Section 1: Executive Summary

1.1 Introduction

The Bremerton Department of Public Works and Utilities (Bremerton) is responsible for providing wastewater services to the City of Bremerton and its surrounding areas. This update to the Wastewater Comprehensive Plan (WWCP) was developed to assess the capacity of the existing and future wastewater system and to outline necessary improvements. Commonly referred to as a "general sewer plan," the WWCP meets the requirements of Washington Administrative Code (WAC) 173-240-020 and the minimum content standards specified in WAC 173-240-050.

The previous WWCP was completed in October 2014 and adopted by the City Council through Ordinance No. 5268 in December 2014. This 2024 WWCP updates the previous WWCP and establishes a 20-year planning horizon from 2024 to 2044. Periodic reviews and revisions may be required to address regulatory changes in system conditions.

1.2 Service Area and System Description

Sections 2 and 3 of the WWCP Update provide an overview of the service area and existing wastewater system. Bremerton, situated in Kitsap County and approximately 15 miles west of Seattle across the Puget Sound, owns, maintains, and operates a comprehensive sanitary sewer collection and treatment system. This system serves West Bremerton, East Bremerton, and the surrounding areas of unincorporated Kitsap County. The system also accepts sanitary sewer flows from the U.S. Navy Puget Sound Naval Shipyard (PSNS), other U.S. Navy Facilities, and Kitsap County Sewer District No. 1 (KCSD No. 1) in West Bremerton. However, apart from the U.S. Navy, the system does not provide sewer service for significant industrial dischargers.

The City's sewer infrastructure comprises several key components:

- **Sewer Basins:** Twenty-two (22) sewer basins; six (6) in East Bremerton with a sewered area of 1,660 acres, and sixteen (16) in West Bremerton with a sewered area of 5,360 acres.
- **Pipelines:** Approximately 176 miles of gravity and pressure pipelines, ranging in size from six to 42 inches in diameter. Materials include polyvinyl chloride (PVC), high density polyethylene (HDPE), asbestos-cement, clay, cast iron, concrete cylinder pipe, and ductile iron (DI) pipe.
- **Pump Stations:** Forty (40) sewer pump stations including the two Kitsap County pump stations, WB-1 and WB-2.
- **Odor Control Stations:** Two (2) odor control stations are located in the collection system at surge chambers where pressure sewers transition to gravity sewers. Additionally, five (5) pump stations have dedicated odor control systems at the pump station wet wells.

- **CSO Outfalls:** Fourteen (14) CSO outfalls which allow discharge of untreated combined sewer flows into Puget Sound during extreme wet weather events.
- **Westside Treatment Plant (WWTP):** One conventional wastewater treatment plant for treating dry weather flows and the majority of wet weather flows. This plant treats all flows generated in the City and service area.
- **Eastside Treatment Plant (ESTP):** One high-rate clarification and UV disinfection treatment plant for treating excess combined sewer flows generated in East Bremerton during some heavy wet weather conditions

1.3 Business Risk and Vulnerability Assessment

Section 4 describes the development process of the Business Risk and Vulnerability Assessment (BRVA) and the scoring outputs from the analysis. The intent of the BRVA is to identify the most vulnerable unit processes that might impact the ultimate performance of the City's facilities and systems The risk score was developed with consideration to the process area's consequence of failure (CoF) against business vulnerabilities (BV), helping to identifying assets that are more susceptible to failure.

The City's WWCP BRVA preparation kicked off with a workshop series where City staff gathered to discuss their various systems, operational risks, potential modes of failure, and opportunities for improvement. During these workshops, CoF and BV criteria matrices were developed and process areas were scored. City staff from operations and maintenance (O&M), engineering, and management were included in these conversations. Subsequent field investigations and desktop analyses confirmed many of the findings from the BRVA interviews.

Of the more than 40 assets scored in the BRVA, the following assets were identified as highly critical.

- Port Washington Narrows Siphon
- Electrical system
- Crosstown Pipeline
- Central Bremerton Force Main
- Final Effluent Channel/Outfall
- Anaerobic Digesters
- Oyster Bay Basin Collections System

The complete BRVA findings are available in Section 4.

1.4 Historical and Projected Flow and Loads

Section 5 describes the historical flows and loads entering the wastewater treatment plant, and also projects the sewer flows and loads to be leveraged in both future wastewater treatment

plant and collection system analyses to identify capacity-related capital improvement opportunities.

1.4.1 Historical Flows and Loads

The discharge monitoring reports (DMRs) for the influent flows and loads were provided for the period January 2018 through December 2023. This range includes periods for pre-COVID 19 pandemic years (2018-2019). Flow averages for this time period are summarized below in Table 1-1.

Table 1-1: Historical WWTP Flow Summary (2018-2023)

Parameter	2018 (MGD)	2019 (MGD)	2020 (MGD)	2021 (MGD)	2022(1) (MGD)	2023(1) (MGD)
Average Dry Weather Flow (ADWF)	4.2	3.7	3.6	3.6	3.5	3.2
Annual Average Flow (AAF)	5.1	4.4	4.8	5.2	4.6	4.2
Maximum Month DWF (MM DWF)	4.6	4.0	4.0	3.9	4.3	3.6
Peak Day DWF (PD DWF)	6.2	8.7	10.4	7.3	6.9	5.8
Maximum Month Wet Weather Flow (MM WWF)	9.3	7.2	9.5	10.7	9.9	8.7
Peak Day WWF (PD WWF)	19.3	22.3	18.4	22.4	26.0	26.0

(1) Due to issues with influent measurement, effluent flow has been recorded as influent flow in the DMR since 2022.

Average day and maximum month loads for Biological Oxygen Demand (BOD) and Total Suspended Solids (TSS) between 2018 and 2023 are summarized in Table 1-2 below.

Table 1-2: WWTP Historical Influent Loads

Parameter	2018 (ppd)	2019 (ppd)	2020 (ppd)	2021 (ppd)	2022 (ppd)	2023 (ppd)
Average Annual Load (AAL) for CBOD	8,100	7,100	6,200	6,500	7,100	5,900
Maximum Month Load (MML) for CBOD	9,900	8,400	8,300	7,700	14,000	7,500
Peak Day Load (PDL) for CBOD	15,700	12,200	17,400	13,200	21,300	10,700
AAL for TSS	9,300	9,100	8,400	7,500	8,900	7,000
MML for TSS	12,100	10,000	10,600	9,400	17,700	8,500

1.4.2 Projected Flows and Loads

Traffic Analysis Zone (TAZ) data provided by Kitsap County to the City of Bremerton was analyzed to determine the increase in residential and employment population through 2044, and subsequent increases to sewer flows and loads across the planning horizon.

According to the City of Bremerton Water Utility's 2020 Water Use Efficiency Plan, water consumption per Equivalent Residential Unit (ERU) was estimated to be 143 gallons per day (gpd) between 2013 and 2019. Based on an average household size of 2.33 persons per ERU, residential water usage was calculated at 61 gallons per capita per day (gpcd). The water consumption rate for employment-related use remained consistent with the 42 gpcd value established in the 2014 Wastewater Comprehensive Plan (WWCP) Update.

In the 2014 WWCP Update, the sewer generation factor was derived by applying a reduction to the water consumption factor to align estimated sewer generation with the 2012 Average Dry Weather Flow (ADWF). This same approach was utilized to determine the reduction from the updated residential water consumption rate and the 2014 employment water consumption rate to the corresponding sewer generation factor. A 20% reduction from water consumption to sewer generation was applied to align with historical ADWF data from 2020 through 2023, yielding an average variance of 2%. The reduced residential and employment per capita per day usage rates were calculated as 49 gpcd and 34 gpcd respectively.

The ADWF projections were developed using sewer generation factors applied to the projected sewered population as summarized in Table 1-3.

Table 1-3: Average Dry Weather Flow (ADWF) Projection

	Sewered Population		Base Flow ADWF Projection		
Year	**Residential**	**Employment**	**Residential**	**Employment**	**ADWF**
2024	42,100	44,617	2.1	1.5	3.6
2034	51,241	47,795	2.5	1.6	4.1
2044	62,161	51,279	3.1	1.7	4.8

To establish other design flow baselines, historical peaking factors of AAF to ADWF, and those of peak day (PD) and maximum month (MM) flows to AAF were estimated from DMR data over the past six years for both wet weather flow (WWF) and dry weather flow (DWF). The average of the six peaking factors (PFs) was used to project all flows except for the MM WWF, where the highest PF among the six historical PFs was used. These additional projected design flows are listed in Table 1-4.

Table 1-4: Additional Design Flow Projections (MGD)

Year	ADWF	AAF	MM DWF	PD DWF	MM WWF
2024	3.6	4.6	4.0	7.4	10.1
2034	4.1	5.3	4.6	8.6	11.7
2044	4.8	6.2	5.3	9.9	13.5
Peaking Factors	0.77	1.00	0.86	1.61	2.18

The projected 2044 peak hour flows are summarized in Table 1-5 below.

Table 1-5: Peak Wet Weather Flow Projection in MGD

Year	ADWF	Current I/I	New Area I/I	PD WWF	PHF
2024	3.6	22.8	0	26.4	46.9
2034	4.1	22.8	2.8	29.7	52.9
2044	4.8	22.8	5.6(2)	33.2	59.0

To estimate loading for residential and employment areas, the City used King County's 2014 WWCP Update loading factors for treatment plant flow and waste-load projections. Although the City is not part of King County and lacks specific local data, these figures were adopted based on their assumed regional applicability. Historical data confirmed that these assumptions closely matched local conditions, with average differences of less than 2% in influent BOD and TSS loads from 2020 to 2022. The average annual load (AAL) projections were then calculated using these factors and applied to the projected sewered population, as summarized in Table 1-6.

Table 1-6: Average Annual Load Projections

Year	Sewered Population: Residential	Sewered Population: Employment	AAL for BOD (ppd)	AAL for TSS (ppd)
2024	42,100	44,617	8,100	8,500
2034	51,241	47,795	9,600	10,100
2044	62,161	51,279	11,400	12,000

To establish additional design loads, historical peaking factors for maximum month load (MML), maximum week load (MWL), and peak day load (PDL) relative to annual average load (AAL) were estimated using six years of DMR data. The average of five peaking factors, after excluding an outlier from 2022, was used to project both MWL and PDL. For the MML, the highest peaking factor among the remaining five historical values was applied to the projected AAL to estimate the MML. Table 1-7 summarizes the projected BOD and TSS design loads.

Table 1-7: BOD and TSS Load Projection

	BOD Projection			TSS Projection	
Year	**AAL**	**MML**	**PDL**	**AAL**	**MML**
2024	8,100	10,900	16,800	8,500	11,100
2034	9,600	13,000	19,900	10,100	13,100
2044	11,400	15,400	23,600	12,000	15,600
Peaking Factors	1.00	1.35	2.07	1.00	1.30

1.5 Collection System Evaluation

Section 6 describes collection system hydraulic model development, calibration, and analysis at dry weather and wet weather steady state scenarios to identify areas of concern as the population grows across the planning area. The section also includes the results of a focused collection system field inspection effort to assess condition of several assets identified by City staff.

A hydraulic model was developed for the WWCP from GIS data, as-built drawings, and other information provided by the City. The model was calibrated using rainfall data from a storm in 2023 to simulate the flow response in the model. Settings in the model were calibrated to match the modeled flow response with flow monitoring data from pump stations and Westside

Wastewater Treatment Plant DMR data. The projected 2044 peak hour flow established in the model totaled 56.5 MGD, within 4% of the projected peak hour flow based on DMR data.

The model was then used to simulate a flow response due to population growth across each basin per County-provided TAZ data. The collection system evaluation, along with the focused field inspection effort, estimated the impact to each structure and recommended alternatives for improvement where necessary.

Results of the evaluation indicate the current wastewater facilities generally have sufficient capacity to accommodate existing flows, with the exception of some localized capacity limitations in certain segments of the collection system, including the Sinclair Park, Callow Basin, Anderson Cove, and Kitsap Sewer District No. 1 basins. Projecting to 2044, the main trunklines in these areas, along with those in the Callow Basin, Kitsap Sewer District No. 1, Pacific Avenue Basin, and Anderson Cove, are anticipated to face capacity constraints, as indicated by the future WWF scenarios. These deficiencies can be addressed through upsizing sewer lines and mitigating I&I issues. The most critical concerns resulting from the field inspections include wet well degradation at numerous pump stations, pipe corrosion, and the need for arc flash testing. Since these recommendations do not relate to a single pump station in particular, a programmatic approach to addressing these concerns is proposed.

1.6 Treatment Facilities Evaluation

The treatment system evaluation, described fully in Section 7, was conducted to assess the WWTP's current capacity and performance under projected 2044 conditions in accordance with the Ecology's Criteria for Sewage Works Design (Orange Book) and the design and construction standards outlined in WAC 173-240. This evaluation ensured that the facility would maintain compliance with regulatory requirements while meeting future demands. The assessment utilized three primary methods:

Plant Hydraulic Analysis: A plant-wide hydraulic model was developed to evaluate the plant's overall hydraulic capacity. The goal of this assessment was to verify that the existing facilities can handle the design flows without overtopping the structures' walls and to confirm the proper operation of the flow split structure. The hydraulic profile was established from the headworks to the Sinclair Inlet. Field measurement data was collected by plant operators on March 30 and May 20, 2024 and used to evaluate the current hydraulic conditions.

Process Modeling Analysis: A process model was created to simulate the existing WWTP processes. Plant daily monitoring data from January 2018 through September 2023, along with additional sampling data collected between October 16 and December 18, 2023 were used to develop the detailed influent wastewater characteristics for the model.

Desktop Calculations: The capacity of the remaining major process units was evaluated through desktop calculations, comparing key design and operational parameters with typical values recommended and ranges from Wastewater Engineering: Treatment and Resource Recovery (5th Edition, 2014, by Metcalf & Eddy), as well as the requirements outlined in the WA Orange Book.

Key outcomes from the analyses and calculations include:

- The WWTP is expected to be unable to handle the 2044 projected peak hour flow at the record high tide in many locations across the plant, including overtopping in the secondary processes and the chlorine contact chamber. Other process areas will face submerged conditions.
- The outfall system limits the plant's capacity and causes constraints in upstream processes in multiple modelled scenarios. The submerged outfall conditions have been field confirmed with manhole overtopping upstream of the outfall.
- Process modelling scenarios helped to confirm that additional secondary treatment capacity is adversely affected by undersized primary treatment processes, and therefore improvements to primary processes can improve secondary treatment capacity.
- The aerations basins are running at or above their estimated capacity.
- The secondary clarifiers are undersized for max month wet weather flow and depend on operational parameter adjustments to meet average annual flow conditions.
- Solids stream pumping capacity and anaerobic digestion capacity was found to be adequate to handle the anticipated increase in solids handling across the planning horizon. However, there is currently no redundant digester capacity.
- Grit migration beyond the headworks is adversely affecting downstream treatment process performance and capacity, including the anaerobic digesters.
- The disinfection system requires additional capacity to achieve required detention time under peak flow conditions.

1.7 Capital Improvement Plan

Section 8 describes the capital improvement projects identified as the culminating effort between field inspections, hydraulic and process model analyses, and operator and engineering staff interviews. A financial plan to meet the 20-year CIP goals is also proposed in this section.

The following types of capital improvement projects are included in the Capital Improvement Plan (CIP):

- **Collection System Improvements:** Replacement or repair of existing pipelines to correct existing conveyance deficiencies or to convey future flows. This includes the PSIC and CPT improvements as well.
- **Facilities and Equipment:** Rehabilitation, replacement, or upgrades to building, equipment, and facilities.
- **Wastewater Treatment Plant:** Rehabilitation, replacement, or upgrades to the WWTP infrastructure.
- **Operations and Maintenance Improvements:** Annual programs for substandard main replacement, main cleaning, miscellaneous equipment improvements, and controls upgrades. This also includes additional projects that improve the operation and maintenance of the sewer system. A detailed list of the recommended CIP projects is provided in Section 8.

In total, the 20-year CIP was estimated to cost approximately $279 million dollars in present worth. Major improvement projects include those shown in Table 1-8.

Table 1-8: CIP Summary

Improvement Type	Schedule of Improvements (2025 $1,000)							
	2025	2026	2027	2028	2029	2030	2025-2030	2031-2044
Collection System Improvements (C)	$17,870	$3,942	$4,700	$3,500	$1,600	$2,700	$34,312	$97,950
Facilities and Equipment (F)	$100	$100	$100	$100	$100	$100	$600	
Wastewater Treatment Plant (T)	$2,491	$11,040	$2,510	$100	$100	$700	$16,941	$108,630
Operations and Maintenance Improvements (M)	$900	$900	$900	$2,400	$900	$900	$6,900	$13,600
Total CIP	$21,400	$16,000	$8,200	$6,100	$2,700	$4,400	$59,000	$220,000

1.8 Operations and Maintenance

Section 9 describes roles and responsibilities within the County's wastewater/utilities organization and the staff levels required to successfully manage and operate the system. The operations and maintenance responsibilities are divided between the Wastewater Manager and the Utilities Operations Manager, both of whom report directly to the Director. The Wastewater Manager is responsible for overseeing the Wastewater Division, which includes the operation and maintenance of sewer pump stations, odor control stations, and wastewater treatment facilities and directs 20 full-time employees (FTEs). The Utility Operations Manager oversees the collection system and directs 12 FTEs.

To account for expanding new and expanding facilities and programs such as PSIC improvements and the pump station improvements program, the City should anticipate adding a minimum of three (3) FTEs. Actual FTE needs should be assessed as programs expand and improvements are made.

1.9 Implementation

Section 10 describes the general strategies for adopting and implementing the WWCP.

This WWCP addresses system additions and improvements that will be required to fully develop the service area. It is recommended that Bremerton periodically review progress it has made in implementing the WWCP before the next WWCP is developed.

Bremerton should continue to deliver on its CIP and meet the identified O&M goals. Bremerton should also continue to assess financial expenditures yearly to confirm rate increases as projected are necessary. Current population, population projections, and current and future

financial resources should be reviewed and adjusted as necessary to reflect actual conditions and accommodate future project implementation.