7). This marks an increase from FY 2023 (9.2% of total CBWTP influent volume, 2.4 billion gallons). This is expected for wetter years.
- An EWWPT event was in progress during 11.8% of the year for a total of 1,039 hours. WWTF discharge occurred on 77 calendar days (just under 1.5 days per week). This is an increase from FY 2023 which experienced 645 hours (7.4% of the year) and 65 calendar days (1.25 days per week). This is expected for wetter years.
- Schedule A, Condition 2.d, of the NPDES permit stipulates that a minimum 110 MGD is required at the onset of any EWWPT event. The lowest flow at the onset of an EWWPT event was 112 MGD on September 25, 2023, which meets the permit requirement.
- The average event mean concentrations for BOD was 54 mg/L; for TSS was 37 mg/L. This is a decrease in the performance achieved in FY 2023 (BOD of 50 mg/L; TSS of 36 mg/L).
- Operators maintained an average of 98 MGD in the dry weather clarifier system during EWWPT events. This rate is 55% of the average flow rate reaching the plant during an EWWPT event (179 MGD).
    - As documented in notifications sent to DEQ on July 21, 2023; March 7, 2024; and April 29, 2024; the operating dry weather setpoint for EWWPT events was lowered from 110 MGD to 80 MGD to accommodate rehabilitation of the aeration basins. EWWPT events with the reduced setpoint occurred in August, September and October 2023, and in April, May and June 2024.
    - During months with a setpoint of 110 MGD, an average of 109 MGD was maintained during EWWPT events.

  - During months with a setpoint of 80 MGD, an average of 82 MGD was maintained during these events.
  - BES has noted a continued decline in average flow into secondary treatment during EWWPT events when using a setpoint of 110 MGD.
  - The assets that divert flow away from the biological system were inspected, and no faults were found. The programming of the control system was reviewed, and no obvious changes were found. From this point forward, the setpoint will be moved to between 113 and 115 MGD. Historical data will be reviewed, and system performance will be observed during storm events to see if more information about the cause can be revealed.
  - During EWWPT events with a setpoint of 110 MGD, the average secondary effluent flows during EWWPT events was 122 MGD, indicating that secondary treatment continues to be maximized per Schedule A, Section 2, of the NPDES permit.
- EWWPT events lasted 31.5 hours on average and typically occurred for 2.3 days. This is longer than last year (FY 2023), when the average event lasted 20 hours and typically occurred for 2.0 days.

BOD and TSS removal efficiencies compared to event volume are shown in Figure 3 and Figure 4, respectively. Small events tend to have higher BOD and TSS concentrations, while larger volume events conversely have lower concentrations. The CEPT system achieves better than 50% BOD and 70% TSS removal efficiencies most of the time overall. Most wet weather events this fiscal year placed above the target efficiencies, as seen in Figure 3 and Figure 4.

Figure 3 WWTF BOD Removal Efficiency Versus Event Volume

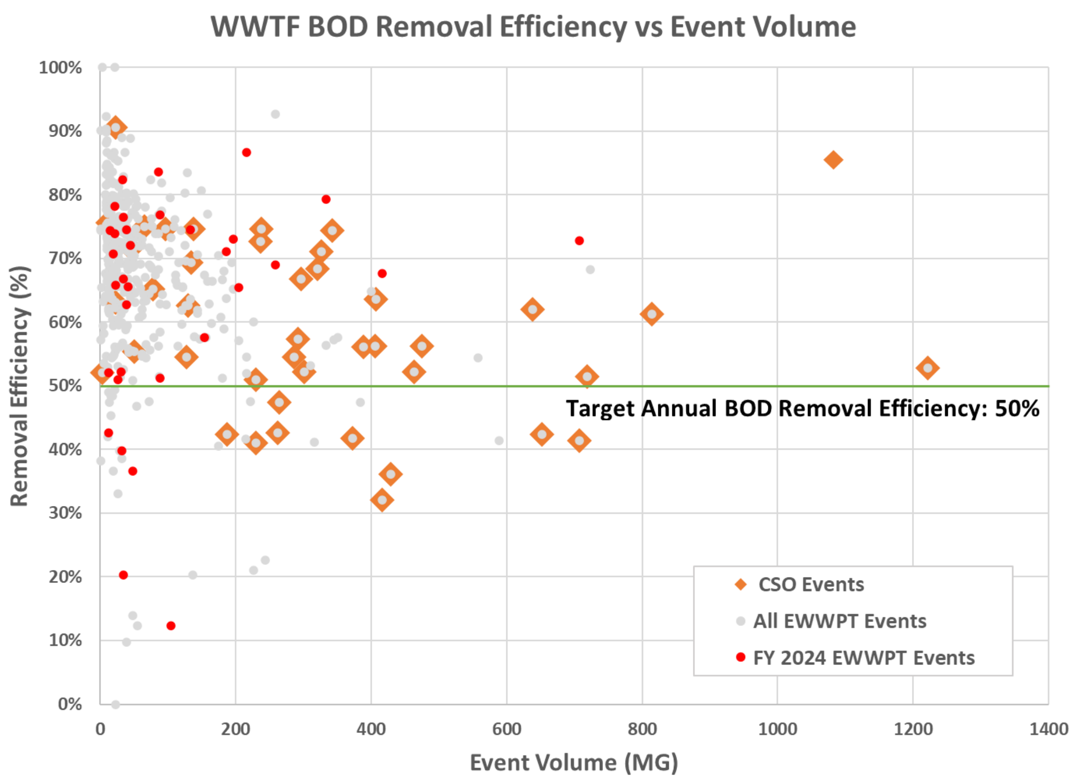


Figure 4 WWTF TSS Removal Efficiency Versus Event Volume

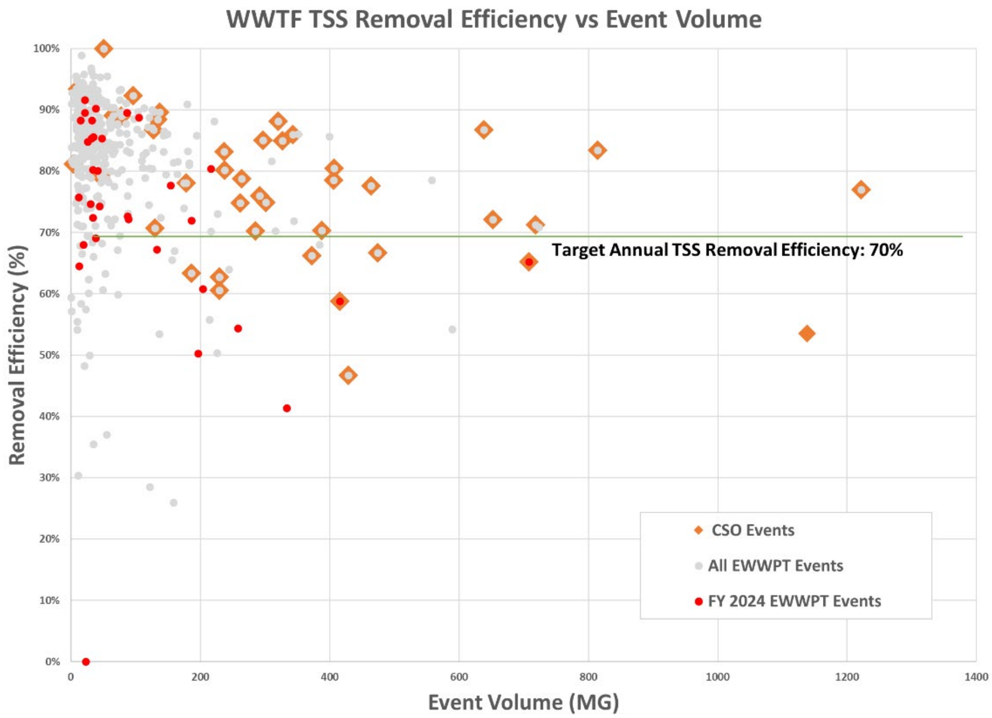


Table 13 Enhanced Wet Weather Primary Treatment Events - Detailed Information

Date and Time Bypass Event Started	Event #	CBWTP Flows		WWTF Flows				WWTF Effluent			
		Avg Influent During EWWPT (MGD)	Avg Secondary Flow During EWWPT (MGD)	Avg WWTF Flow (MGD)	Discharge Volume (MG)	Duration of Discharge (hours)	Calendar Days Discharge Occurred	Event BOD Load Discharged (lbs)	Event TSS Load Discharged (lbs)	EMC BOD (mg/L)	EMC TSS (mg/L)
8/31/23 13:15	1	117	80	25	13	12.7	2	14,905	3,860	133	34
9/25/23 11:30	2	118	79	31	24	19.0	2	5,208	2,257	26	11
9/27/23 5:45	3	123	80	28	7	5.7	1	2,416	1,630	43	29
10/16/23 11:45	4	207	85	112	78	16.8	2	35,078	23,564	54	36
10/24/23 16:45	5	114	79	28	40	34.3	3	30,096	5,217	91	16
11/1/23 20:15	6	220	110	101	30	7.2	2	10,947	6,158	43	24
11/4/23 0:45	7	262	109	142	125	21.0	1	33,273	39,512	32	38
11/5/23 18:00	8	224	110	106	178	40.5	3	58,647	56,592	39	38
11/18/23 21:45	9	162	109	34	4	3.0	2	2,793	3,002	78	84
12/1/23 7:30	10	190	105	78	250	76.8	4	14,729	106,066	7	51
12/5/23 5:00	11	290	110	172	408	57.0	3	118,122	107,393	35	32
12/9/23 22:00	12	275	110	155	196	30.3	3	67,982	87,679	42	54
12/19/23 7:00	13	223	109	99	24	5.7	1	24,220	8,073	122	41
12/22/23 10:15	14	193	109	69	26	9.3	1	15,823	6,686	72	30
12/25/23 14:00	15	163	109	46	30	15.8	2	19,749	5,165	78	21
1/3/24 13:00	16	153	109	33	4	3.0	1	2,154	1,459	62	42
1/6/24 2:15	17	175	106	62	80	31.0	2	28,608	27,999	43	42
1/8/24 10:30	18	170	108	55	208	91.0	5	71,832	41,667	41	24
1/18/24 1:15	19	206	111	90	189	50.5	3	53,739	62,423	34	40

Date and Time Bypass Event Started	Event #	CBWTP Flows		WWTF Flows				WWTF Effluent			
		Avg Influent During EWWPT (MGD)	Avg Secondary Flow During EWWPT (MGD)	Avg WWTF Flow (MGD)	Discharge Volume (MG)	Duration of Discharge (hours)	Calendar Days Discharge Occurred	Event BOD Load Discharged (lbs)	Event TSS Load Discharged (lbs)	EMC BOD (mg/L)	EMC TSS (mg/L)
1/20/24 22:15	20	207	110	89	700	188.5	9	222,122	183,445	38	31
2/14/24 21:30	21	211	110	92	97	25.2	2	32,398	21,515	40	27
2/21/24 0:45	22	140	111	20	18	20.8	1	8,542	6,057	58	41
2/26/24 0:45	23	209	109	79	15	4.5	1	5,393	4,194	44	34
2/28/24 21:15	24	195	108	81	326	96.7	5	95,863	97,095	35	36
3/10/24 11:30	25	138	79	48	26	12.8	2	23,660	13,018	110	61
3/11/24 17:45	26	124	80	35	33	22.8	2	16,225	9,516	59	34
3/27/24 11:45	27	138	105	25	36	35.0	2	16,641	13,830	55	46
4/30/24 14:15	28	165	81	73	26	8.5	1	13,010	9,757	60	45
5/2/24 5:15	29	171	80	73	14	4.5	1	0	1,854	0	16
5/3/24 23:00	30	166	83	73	146	48.0	3	46,512	30,185	38	25
5/6/24 8:30	31	134	80	42	22	12.8	1	9,472	7,767	51	42
5/21/24 20:15	32	119	78	31	11	8.7	2	7,824	4,878	83	52
6/2/24 17:45	33	189	82	99	80	19.5	2	29,847	25,153	44	37
Total	**33**				**3,465**	**1,039**	**77**	**1,137,829**	**1,024,666**		
Average/Event		**179**	**98**	**71**	**105**	**31**	**2.3**	**34,480**	**31,050**	**54**	**37**

BOD = biochemical oxygen demand; CBWTP = Columbia Boulevard Wastewater Treatment Plant; EMC = event mean concentration; EWWPT = Enhanced wet weather primary treatment; lb = pound; MG = million gallons; MGD = million gallons per day; mg/L = milligrams per liter; TSS = total suspended solids; WWTF = wet weather treatment facility.

2.5 CSO System and Water Quality Monitoring

2.5.1 CSO Discharge Sampling

The CBWTP NPDES permit requires CSO discharges be monitored at least five times per permit cycle for CSO pollutants of concern: zinc, lead, copper, TSS, and *Escherichia coli (E. coli)*. The purpose of this sampling is to confirm that CSO discharges protect beneficial uses and provide for attainment of the Willamette River water quality standards (Schedule A, Condition 5.b.iii). The City reports results of the sampling in this section each year that viable samples are collected.

The 2020 NPDES permit modifies the CSO sampling program dictated by the 2011 permit by requiring analysis for total dissolved copper plus Biotic Ligand Model (BLM) parameters instead of just total dissolved copper. Otherwise, the discharge sampling is identical to that reported in the FY 2015 *Annual CSO and CMOM Report*.

Portland obtained its fifth sample for the current NPDES permit, of which five are required for the current cycle, per Schedule A, Condition 5.b.iii.(A).

BLM and Oregon copper rule. Table 14 compares the instantaneous water quality criteria calculated using the copper BLM with the grab samples collected near Outfall 36 (SE Alder) on December 6, 2023, during the December 4–6 CSO event. The CSO sample analysis results of 2.47 micrograms per liter (µg/L) exceeded the instantaneous water quality criteria for a criterion continuous concentration (CCC) of 2.15 µg/L at the end of pipe. The NPDES permit Schedule A, Condition 3.b, grants a regulatory mixing zone for the SE Alder outfall with a 10:1 dilution for total copper. An ambient comparison sample was not collected for the December 4–6, 2023, CSO event. Ambient comparison samples were collected 28 days after the event on January 3, 2024, at the Morrison Bridge, close to Outfall 36. Applying the dilution, the December 4–6, 2023, discharge event does not have reasonable potential to exceed the water quality criteria.

Table 14 Copper Biotic Ligand Model Comparison

Ambient Sample				CSO Sample			
Sample Date	Final Acute Value (µg/L)	CMC (µg/L)	CCC (µg/L)	Sample Date	Cu (µg/L)	> CMC	> CCC
1/3/2024	4.3059	2.1529	1.3372	12/6/2023	2.47	Yes	Yes

CCC = criterion continuous concentration; CMC = criterion maximum concentration; Cu = copper; µg/L = micrograms per liter.

2.5.2 Willamette River Instream Water Quality Sampling

Willamette River instream water quality sampling results are provided in Appendix B and show the water quality trends along the Portland stretch of the Willamette River for five parameters: zinc, lead, copper, TSS, and *Escherichia coli (E. coli)*. These metals and bacteria parameters are the pollutants of concern for Portland CSO discharges. The sampling results indicate continued similar performance as previous fiscal years, with concentrations of all parameters fluctuating seasonally.

Section 3 CMOM Program Implementation

The City of Portland's CMOM program is designed to ensure that components of the collection system are cleaned and inspected at the right frequency and that preventive maintenance and repairs are performed to cost-effectively reduce the number of sewer releases, extend the useful life of the City's sewer infrastructure, properly manage collection system operations to protect public health, safety, and the environment. This annual summary for FY 2024 provides a brief overview of collection system operation and maintenance programs and practices as context for evaluation of the effectiveness of CMOM activities. Section 4 of this report includes sewer release analysis and performance.

3.1 Collection System – Gravity Sewer Operation and Maintenance

BES has programs in place to ensure that gravity sewers and maintenance holes are properly inspected, cleaned, and repaired. Closed-circuit television (CCTV) inspection activities are key for an accurate determination of the structural and operational condition of collection system assets. Cleaning helps maintain asset condition and hydraulic capacity, enhances the effectiveness of inspections, and helps to control odors. Repairing structural deterioration protects the community's infrastructure investment, can extend an asset's useful life, and reduces the potential for catastrophic failures.

3.1.1 Sewer Inspections and Cleaning

The *Collection System Inspection and Cleaning Plan* submitted to DEQ in December 2012 provides detailed information about the City's "needs-based" maintenance strategy for prioritizing maintenance, inspection, and cleaning activities and expenditures. Sewer mainlines are inspected for general preventive maintenance, special investigations in support of the chemical root and grease management programs in response to sewer problems, and to support asset reinvestment projects through the Capital Improvement Program (CIP). The sewer cleaning program includes preventive maintenance, accelerated cleaning in grease management areas, support for the root treatment program, special investigations related to collection system problems, and support of CIP projects. Inspection and cleaning program activities for FY 2024 are summarized in Table 15.

Table 15 Sewer Inspection and Cleaning Summary in FY 2024

Activity	Quantity	Comments
Planned mainline sewer inspection	707,922 linear feet 7.0% of total mainline	Increased from previous year's total of about 597,000 linear feet
Planned mainline sewer cleaning	1,140,752 linear feet 11.2% of total mainline	Increased from previous year's total of about 1,104,000 linear feet
Unplanned mainline sewer inspection	17,483 linear feet 0.2% of total mainline	Increased from previous year's total of about 14,000 linear feet
Unplanned mainline sewer cleaning	83,506 linear feet 0.8% of total mainline	Increased from previous year's total of about 43,000 linear feet
Service lateral inspections	367 laterals	Decreased from previous year's total of 462 laterals

In support of BES's integrated approach toward overall watershed health, Maintenance Engineering and Watershed operations and maintenance staff typically conducts stream walks and data analysis to assess external factors that might affect sewer pipes near streams. Because of reduced staffing, no stream walks were conducted in FY 2024.

BES may resume stream walks in FY 2025 and will continue to evaluate all the stream walk data collected to assess the usefulness of external visual inspection and observations of site conditions in conjunction with other preventive maintenance activities. The evaluation will be used to develop a standardized, repeatable condition assessment approach for this type of inspection moving forward.

3.1.2 Sewer Assessment and Repairs

Maintaining the wastewater collection system in good repair is a core service the City provides to its ratepayers. The City has a well-established sewer and maintenance hole repair program. Priority codes in the Hansen computerized maintenance management system (CMMS)[2] are assigned when work orders are created. The priority codes are used when scheduling and assigning work and to help manage the backlog of open work orders to ensure that repairs are completed according to their relative likelihood and consequence of failure (e.g., top priority is

[2] *Hansen* refers to Infor Public Sector, © 2017 Infor. All rights reserved. www. infor.com.

given to sanitary sewer releases and hazard-related repairs). The *CMOM Program Report* includes detailed descriptions of sewer repair maintenance activities and equipment.

The majority of planned repairs occur either from defects identified by the preventive maintenance CCTV inspection program or when additional repairs on a line are made in conjunction with an unplanned repair. Repairs are considered unplanned if the work is conducted in direct response to a collection system problem, such as a sewer release or surface cavity, or if the severity of the problem is significant enough to warrant repairs within 30 days. For larger urgent or emergency projects, BES Maintenance Engineering coordinates closely with BES Engineering Services to conduct work under the Maintenance Capital Contract Program or emergency CIP projects.

Planned service lateral repairs generally occur with adjacent repairs on mainline sewers. Service lateral repairs typically involve the complete replacement or renewal of the lateral and the addition of a cleanout at the curb for improved future maintenance. Unplanned service lateral repairs are typically in response to a problem such as a sewer backup or a positive dye test from a sewer investigation. A summary of sewer repairs in FY 2024 is summarized in Table 16.

Table 16 Sewer Repair Summary in FY 2024

Activity	Quantity	Comments
Planned mainline sewer repairs	3,090 linear feet	Decreased from previous year's total of about 5,100 linear feet
	0.03% of total mainline	
Unplanned mainline sewer repairs	2,213 linear feet	Decreased from previous year's total of about 3,000 linear feet
	0.02% of total mainline	
Major emergency repairs	987 linear feet of pipe	Total consists of urgent and emergency work completed by on-call contractors for the City
	1 maintenance hole	
Planned service lateral repairs	1,354 linear feet	Slightly above last year's total of 1,350 linear feet
Unplanned service lateral repairs	3,910 linear feet	Slightly above last year's total of 3,860 linear feet

3.1.3 Root Management and Control Actions

Portland is renowned for its urban forest and must balance the need to protect both trees and sewer infrastructure. During FY 2024, BES Maintenance Engineering continued to manage the chemical root control program using third-party service providers who apply dense herbicidal foam that kills roots on contact without harming trees or surface vegetation. The City's Root Control Program uses a priority ranking system so that sewers with the greatest need for chemical root treatment are addressed first. During FY 2024, 283,950 linear feet (54 miles) of mainline sewer were chemically treated for roots. In addition to chemical root foaming, City crews cleaned approximately 9,200 linear feet of sewer to locally remove roots using root saws and conventional cleaning in support of sewer inspection activities as well as in response to sewer system problems.

3.1.4 Grease Management and Control Actions

In FY 2024, three sewer releases from the City-maintained sewer system were attributable to grease. This low number emphasizes the effectiveness of Portland's program to control fats, oils, and grease (FOG), which was described in the *City of Portland Grease Management and Control Program* document that was included in the *CMOM Program Report*.

Areas of the collection system vulnerable to FOG buildup and blockages are managed on a more frequent preventive maintenance and cleaning cycle (accelerated grease cleaning areas, or AGCAs). Each year, lines are removed from AGCAs because sources of FOG have been addressed and accelerated cleaning is no longer needed.

Some AGCA lines may be re-assigned to a non-FOG accelerated cleaning list when baseline levels of FOG are exacerbated by sewer main deficiencies (i.e., sags, roots, running more than half full, and flat slopes). Not all mains in the program are cleaned or inspected every year. Cleaning and inspection frequencies are variable depending on the severity of the issue.

Inspections occur at food service establishments in the City of Portland and the City of Lake Oswego to ensure that grease interceptors are installed correctly, in a proper state of repair, and are cleaned at the proper frequency. FOG inspections and cleanings for FY 2024 are summarized in Table 17. Enforcement actions in FY 2024 are summarized in Table 18.

Table 17 FOG Inspection and Cleaning Summary in FY 2024

Activity	Quantity	Comment
Accelerated grease cleaning area (AGCA) cleaning	18,098 linear feet	Increased from last year's total of 12,754.38 linear feet
	-	
AGCA inspections	7,886 linear feet	None
	62% of total AGCAs	
Food service establishment inspections	1,147 grease interceptors	2,669,918 gallons of FOG removed from grease interceptors or 5,289,275 pounds removed from collection system
	205 service laterals	

Table 18 FOG Enforcement Activities in FY 2024

Description	Quantity	Requirement
Warning notice	76	Increase grease removal device cleaning frequency
	30	Repair or replace grease removal devices
Notice of violation with civil penalties/ cost recovery	6	Plumb all fixtures to a grease interceptor
	1	Service grease interceptor at prescribed cleaning frequency
	0	Make required grease interceptor repairs
	0	Escalated enforcement for failing to meet compliance dates for the original notice of violation

The FOG Coordination Team continues to meet three times a year to improve FOG-related activities performed by work groups responsible for FOG inspection and compliance, maintenance engineering, sewer cleaning and maintenance, pump station operations and maintenance, and asset management and data management. Based on CCTV inspection results and similar information, the FOG Coordination Team determines areas that are cleaned at an increased frequency.

3.1.5 Maintenance Hole Inspection

During FY 2022, BES made the decision to temporarily suspend risk-based Tier 2 maintenance hole inspections. A higher priority was instead placed on completing routine mainline sewer cleaning and CCTV inspections. Since staffing issues continued into FY 2024, the decision was made to perform these types of inspections at a reduced rate. In FY 2025, the City will assess whether to continue Tier 2 inspections at a reduced rate due to continued budget constraints and staffing issues.

In FY 2024, 45 Tier 2 maintenance hole inspections were completed. Of the Tier 2 maintenance holes inspected in FY 2024, none needed total replacement or repairs.

Section 4 Sewer Release Analysis and Performance

The City of Portland's *Sewer Release Response Plan* establishes the process for responding to sewer releases from the City's combined and sanitary sewer system and reporting to DEQ as required by the NPDES permit.

4.1 Sewer Release Tracking and Reporting

The BES Spill Protection and Citizen Response (SPCR) Section is responsible for coordination of the overall response to sewer release events, maintaining official City sewer release records, and reporting releases to DEQ.

BES maintains sewer release data within the Hansen CMMS, allowing service call information to be connected with follow-up actions and work history of assets. BES has developed a standardized list of causes to facilitate tracking and analysis of sewer releases, as shown in Table 19.

Table 19 Sewer Release Cause Descriptions

Sewer Release Cause	Description
Structural defect	Release caused by a physical failure of the pipeline
Equipment failure	Release directly resulting from equipment failure typically either at a pump station or during a bypass pump around
Maintenance	Release caused by a City-related maintenance activity
Weather event	Release caused by hydraulic capacity issues associated with weather (there are three subcategories described in Table 20)
Grease	Release caused by a blockage due primarily to grease
Debris	Release caused by a soft blockage due to sediment or other material
Roots	Release caused by a blockage due primarily to roots
Surcharge	BES collection system surcharging but not weather-event related
Cause unknown	A release where the investigation does not identify a specific cause

BES further categorizes weather-related sewer releases, as shown in Table 20, to more directly associate these releases with the City's levels of service established through the BES Asset Management Improvement Program.

Table 20 Weather-related Sewer Release Terminology

Term	BES Definition
Hydraulically overloaded system	Rainfall less than or equal to the 5-year, 24-hour storm (the BES level of service is to prevent sewer releases to surface waters for all storm events up to a 5-year frequency)
Extreme weather	Rainfall in excess of the 5-year, 24-hour storm but less than or equal to the 25-year, 6-hour storm
Force majeure	Rainfall exceeds the 25-year storm (the BES level of service is to convey combined sewage to prevent releases to buildings or streets up to a 25-year storm frequency)

4.2 Sewer Release Key Performance Indicators

Striving for continuous improvement is a cyclical process of evaluating current practices, identifying needed improvements, and measuring performance. BES has developed a set of key performance indicators to gauge the effectiveness of the CMOM program.

4.2.1 Sewer Releases per Hundred Miles of Pipe

Sewer releases provide a good measure of the overall effectiveness of maintenance programs for controlling roots, FOG, structural failures, and pump station performance. By tracking sewer releases per 100 miles of sewer, BES has a succinct metric for gauging overall success toward minimizing sewer releases.

As of the end of FY 2024, BES owned and maintained approximately 1,925 miles of mainline sanitary and combined sewers, and 737 miles of sewer laterals. The City is typically responsible for maintaining the portion of the service lateral extending from the main sewer to the curb. During FY 2024, the City experienced 134 sewer releases over the 2,662 miles of collection system, which is approximately 5.0 releases per 100 miles of sewer.

Sewer release data is updated by SPCR as more complete information becomes available and investigations are conducted, and thus totals in this report reflect current records and may not match previous years' reports and/or monthly discharge monitoring report submittals. A comparison with previous fiscal years is shown in Figure 5.

Figure 5 Sewer Releases per 100 Miles of Sewer (Lower Numbers Are Better)

4.2.2 Response to Urgent Health and Safety-Related Service Requests

The City's goal is for a sewer emergency crew to be on site within 2 hours of receiving the initial call reporting an urgent sewer release. SPCR is responsible for maintaining records of sewer releases, and their records are used to assess the response time of the on-site emergency crew. Under certain circumstances, such as when the caller is reporting a release that occurred in the past or is requesting to meet the City crew at a prearranged time, a sewer release is considered non-urgent, and the 2-hour on-site response goal does not apply. Response time performance for FY 2024 is shown in Table 21.

A comparison with previous fiscal years is shown in Figure 6. Sewer emergency response crews arrived on site within the City's 2-hour response time target of 97% of the time during FY 2024.

Figure 6 Sewer Release Response Time Comparison

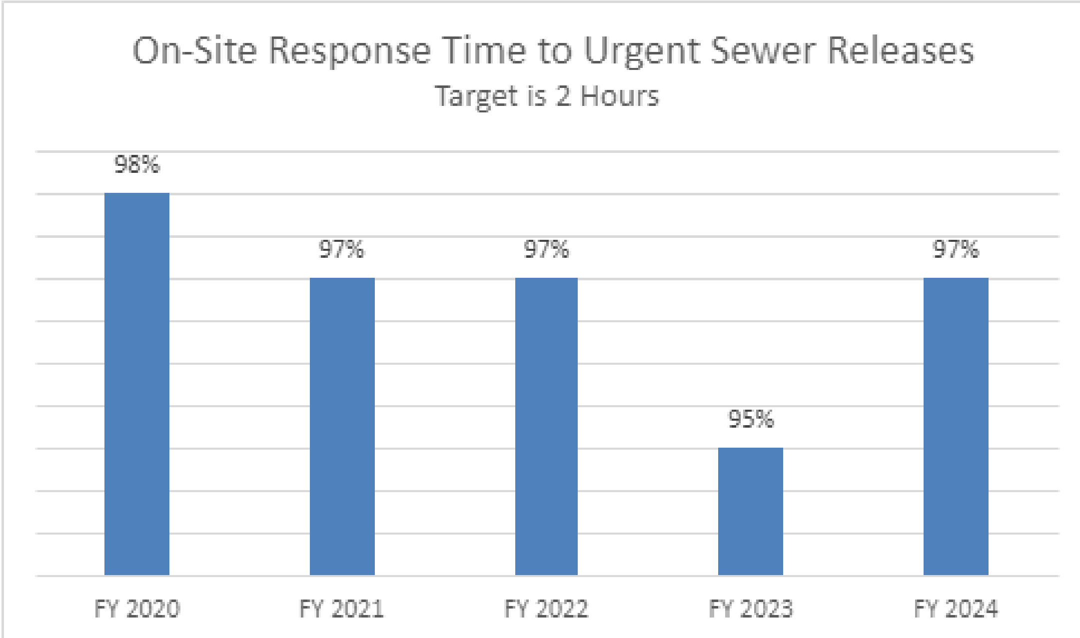


Table 21 Sewer Release Response Time and Counts for FY 2024

FY 2024 Urgent Sewer Release Calls	Number of Calls	Percent of Total
Urgent calls with response time less than 2 hours	347	97%
Urgent calls with response time 2 hours or more	11	3%
Total	358	100%

4.3 Analysis of Causes and Locations of Sewer Releases

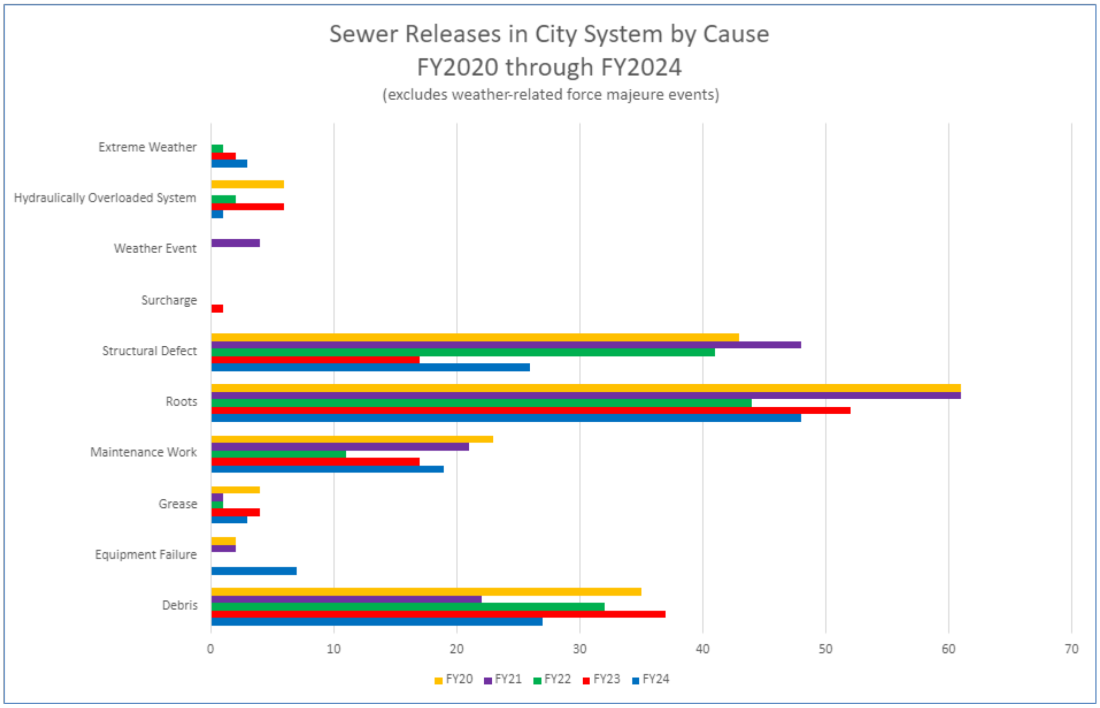
During FY 2024, the City experienced 134 releases from the sanitary and combined sewer systems.

There were 53 sewer releases associated with mainlines, maintenance holes, and pump stations, which equates to 2.7 releases per 100 miles of mainline sewer. There were also 81 sewer releases caused by issues in the sewer laterals, which is approximately 11.0 releases per 100 miles of sewer lateral pipe.

A chart comparing the causes of releases in FY 2020 through FY 2024 is shown in Figure 7. The release data shown are for releases due to problems in the City-maintained portion of the collection system (excluding releases due to causes resulting from problems in privately owned sewers or laterals).

The locations of the sewer releases in FY 2024 are shown on the map in Figure 8.

Figure 7 Comparison of Causes of Sewer Releases in FY 2020 Through FY 2024



Notes:

1. The chart excludes weather-related *force majeure* events from storms with greater than the 1-per-25-year return interval.
2. Extreme weather includes storms greater than the 1-per-5 year but less than the 1-per-25-year interval, and ice or snow events.
3. Hydraulically overloaded system data includes storms less than or equal to the 1-per-5-year return interval.
4. Weather event data includes releases caused by ice/snow issues.
5. Surcharge is defined as a release caused by a non-weather event.

Structural defects. There were 26 releases caused by structural defects in FY 2024. Fifteen were associated with defective laterals, eight with a mainline sewer, and three with pump stations. As part of the City's ongoing CIP sewer rehabilitation program, poor condition mainline sewers with structural defects are identified for repair. The laterals connecting to those pipes are inspected during the design process and included for replacement or rehabilitation if structurally deficient.

Roots. During FY 2024, 48 releases were caused by roots. Of those, only five were in sewer mainlines, while 43 were in service laterals. To reduce the risk of future root intrusion, City crews installed cured-in-place-pipe (CIPP) liners or excavated and replaced the overwhelming majority of laterals where releases occurred in FY 2024.

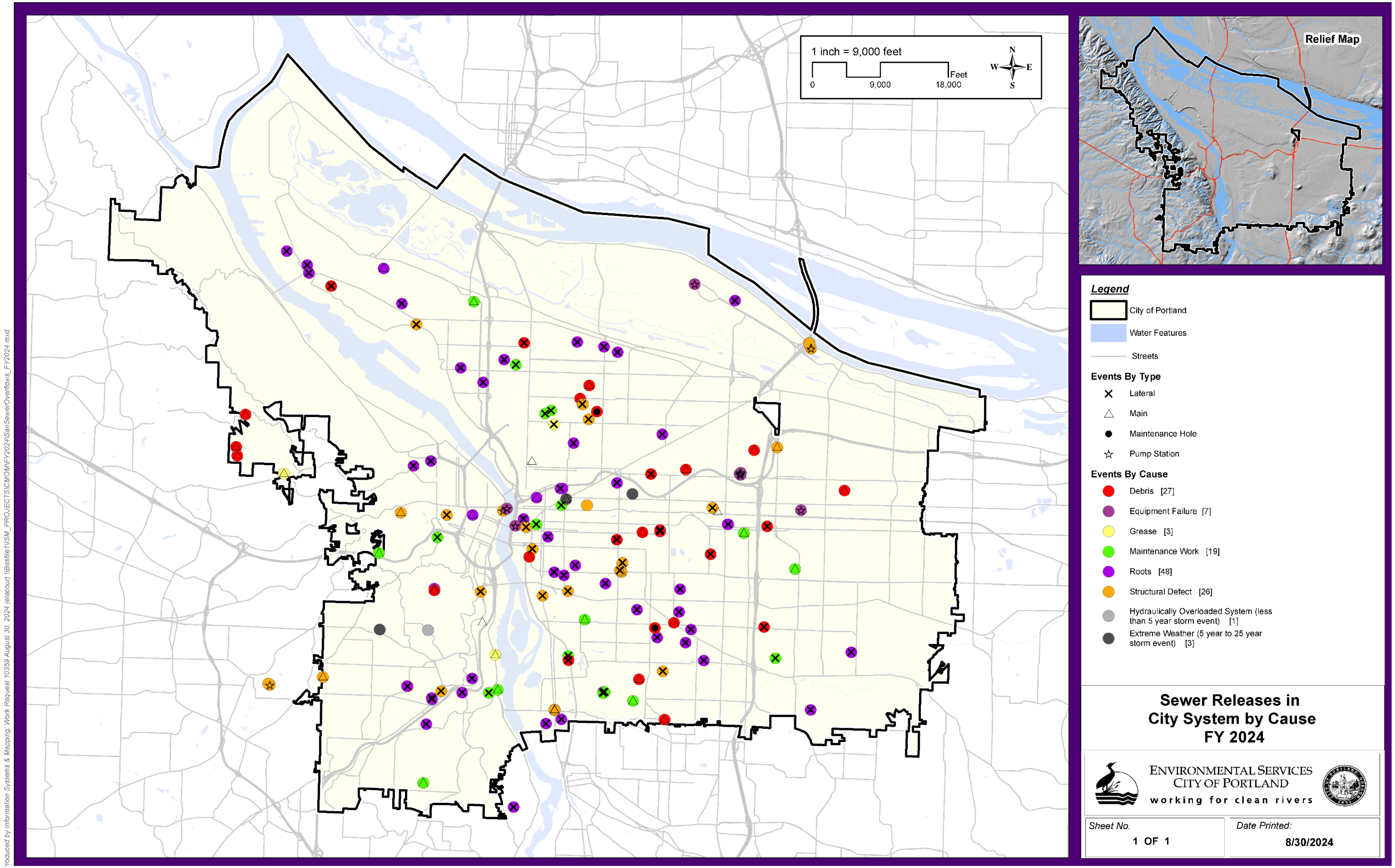
Maintenance. In FY 2024, there were 19 releases associated with maintenance activities: 11 of the occurrences were associated with mainlines and eight were associated with laterals.

Nine of the 19 releases were associated with sewer cleaning operations; many of these releases were associated with blowback (blowback is an eruption of air and water discharging incorrectly from a plumbing fixture drain) from toilets and the volume was less than 10 gallons (two of these releases were attributed to BES contractors). While precautions are taken to prevent these "blowback" occurrences, some private plumbing systems lack adequate venting, and the configuration of some City sewers makes it very challenging for cleaning equipment operators to work in some locations. Special precautions, such as using cleaning nozzles with steeper jet angles and running lower pressures, are taken in areas prone to blowback.

Six releases were related to work done by other City bureaus or by private contractors performing other types of utility work. Three releases were related to either open-cut repairs or installation of CIPP liners by City crews. One maintenance-related release was associated with a City sewer construction project.

Debris. There were 27 releases caused by debris in FY 2024, 14 of which were associated with mainlines, two from maintenance holes, and 11 from service laterals. Since debris in the sewer system continues to be an issue, BES continues to conduct a "what not to flush" public outreach campaign. Also, BES is considering ideas for accelerated cleaning in sewer mains where pipe sags and debris have been found in past CCTV inspections to reduce this type of release in the future.

Figure 8 FY 2024 Sewer Release Map



4.3.1 Sewer Releases to Surface Water in FY 2024

Sewer releases to surface water occurred at eight locations in FY 2024. The circumstances of those releases are described below.

2137 NW Cedar View Lane (release to Mill Pond)

On August 29, 2023, a community member contacted the City to report possible sewage going into the pond near the address of 2137 NW Cedar View Lane. A City sewer investigation crew responded and collected a water sample near maintenance hole ARX556. The result was received on August 30, 2023, and showed *E.coli* levels exceeding 240,000 Most Probable Number (MPN) per 100 mL.

Upon further investigation, the City crew identified sewage coming out of maintenance hole ABA805. This maintenance hole is well off-road and located in a vegetated area upstream of Mill Pond. A City sewer crew then cleared a blockage in the sewer main just downstream of maintenance hole ABA805 and the release was stopped at 10:36 PM on the evening of August 30, 2023.

The volume was estimated at 48,000 gallons using a flow/duration calculation. *E.coli* samples were collected again on September 6, 2023. Those samples showed a return to baseline conditions. The sewer mains in this area are PVC mains, which were constructed in the 1990s. They were investigated at the time of this incident and all were found to be in very good condition.

3400 SW Sherwood Place (release to an unnamed creek in Marquam Nature Park)

On September 1, 2023, a contractor performing CCTV inspection work reported an overflowing maintenance hole, ABY271, in an area far off-road and within Marquam Nature Park. A City sewer emergency crew responded and cleared a blockage in the sewer main downstream of that maintenance hole on the same day.

A City crew collected a water sample near maintenance hole ABY271. The result received on September 1, 2023, showed *E.coli* levels exceeding 65,000 MPN per 100 mL.

The channel downstream of this location was reinspected on September 5. No surface water was observed in the channel so no new sample was collected. This downstream channel leads to a field inlet, which directs flow to the combined sewer system within the park.

A follow-up CCTV inspection was conducted, and roots were observed in the main sewer. There is a potential future CIP that includes these difficult-to-access sewer mains that run through Marquam Nature Park. That project is currently in the planning stages and does not yet have an estimated timeline for construction.

Due to their difficult location, most of the sewer mains within Marquam Nature Park are extremely difficult to properly clean and inspect since vehicles cannot get close to many of the maintenance holes within the park. Despite these difficulties, more maintenance work is planned between now and that possible CIP project to try to remove root intrusions in the sewer main located immediately downstream of ABY271, which may reduce the likelihood of another sewer release at this location.

56 SE Stark Street (release to the Willamette River)

At 2:18 AM on October 2, 2023, an alert was sent by the HYDRA monitoring system that a CSO was occurring at Outfall 36 (OF36) just downstream of the Alder Pump Station in southeast Portland. The HYDRA system monitors level sensors within the combined sewer system and is responsible for sending alert messages when CSOs occur.

Telemetry data indicated that this overflow lasted between 2:09 AM and 2:15 AM because storm pumps within the Alder Pump Station automatically activated and sent flows from the pump station to the Willamette River via combined sewer OF36. This outfall is located on the east side of the Willamette River, approximately 175 feet north of the Morrison Bridge in Portland.

Crews from the pump stations and electronic instrumentation operations and maintenance work groups were dispatched to investigate. They determined that the alert message was accurate and that a discharge to the river from Alder Pump Station did occur. The volume of the release was estimated at 10,800 gallons.

The cause of the release was not immediately apparent and was subsequently investigated by the BES Risk Assessment Division. The group determined that the issue was related to a faulty solenoid valve associated with a bubbler tube, which is used as part of the HYDRA system to sense water levels within the pump station wet well.

During a routine purge cycle on October 2, a solenoid valve in the bubbler system remained closed when it should not have. This resulted in high pressure remaining in the bubbler tube after that purge cycle should have been completed. This was interpreted as a high wet well level that then led to the activation of the storm pumps, which subsequently pumped sewage to Outfall 36.

That solenoid valve has since been replaced. Other corrective actions include replacing the smaller components of the bubbler system more frequently and gaining the ability to log when bubbler system purges are completed and doing so in a way that will send an alarm if a purge is missed.

E.coli samples were collected from the Willamette River on October 2, 2023. Three samples were collected (one from upstream of OF36, and two downstream). These samples showed baseline levels of *E.coli* at all locations. Since these samples indicated *E.coli* levels already at baseline levels, an additional round of samples was not collected.

2309 SW Sunset Boulevard (release to waterway that drains to Fanno Creek)

On December 6, 2023, the City was notified of possible sewage coming out of a cleanout at this address. A City emergency crew responded and observed a discharge from the cleanout. Possible sewage was running down the street and entering inlet ACH320. This inlet leads to an unnamed creek that then leads to Fanno Creek downstream of this location. The rate of release was estimated at 20 gallons per minute, and the volume of the release was estimated at 3,000 gallons.

There was significant rainfall occurring at the time of the release. The cause of the release was determined to be a weather event in the category of a hydraulically overloaded system (storms less than or equal to a 5-year return frequency). Due to the large amount of rainfall occurring at that time, the impacted road surface and storm sewer were scoured clean. Therefore, no cleaning of these assets was performed.

E.coli samples were collected from two locations downstream from the release site on December 7 and again on December 12. These samples showed baseline levels of *E.coli* at all locations.

6885 SW 86th Avenue (release to Fanno Creek)

On January 17, 2024, the City was notified of the sound of rushing water at the SW 86th Avenue Pump Station. A City emergency sewer crew responded and observed a broken fitting at one of the surge tanks, releasing sewage to the ground. The release occurred on pump station property and drained to Fanno Creek.

The emergency crew shut down the surge tank and isolated it from the system, stopping the release at 11:11 PM that day. The estimated volume of the release was calculated to be 12,000 gallons.

E.coli samples were collected from Fanno Creek by Clean Water Services on January 18 and by BES on January 24. Samples were collected both upstream and downstream of the pump station. The samples showed a return to baseline *E.coli* levels of at all locations by January 24.

At the time of the release, the region was experiencing an extremely cold weather event that was causing power outages in the region, including at this pump station. The emergency generator at the neighboring Fanno Basin Pump Station started up and took control over all sewage pumping activities for both pump stations as designed. The SW 86th Avenue Pump Station does not have a separate backup power supply.

The release occurred when a pipe manifold, also known as a suction spool, on the surge tank recirculating system at the SW 86th Avenue Pump Station fractured due to the extreme cold weather. This fracture resulted in sewage being released from the system to the ground surface. There is a heater within the structure where the suction spool is located to keep the area around this pipe manifold warm during normal operations. But the power outage had disabled the system.

To ensure this does not occur in the future, pump station crew members will be on site to ensure that the system is functioning correctly when the pump station resumes operations after a power outage. Also, pump station operators will be prepared to use propane heaters to make sure pipes do not freeze and break during cold weather events when there is a power outage.

30 NW Naito Parkway (release to the Willamette River)

On February 5, 2024, the City was notified of possible sewage coming out of a fenced area that surrounds Ankeny Pump Station. A City pump station repair crew responded and observed sewage coming out of the ground at the base of a concrete pad within the pump station grounds.

The released material ran into two storm inlets on pump station property. Building plans indicate that those two storm inlets discharge to the Willamette River. Solids had obstructed those inlets, and sewage accumulated on the surface and then flowed on the ground surface beyond that fenced area. In addition, possible sewage was observed seeping into the basement of the pump station where a 30-inch force main exited through the basement wall.

The pump station crew identified two sewer force mains (a 30-inch and 42-inch force main, side-by-side) directly beneath the area where sewage was coming out of the ground. These lines were identified as likely sources of the release.

The gate valves were closed for both force mains. This reduced the flow but did not stop it entirely. After multiple attempts to stop the release using the gate valves, the pump station was shut down, and the release was stopped at 2:10 PM on February 6, 2024.

The estimated volume of the release was calculated to be 1,400 gallons. Cleanup of the impacted surface areas was started on February 5, 2024, and was completed on February 6, 2024.

One sample was collected upstream of the release and two samples were collected downstream of the release. Sample results did not show elevated levels of *E.coli* at any of those locations.

The cause of the release is believed to be structural defects in both the 30-inch and 42-inch sewer force mains leading from the Ankeny Pump Station. A repair project has been initiated to fix those force mains. BES has engaged a contractor and work is currently expected to be completed this September. The Ankeny Pump Station will remain shut down until that work is completed.

9721 N Columbia Boulevard (release to the lower Columbia Slough)

On March 21, 2024, BES was notified of possible sewage coming out of the ground at the base of the N Columbia Boulevard overpass bridge abutment near N Lombard Street. Material was observed coming out of the ground and running across the ground surface, where it reached a nearby water quality swale. The swale empties into the lower Columbia Slough.

Maps showed that the release was most likely coming from the nearby sanitary sewer force main from the Lombard Pump Station that leads to the CBWTP. The force main from the Lombard Pump Station does not have an alternate routing option, meaning that it cannot be bypassed. Shutting off the pump station would cause an overflow from the pump station wetwell to the Columbia Slough. Because locating the defect would take an unknown amount of time and since the force main could not be shut off, the decision was made to capture as much of the material released at the bridge abutment and pump it to the sanitary sewer.

The City hired Titan Utilities to perform emergency work at this location. Titan excavated at the base of the bridge to create an impoundment area that would capture the flow. That captured material was then pumped to a nearby sanitary maintenance hole. The excavation, containment, and pumping system repair was completed by 6:30 PM on the evening of March 21. The sewage release to the water quality swale was stopped at that time.

On March 23, 2024, the investigation identified the most likely location of the defect to be 100 yards to the south of the bridge on N Columbia Boulevard. An excavation to the force main was initiated in the street, and the defect in the force main was located on March 26. Once the defect was uncovered, sewage began coming out of the force main directly into the excavated area.

Crews then installed additional pumps at that location to convey the released material to another nearby sanitary sewer. Subsequently, the sewage release originally observed at the base of the bridge abutment stopped. From that point onward, all released material was being captured at the excavated area and then redirected to the sanitary sewer system.

Inspection of the force main showed that the joint between two force main segments had separated that had allowed sewage to escape. On the morning of March 27, a temporary repair patch was installed and stopped the release. On April 2, the permanent repair of the force main was completed.

An estimated 50,600 gallons was released to the environment. Most of that material flowed to the nearby water quality swale. An additional estimated 1,150,000 gallons of sewage was captured in the two containment areas described above and then returned to the sanitary sewer.

Water quality samples were collected from the Columbia Slough. Samples were collected from upstream and downstream and also from three locations at the release site itself. Sample results showed elevated *E.coli* levels near the release site at the time of impact. Follow-up samples, collected after the release had stopped, showed a return to baseline conditions.

That emergency repair work is now complete. A subsequent construction project to upgrade the force main associated with the Lombard Pump Station has completed the design phase and is expected to begin construction later this year.

30 NW Naito Parkway (release to the Willamette River)

On April 24, 2024, while performing repair work related to the Ankeny Pump Station sewer release described above (also at 30 NW Naito Parkway), a repair crew noticed a drip coming from a gasket joint on a 42-inch force main. That main was shut down for repairs at the time. The rate was one drip per second. The drips were observed falling into water that regularly accumulates underneath the Burnside Bridge and has connectivity to the Willamette River.

The crew immediately set up a bucket capture system to stop the drips from reaching the flow path to the river. Crews have reported that the dripping has stopped. This container will remain in place and continue to be monitored throughout the construction project at this location. The faulty gasket joint on the 42-inch force main will be rebuilt as part of this construction project, which currently is projected to be completed in September 2024.

4.4 Conclusions and Follow-Up Actions for Sewer Release Reduction

The City of Portland's CMOM program is being fully implemented. The City is shifting toward risk-based operation and maintenance of the collection system that, over time, should result in a positive trend toward planned, proactive maintenance and fewer sewer releases. This shift in approach may be a contributing factor to the reduced number of releases in the last couple of years.

The City is also implementing a force main condition assessment program to create a framework to assess and manage the force main network assets. The intent is to develop a long-term, systematic maintenance plan for preventive activities such as inspection, cleaning, and repairs. BES continues to develop and improve the Hansen CMMS to facilitate work prioritization and asset management in the gravity collection system. BES's CMOM program effectively incorporates the essential elements and best management practices for proper operation and maintenance of the collection system.

BES continues to evaluate ways to improve the overall effectiveness of the sewer mainline cleaning program, specifically focusing on ways to reduce sewer releases related to operational problems such as grease, roots, and debris. Because of this, BES continues to reassess the thresholds for placing pipes into the chemical root treatment program. Although operational issues continue to challenge the daily workings of the collection system, it should be noted that the number of mainline sewer releases associated with grease, debris, and roots totaled just 23, or 1.19 per 100 miles of mainline for FY 2024.

There were 11 mainline sewer releases associated with structural defects in FY 2024. This low number shows the benefits of the large number of sewer mains that have been rehabilitated or replaced in CIP projects in recent years. It also reflects the benefits of spot repairs performed by City repair crews on sewer mains in response to issues found in preventive maintenance CCTV inspections.

Significant annual project reinvestments within the CIP will continue to renew and replace structurally deteriorated sewers. These projects focus on collection system assets with the highest risk and consequence of failure. In doing so, the completion of these projects is helping the City conduct more proactive rather than reactive maintenance. The methodology used for risk-based prioritization of CIP projects was presented in the *Collection System Assessment and Rehabilitation Plan* submitted to DEQ in December 2012.

Service laterals continue to challenge the daily operation of the collection system and are where most sewer releases originate. The Bureau's two primary methods for addressing laterals in poor condition are through the maintenance and mainline sewer rehabilitation projects in the CIP.

Structurally defective laterals where releases occurred in FY 2024 have been repaired by City crews using CIPP liners or were excavated and replaced. Additionally, to proactively prevent sewer releases from laterals, CIP projects for the replacement, repair, and rehabilitation of sewer mainlines also include inspection and repair/replacement of service laterals based on their risk of structural or operational failure. The City will continue to utilize opportunities for making cost-effective improvements to laterals.

Overall, continued implementation of the *BES System Plan—Combined and Sanitary Sewer Elements*, dated March 2012, will address condition and capacity risks in both the combined and separated sanitary sewer systems. The BES System Plan's consolidated, system-wide approach to prioritizing reinvestment and business risk reduction through CIP projects should also reduce the potential for sewer releases.

Section 5 Maximization of Storage in the Collection Systems

Keeping combined sewage within the sewer system using existing in-system storage optimizes the volume sent to enhanced wet weather treatment, increasing the volume treated by biological secondary processes and reducing the number and volume of CSO events. While this control originally focused on keeping sewers free of blockages, removing relatively clean stormwater from the collection system also contributes to maximizing available storage and conveyance capacity. The programs documented here have the added benefits of increased visibility of these efforts and public education opportunities.

5.1 Private Development and Redevelopment

BES's *Stormwater Management Manual* (SWMM) applies to all development and redevelopment proposals that create or redevelop over 500 square feet of impervious area. City staff continue to implement the requirements in the 2020 SWMM.

In FY 2024, implementation of the SWMM in combined sewer basins led to the construction of stormwater facilities at 261 properties, managing 40 acres of private impervious area onsite, thereby reducing stormwater volume into the combined system.

5.2 Private Property Retrofit Program

The Private Property Retrofit Program (PPRP) continues the installation of stormwater facilities on private property in support of larger BES CIP capacity and sewer improvement projects. Guided by the 2012 *BES System Plan—Executive Report: Combined and Sanitary Sewer Elements* and its CIP, this program implements opportunities with private property owners to voluntarily retrofit or install on-site stormwater infiltration facilities, such as rain gardens, drywells, and pervious pavers to keep runoff out of the combined sewers. In turn, participating property owners agree to keep and maintain the new stormwater systems via an operations and maintenance agreement that is recorded with Multnomah County. Eliminating runoff helps reduce local sewer capacity problems and CSO volumes. For more information, see previous annual CSO and CMOM reports (FYs 2014 and 2015).

FY 2024 project installation season started in mid-October of 2023 and lasted through the end of June 2024. PPRP partnered with property owners in one CSO target program area (Taggart D sewer basin) located in the Richmond neighborhood of southeast Portland. The program installed 24 rain gardens, 27 hybrid drywell/rain gardens, 1 downspout disconnection, and seven drywell-only projects, for a total of 59 projects during the FY 2024 season. All of these projects (59) were implemented in the Richmond neighborhood to help alleviate flows and surcharging to the Taggart D trunk sewer. This resulted in control of 1.6 acres of impervious surfaces in FY 2024. During the past five construction seasons starting in FY 2020, PPRP has installed 249 projects controlling 6.5 acres of impervious area in the Taggart D sewer basin alone.

Examples of FY 2024 retrofit projects are shown in and Figure 10. PPRP will wrap up project implementation in the Taggart D sewer basin in the beginning of FY 2025 and will target projects in the Sullivan basin located in the Laurelhurst and Kerns neighborhoods of Portland to help reduce elevated sewer capacity risk.

Figure 9 Example Retrofit Project, Richmond Neighborhood: Raingarden Before and After Construction

Figure 10 Example Retrofit Project, Richmond Neighborhood: Rain Garden After a Rain Event

5.3 Ecoroofs

Ecoroofs replace conventional roofing with a layer of vegetation over a growing medium on top of a synthetic, waterproof membrane. An ecoroof significantly decreases stormwater runoff, saves energy, reduces pollution and erosion, absorbs carbon dioxide, and reduces heat island effects.

The City of Portland strongly supports the installation of ecoroofs through Central City requirements, the City's Green Building Policy, SWMM, and developer floor area ratio bonuses in specific portions of the city.

As of June 2024, Portland has 570 ecoroofs installed throughout the City, managing over 40.9 acres of roofs. Approximately 449 of those ecoroofs are in the combined sewer area. An estimated two new ecoroofs were installed in the combined sewer area in the past fiscal year, although the date of some ecoroof installations is uncertain. Those ecoroofs manage approximately 0.7 acres of roofs. This roof area represents 700,000 gallons of rainfall to the combined system annually, and Portland's monitoring data indicate that approximately 350,000 gallons are retained by the ecoroofs and returned to the atmosphere through evapotranspiration.

5.4 Public Right-of-Way Development and Redevelopment

As of June 2024, Portland has implemented more than 2,600 green streets in the right-of-way, with approximately 1,160 in the combined sewer area. The *Post-2011 Combined Sewer Overflow Facilities Plan* identifies specifically how Portland will continue to implement both public and private stormwater controls to further reduce stormwater entering the combined sewer system and thereby increase the storage available for capturing CSO discharges.

During FY 2024, five new green street facilities were installed in the combined sewer area. The facilities were implemented in two private development projects. Collectively, these facilities manage approximately 0.5 acres of impervious area that generate 500,000 gallons of stormwater entering the combined sewer system annually. Based on the City's performance monitoring of green street facilities, these facilities will remove approximately 350,000 gallons of runoff annually from the combined sewer system through infiltration and evapotranspiration.

Section 6 System Reinvestment and Risk Reduction

The City of Portland BES asset management program is founded on strategically reducing risk through cost-effective investments. The City has improved its methods for calculating risk and making cost-effective decisions to reduce risk through investment activities. This section discusses how the City evaluates existing risk in the collection system and how its investments reduce risk to meet service levels.

6.1 FY 2024 Reporting Methodology, Changes, and Improvements

Inspections and hydraulic modeling generally determine risks in mainline pipes and pump stations.

Pipe inspections provide the condition data used to determine the risk of structural failure. The inspections include routine maintenance inspections to assess the structural condition of the pipes and post-repair acceptance inspections to ensure that repairs meet designated standards and/or contract specifications. The structural risk of laterals is assumed based on the quantity of laterals repaired.

Hydraulic modeling is used to determine the risk of capacity failure, specifically the likelihood of basement and surface flooding with respect to the Bureau's adopted levels of service.

Likewise, pump station inspections also provide condition data to determine the risk associated with operational failure of the critical assets within a pump station. Hydraulic modeling determines the risk of capacity failure, specifically to determine the likelihood and consequence of overflows.

System risks change over time as a result of the following:

1. **CIP:** Capital projects repair, rehabilitate, or replace existing assets or create new ones to reduce system capacity (level of service) risk and structural (mortality) risk.
2. **Maintenance:** Preventive maintenance work orders seek to reduce structural risk in the system by applying targeted repairs and rehabilitation on high-risk assets.

3. **Change in asset condition due to aging and use:** Inspections provide more accurate information about asset condition than simple age-based assumptions. Changes in risk can be due to actual aging, as indicated by consecutive inspections, or related to the inspection of assets that varies from the age-based assumed condition. Since the actual asset condition can be more accurate for determining Remaining Useful Life than the assumed condition based on age, risks can decrease for a particular asset after it is inspected.
4. **Unexpected changes in hydrologic conditions:** Generally, future development conditions predicted by the Bureau of Planning and Sustainability allow BES to provide sufficient capacity for anticipated hydrologic demands on the conveyance system. Future conditions are primarily defined by the City Comprehensive Plan. In some instances, development may differ from the Comprehensive Plan that may have a positive or negative effect on capacity risk.
5. **Inflation and increased costs:** Risk increases as the cost of responding to emergency failures (due to inflation or other factors) increases.

Items 1 and 2 above are the focus of this section.

The City of Portland has developed a risk-reporting methodology for pipe rehabilitation over the past fiscal year. The methodology relies on existing asset management and project tracking systems. These systems underwent significant changes and upgrades over the past year but should be further refined to enhance risk reduction reporting.

The City is improving risk calculations for large-diameter (36-inch or larger vertical and/or horizontal dimension) pipe assets. The risks for large-diameter assets assume different failure scenarios and rehabilitation methods compared to smaller-diameter pipes. Results presented in Section 6 apply to smaller-diameter pipes (less than 36-inch diameter).

The City also completed a Pump Station System Plan in 2020. The plan developed a data-driven risk analysis process to determine pump station investments required to manage risk. The asset management approach developed for the pipe collection system was tailored for pump stations to support consistent decision-making. Pump station asset condition, capacity, efficiency, and level of service deficiencies are used to quantify risk and determine the appropriate risk management strategy. These strategies meet the BES mission by protecting public health, water quality, and the environment and optimize the return on investment for rate-paying customers.

6.2 FY 2024 Activity for Risk Reduction

Risk reduction is the present cost of repairing, rehabilitating, or replacing infrastructure, thereby deferring failure and its related consequences.

Risk reduction is now reported on a calendar year basis for projects that reach the "Substantial Completion" phase, as fiscal year reporting is delayed due to construction during the summer and end of the fiscal year. Risk is not reported for investments correcting non-conforming sewers (e.g., sewers not constructed to current standards), nor for unplanned sewer maintenance or repair activities.

6.2.1 Risk Change Due to Capital Improvements and Inspections

Capital improvement projects are designed and constructed to address risk. Risk resolution is included in the risk reduction calculations.

BES had five projects that met the risk reduction criteria during the 2023 calendar year. Total risk reduction is estimated at $1,631,000 and attributed to investment in repaired/replaced gravity and pressurized assets via the CIP. These projects replaced or rehabilitated 12 combined gravity mains.

Several pump station projects are in various stages of permitting, design, or construction, but none have met the threshold to be included in risk reduction calculations for the 2023 calendar year.

6.2.2 Risk Change Due to Maintenance Activity

Maintenance repairs reduce risk in the collection system and involve localized sewer repairs and the replacement of service laterals. Planned maintenance activities included approximately 3,365 linear feet of repair and lining work on sewer main assets and 187 laterals that were replaced or lined. The total risk reduction due to maintenance activity during the 2023 calendar year is estimated at $6,094,000.

Additional maintenance work was performed on pump stations during the 2023 calendar year. These are typically smaller projects that do not meet BES's capitalization threshold and do not require a contractor. Examples include upgrades, repairs, and rebuilds of smaller components to meet the manufacturer's maintenance specifications.

Total risk reduction due to pump station maintenance activities during the 2023 calendar year is estimated at $516,910.

Section 7 Inflow and Infiltration

In the past, the City made concerted efforts to study and mitigate problems caused by inflow and infiltration (I&I). Significant historical improvements to the collection system and CBWTP, as well as the City's execution of its Nine Minimum Controls, means the City no longer needs a widespread I&I program to improve CBWTP's ability to treat received wastewater and stormwater.

Planned I&I activities are now mostly limited to a few basins. Ongoing I&I analysis and projects are focused in the Fanno, Burlingame, and Council Crest basins. These three sewer basins are the only separated areas within the CBWTP collection system known to have widespread I&I problems, and therefore successfully addressing these problems requires a relatively large-scale approach and a more comprehensive analysis, compared with other areas of the system. This approach is necessary due to challenges such as complex rainfall-derived I&I (RDII) response, difficult site conditions for implementing system improvements, and the interconnectedness of the collection systems that serve each sewer basin.

7.1 FY 2024 Activities

A significant amount of progress was made on a project to address sanitary sewer overflow risk in the Council Crest sewer basin. This work included refining planning alternatives using hydrologic and hydraulic models of the sanitary sewer system, downstream combined sewer system, and local stormwater and surface water systems. Planning-level cost estimates were also developed. Final alternatives being considered include adding new inline storage vaults to the collection system and building a new cross-connection to divert high flows to the Burlingame sewer system.

7.2 Planned FY 2025 Activities

Work will continue on the Council Crest Integrated RDII project to identify a suitable recommended alternative for eliminating the risk of sanitary sewer overflows. Once a recommended alternative is chosen, the project will proceed through design and to construction.

After a final recommended alternative for the Council Crest project is selected, its impact on the Fanno and Burlingame systems will be evaluated, since the recommended alternative will most likely involve building a new connection between the two systems.

The outcome of this RDII analysis for the Fanno and Burlingame systems will directly impact the fate of the Cambridge Village Pump Station, which is a small wet weather diversion pump station located on the upper Fanno Creek Interceptor. This pump station is identified as requiring investment in the near-term to continue reliable operation. Depending on the results of the RDII analysis, this pump station could be abandoned, upgraded, or left in service as-is.

This analysis will include an overall evaluation of I&I in the Fanno and Burlingame basins, including the effectiveness of recently completed work to reduce I&I in the Hillsdale Crest area, and also evaluating proposed RDII reduction projects along the Beaverton-Hillsdale Highway and Vermont Street. These RDII reduction projects have been approved and added to the CIP, but they have been delayed due to funding issues resulting from the CBWTP Secondary Treatment Expansion Program's budgetary requirements.

Section 8 Update of the CSO Public Notification Program

The goals of the CSO public notification program are to:

1. Make the public aware that the City has a combined sewer system that can overflow.
2. Explain what a CSO is and how it impacts water quality and can threaten public health.
3. Inform the public when a CSO has occurred and warn against contact with receiving waters.
4. Raise public awareness of the benefits to the community of the City's investment in CSO Control.

When the CSO Policy was adopted, the Public Notification element of the Nine Minimum Controls focused mostly on outreach through brochures, public meetings, and posted warnings at public access points on the Willamette River and Columbia Slough. The changes in communication technology provide additional tools for public notification.

The City of Portland's CSO notification procedures changed with the completion of its CSO implementation program in December 2011. Throughout the 20-year program, the City relied on its HYDRA system to measure rainfall and trigger the CSO notification process. As of December 2011, all combined sewer outfalls that can discharge are monitored, and public notification takes place when an overflow is measured at a specific location.

8.1 Changes in the Public Notification/River Alert Program

The program continues to use these integrated communication tools to notify the public:

- News media outreach: https://www.portland.gov/bes/news
- CSO general information: https://www.portland.gov/bes/about-csos
- Big Pipe general Information: https://www.portland.gov/bes/about-big-pipe
- CSO tracker: https://www.portland.gov/bes/big-pipe-tracker
- Postings of CSO media advisories on X, formally known as Twitter: X. It's what's happening / X; Handle: @BESPortland

The Big Pipe Tracker webpage is available at all times. The online Big Pipe Tracker, launched in 2021, allows the public to see a visualization of how the Big Pipe system is keeping the Willamette River sewage-free. The tracker also serves as an on-demand public notification tool in case CSOs occur.

The news media continues to be the fastest way to reach hundreds of thousands of residents. BES sends out news advisories ("CSO advisories") when a rare CSO incident occurs on the CSO general information website.

In addition to the website information described above, the program continues to post warning signs at eight public access points along the Willamette River ("River Alert"). The City is evaluating the effectiveness of the River Alert warnings and may elect to discontinue them this fiscal year.

Section 9 Pollution Prevention Programs to Reduce Contaminants in CSOs

BES maintains a Toxics Reduction Program, which focuses on source control and pollution prevention activities, including outreach and education. Program activities evolve based on bureau needs. The Toxics Reduction Program supports longstanding City education programs in meeting the Nine Minimum Control - Pollution Prevention Programs to Reduce Contaminants in CSOs.

9.1 Pollution Prevention Program Activity

Activities for FY 2024 include:

- Updating detailed Best Management Practice fact sheets for industrial businesses, which were posted on the City's website and are available for distribution by other programs within the City.
- Development of a mercury minimization fact sheet for use in school curricula.
- Internal educational webinars for staff regarding emerging contaminants.
- Participation in and coordination on regional pollution prevention activities, such as an educational mailer with Best Management Practice information for regional carpet cleaners.

Changes to the Pollution Prevention Program for FY 2024:

- BES ceased administering the Eco-Logical Business (EcoBiz) Certification Program in its service area due to funding constraints. BES continues to evaluate programs and projects to effectively reduce pollution within its systems.

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Appendix A CSO Event History

When reporting on the CSO system's performance, the City of Portland usually refers to the number of events and the size of overflows that have occurred since the system became fully operational in December 2011. BES has validated and reported 48 permitted events at the Willamette River and Columbia Slough CSO facilities.

Before December 2011, the Amended Stipulation and Final Order from DEQ required the City of Portland to eliminate most overflows to the Columbia Slough by December 1, 2000. Another 16 outfalls (represented by a mix of outfalls from the west and east sides of the Willamette River) were controlled by December 1, 2006.

Columbia Slough CSO Events Since October 2000

Table A-1 presents the CSO events to the Columbia Slough since the Columbia Slough CSO system became fully operational in October 2000. The FY 2024 event is listed in the box outlined in bold. Winter season events are not shaded and summer season events are shaded grey. All events were permitted under the NPDES permit at the time.

Table A-1 Columbia Slough CSO Events Since October 2000

CSO Discharge Events			Storm Characteristics			System Totals		West Side Totals	
Event #	Dates of Storm/Overflow Events	Description	6-hr	12-hr	24-hr	Overflow (million gallons)	Duration (hours)	Overflow (million gallons)	Duration (hours)
			Rainfall (inches)						
1	May 26, 2012	> 100-year, 30-minute storm [1]	-	-	-	0.022	0.20	0.022	0.20
2	December 5-13, 2015	25-year, 3 to 6 hour storm	2.04	2.61	3.19	0.01	0.15	0.01	0.15
3	October 10, 2023	10-year, 15 minute to 2-hour summer storm	1.22	1.68	2.28	0.01	0.13	0.01	0.13

1. The duration of the storm was less than 6 hours. Therefore, rainfall for 6, 12, and 24-hour durations was not reported.

Willamette River CSO Events from December 2006 to December 2011

Table A-2 presents the CSO events in the Willamette River since the West Side Willamette River CSO Tunnel became fully operational in December 2006 and until the full Willamette system became operational in December 2011. Winter season events are not shaded and summer season events are shaded grey. All events complied with the requirements of the NPDES permit and the 1994 Amended Stipulation and Final Order in effect at the time.

Table A-2 Willamette River CSO Events, December 2006 to December 2011

CSO Discharge Events			Storm Characteristics			System Totals		West Side Totals	
Event #	Dates of Storm/ Overflow Events	Description	6-hr Rainfall (inches)	12-hr Rainfall (inches)	24-hr Rainfall (inches)	Overflow (million gallons)	Duration (hours)	Overflow (million gallons)	Duration (hours)
1	December 14, 2006	4-per-winter storm	0.82	1.17	1.60	66.85	18.37	66.85	18.37
2	January 3, 2007	4-per-winter storm	0.69	1.04	1.54	5.15	4.35	5.15	4.35
3	December 2-3, 2007	> 5-year, 24-hour winter storm	0.97	1.76	3.09	154.5	26.85	154.5	26.85
4	November 12, 2008	4-per-winter storm	0.76	1.02	1.38	8.1	4.1	8.1	4.1
5	January 1-2, 2009	5-year winter storm	1.12	1.52	2.73	122.60	21.58	122.60	21.58
6	May 4, 2009	3-year summer storm (3-6 hour duration)	0.94	1.02	1.18	5.26	1.05	5.26	1.05
7	November 7, 2009	2-per-winter storm	0.93	1.22	1.51	9.60	2.92	9.60	2.92
8	June 6, 2010	3-year summer storm	1.07	1.25	1.43	26.02	3.08	26.02	3.08
9	November 17, 2010	1-per-winter storm	1.03	1.56	1.77	11.48	5.58	11.48	5.58
10	December 8-12, 2010	5-year winter storm	1.43	1.52	2.34	41.82	8.92	41.82	8.92
11	December 28, 2010	2-per-winter storm	0.57	0.89	1.58	6.85	5.50	6.85	5.50
12	January 15-16, 2011	1-per-winter storm	0.94	1.21	2.13	26.27	8.92	26.27	8.92
13	February 27-March 4, 2011	1-per-winter storm	1.15	1.70	2.41	75.98	28.25	75.98	28.25
14	November 21-23, 2011	5-year winter storm	1.44	1.66	2.24	115.96	6.25	115.96	6.25

Willamette River CSO Events Since December 2011

Table A-3 presents the CSO discharges to the Willamette River since the Willamette River CSO Tunnel system became fully operational in December 2011. FY 2024 events are listed in the boxes outlined in bold. Winter season events are not shaded, and summer season events are shaded grey. All events were permitted under the NPDES permit at the time.

Table A-3 Willamette River CSO Events Since December 2011

CSO Discharge Events			Storm Characteristics			System Totals		West Side Totals		East Side Totals	
Event #	Dates of Storm/Overflow Events	Description	6-hr Rainfall (inches)	12-hr Rainfall (inches)	24-hr Rainfall (inches)	Overflow (million gallons)	Duration (hrs)	Overflow (million gallons)	Duration (hours)	Overflow (million gallons)	Duration (hours)
1	January 17-21, 2012	> 5-yr, 12-hr winter storm	1.48	2.15	2.32	304.90	10.30	86.40	10.30	218.50	10.30
2	May 26, 2012	> 100-yr, 30-min storm[2]	-	-	-	14.89[1]	0.42	-	-	14.89[1]	0.42
3	November 17-21, 2012	5-yr, 24-hr Winter Storm	1.22	1.65	2.44	176.40	9.50	44.00	9.50	132.40	9.30
4	November 24, 2012	3-per-winter, 24-hr storm	0.61	1.09	1.49	0.50	0.80	0.50	0.80	-	-
5	May 23, 2013	3-yr, 12-hr summer storm	0.90	1.22	1.50	26.30	2.30	11.90	2.30	14.40	1.80
6	September 27-30, 2013	10-yr, 24-hr summer storm	1.20	1.41	2.08	88.50	7.00	27.00	7.00	61.50	5.40
7	March 25-30, 2014	2-per-winter, 12-hr storm	0.89	1.26	1.53	39.19[1]	3.00	14.30	3.00	24.85[1]	2.42[1]
8	June 15-16, 2014	3-yr, 30-min summer storm[2]	-	-	-	0.03	0.20	-	-	0.03	0.20
9	October 22-23, 2014	10-yr, 24-hr summer storm	1.42	1.68	2.11	69.4	3.92	13.41	3.50	56.00	3.92
10	December 4-6, 2014	5-yr, 3-hr winter storm	0.95	1.37	1.56	1.6	1.57	0.05	0.27	1.52	1.57
11	January 17-18, 2015	1-per-Winter, 24-hr storm	0.97	1.50	2.04	91.6	7.98	15.15	6.75	76.43	7.98
12	March 14-15, 2015	1-per-winter, 48-hr storm	1.05	1.80	2.41	78.9	6.48	16.61	5.92	62.31	6.48
13	October 30-November 2, 2015	50-yr, 2-hr storm	1.94	1.98	2.55	190.5	6.35	30.24	4.88	160.05	6.35
14	November 16-17, 2015	1-per-winter, 1-hr storm	0.80	0.85	1.37	0.03	0.17	-	-	0.03	0.17
15	December 5-13, 2015	25-yr, 3- to 6-hr storm	2.04	2.61	3.19	638.7	15.60	134.86	13.33	503.83	15.60
16	December 16-19, 2015	1-per winter, 3- to 48-hr storm	1.11	1.56	2.37	145.8	11.00	26.79	9.70	118.99	10.30

CSO Discharge Events			Storm Characteristics			System Totals		West Side Totals		East Side Totals	
Event #	Dates of Storm/Overflow Events	Description	6-hr Rainfall (inches)	12-hr Rainfall (inches)	24-hr Rainfall (inches)	Overflow (million gallons)	Duration (hrs)	Overflow (million gallons)	Duration (hours)	Overflow (million gallons)	Duration (hours)
17	May 19, 2016	3-yr, 30-min summer storm[2]	-	-	-	0.02	0.18	-	-	0.02	0.18
18	October 13-17, 2016	> 100-yr, 1- to 2-hr storm	1.56	1.81	2.09	0.92	0.63	0.89	0.63	0.03	0.33
19	November 22-25, 2016	5-yr winter, 3-hr storm	1.20	1.81	2.47	210.5	17.00	49.36	16.10	161.15	16.60
20	January 17-18, 2017	2-per-winter, 1-day storm	0.61	1.03	1.78	93.5	8.90	20.82	7.50	72.70	8.90
21	February 3-6, 2017	5-yr winter, 1-day storm	0.81	1.48	2.53	206.0	12.10	53.07	11.5	152.95	12.1
22	February 7-10, 2017	4-per-winter, 1-day storm	0.51	0.82	1.36	0.0035	0.17	0.0035	0.17	-	-
23	February 15-16, 2017	1-per-winter, 1- to 2-day storm	0.80	1.25	1.98	89.6	6.4	25.61	5.8	63.98	5.8
24	May 12-14, 2017	>10-yr summer, 15-min storm	0.43	0.68	0.75	0.0051	0.20	0.0051	0.20	-	-
25	September 17-20, 2017	10-yr summer, 15-min to 2-hr storm	0.76	1.18	1.58	0.097	0.63	-	-	0.097	0.063
26	October 19-22, 2017	10-yr summer, 24-hr storm	0.96	1.64	2.29	70.5	6.17	19.82	4.92	50.68	6.00
27	April 6-8, 2018	1-per-winter, 12- to 48-hr storm	0.74	1.29	1.94	24.7	2.55	4.71	2.32	19.95	2.52
28	October 25-29, 2018	25-yr, 10-min to 2-hr storm	1.46	2.06	2.12	0.0037	0.17	-	-	0.0037	0.17
29	August 10, 2019	100-yr, 5-min to 3-hr storm	1.93	1.93	1.93	0.060	0.38	0.060	0.38	-	-
30	December 18-22, 2020	1-per-winter, 12- to 24-hr storm	0.85	1.44	1.93	12.3	3.42	1.2	1.40	11.1	3.42
31	January 11-12, 2021	5-yr winter, 3- to 6-hr storm	1.24	1.37	2.30	138.6	5.85	39.9	4.82	98.7	5.85
32	September 17-19, 2021	1-per-10 summer, 3-to 24-hr storm	0.87	1.28	1.34	0.06	0.23[3]	-	-	-	-
33	September 26-28, 2021	1-per-10 summer, 15-min to 24-hr storm	0.65	1.07	1.40	0.03	0.35	0.03	0.35	-	-
34	November 10-12, 2021	1-per-5 winter storm	0.93	1.61	2.49	127.43	10.58	28.64	8.65	98.79	10.58
35	December 16-20, 2021	2-per-winter 6- to 24-hr storm	0.89	1.30	1.79	2.05	1.97	0.03	0.43	2.02	1.97
36	January 2-7, 2022	1-per-5 winter storm	1.42	1.77	2.08	103.48	9.4	18.8	7.38	84.68	9.4
37	April 28-30, 2022	25-yr, 15- to 30-min storm	0.87	1.50	1.63	0.004	0.08[3]	-	-	-	-

CSO Discharge Events			Storm Characteristics			System Totals		West Side Totals		East Side Totals	
Event #	Dates of Storm/Overflow Events	Description	6-hr	12-hr	24-hr	Overflow (million gallons)	Duration (hrs)	Overflow (million gallons)	Duration (hours)	Overflow (million gallons)	Duration (hours)
			Rainfall (inches)								
38	June 9-12, 2022	1-per-3 summer, 6- to 48-hr storm	0.81	1.24	1.53	0.0003	0.05	0.0003	0.05	-	-
39	November 3-4, 2022	1-per-winter, 24-hr storm	0.79	1.29	2.00	35.23	4.15	4.51	3.17	30.72	4.15
40	December 24-27, 2022	5-yr, 12- to 48-hr storm	1.07	1.83	2.61	286.26	16.18	122.84	14.35	163.42	16.18
41	March 11-13, 2023	2-per-winter, 6- to 12-hr storm	0.87	1.34	1.57	17.94	3.35	1.93	2.20	16.01	3.35
42	May 8, 2023	10-yr, 1- to 3-hr summer storm	1.21	1.21	1.21	0.08	0.42	0.08	0.42	-	-
43	October 10, 2023	3-yr, 15-min to 2-hr summer storm	0.68	0.68	0.84	0.04	0.25[3]	-	-	-	-
44	December 4-6, 2023	4-per-winter, 2-day storm	1.17	1.60	2.08	88.12	5.78	21.48	4.35	66.64	5.73
45	January 26-28, 2024	2-per-winter, 2-day storm	0.74	1.26	1.85	67.89	9.43	8.65	7.73	59.24	9.43

1. Corrected from previous reports.

2. The duration of the storm was less than 6 hours. Therefore, rainfall for 6, 12, and 24-hour durations was not reported.

3. CSO occurring in the North Portland Willamette area only. West and East Side statistics were not added.

Appendix B Willamette River Instream Water Quality Sampling Results

Figure B-1 Willamette River Monitoring Results for Zinc

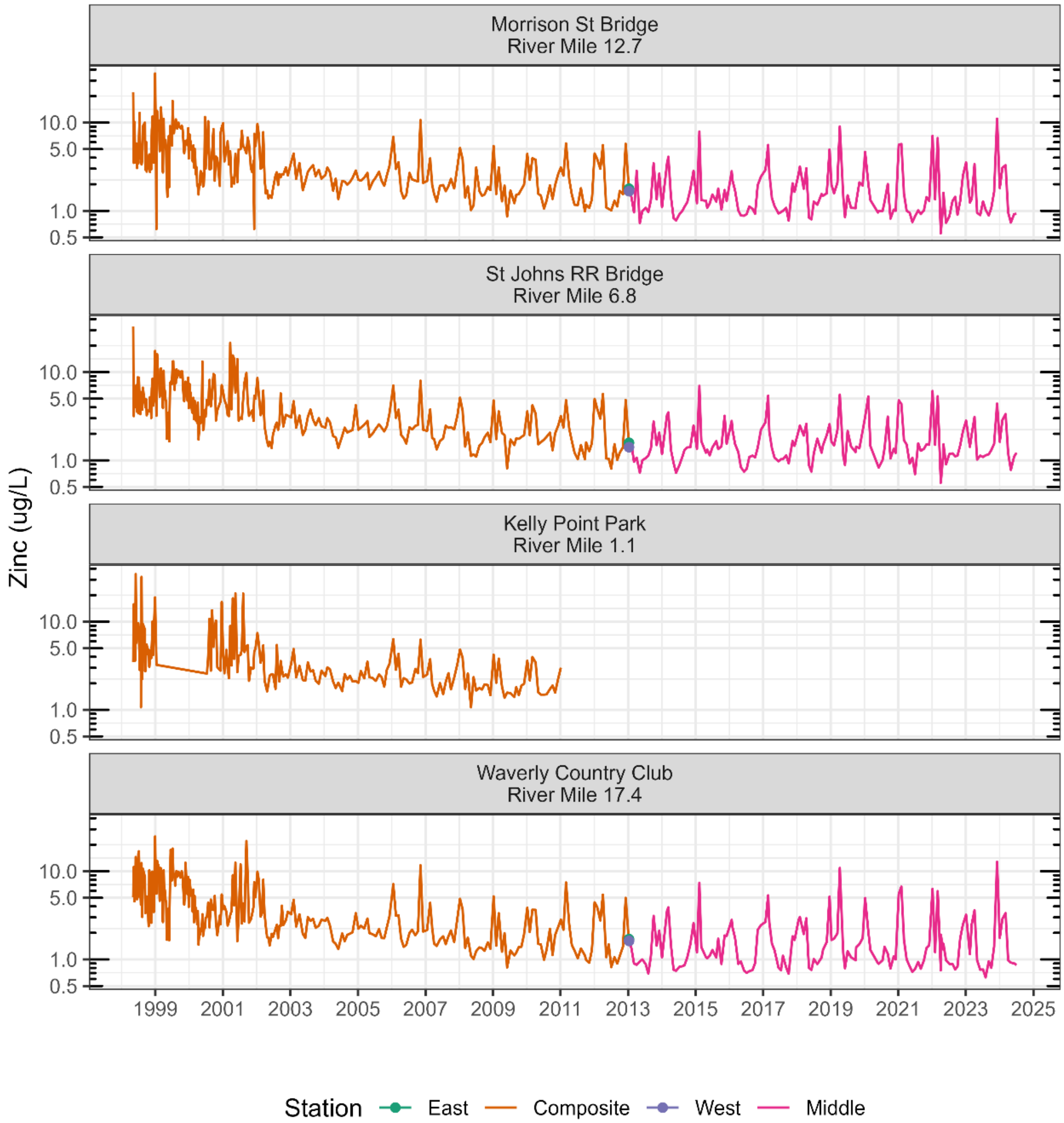

Figure B-2 Willamette River Monitoring Results for Lead

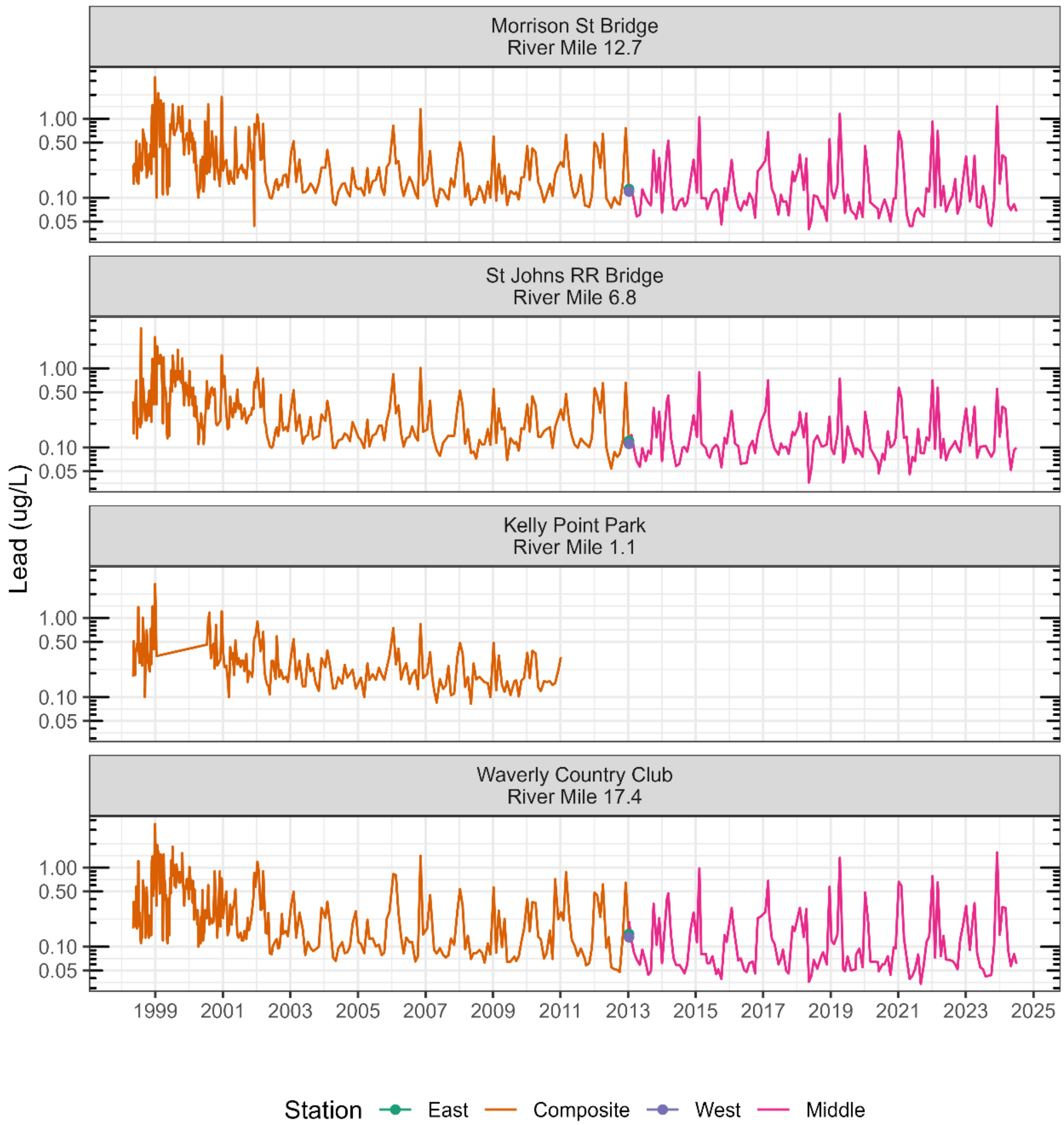

Figure B-3 Willamette River Monitoring Results for Copper

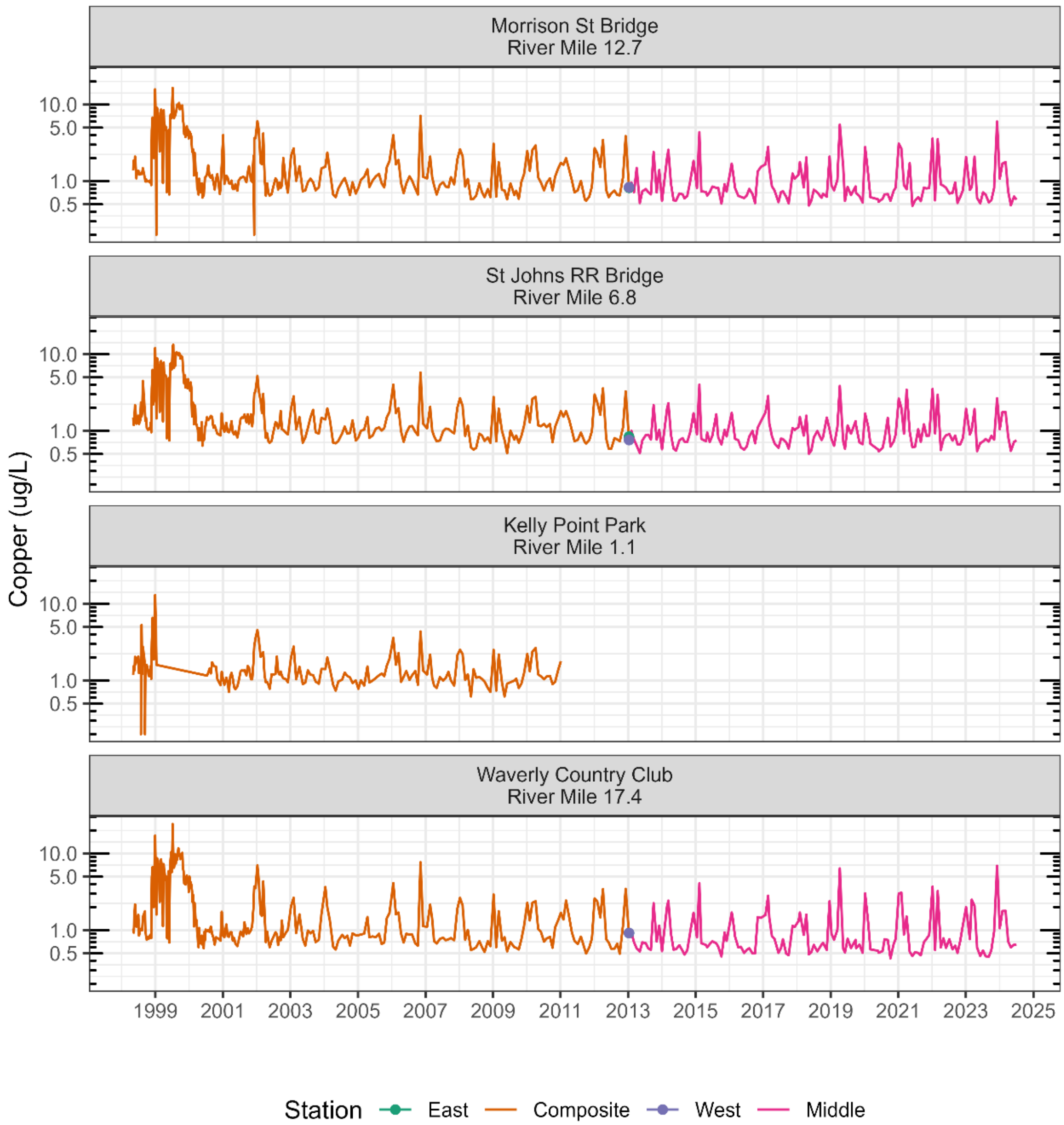

Figure B-4 Willamette River Monitoring Results for Total Suspended Solids

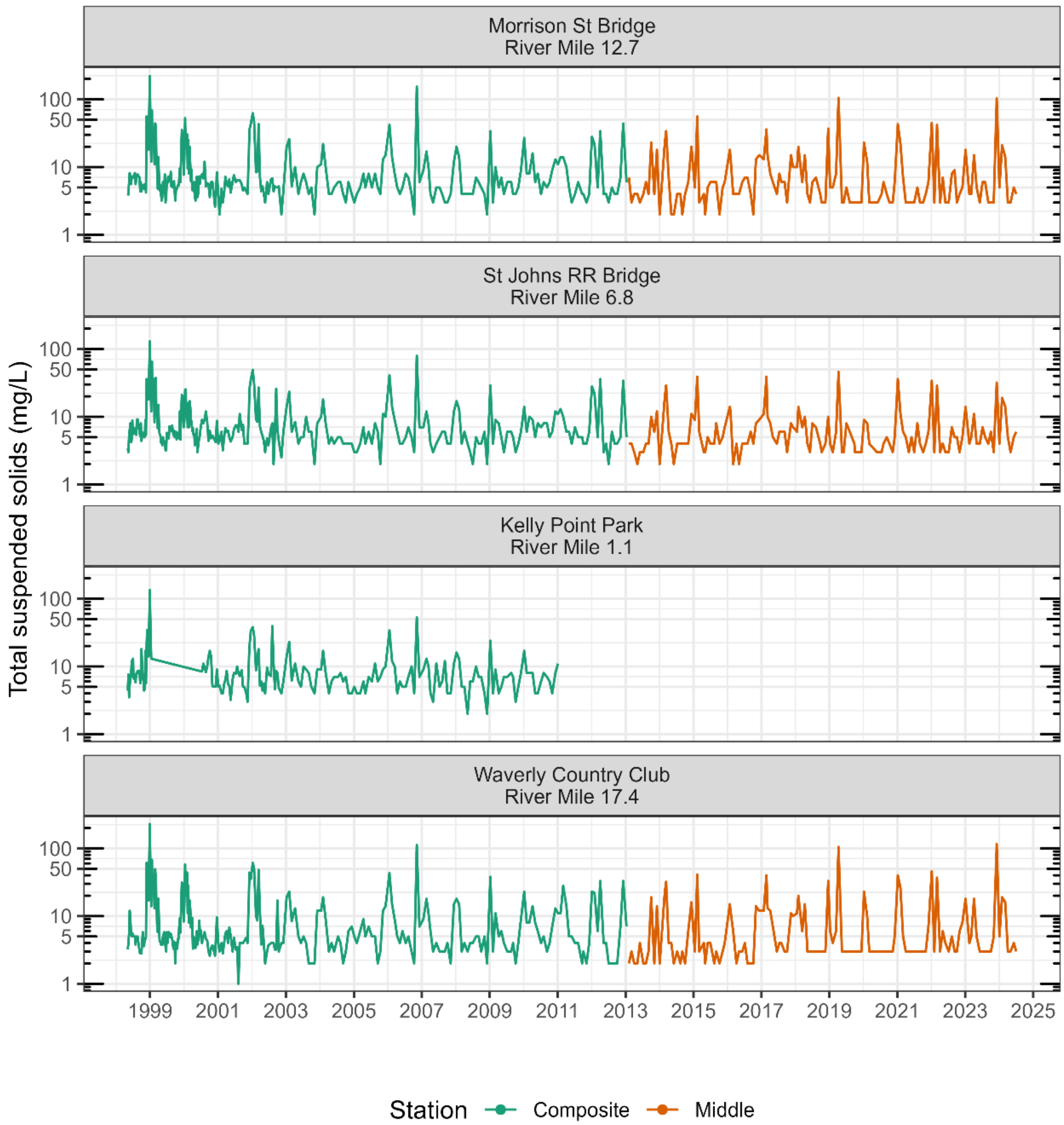

Figure B-5 Willamette River Monitoring Results for *E. coli*