MAY 2024

FINAL JULY 2024

City of Port Townsend

GENERAL SEWER PLAN

PREPARED BY RH2 ENGINEERING

Dan Mahlum, PE, Project Manager

Adopted: Ordinance 3342, December 2, 2024

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City of Port Townsend General Sewer Plan

MAY 2024
FINAL JULY 2024

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CERTIFICATION

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TABLES

CHARTS

FIGURES

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E | EXECUTIVE SUMMARY

PURPOSE OF THE PLAN

The City of Port Townsend's (City) sewer system is a major infrastructure, most of which is invisible to the customers it serves. The sewer system requires qualified staff to operate and maintain an ongoing capital improvement plan to replace old components to meet the requirements mandated by federal and state laws. The primary purpose of the City's General Sewer Plan (GSP) is to identify and schedule sewer system improvements that correct existing deficiencies and ensure a safe and reliable sewer system for current and future customers. This GSP has been prepared in accordance with Washington Administrative Code (WAC) 173-240-050.

SUMMARY OF KEY ELEMENTS

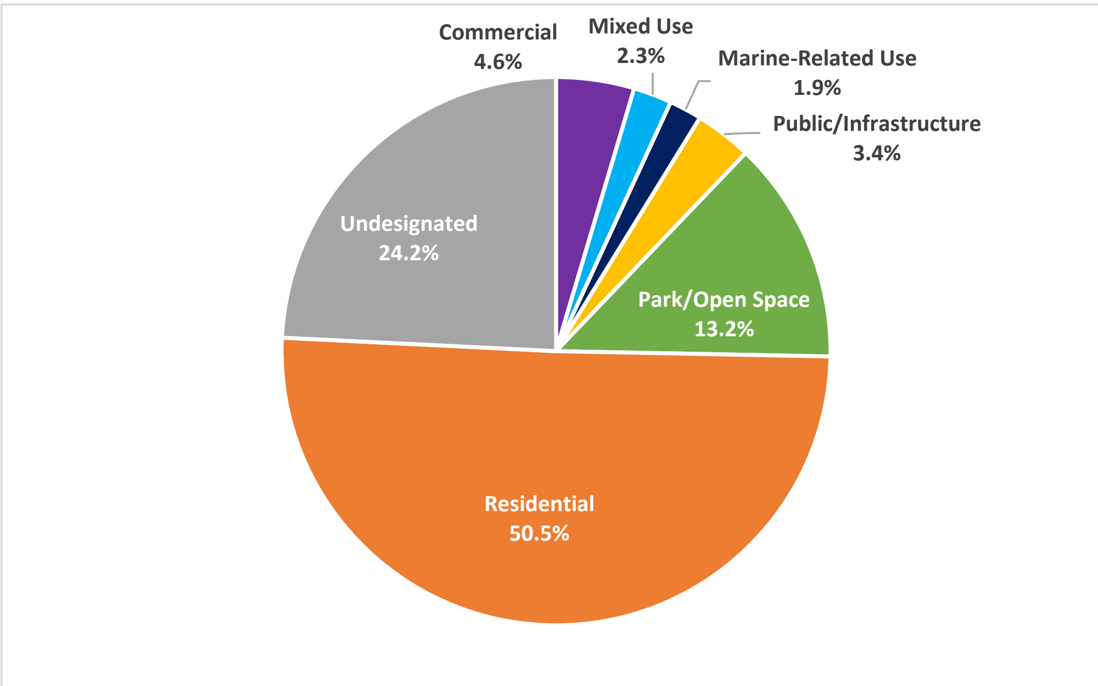
Sewer Service Area, Land Use, and Population

The City limits coincide with the Urban Growth Area (UGA) boundary, and encompass an area of approximately 7.4 square miles. Approximately 50 percent of the land within the City's future wastewater service area is designated for residential use, while the remaining land is designated for other uses such as open space/parks, commercial use, public/infrastructure use, and other land uses. **Table ES-1** presents the land uses within the future wastewater service area. **Chapter 3** provides more information regarding the population projections and designated land use within the City's planning area.

The City's 2021 population was 10,220 people, which is expected to grow to 13,300 people by 2043. The City's residential areas largely are comprised of single-family homes, with approximately 75 percent of the housing units being single-family residences. The 2021 sewer service population is estimated at approximately 9,829 people. The City's sewer system population is expected to grow to 12,720 people in 2033 and to 15,242 people by 2043. The residential population estimate is based on an average single-family household size of 1.9 persons per household in the City.

Table ES-1
Land Use Inside Future Wastewater Service Area

Land Use Type	Acres	% of Total
Commercial	205	4.6%
Mixed Use	101	2.3%
Marine-Related Use	86	1.9%
Public/Infrastructure	150	3.4%
Park/Open Space	588	13.2%
Residential	2,254	50.5%
Undesignated	1,081	24.2%
Total	**4,466**	**100.0%**



Existing Facilities and Discharge Regulations

The City's sewer system includes a gravity collection and conveyance system, seven wastewater lift stations, force mains, the wastewater treatment facility (WWTF), a Compost Facility, and an outfall. A summary of the sewer system characteristics is provided in **Table ES-2**. **Chapter 2** describes the City's gravity collection and conveyance system, lift station, and general WWTF characteristics.

Table ES-2
2021 City Sewer System Data

Description	Data
City Population	10,220
Number of Properties on Septic Systems	211
Sewer System Population	9,829
Total Connections	4,710
Sewer Planning Area - UGA (Square Miles)	7.4
Average Gallons per Capita per Day (gpcd)	85
Average Annual Flow (MGD)	0.84
Maximum Month Average Flow (MGD)	1.02
Maximum Day Flow (MGD)	2.18
Number of Lift Stations	7
Total Length of Gravity Main (Miles)	75.2
Length of 8-inch-diameter Gravity Main (Miles)	45.3
Total Length of Force Main (Miles)	2.2
WWTF Permitted Maximum Month Average Flow (MGD)	2.05

gpcd = gallons per capita per day

Gravity Sewer Collection Piping

The City's existing sewer service area is comprised of 14 sewer drainage basins. Approximately 75.2 miles of gravity sewer piping, ranging in size from 6 to 30 inches, serves the City's sewer system customers. As shown in **Table ES-3**, most of the sewer pipe (approximately 60 percent) within the sewer service area is 8-inch diameter.

Table ES-3
Gravity Sewer Collection Piping Inventory – Diameter

Diameter (inches)	Total Length (feet)	Total Length (Miles)	% of System
6 and smaller	100,808	19.09	25.4%
8	239,222	45.31	60.2%
10	20,188	3.82	5.1%
12	10,131	1.92	2.6%
14	1,963	0.37	0.5%
15	80	0.02	0.0%
16	3,462	0.66	0.9%
18	6,974	1.32	1.8%
22	1,376	0.26	0.3%
24	179	0.03	0.0%
30	6,471	1.23	1.6%
Unknown	6,222	1.18	1.6%
Total	**397,077**	**75.20**	**100.0%**

The City also has 2.2 miles of force mains. A summary of the force mains by diameter is provided in **Table ES-4**.

Table ES-4
Force Main Inventory – Diameter

Diameter (inches)	Total Length (feet)	Total Length (Miles)	% of System
4	1,718	0.33	15.1%
6	4,333	0.82	38.0%
10	2,706	0.51	23.8%
12	2,179	0.41	19.1%
16	381	0.07	3.3%
Unknown	78	0.01	0.7%
Total	**11,395**	**2.16**	**100.0%**

Lift Stations

The City currently owns, operates, and maintains seven wastewater lift stations. The characteristics of the lift stations are summarized in **Table ES-5**.

Table ES-5
Lift Station Characteristics

	Lift Station					Pumps			
Lift Station Name	**Year Constructed**	**Force Main Diameter (inches)**	**No. of Pumps**	**Type**	**Manufacturer**	**Horsepower (hp)**	**TDH (feet)**	**Design Capacity (gpm)**	**Design Firm Capacity (gpm)**
Gaines Street Lift Station	1967 - Constructed 2022 - Upgrade	6	3	Submersible	Flygt	60	107	1,050 1,050 1,050	2,100
Monroe Street Lift Station	1965 - Constructed 2008 - Upgrade	10	3	Dry Pit	Chicago	15		600 600 600	1,200
Port Lift Station	1967	6	2	Submersible	Cornell	5		200 200	200
31st Street Lift Station	1996	4	2	Submersible	Gorman-Rupp	3		100 100	100
Island Vista Lift Station	1985 - Constructed 2004 - Upgrade	4	2	Submersible	Flygt	6.5	100	100 100	100
Point Hudson Lift Station	1975 - Constructed 1988 - Upgrade	4	2	Submersible	Peabody Barnes	1.5		150 150	150
Hamilton Heights Lift Station	1997	6	2	Submersible	FairBanks Morse	10	58	250 250	250

Wastewater Treatment and Disposal Facilities

The City's WWTF is located just west of Fort Worden in the North Beach neighborhood. The WWTF originally was constructed in 1967 and provided primary treatment and disinfection using chlorine gas. The WWTF was expanded in 1993 to provide secondary treatment.

Raw wastewater enters the WWTF from two gravity sewers, and an influent pump station lifts the wastewater to the headworks. Within the headworks, a bar screen removes rags and floating debris, and then a grit classifier settles out the sand and heavy materials. The flow rate of the screened and de-gritted influent is measured in a Parshall flume and the liquid then flows to the oxidation ditches. In the oxidation ditches, surface mixers stir air into the liquid, promoting the growth of microbiological cultures that consume the biochemical oxygen demand in the mixture and form a solution known as mixed liquor. The mixed liquor flows to the secondary clarifier, where the biological solids settle out. The clarified effluent flows to the chlorination basins, where it is chlorinated using liquid sodium hypochlorite. The biological solids (liquid sludge) produced during secondary clarification are pumped to the small aerobic digesters for a short stabilization period. The liquid sludge is then pumped to the control building, where it is blended with polymer and dewatered using a belt filter press.

Descriptions of processes and further details of the WWTF are presented in **Chapter 7**.

NPDES Regulations and City Permit

The City has a National Pollutant Discharge Elimination System (NPDES) Permit issued by the Washington State Department of Ecology (Ecology). The permit includes effluent limits for treated water discharged to the City's outfall in the Strait of Juan de Fuca in Puget Sound. In addition, the permit includes facility flow and loading design criteria for the WWTF as shown in **Table ES-6**.

Table ES-6
WWTF Permitted Flow and Loading Design Criteria

Parameter	Design Quantity
Maximum Month Design Flow (MMDF)	2.05 MGD
Annual Average Flow	1.44 MGD
BOD_5 Influent Loading for Maximum Month	3,754 ppd
TSS Influent Loading for Maximum Month	4,568 ppd
Design Population	12,000

MGD = million gallons per day

ppd = pounds per day

Compost Facility and Solids Handling

The Compost Facility has been successfully operating since 1993. Dewatered biosolids, dewatered septage, and ground yard waste are composted to produce a product used for soil conditioning. The City's Compost Facility is covered under the general permit to produce Class A biosolids as defined in the federal 40 CFR 503 regulations and is covered under a State Waste Discharge Permit (SWDP). The SWDP effluent limits for the sequencing batch reactor (SBR) and wetlands are shown in **Tables ES-7** and **ES-8**.

Table ES-7
SWDP SBR Effluent Limits

Parameter	Average Monthly	Average Weekly
BOD_5	30 mg/L 1 ppd 85% removal of influent BOD_5	45 mg/L 1.5 ppd
TSS	30 mg/L 1 ppd 85% removal of influent TSS	45 mg/L 1.5 ppd
Parameter	**Minimum**	**Maximum**
pH	6.0 standard units	9.0 standard units

Table ES-8
SWDP Wetland Effluent Limits

Parameter	Monthly Geometric Mean	7-Day Geometric Mean
Fecal Coliform	200 col/100 mL	400 col/10 mL
Parameter	**Average Monthly**	**Average Weekly**
Total Residual Chlorine	0.5 mg/L	0.75 mg/L
Effluent Limits: Wetland Effluent		
Parameter	**Average Monthly**	**Average Weekly**
Nitrate	10 mg/L as N	-

Existing Wastewater Flow and Loading

Flow and load values in a sewer system are used to determine the size of gravity collection piping, lift station facilities, and force main piping, and the size and type of treatment facilities needed. This information also is used to develop the sewer service provider's NPDES Permit, which is required by Ecology. **Chapter 4** presents the historical and projected WWTF flow and loading rates.

The total influent flow to the WWTF is made up of wastewater flow from primarily residential customers but also includes flow from a number of commercial, hospitality, and retail businesses, schools, and the Jefferson Healthcare Medical Center. The historical 2016 through 2021 influent average annual flow (AAF), maximum month average flow (MMF), and maximum day flow (MDF) (including infiltration and inflow) is summarized in **Table ES-9**. The 2021 AAF was 0.84 million gallons per day (MGD).

Table ES-9
Historical WWTF Influent Flow Summary

Year	Sewer System Population	AAF (MGD)	AAF per Capita (gpcd)	MMF (MGD)	MDF (MGD)	PHF (MGD)	Percent of NPDES Permit Max. Month Limit[1]	Peaking Factors MMF/AAF	MDF/AAF	PHF/AAF
2016	9,414	0.85	91	1.07	1.99	--	52%	1.26	2.33	--
2017	9,480	0.84	88	0.92	1.39	2.79	45%	1.10	1.66	3.33
2018	9,559	0.87	91	1.16	1.82	3.06	57%	1.33	2.09	3.52
2019	9,669	0.78	81	0.87	1.12	2.35	43%	1.11	1.43	2.99
2020	9,757	0.80	82	1.15	2.37	3.34	56%	1.43	2.96	4.17
2021	9,829	0.84	85	1.02	2.18	---	50%	1.22	2.60	---
2016 to 2019 Average[2]		**0.84**	**88**	**1.01**	**1.58**	**2.74**	**--**	**1.20**	**1.88**	**3.28**
2016 to 2019 Max.[2]		**0.87**	**91**	**1.16**	**1.99**	**3.06**	**--**	**1.33**	**2.33**	**3.52**

1 = The City's WWTF is permitted for a maximum month average influent flow of 2.05 MGD.
2 = 2020 and 2021 values are not included in the historical averages and maximums due to the COVID pandemic.

Table ES-10 summarizes the historical 5-day biochemical oxygen demand (BOD_5), and **Table ES-11** summarizes the historical total suspended solids (TSS) loadings for 2016 through 2021 in pounds per day (ppd) and pounds per capita per day (ppcd).

Table ES-10
Historical WWTF Influent BOD_5 Loading Summary

Year	Sewer System Population	Average Annual BOD_5 (mg/L)	Average Annual BOD_5 (ppd)	Average Annual BOD_5 (ppcd)	Max. Month BOD_5 (mg/L)	Max. Month BOD_5 (ppd)	Percent of NPDES Permit Max. Month Limit[1]	BOD_5 Max. Month Average/Average Annual Peaking Factor
2016	9,414	332	2,242	0.24	405	2,442	65%	1.09
2017	9,480	329	2,289	0.24	364	2,538	68%	1.11
2018	9,559	363	2,509	0.26	454	2,968	79%	1.18
2019	9,669	400	2,591	0.27	437	2,718	72%	1.05
2020	9,757	336	2,147	0.22	374	2,422	65%	1.13
2021	9,829	334	2,221	0.23	393	2,500	67%	1.13
2016 to 2019 Average[2]		**356**	**2,408**	**0.25**	**415**	**2,667**	**---**	**1.11**
2016 to 2019 Max.[2]		**400**	**2,591**	**0.27**	**454**	**2,968**	**---**	**1.18**

1 = The City's WWTF is permitted for a maximum month BOD_5 influent loading of 3,754 ppd.
2 = 2020 and 2021 values are not included in the historical averages and maximums due to the COVID pandemic.

Table ES-11
Historical WWTF Influent TSS Loading Summary

Year	Sewer System Population	Average Annual TSS (mg/L)	Average Annual TSS (ppd)	Average Annual TSS (ppcd)	Max. Month TSS (mg/L)	Max. Month TSS (ppd)	Percent of NPDES Permit Max. Month Limit[1]	TSS Max. Month Average/Average Annual Peaking Factor
2016	9,414	331	2,240	0.24	388	2,458	54%	1.10
2017	9,480	329	2,291	0.24	367	2,564	56%	1.12
2018	9,559	359	2,493	0.26	431	2,799	61%	1.12
2019	9,669	376	2,437	0.25	417	2,686	59%	1.10
2020	9,757	341	2,188	0.22	386	2,725	60%	1.25
2021	9,829	322	2,146	0.22	390	2,481	54%	1.16
2016 to 2019 Average[2]		**349**	**2,365**	**0.25**	**401**	**2,627**	**---**	**1.11**
2016 to 2019 Max.[2]		**376**	**2,493**	**0.26**	**431**	**2,799**	**---**	**1.12**

1 = The City's WWTF is permitted for a maximum month TSS influent loading of 4,568 ppd.
2 = 2020 and 2021 values are not included in the historical averages and maximums due to the COVID pandemic.

Inflow and Infiltration

Inflow and infiltration is the combination of groundwater and surface water that enters the sewer system. The U.S. Environmental Protection Agency (EPA) published a report in May 1985, *Infiltration/Inflow, I/I Analysis and Project Certification,* that developed guidelines to help determine what amount of inflow and infiltration (I/I) is considered to be excessive and what amount can be cost-effectively removed.

Inflow is considered to be non-excessive if the average daily flow during periods of heavy rainfall or spring thaw does not exceed 275 gallons per capita per day (gpcd). The peak recorded flow data in the 6 years of data analyzed for the City was 2.37 MGD. This peak inflow event equates to 243 gpcd, which is below the EPA's maximum guideline of 275 gpcd. The City did not experience any peak inflow events above the EPA's maximum inflow criterion. The City should continue to monitor inflow throughout the system, particularly in areas over 50 years old that previously may have been combined collection systems.

The determination of non-excessive infiltration was based on the national average for dry weather flow of 120 gpcd. In order for the amount of infiltration to be considered non-excessive, the average daily flow must be less than 120 gpcd. The peak dry weather flow period in the last 6 years (2016 through 2021) of record for the City, occurring after a few consecutive days of rain, was the 5-day period from January 22 through January 26, 2016. This period also was directly preceded by heavy rains, and yielded an average flow of 1.20 MGD, equating to 128 gpcd. The second highest peak dry weather flow period occurred in February 2018 and yielded an average flow of 124 gpcd. The third highest peak dry weather flow period occurred during a 14-day period in February 2020, resulting in an average flow of 121 gpcd. All three events are slightly above the EPA's maximum infiltration criterion; therefore, the amount of infiltration is considered excessive. The City should continue to monitor infiltration throughout the system.

Peaking Factors

Projected flows are used to analyze how well the existing sewer system will perform in the future and determine improvements required to maintain or improve system function. Peaking factors are needed to establish projected flow scenarios for the sewer system, which are then applied to future flow rates. **Table ES-12** shows a summary of peaking factors for flows at the City's WWTF for the 2016 through 2021 period.

Table ES-12
WWTF Peaking Factor Summary for Flows

Flow	
Max. Month Average Flow/Average Annual Flow (MMF/AAF)	1.33
Max. Day Flow/Average Annual Flow (MDF/AAF)[1]	2.83
Peak Hour Flow/Average Annual Flow (PHF/AAF)[1]	4.00
BOD_5	
Max. Month Average/Average Annual Loading	1.18
TSS	
Max. Month Average/Average Annual Loading	1.12

1 = The MDF and PHF for 2016 through 2021 both occurred in 2020 during the COVID pandemic. 2020 had a lower than typical AAF, so the PHF/AAF and MDF/AAF peaking factors were estimated with the PHF and MDF from this year divided by the average AAF for 2016 through 2019.

Peaking factors also are developed to determine maximum month average BOD_5 and TSS loading projections, as shown in **Table ES-13**. These loading peaking factors are the average historic maximum month to average annual loadings from 2016 to 2019. Data obtained during the COVID pandemic (2020 and 2021) may not represent normal flow and load conditions.

Table ES-13
WWTF Peaking Factor Summary for Loadings

Year	BOD_5 Max. Month Average/Average Annual Peaking Factor	TSS Max. Month Average/Average Annual Peaking Factor
2016	1.09	1.10
2017	1.11	1.12
2018	1.18	1.12
2019	1.05	1.10
2020	1.13	1.25
2021	1.13	1.16
Average[1]	**1.11**	**1.11**

1 = The peaking factors used for projections are the averages of the peaking factors from 2016 to 2019. 2020 and 2021 values are not included in these averages due to the COVID pandemic.

Projected Wastewater Flow

The City's sewer system is projected to add a total of 5,683 additional persons by 2043 using 2018 as the base year. **Table ES-14** provides a summary of the projected flows for the WWTF. According to these projections, the WWTF will not exceed the NPDES permit maximum month limit capacity during the 20-year planning period. However, the City should evaluate the WWTF for upgrades when the average MMF exceeds 85 percent of the NPDES Permit limit. According to these projections (based on flow), the City should prepare for WWTF upgrades by 2038.

Table ES-14
Total Projected WWTF Flow including Special Study Area Expansion

Year	Equivalent Sewer System Population	Projected AAF[1] (MGD)	Projected MMF[2] (MGD)	Percent of NPDES Permit Max. Month Limit[3]	Projected MDF[4] (MGD)	Projected PHF[5] (MGD)	Projected PHF with Inflow Reduction[6] (MGD)
2018 (Baseline)	**9,559**	**0.87**	**1.16**	**57%**	**1.82**	**3.06**	**--**
2019	9,669	0.78	0.87	43%	1.12	2.35	--
2020	9,757	0.80	1.15	56%	2.37	3.34	--
2021	9,829	0.84	1.02	50%	2.18	---	--
2022	9,981	0.91	1.21	59%	2.57	3.63	--
2023	10,134	0.92	1.23	60%	2.61	3.69	--
2024	10,289	0.94	1.25	61%	2.65	3.75	--
2025	10,553	0.96	1.29	63%	2.73	3.87	--
2026	10,819	0.99	1.32	65%	2.81	4.00	--
2027	11,086	1.02	1.36	66%	2.89	4.13	--
2028	11,354	1.05	1.40	68%	2.97	4.26	--
2029	11,624	1.08	1.44	70%	3.05	4.39	--
2030	11,896	1.11	1.47	72%	3.13	4.52	--
2031	12,169	1.13	1.51	74%	3.21	4.65	--
2032	12,444	1.16	1.55	76%	3.29	4.78	--
2033 (+ 10 years)	**12,720**	**1.19**	**1.59**	**78%**	**3.38**	**4.91**	**4.50**
2034	12,927	1.21	1.62	79%	3.44	5.01	4.59
2035	13,140	1.24	1.65	80%	3.50	5.10	4.69
2036	13,361	1.26	1.68	82%	3.56	5.20	4.79
2037	13,603	1.28	1.71	83%	3.64	5.31	4.90
2038	13,853	1.31	1.75	85%	3.71	5.42	5.01
2039	14,111	1.34	1.78	87%	3.79	5.54	5.13
2040	14,379	1.36	1.82	89%	3.86	5.66	5.25
2041	14,656	1.39	1.86	91%	3.95	5.79	5.38
2042	14,944	1.42	1.90	93%	4.03	5.92	5.51
2043 (+ 20 years)	**15,242**	**1.46**	**1.94**	**95%**	**4.12**	**6.06**	**5.65**
Buildout	**25,806**	**2.39**	**3.19**	**156%**	**6.77**	**9.82**	**9.40**

1 = Total projected AAF was estimated by adding City limit and sewer system expansion flows together.
2 = Total projected MMF was estimated by adding City limit and sewer system expansion flows together.
3 = The City's WWTF is permitted for a maxium month average influent flow of 2.05 MGD.
4 = Total projected MDF was estimated by adding City limit and sewer system expansion flows together.
5 = Total projected PHF was estimated by adding City limit and sewer system expansion flows together.
6 = Projected PHFs with inflow reduction were estimated by reducing projected PHFs after 2032 by 288 (0.41 MGD) to account for the removal of inflow estimated to be contributed by catch basins connected to the City's sewer system along Lawrence Street.

Projected Wastewater Quality

Projected BOD_5 and TSS loadings are presented in **Tables ES-15** and **ES-16**. According to these projections, the WWTF will exceed the NPDES Permit maximum month limit capacity for BOD_5 during the 20-year planning period. However, the City should prepare the WWTF for upgrades when the maximum month average BOD_5 load exceeds 85 percent of the NPDES permit limit. According to these projections (based on BOD load), the City should begin planning and preparing for WWTF upgrades by 2027. Near-term upgrades will be completed to enable the City to reach 100-percent capacity. However, the WWTF will not exceed the NPDES Permit maximum month limit capacity for TSS during the 20-year planning period. The City should prepare the WWTF for upgrades when the maximum month average TSS load exceeds 85 percent of the NPDES Permit limit. According to these projections, the City should prepare for WWTF upgrades for TSS by 2041. Capital improvement plan projects for WWTF upgrades are included in **Chapter 10**.

Table ES-15
Total Projected WWTF BOD_5 Loading including Special Study Area Expansion

Year	Equivalent Sewer System Population	Projected Average Annual BOD_5 (ppd)[1]	Projected Max. Month Average BOD_5 (ppd)[2]	Percent of NPDES Permit Max. Month Limit[3]
2018	9,559	2,509	2,968	79%
2019 (Baseline)	**9,669**	**2,591**	**2,718**	**72%**
2020	9,757	2,147	2,422	65%
2021	9,829	2,221	2,500	67%
2022	9,981	2,654	2,939	78%
2023	10,134	2,684	2,973	79%
2024	10,289	2,715	3,007	80%
2025	10,553	2,768	3,066	82%
2026	10,819	2,821	3,125	83%
2027	11,086	2,875	3,184	85%
2028	11,354	2,928	3,243	86%
2029	11,624	2,982	3,303	88%
2030	11,896	3,037	3,363	90%
2031	12,169	3,091	3,424	91%
2032	12,444	3,146	3,485	93%
2033 (+ 10 years)	**12,720**	**3,202**	**3,546**	**94%**
2034	12,927	3,243	3,592	96%
2035	13,140	3,286	3,639	97%
2036	13,361	3,330	3,688	98%
2037	13,603	3,378	3,741	100%
2038	13,853	3,428	3,797	101%
2039	14,111	3,480	3,854	103%
2040	14,379	3,533	3,913	104%
2041	14,656	3,589	3,975	106%
2042	14,944	3,646	4,039	108%
2043 (+ 20 years)	**15,242**	**3,706**	**4,105**	**109%**
Buildout	**25,806**	**5,819**	**6,445**	**172%**

1 = Projected average annual BOD_5 loadings were estimated by adding City limit and sewer system expansion loadings together.
2 = Projected maximum month average BOD_5 loadings were estimated by adding City limit and sewer system expansion loadings together.
3 = The City's WWTF is permitted for a maximum month average influent BOD_5 loading of 3,754 ppd.

Table ES-16
Total Projected WWTF Influent TSS Loading including Special Study Area Expansion

Year	Equivalent Sewer System Population	Projected Average Annual TSS (ppd)[1]	Projected Max. Month Average TSS (ppd)[2]	Percent of NPDES Permit Max. Month Limit[3]
2018 (Baseline)	**9,559**	**2,493**	**2,799**	**61%**
2019	9,669	2,437	2,686	59%
2020	9,757	2,188	2,725	60%
2021	9,829	2,146	2,481	54%
2022	9,981	2,577	2,862	63%
2023	10,134	2,608	2,896	63%
2024	10,289	2,639	2,930	64%
2025	10,553	2,692	2,989	65%
2026	10,819	2,745	3,048	67%
2027	11,086	2,798	3,107	68%
2028	11,354	2,852	3,167	69%
2029	11,624	2,906	3,227	71%
2030	11,896	2,960	3,287	72%
2031	12,169	3,015	3,347	73%
2032	12,444	3,070	3,408	75%
2033 (+ 10 years)	**12,720**	**3,125**	**3,470**	**76%**
2034	12,927	3,167	3,516	77%
2035	13,140	3,209	3,563	78%
2036	13,361	3,253	3,612	79%
2037	13,603	3,302	3,666	80%
2038	13,853	3,352	3,721	81%
2039	14,111	3,403	3,779	83%
2040	14,379	3,457	3,838	84%
2041	14,656	3,513	3,900	85%
2042	14,944	3,570	3,964	87%
2043 (+ 20 years)	**15,242**	**3,630**	**4,030**	**88%**
Buildout	**25,806**	**5,742**	**6,376**	**140%**

1 = Projected average annual TSS loadings were estimated by adding City limit and sewer system expansion loadings together.
2 = Projected maximum month average TSS loadings were estimated by adding City limit and sewer system expansion loadings together.
3 = The City's WWTF is permitted for a maximum month average influent TSS loading of 4,568 ppd.

Policies and Design Criteria

The City operates and plans sewer service for the City and associated sewer service area residents and businesses according to the design criteria, laws, and policies that originate from the EPA and Ecology.

These laws, design criteria, and policies guide the City's operation and maintenance of the sewer system on a daily basis, as well as the City's plan for growth and improvements. The overall objective is to ensure that the City provides high quality sewer service at a fair and reasonable cost to its customers. They also set the standards the City must meet to ensure that the sewer system is adequate to meet existing and future flows. The collection system's ability to handle these flows is detailed in **Chapter 6**, and the recommended improvements are identified in **Chapter 10**. The City Council adopts regulations and policies. The City's policies cannot be less stringent or in conflict with those established by federal and state governments. The City's policies take the form of ordinances, memoranda, and operational procedures, many of which are summarized in **Chapter 5**.

The City will maintain an updated GSP that is coordinated with the Land Use Element of the City's *Comprehensive Plan*, so that new development will be located where sufficient sewer system capacity exists or can be efficiently and logically extended.

Operation and Maintenance

Chapter 9 addresses the operation and maintenance (O&M) staff for the City's WWTF and collection system. Currently, there are approximately 8 personnel funded and assigned to the O&M of the City's sewer system.

The collection system and WWTF will continue to expand with population growth, and the City will need additional staff to continue maintaining the gravity sewers, force mains, and lift stations. For O&M needs, the City recommends a total of 2.6 full-time employees (FTEs) for the wastewater collections. The City also has requested and is planning to add 1.0 FTE for the WWTF and Compost Facility. This results in a total of approximately 10 FTEs for the O&M of the City's sewer system.

Summary of Improvements

A general description of improvements and an overview of the deficiencies they will resolve are presented in **Chapter 10**. Some of the improvements are necessary to resolve existing system deficiencies. The sewer system improvements were identified from the results of the collection system evaluation presented in **Chapter 6** and the WWTF and Compost Facility evaluation presented in **Chapters 7** and **8**. The sewer system improvements were sized to meet the system's projected 2043 demand conditions.

Collection system improvements to accommodate new growth are not shown in detail in this CIP. It is assumed that most of the new growth will occur at or near the Mill site. This CIP includes a lift station to allow development of the Mill site and conveyance for the new lift station's discharge throughout the existing collection system.

It is intended that this GSP contain an inclusive list of recommended system improvements; however, additional projects may need to be added or removed from the list as growth occurs or conditions change. The City will evaluate the capacity of the wastewater collection system, WWTF, and Compost Facility as growth occurs and as development permits are received.

Project costs for the proposed improvements were estimated based on costs of similar recently constructed sewer projects around the Puget Sound area and are presented in 2023 dollars. The cost estimates include the estimated construction costs and indirect costs. The existing system improvements were prioritized by the City based on a perceived need for the improvement to be completed prior to projects with fewer deficiencies or less risk of damage due to failure of the system. A general schedule has been established for planning purposes; the schedule should be modified based on City preferences, budget, or as development fluctuates. In addition, the City retains the flexibility to reschedule, expand, or reduce the projects presented in **Table ES-17** when new information becomes available for review and analysis.

Table ES-17
Proposed CIP Implementation Schedule

CIP No.	Project Description	Length (LF)	Estimated Cost (2023 $)	2024	2025	2026	2027	2028	6-10 years	11-20 years
	Sewer Main Improvements									
SM1	Sims Way Crossing and Wilson Street Realignment	786	$1,212,000	$100K	$606K	$506K				
SM2	Howard Street and S Park Avenue	1,079	$1,578,000						$1,578K	
SM3	Sims Way, 3rd Street, and Gise Street	796	$1,186,000						$1,186K	
SM4	Holcomb Street	531	$819,000						$819K	
SM5	Howard Street, S Park Avenue, and McPherson Street	1,685	$2,463,000							$2,463K
SM6	West Sims Way and 3rd Street	1,149	$1,679,000							$1,679K
SM7	Future Interceptor Upsizing	3,785	$6,722,000							$6,722K
SM8	Sewer System Defect Investigation and Repair	--	$3,300,000	$150K	$350K	$350K	$350K	$350K	$1,750K	
SM9	Lawrence Street Combined Sewer Separation*	1,800	$2,826,000		$500K	$1,163K	$1,163K			
SM10	Suitcase Pipe Replacement on Washington Street	303	$399,000		$399K					
SM11	Long-Term Sewer System Investigation and Refurbishment**	--	$56,000,000							$56,000K**
SM12	Water Street Sewer Replacement	1,600	$2,100,000	$2,100K						
Total - Sewer Main Improvements			**$80,284,000**	**$2,350K**	**$1,855K**	**$2,019K**	**$1,513K**	**$350K**	**$5,333K**	**$66,864K**
	Lift Station Improvements									
WW1	Existing Monroe Street Lift Station Improvements		$5,000,000					$500K	$4,500K	
WW2	Sewer Camera Van, Video Camera and Tractor, Recording Software and Hardware, and Staff Training		$300,000	$300K						
WW3	General Lift Station Improvements		$1,000,000	$50K	$50K	$50K	$50K	$50K	$250K	$500K
WW4	Mill Lift Station		$6,300,000	$1,100K	$3,200K	$2,000K				
Total - Lift Station Improvements			**$12,600,000**	**$1,450K**	**$3,250K**	**$2,050K**	**$50K**	**$550K**	**$4,750K**	**$500K**
	Wastewater Treatment Facility Improvements									
F1	Influent Pump Station and Odor Control Improvements		$2,120,000	$300K	$1,820K					
F2	Headworks Rehabilitation		$1,200,000						$1,200K	
F3	Clarifier No. 1 Improvements		$1,250,000						$1,250K	
F4	Clarifier No. 2 Improvements		$1,250,000						$1,250K	
F5	Non-Potable Water Pump Replacements (City to Install)		$120,000	$60K		$60K				
F6	SCADA Upgrades		$1,140,000		$150K	$990K				
F7	Electrical Upgrades		$630,000			$630K				
F8	Near-Term Oxidation Ditch Improvements		$2,940,000		$100K			$400K	$2,440K	
F9	Outfall Upgrades		$4,000,000	$500K	$600K	$2,900K				
F10	On-Site Solids Handling Improvements		$3,000,000						$3,000K	
F11	Land Acquisition for WWTF Expansion		$2,000,000		$2,000K					
F12	Long-Term WWTF Expansion (Budgetary Estimate)		$30,000,000							$30,000K
Total - Facility Improvements			**$49,650,000**	**$860K**	**$4,670K**	**$4,580K**	**$0K**	**$400K**	**$9,140K**	**$30,000K**
	Compost Facility and Solids Handling Improvements									
C1	Solids Handling Influent Screening and Grit Removal		$890,000			$160K	$365K	$365K		
C2	Solids Handling Tank Replacement and Mechanical Upgrades		$700,000		$150K	$130K	$130K	$130K	$160K	
C3	Compost Screen Replacement		$460,000	$460K						
C4	Compost Case Loader Replacement		$390,000		$390K					
C5	Compost Blowers Replacements		$80,000	$19K	$19K	$19K	$23K			
C6	Compost Facility Infrastructure Upgrades		$410,000		$15K					$395K
C7	6-inch Hydrant Line		$670,000		$100K	$285K	$285K			
C8	Office with Dedicated Lunchroom		$300,000		$300K					
Total - Facility Improvements			**$3,900,000**	**$479K**	**$974K**	**$594K**	**$803K**	**$495K**	**$160K**	**$395K**
	Miscellaneous and Planning Improvements									
M1	Arc Flash Analysis		$90,000		$90K					
M2	Public Works Shop - Sewer Collection Share		$2,850,000		$100K				$2,750K	
M3	General Sewer Plan Update		$250,000							$250K
M4	Downtown Restrooms		$250,000		$250K					
Total - Miscellaneous Improvements			**$3,440,000**	**$0K**	**$440K**	**$0K**	**$0K**	**$0K**	**$2,750K**	**$250K**
Total Estimated Project Costs of City-funded Improvements			**$149,874,000**	**$5,139K**	**$11,189K**	**$9,243K**	**$2,366K**	**$1,795K**	**$22,133K**	**$98,009K**

*50% cost shown in the CIP table. It is assumed an additional 50% will be paid by the Road and Storm Drainage departments.

**Costs are budgetary for pipe replacement of unknown materials. As the City video inspects the system and updates condition, this is subject to change. Rate analysis only includes anticipated grants to reduce City expenditure to $21 million.

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1 | INTRODUCTION

SEWER SYSTEM OWNERSHIP AND MANAGEMENT

The City of Port Townsend (City), located in Jefferson County (County), is a municipal corporation that provides wastewater collection and treatment, among other municipal services. The City owns, operates, and maintains the sewer system. Ownership information, including the owner's authorized representative, is as follows.

Physical Address:
250 Madison Street, Suite 2R
Port Townsend, WA 98368

Authorized Representative Name and Phone Number: City Manager, John Mauro,
(360) 349-5043

Operation and management of the sewer system is provided by the wastewater division of the City's Public Works Department with the following contacts:

- City Public Works Director, Steve King, (360) 379-5090
- Wastewater Treatment and Compost Operations Manager, Bliss Morris, (360) 344-3043
- Streets and Collection Operations Manager, Brian Reid, (360) 385-3197

OVERVIEW OF EXISTING SYSTEM

The City's sewer system is comprised of a wastewater treatment facility (WWTF), 7 sewer lift stations, and approximately 77.4 miles of gravity and force main pipes. The City also owns and operates a Compost Facility for solids from the WWTF, and septage receiving station and separate WWTF at the Compost Facility. The City provided wastewater collection and treatment to an estimated 9,829 people in 2021, compared to the City's population of 10,220. Currently, 206 properties within the City limits are using on-site septic systems. As of 2021, the City's number of wastewater service customer connections was approximately 4,710. The City's sewer planning area is the same as its Urban Growth Area (UGA).

The main WWTF consists of an Influent Pump Station (IPS), headworks, oxidation ditches, secondary clarifiers, and chlorine contact basins. Waste sludge is captured in the aerobic sludge holding tanks and hauled to the City's Compost Facility. The WWTF is permitted for a maximum month average flow (MMF) of 2.05 million gallons per day (MGD). The Compost Facility produces a Class A biosolids product for local beneficial use and handles some of the County's septage in a sequencing batch reactor with disinfection and disposal to constructed wetlands and infiltration.

A summary of the City's sewer system data is provided in **Table 1-1**.

Table 1-1
2021 City Sewer System Data

Description	Data
City Population	10,220
Number of Properties on Septic Systems	211
Sewer System Population	9,829
Total Connections	4,710
Sewer Planning Area - UGA (Square Miles)	7.4
Average Gallons per Capita per Day (gpcd)	85
Average Annual Flow (MGD)	0.84
Maximum Month Average Flow (MGD)	1.02
Maximum Day Flow (MGD)	2.18
Number of Lift Stations	7
Total Length of Gravity Main (Miles)	75.2
Length of 8-inch-diameter Gravity Main (Miles)	45.3
Total Length of Force Main (Miles)	2.2
WWTF Permitted Maximum Month Average Flow (MGD)	2.05

gpcd = gallons per capita per day

AUTHORIZATION AND PURPOSE

The City authorized RH2 Engineering, Inc., (RH2) to prepare a General Sewer Plan (GSP) in accordance with Washington Administrative Code (WAC) 173-240-050. The previous *Wastewater Comprehensive Plan* was prepared by CH2MHILL for the City in 1999 and was approved by the Washington State Department of Ecology (Ecology) in 2000. In addition, a *Wastewater Facilities Plan* was completed in 2000 by Gray & Osborne, Inc., to address Ecology comments on the *Wastewater Comprehensive Plan* and focus on major system components with a capital program.

The purpose of this updated GSP is as follows:

- To update the City's GSP for consistency with the future population and employment growth projections from the City's Planning and Community Development Department.
- To evaluate existing sewer flow and loading data and project future flows and loadings.
- To analyze the existing sewer system to determine if it meets minimum requirements mandated by Ecology and the City's own policies and design criteria.
- To determine the overall reliability and vulnerability of the existing wastewater lift stations.
- To evaluate the existing WWTF to determine if the treatment facility meets the City's National Pollutant Discharge Elimination System Permit requirements.
- To identify sewer system collection improvements that will resolve existing system deficiencies and accommodate future needs of the system.

- To identify WWTF improvements that will resolve existing system deficiencies and accommodate future wastewater treatment needs.
- To prepare a schedule of improvements that meets the goals of the City's financial program.

PREVIOUS PLANNING EFFORTS

The following documents provide a history of the planning efforts involving the City's sewer system.

1999 *Wastewater Comprehensive Plan*

2000 *Wastewater Facilities Plan*

2009 *Southwest Sewer Basin Study*

2012 *Mill Road Pump Station and Force Main Predesign Report*

2019 *Port Townsend Condition Assessment Summary Report*

SUMMARY OF PLAN CONTENTS

A brief summary of the content of the chapters in this GSP is as follows:

- **Chapter 1** introduces the reader to the City's sewer system, the objectives of the GSP, and the GSP organization.
- **Chapter 2** presents the sewer service area and describes the existing sewer system.
- **Chapter 3** presents related plans, land use, and population characteristics.
- **Chapter 4** identifies existing wastewater flow and loading rates and projects future flow and loading rates.
- **Chapter 5** presents the City's operational policies and design criteria.
- **Chapter 6** discusses the wastewater collection system analyses and deficiencies.
- **Chapter 7** discusses the existing WWTF and Compost Facility analyses and deficiencies.
- **Chapter 8** evaluates future improvement needs for the WWTF and Compost Facility to address existing and projected deficiencies.
- **Chapter 9** discusses the City's operations and maintenance program.
- **Chapter 10** presents the proposed Capital Improvement Plan (CIP), including wastewater collection system, WWTF, and Compost Facility improvements, their estimated costs, and a schedule for implementation.
- **Chapter 11** summarizes the financial status of the sewer utility and presents a plan for funding the sewer improvements.

LIST OF ABBREVIATIONS

The abbreviations listed in **Table 1-2** are used throughout this GSP.

Table 1-2
Abbreviations

Abbreviation	Description
AACE	Association of Cost Engineers
AAF	average annual flow
AC	asbestos cement
AKART	all known, available, and reasonable treatment
BOD_5	5-day biochemical oxygen demand
CI	cast iron
CIP	Capital Improvement Plan
CIPP	cured-in-place pipe
City	City of Port Townsend
County	Jefferson County
CWA	Clean Water Act
DI	ductile iron
DMR	Discharge Monitoring Report
Ecology	Washington State Department of Ecology
EPA	U.S. Environmental Protection Agency
FRP	fiberglass reinforced plastic
FTE	full-time staff equivalents
GMA	Growth Management Act
gpcd	gallons per capita per day
GSP	General Sewer Plan
HDPE	high-density polyethylene
IFAS	integrated fixed film activated sludge
I/I	Inflow and Infiltration
IPS	Influent Pump Station
LAMIRD	local area of more intense rural development
lf	linear feet
LID	Local Improvement District
MABR	membrane aeration biofilm reactors
MCC	Motor Control Center
MDF	maximum day flow
MG	million gallons
MGD	million gallons per day
mg/L	milligrams per liter
MLE	Modified Ludzach-Ettinger
MLSS	mixed liquor suspended solids
MMDF	maximum month design flow
MMF	maximum month average flow

Table 1-2
Abbreviations (Continued)

Abbreviation	Description
MOB	mobile organic biofilm
MUTCD	Manual on Uniform Traffic Control Devices
NES	National Electrical Code
NOP	Nitrogen Optimization Plan
NPDES	National Pollutant Discharge Elimination System
NPW	non-potable water
OFM	Office of Financial Management
O&M	operations and maintenance
ORP	oxidation-reduction potential
OSHA	Occupational Safety and Health Administration
PHF	peak hour flow
ppcd	pounds per capita per day
ppd	pounds per day
psi	pounds per square inch
PSNGP	Puget Sound Nutrient General Permit
PTMC	Port Townsend Municipal Code
PVC	polyvinyl chloride
RAS	return activated sludge
RCW	Revised Code of Washington
RH2	RH2 Engineering, Inc.
SBR	sequencing batch reactor
SCADA	supervisory control and data acquisition
SEPA	State Environmental Policy Act
SLR	solids loading rate
SRT	solids retention time
SVI	sludge volume index
SWDP	State Waste Discharge Permit
TIN	total inorganic nitrogen
TSS	total suspended solids
UGA	Urban Growth Area
VC	vitrified clay
VFD	variable frequency drive
WAC	Washington Administrative Code
WAS	waste activated sludge
WISHA	Washington Industrial Safety and Health Act
WWTF	wastewater treatment facility

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2 | SEWER SYSTEM DESCRIPTION AND DISCHARGE REGULATIONS

INTRODUCTION

This chapter describes the City of Port Townsend's (City) sewer service area, wastewater collection and treatment system, lift stations, and discharge and disposal regulations and permits. Included in this chapter is a brief overview of the City's topography, geology, and climate to provide a better understanding of the physical characteristics of the City. A brief description of the City's water system facilities also is presented.

Analysis of the existing sewer system is presented in **Chapter 4**. The results of the evaluation and analyses of the existing sewer system are presented in **Chapter 6**. Evaluation of the existing treatment facilities is presented in **Chapter 7**. Improvements to address treatment facility deficiencies are presented in **Chapter 8**.

SEWER SERVICE AREA

History

The City's sewer system was originally constructed as combined wastewater and stormwater sewers serving each small drainage area. There was no requirement for treatment of this combined sewage, so there were many outfalls to Port Townsend Bay and Admiralty Inlet.

In the 1960s, the City responded to new Washington State requirements to provide primary treatment for all combined sewage. Interceptors, lift stations, and the City's first wastewater treatment facility were constructed and placed in service, and the existing outfall was extended in 1967.

In the early 1970s, the Federal Government established new standards requiring higher levels of treatment for municipal wastewater. For most cities, including Port Townsend, these higher standards meant that additional (secondary) treatment facilities would be required.

In 1976, the City completed a Wastewater Facilities Plan under the guidelines issued by the U.S. Environmental Protection Agency. The plan evaluated the requirements to upgrade the facility to secondary treatment and was approved by the Washington State Department of Ecology (Ecology). The plan recommended adding sludge dewatering facilities and an oxidation ditch for secondary treatment and conversion to secondary clarifiers. Upon completion of the plan, the City applied for funding from Ecology to implement the plan. Ecology did not assist the City with funding at that time; therefore, no improvements were made.

In 1982 and 1983, the City prepared and submitted an Application for Modification of Secondary Treatment Requirements for Discharge into Marine Waters, as allowed under Section 301(h) of the Clean Water Act. The waiver of secondary treatment was denied by state and federal agencies.

The City later entered into a consent agreement with Ecology to have secondary treatment facilities operational by 1993. In 1987, engineering for upgrading the wastewater treatment facility (WWTF) to secondary treatment began. In 1989 and 1990, several permit issues surfaced and a citizens group filed an action against the City to stop construction. The City and the citizens group worked cooperatively to resolve the permit issues through design changes. The City commenced construction, and the new secondary wastewater treatment facility was installed at the same site as the original plant. The new facility began service in July of 1993.

The City originally disposed of the biosolids produced by the WWTF at the Jefferson County (County) landfill until 1991 when the landfill was closed. Biosolids were then hauled to Bremerton as an interim biosolids disposal method. The City explored a number of alternative methods for disposal of the generated biosolids and septage, ranging from forest application and incineration to lime and kiln dust stabilization. After a detailed analysis and substantial public involvement, composting was chosen as the preferred approach to biosolids management. The Compost Facility has been successfully operating since 1993. Dewatered biosolids, dewatered septage, and yard waste are composted to produce a product used for soil conditioning. The finished compost meets federal 40 CFR 503 regulations for a class A product and is thus allowed for unrestricted use.

The City has been growing steadily since the original interceptors, lift stations, and WWTF were constructed in 1967. Since that time, improvements to the collection system have consisted of regular maintenance and repair activities at the lift stations and expansion of the collection system to serve unsewered areas. Most of the collection system improvements identified in the 2000 *Wastewater Facilities Plan* have been completed. The work performed over the last 20 years was funded through loan and grant contributions, along with sewer rates. **Figure 2-1** shows the extents of the sewer collection system.

Geology

The soils in the Port Townsend area are primarily of the Clallam-Hoypus-Dick association, which are composed of gravel, loam, and sand. These soils vary from 20 to 60 inches in depth, and most areas are well drained. Compact gravelly sand and glacial till underlie these soils. Till is a deposit of unsorted material that has been densely compacted under the weight of a glacier. The City's service area has undergone repeated glacial advances and retreats until as recently as 10,000 years ago. Glacial till is relatively impermeable and is the cause of many on-site septic system problems over the years. There are many small, isolated areas across the City where the glacial till is exposed and the soils are poorly drained. Drainage in these areas is problematic with many perched, wet areas that further complicate the application of on-site septic systems.

Topography

Figures 2-2 and **2-8** show the topography and natural drainage basins with the City limits. The City has several high hills and steep bluffs, and elevations range from sea level to just over 300 feet. The undulating topography creates many isolated areas of low spots. These areas can be challenging to sewer with gravity mains, but in general, the large amount of relief over the City allows many sewers to be placed at steeper than minimum grades, reducing required sewer sizes and the required time for wastewater to get to the treatment facility.

Unfortunately, there are several areas that drain naturally to local low points away from the WWTF, where lift stations already exist or may be necessary in the future to provide sewer service to those areas.

Climate

The northern end of the Quimper Peninsula, where the City is located, does not typically receive heavy precipitation common in other parts of the Olympic Peninsula and Puget Sound lowlands. The City lies in the rain shadow of the Olympic Mountains. As a result, the City receives relatively little precipitation in the summer months when prevailing winds are from the west. The majority of the City's annual precipitation occurs in the winter months when most weather patterns pass over the City from the south. The City's average annual minimum and maximum precipitation are approximately 12 inches and 27 inches, respectively. Average daily minimum and maximum precipitation ranges from approximately 0.4 to 0.8 inches per day, respectively.

Sea Level Rise

The City and the County joined forces to develop a Climate Action Committee. This committee has worked diligently to develop several reports and studies associated with the following:

- Modeling County carbon dioxide equivalent emissions with the goal of reducing and measuring greenhouse gas emissions produced in the County overtime.
- Addressing the need to adapt to climate change in terms of impacts to weather patterns and the hydrology of the area.
- Addressing the impacts of Sea Level Rise and developing forecasting tools to assess the impacts of Sea Level Rise on City infrastructure.

The City of Port Townsend Sea Level Rise and Coastal Flooding Risk Assessment (2022, City of Port Townsend and Cascadia Consulting Group) (**Appendix K**) incorporates the best available science and information concerning climate change, and specifically Sea Level Rise, on the City's sewer infrastructure. In particular, Sea Level Rise will impact the City's WWTF, three sewer lift stations, and the City's collection system over the next 100 years. Infrastructure planning for these facilities incorporates this understanding, with the long-term goal of moving or transitioning sewer facilities to become more resilient to Sea Level Rise. The City already has experienced impacts of king tides, with one of the largest king tides occurring on December 27, 2022. This king tide event flooded a portion of the Port of Port Townsend Boat Haven Marina boat yard and contributed to the collapse of an asbestos cement (AC) gravity sewer pipe, which settled due to a high water table caused by the king tide and the backup of water into the storm system directly above the AC pipe. None of the City's lift stations incurred damage, but this event illustrates how close the City is to experiencing the effects of Sea Level Rise combined with a king tide event.

Water Bodies and Floodplains

The City is bounded by the Salish Sea with Port Townsend Bay to the south, Admiralty Inlet to the east, and the Strait of Juan de Fuca to the north. The natural drainage basins within the sewer service area drain primarily to the sea, Kah Tai Lagoon, or Chinese Gardens Lagoon. These natural drainage basins are shown in a figure from the City's 2019 *Stormwater Management Plan* in **Appendix A**. Both the Kah Tai and the Chinese Gardens Lagoons are somewhat tidally influenced through pipe connections to the Salish Sea. There are no rivers or streams located within the City limits, although there are a number of small, natural ponds or depressions throughout the area, as well as several wetlands. The City's 2019 *Stormwater Management Plan* addresses how surface water is dealt with within the City. A map of the existing stormwater facilities is presented in **Appendix A**.

A small portion of the City is located within the 100-year floodplain along its marine shorelines, including the Port of Port Townsend's Point Hudson and Boat Haven, Kah Tai Lagoon, and the Lincoln Beach area. Furthermore, there are several small wetlands and riparian areas throughout the City. These sensitive areas and steep slopes limit the buildable area.

Given the City is surrounded by the Salish Sea, the City coordinates with the County Marine Resources Council and the City's Climate Action Committee concerning sewer project impacts to the Salish Sea and/or the impacts of the sea on the operations and development of the sewer system.

City Limits, Urban Growth Area, and Sewer Service Area Boundary

The sewer service area coincides with the Urban Growth Area (UGA) boundary, which is also the City limits, and encompasses an area of approximately 7.4 square miles. The majority of the developed area within the City limits is currently served by the City's existing sewer system. Within the sewer service area, approximately 5 percent of residences are served by privately owned and operated on-site sewage systems (i.e. septic tanks with drain fields). Currently, 211 properties within the City limits are on on-site systems. The City's sewer planning area (i.e. future sewer service area) includes the City's UGA (**Figure 2-1**).

The Glen Cove area directly adjacent and southwest of the City limits has been designated as a Special Study Area for possible future inclusion in the City's service area. The primary basis for allowing this area to be incorporated into the City sewer service area is based on the following factors:

1. The Glen Cove industrial area is a Type 3 Local Area of More Intense Rural Development (LAMIRD) intended for light industrial and limited commercial use that could benefit from the presence of sewer. Currently, all uses in this area are required to have an on-site septic system, which may be limiting industrial activities and potentially resulting in environmental degradation. LAMIRDs are permitted to be served by sanitary sewer per the Growth Management Act (Washington Administrative Code (WAC) 365-196-425(6)(c), Rural Element).
2. In this area, the Port Townsend Paper Mill currently has an industrial waste treatment system and a domestic waste treatment system, both of which discharge to Port Townsend Bay. The City may consider allowing the domestic system to connect to the City's sewer system for the environmental benefit of eliminating a discharge to Port Townsend Bay. This option would need to be approved by Ecology and the Department of Commerce before executing a sewer service agreement for the Paper Mill.

3. Through a UGA expansion or swap in cooperation with the County. Based on existing, more intense development patterns, the Glen Cove Area may be deemed a key area to serve existing and future uses to support the local economy given the lack of industrially zoned properties and the need for housing within the City. An additional 20-acre parcel directly adjacent to the City is owned by the County and is serving as a homeless shelter. This parcel serves key public needs of providing for the poor and infirm. Sewer service to this property may be of great benefit to the community and may serve as a basis for a UGA expansion.
4. A portion of the area within the Glen Cove drainage basin is already in the City limits and does not have access to sewer without the installation of a sewer lift station. Therefore, locating a sewer lift station in an appropriate area that keeps options open will allow the City to make sewer service available for unsewered areas within the City limits while allowing Factors 1 through 3 above to be considered.

All four of these factors involve the City and County working closely together to evaluate impacts of sewer extension. The purpose of the Special Study Area is to document the sewer basin planning process performed in 2012 as outlined in the *Mill Road Pump Station and Force Main Predesign Report* (**Appendix B**). The City has funding to site a lift station in the Mill Road area to serve the current UGA. Siting of this lift station, which could serve as described above, is an important consideration for this Special Study Area to guide public investment of approximately $4 million.

This General Sewer Plan (GSP) will address service needs in the Glen Cove Area and account for Glen Cove's possible future inclusion in the UGA.

EXISTING SEWER FACILITIES

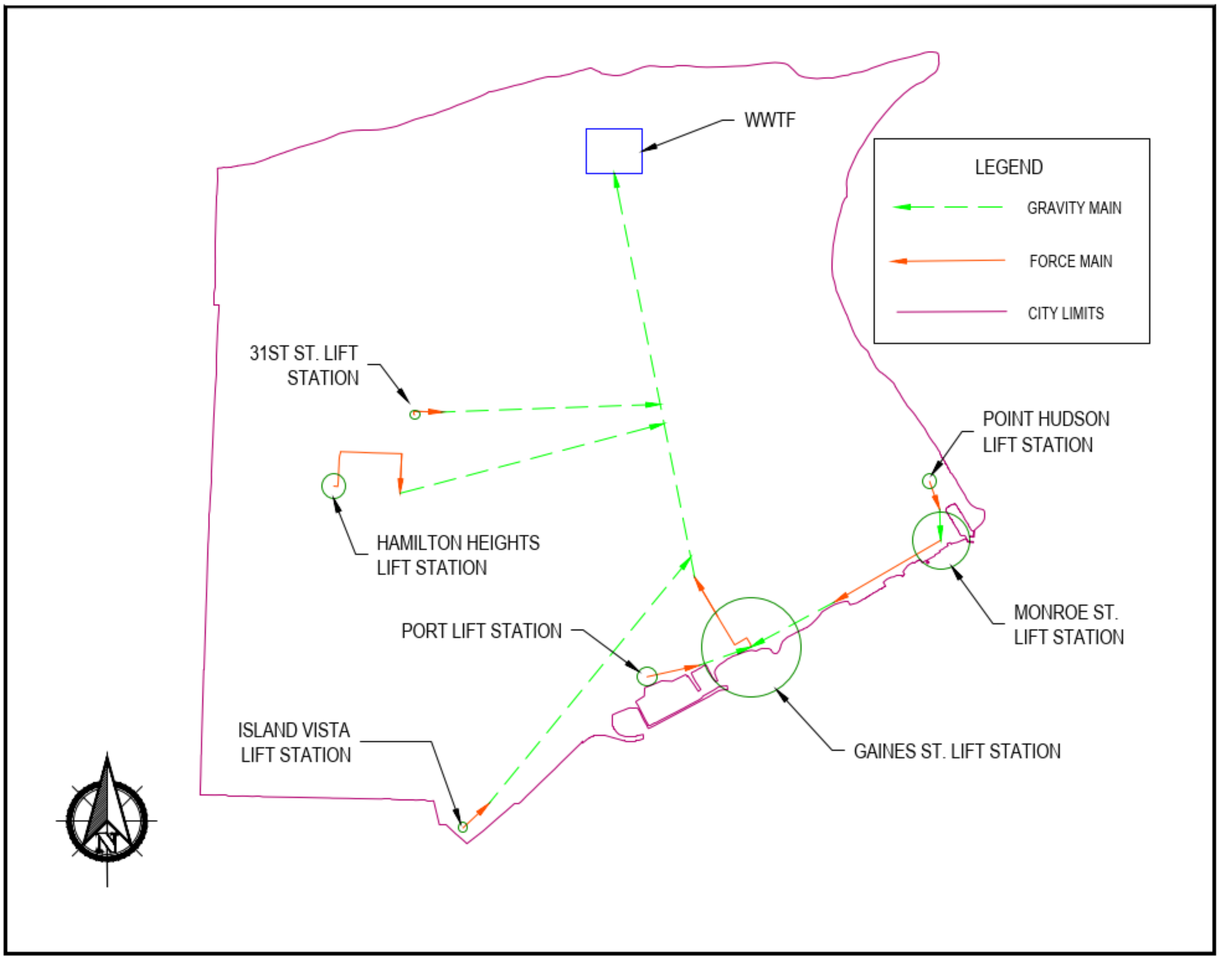
The City owns, operates, and maintains the wastewater system, which includes a gravity collection and conveyance system, seven wastewater lift stations, force mains, a WWTF, and an outfall.

Sewer Drainage Basins

The City's existing sewer service area is comprised of 14 sewer drainage basins that flow by gravity to the 7 lift stations and WWTF, as shown in **Figure 2-2**.

The wastewater from the eastern part of the City is conveyed by the Point Hudson Lift Station and the Monroe Lift Station, where flow is then conveyed to the Gaines Street Lift Station before traveling by gravity main to the City's WWTF. In other words, all of the sewer flow from uptown, downtown, and the eastern shoreline is routed through the Gaines Street Lift Station. Southern flows from the Port Lift Station also are conveyed to the Gaines Street Lift Station before reaching the City's WWTF. Wastewater from the western portion of the City is conveyed to the Hamilton Heights Lift Station and the 31st Street Lift Station, which both then route wastewater flows by gravity to the WWTF. A small portion of wastewater in the southwestern portion of the City is sent to the Island Vista Lift Station, where it then flows by gravity to the WWTF. All other wastewater collected in the City flows via gravity to the WWTF, where it is pumped to the outfall. **Figure 2-3** shows a schematic representation of the general location and flow path for each of the primary sewer drainage basins.

Figure 2-3
Sewer Drainage Basins Schematic



Gravity Sewer Collection Piping

The City has 75.2 miles of gravity sewer piping, including collection sewers and interceptors and treated effluent sewers from the WWTF. A majority of the system is 8-inch-diameter gravity main, totaling 45.3 miles. The predominant material used in the system, accounting for approximately 54 percent of gravity piping, is polyvinyl chloride (PVC).

Approximately 72 percent of the gravity sewer's installation year is unknown. Assumptions of pipe ages based upon the material were made in an effort to determine the general age of the collection system piping. AC was a popular material in sewer pipe construction between the years of 1950 and 1970. A median installation year of 1960 was assumed for AC pipe where the actual year is unknown. Both cast iron (CI) and vitrified clay (VC) were materials used primarily before the 1950s. Ductile iron (DI) and high-density polyethylene (HDPE) use rises in popularity in 1980 and is still used in present day, although largely for deep sewer pipe construction. A median installation year of 2000 was assumed for DI and HDPE pipe where the actual year is unknown. Reinforced concrete pipe (RCP) is another older material where the use ranged from 1940 to 1960. A median installation year of 1950 was assumed for RCP pipe where the actual year is unknown.

Table 2-1 summarizes the sewer system pipe by diameter, **Table 2-2** summarizes the pipe by material, and **Table 2-3** summarizes the pipe by installation year. **Figure 2-1** illustrates pipe sizes and locations, and **Figure 2-4** illustrates pipe material. **Figure 2-5(a)** illustrates the pipe installation year with the known information. **Figure 2-5(b)** illustrates the assumed pipe installation year based upon known information and pipe material, as described previously.

Table 2-1
Gravity Sewer Collection Piping Inventory – Diameter

Diameter (inches)	Total Length (feet)	Total Length (Miles)	% of System
6 and smaller	100,808	19.09	25.4%
8	239,222	45.31	60.2%
10	20,188	3.82	5.1%
12	10,131	1.92	2.6%
14	1,963	0.37	0.5%
15	80	0.02	0.0%
16	3,462	0.66	0.9%
18	6,974	1.32	1.8%
22	1,376	0.26	0.3%
24	179	0.03	0.0%
30	6,471	1.23	1.6%
Unknown	6,222	1.18	1.6%
Total	**397,077**	**75.20**	**100.0%**

Table 2-2
Gravity Sewer Collection Piping Inventory – Material

Material	Total Length (feet)	Total Length (Miles)	% of System
AC	35,170	6.66	8.9%
CI	617	0.12	0.2%
DI	310	0.06	0.1%
HDPE	4,838	0.92	1.2%
PVC	214,161	40.56	53.9%
RCP	75,643	14.33	19.0%
VC	59,984	11.36	15.1%
Unknown	6,353	1.20	1.6%
Total	**397,077**	**75.20**	**100.0%**

Table 2-3
Gravity Sewer Collection Piping Inventory – Installation Year

Installation Year	Total Length (feet)	Total Length (Miles)	% of System	Total Assumed Length (feet)	Total Assumed Length (Miles)	% of System
Before 1950s	--	--	--	60,502	11.46	15.2%
1950s	--	--	--	74,267	14.07	18.7%
1960s	706	0.13	0.2%	34,023	6.44	8.6%
1970s	1,940	0.37	0.5%	1,940	0.37	0.5%
1980s	10,692	2.02	2.7%	10,692	2.02	2.7%
1990s	30,163	5.71	7.6%	30,163	5.71	7.6%
2000s	51,995	9.85	13.1%	166,646	31.56	42.0%
2010s	14,082	2.67	3.5%	14,082	2.67	3.5%
2020s	269	0.05	0.1%	269	0.05	0.1%
Unknown	287,229	54.40	72.3%	4,492	0.85	1.1%
Total	**397,077**	**75.20**	**100.0%**	**397,077**	**75.20**	**100.0%**

Force Mains

The City has approximately 2.2 miles of force mains. **Table 2-4** summarizes the force mains by diameter, **Table 2-5** summarizes the force mains by material, and **Table 2-6** summarizes the force mains by installation year. **Figure 2-1** illustrates the force main locations.

Approximately 41 percent of the force main installation years are unknown. Assumptions of the pipe ages based upon the material were made in an effort to determine the general age of the collection system piping.

Table 2-4
Force Main Inventory – Diameter

Diameter (inches)	Total Length (feet)	Total Length (Miles)	% of System
4	1,718	0.33	15.1%
6	4,333	0.82	38.0%
10	2,706	0.51	23.8%
12	2,179	0.41	19.1%
16	381	0.07	3.3%
Unknown	78	0.01	0.7%
Total	**11,395**	**2.16**	**100.0%**

Table 2-5
Force Main Inventory – Material

Material	Total Length (feet)	Total Length (Miles)	% of System
CI	6,259	1.19	54.9%
HDPE	381	0.07	3.3%
PVC	4,745	0.90	41.6%
Unknown	11	0.00	0.1%
Total	**11,395**	**2.16**	**100.0%**

Table 2-6
Force Main Inventory – Installation Year

Installation Year	Total Length (feet)	Total Length (Miles)	% of System	Total Assumed Length (feet)	Total Assumed Length (Miles)	% of System
Before 1950s	--	--	--	2,706	0.51	23.8%
1950s	--	--	--	0	0.00	0.0%
1960s	2,179	0.41	19%	2,179	0.41	19.1%
1970s	1,374	0.26	12%	1,374	0.26	12.1%
1980s	0	0.00	0%	0	0.00	0.0%
1990s	3,610	0.68	32%	3,610	0.68	31.7%
2000s	0	0.00	0%	1,515	0.29	13.3%
2010s	0	0.00	0%	0	0.00	0.0%
2020s	0	0.00	0%	0	0.00	0.0%
Unknown	4,232	0.80	37%	11	0.00	0.1%
Total	**11,395**	**2.16**	**100%**	**11,395**	**2.16**	**100.0%**

Lift Stations

The City currently owns, operates, and maintains seven wastewater lift stations. The characteristics of the lift stations are summarized in **Table 2-7**, and a description of each lift station follows.

Table 2-7
Lift Station Characteristics

	Lift Station					Pumps			
Lift Station Name	**Year Constructed**	**Force Main Diameter (inches)**	**No. of Pumps**	**Type**	**Manufacturer**	**Horsepower (hp)**	**TDH (feet)**	**Design Capacity (gpm)**	**Design Firm Capacity (gpm)**
Gaines Street Lift Station	1967 - Constructed 2022 - Upgrade	6	3	Submersible	Flygt	60	107	1,050 1,050 1,050	2,100
Monroe Street Lift Station	1965 - Constructed 2008 - Upgrade	10	3	Dry Pit	Chicago	15		600 600 600	1,200
Port Lift Station	1967	6	2	Submersible	Cornell	5		200 200	200
31st Street Lift Station	1996	4	2	Submersible	Gorman-Rupp	3		100 100	100
Island Vista Lift Station	1985 - Constructed 2004 - Upgrade	4	2	Submersible	Flygt	6.5	100	100 100	100
Point Hudson Lift Station	1975 - Constructed 1988 - Upgrade	4	2	Submersible	Peabody Barnes	1.5		150 150	150
Hamilton Heights Lift Station	1997	6	2	Submersible	FairBanks Morse	10	58	250 250	250

Gaines Street Lift Station

Gaines Street Lift Station

The Gaines Street Lift Station was originally constructed in 1967, and the pumps were upgraded in 2022. The station is located at 201 Gaines Street and is equipped with three 60 horsepower (hp) Flygt submersible pumps. The station has a firm design capacity of 2,100 gallons per minute (gpm) and is a conventional wet well/dry well station. The Gaines Street Lift Station collects wastewater from its sewer basin along with wastewater from the Port, Monroe Street, and Port Hudson Lift Stations in the southeastern portion of the system and conveys it through the gravity collection system to the WWTF. Back-up power is provided by a generator. The lift station is connected by radio communication to the City’s supervisory control and data acquisition (SCADA) system.

Monroe Street Lift Station

Monroe Street Lift Station

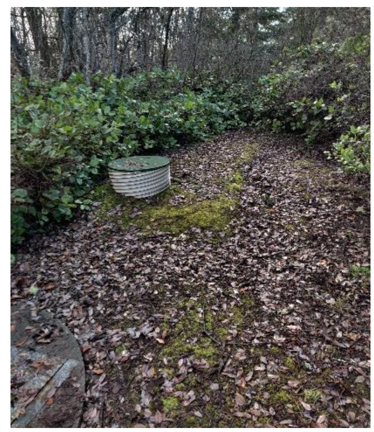
The Monroe Street Lift Station, last upgraded in 2008, pumps wastewater from the gravity collection system to the Gaines Street Lift Station. The Monroe Street Lift Station is equipped with three 15 hp Chicago dry pit pumps that discharge into a 10-inch-diameter force main. The lift station is connected by radio communication to the City’s SCADA system. The lift station has a hookup for a temporary generator, and response time is less than 30 minutes to connect power. The City is alerted when power is out by the SCADA system, and this is the first lift station responded to.

Port Lift Station

Port Lift Station

The Port Lift Station is located in the Port Townsend Boat Haven Marina. Constructed in 1967, this submersible station is equipped with two 5 hp Cornell pumps and has a design firm pumping capacity of 200 gpm. All wastewater from the Port Lift Station is pumped to the Gaines Street Lift Station through a 6-inch-diameter force main before being conveyed to the WWTF. The lift station is connected by radio communication to the City's SCADA system. The lift station has a hookup for a temporary generator, and staff generally have around 60 minutes to connect power. The City is alerted when power is out by the SCADA system, and this is the second lift station responded to.

31st Street Lift Station



31st Street Lift Station

The 31st Street Lift Station was constructed in 1996 and is located at 1920 31st Street. This submersible lift station is equipped with two 3 hp Gorman-Rupp submersible pumps that discharge into a 4-inch-diameter force main. The design capacity of the 31st Street Lift Station is 100 gpm. Wastewater from the lift station mostly consists of infiltration and inflow and is conveyed via gravity mains to the City's WWTF. The lift station is connected by radio to the City's SCADA system. The 31st Street Lift Station has a hookup for a temporary generator. The City is alerted when power is out by the SCADA system, and operators generally pump this out once or twice in 24 hours.

Island Vista Lift Station

Island Vista Lift Station

The Island Vista Lift Station is located at 112 Vista Boulevard, was constructed in 1985, and was upgraded in 2004. This submersible station collects wastewater and pumps it through the gravity collection system to the WWTF. The lift station consists of two Flygt submersible pumps that are each 6.5 hp with 100 gpm capacity. The lift station is connected by radio to the City's SCADA system. This lift station has a hookup for a temporary generator. The City is alerted when power is out by the SCADA system, and operators generally pump this out once or twice in 24 hours.

Point Hudson Lift Station

Originally constructed in 1967, the Point Hudson Lift Station was most recently upgraded in 1988. The Point Hudson Lift Station collects wastewater that is conveyed to the Monroe Street Lift Station before flowing to the Gaines Street Lift Station and ultimately, the City's WWTF. This submersible lift station has two 1.5 hp Peabody Barnes pumps that have a capacity of 150 gpm each. This lift station is not connected to the City's SCADA system. The Point Hudson Lift Station has a hookup for a temporary generator. The City is alerted when power is out by the SCADA system, and operators generally pump this out once or twice in 24 hours.

Point Hudson Lift Station

Hamilton Heights Lift Station

The Hamilton Heights Lift Station is located near 2500 Howard Street and was constructed in 1997. This submersible lift station consists of two 10 hp FairBanks Morse pumps and has a design capacity of 250 gpm. Wastewater from this lift station is conveyed through a 6-inch force main before flowing by gravity main to the City's WWTF. The lift station is connected by radio to the City's SCADA system. The Hamilton Heights Lift Station has a permanent backup generator.

Hamilton Heights Lift Station

Low Pressure Sewer Systems

The City has permitted a small number of low pressure sewers over the last 20 years. Low pressure sewers consist of a private single pump lift station located at a residential structure with a small force main that ultimately connects to gravity sewer. Often, multiple private pumps will discharge into a shared private force main as illustrated in the schematic that follows.

Low Pressure Sewer System Schematic. Image credit: Environmental One website.

Historically, the City has only allowed low pressure sewers if they were entirely privately maintained, including the force main. The City generally discouraged this approach to sewer service as technology was still under scrutiny and private ownership of pump stations was considered problematic due to pump failures and the inability to quickly fix the problem. Failure of private pumps also leads to sewer overflows. Many cities have not taken on ownership of these private pumps due to the massive impact on city maintenance costs given the pumps were considered unreliable.

The technology and reliability of low pressure sewer pump systems has improved considerably and now failures of the pump systems are rare. Many municipalities are now embracing the application of low pressure sewers in areas that are hard to serve due to undulating topography where gravity sewer is not feasible.

This GSP suggests there are areas within the City that would benefit greatly from the installation of low pressure sewer pump systems. Recommended standards for low pressure sewers are included in **Chapter 5**.

Wastewater Treatment and Disposal Facilities

Existing System

The City's WWTF is located just west of Fort Worden in the North Beach neighborhood. The WWTF was originally constructed in 1967 and provided only primary treatment and disinfection using chlorine gas. The facility was expanded in 1993 to provide secondary treatment.

WWTF Oxidation Ditches

Raw wastewater enters the WWTF from two gravity sewers, and an influent pump station lifts the wastewater to the headworks. Within the headworks, a bar screen removes rags and floating debris, and then a grit classifier settles out the sand and heavy materials. The flow rate of the screened and de-gritted influent is measured in a Parshall flume and the liquid then flows to the oxidation ditches. In the oxidation ditches, surface mixers stir air into the liquid, promoting the growth of microbiological cultures that consume the biochemical oxygen demand (BOD) in the mixture and form a solution known as mixed liquor. The mixed liquor flows to the secondary clarifier, where the biological solids settle out. The clarified effluent flows to the chlorination basins, where it is chlorinated using liquid sodium hypochlorite. Effluent is retained in the chlorine contact chambers for at least 20 minutes to ensure complete disinfection.

WWTF Chlorine Pumping Room

The biological solids (liquid sludge) produced during secondary clarification are pumped to the small aerobic digesters for a short stabilization period. The liquid sludge is then pumped to the control building, where it is blended with polymer and dewatered using a belt filter press.

Treated Wastewater Discharge and Solids Handling

Wastewater from the City's sewer system is processed at the WWTF, resulting in treated water and digested sludge. The treated effluent is dechlorinated using liquid sodium bisulfite and discharged to the Strait of Juan de Fuca via a 2,300-foot-long, 18-inch-diameter pipeline and outfall ending 700 feet offshore.

The dewatered sludge is loaded into a truck and hauled to the City's Compost Facility at the Jefferson County Waste Management Facility site. Sludge from the WWTF is composted at the facility in combination with dewatered septage, yard waste, and other wood wastes. Liquids from the process and a portion of the County's septage hauling are treated in a sequencing batch reactor and constructed wetlands and discharged to infiltration basins for additional treatment and ultimate disposal.

DISCHARGE AND DISPOSAL REGULATIONS AND PERMITS

WWTF NPDES Permit and Regulations

Wastewater flow and loading into the City's WWTF and treated plant effluent water discharged to the Strait of Juan de Fuca in Puget Sound are regulated through the City's National Pollutant Discharge Elimination System (NPDES) Permit.

The federal Clean Water Act (CWA, 1972, and later modifications, 1977, 1981, and 1987) established water quality goals for the navigable (surface) waters of the United States: "The objective of the CWA is the restoration and maintenance of the chemical, physical, and biological integrity of the country's water." The CWA grants individual authority to each state to define the water quality standards (within the limits set by the water quality goals) within its jurisdiction and enforce them. Water quality standards for surface waters in Washington State have been established (Chapter 173-201A WAC) and are enforced by Ecology (Chapter 90.48 Revised Code of Washington (RCW)). The purpose of the water quality standards is to provide "public health and public enjoyment of the waters and the propagation and protection of fish, shellfish, and wildlife." Each surface water in the state is identified as fresh water or marine water and designated for one or more uses, which then determines the specific water quality standards that apply to that water.

The state also has established a permit program for implementation of the NPDES Permit Program created by the CWA. The program requires a discharge permit for any point source, such as a domestic wastewater treatment plant, and discharge of pollutants to surface waters of the state for the purpose of maintaining the water quality standards. Each permit is renewed on roughly a 5-year cycle. The permit and accompanying fact sheet include information on discharge limits, monitoring schedules, and general and special conditions that apply to the applicable point source.

The City's current NPDES Permit (Permit No. WA0037052) has an effective date of December 1, 2015, and expired on November 30, 2020. The WWTF continues to operate under this permit as Ecology is currently reviewing and has not issued a revised NPDES permit since the expiration date. Copies of the permit and accompanying fact sheet are included as **Appendix C**.

Facility Design Criteria

The permitted facility flow and loading design criteria for the WWTF are included in **Table 2-8**.

Table 2-8

WWTF Permitted Flow and Loading Design Criteria

Parameter	Design Quantity
Maximum Month Design Flow (MMDF)	2.05 MGD
Annual Average Flow	1.44 MGD
BOD_5 Influent Loading for Maximum Month	3,754 ppd
TSS Influent Loading for Maximum Month	4,568 ppd
Design Population	12,000

MGD = million gallons per day

ppd = pounds per day

Effluent Limits

Treated plant effluent water is discharged to the Strait of Juan de Fuca through a piped outfall, which is designated as Outfall No. 001 in the NPDES Permit. The effluent limits for Outfall No. 001 are summarized in **Table 2-9**.

Table 2-9

NPDES Permit Effluent Limits

Parameter	Average Monthly	Average Weekly
Biochemical Oxygen Demand (5-Day) (BOD_5)	30 mg/L 513 ppd 85% removal of influent BOD_5	45 mg/L 769 ppd
Total Suspended Solids (TSS)	30 mg/L 513 ppd 85% removal of influent TSS	45 mg/L 769 ppd
Total Residual Chlorine	0.5 mg/L	0.75 mg/L
Parameter	**Minimum**	**Maximum**
pH	6.0 standard units	9.0 standard units
Parameter	**Monthly Geometric Mean**	**Weekly Geometric Mean**
Fecal Coliform Bacteria	200/100 mL	400/100 mL

mg/L = milligrams per liter

mL = milliliters

Future City NPDES Permit Effluent Limits (Outfall No. 001) Changes

Ecology can change water quality standards or NPDES Permit effluent limits (the latter for the purpose of maintaining water quality standards). Known future changes to water quality standards and NPDES Permit effluent limits that are applicable to Outfall No. 001 at the WWTF are summarized in this section.

Bacterial Indicator Effluent Limits

The receiving water of the Strait of Juan de Fuca at Outfall No. 001 is designated for Primary Contact Recreational Use (WAC 173-201A-612, Table 612). To protect water contact recreation in marine water, such as the receiving water, bacterial indicator criteria (standards) are defined (WAC 173-201A-210(3)(b)). Ecology is reviewing adding an *E. coli* standard in future permits.

The *E. coli* and fecal coliform bacterial indicator criteria are both defined in the current version of WAC 173-201A-210(3)(b).

The City's NPDES Permit has a fecal coliform bacteria effluent limit for Outfall No. 001. An *E. coli* bacteria effluent limit for Outfall No. 001 will be evaluated and further monitoring will be required when the permit is renewed. As Ecology continues to review, the current fecal coliform bacteria effluent limit will remain effective.

Other Regulations and Required Permits

WWTF Puget Sound Nutrient General Permit

Section 303(d) of the CWA establishes a process to identify and clean up surface waters that do not meet the applicable water quality standards. Every few years, Ecology performs a water quality assessment using collected data to determine whether water quality of the surface waters meets the standards. Based on the assessment, each surface water is placed into one of five categories that describes the status of the water quality and ranges from meeting the standards (Category 1) to impaired (i.e. polluted) and requiring a water improvement project (Category 5). Surface waters placed into Category 5 are listed on the state's 303(d) list of polluted waters, which is named after the referenced section of the CWA.

At certain times of the year, dissolved oxygen levels in a large number of locations throughout Puget Sound do not meet the applicable water quality standards, and in many other locations show evidence of not meeting the standards in the future. The surface waters within Puget Sound that are not meeting the dissolved oxygen standards are listed in the state's 303(d) list. Ecology initiated the Puget Sound Nutrient Reduction Project (Project) in the spring of 2017 to address the problem of human sources of nutrients contributing to the low and decreasing dissolved oxygen levels throughout Puget Sound. As a result of modeling, Ecology believes discharges of nutrients to Puget Sound from domestic wastewater treatment plants are significantly contributing to the problem. The goal of the Project is to develop a nutrient source reduction strategy, which includes reducing nutrient levels discharged from domestic wastewater treatment plants.

Ecology has been utilizing a model of Puget Sound to understand the problem and simulate potential improvements. Ecology has identified nitrogen as the limiting nutrient, with inorganic nitrogen, consisting of nitrate-nitrite and ammonia, as the "biologically available" form. Ecology is performing additional modeling for optimization scenarios; however, results from completed modeling are being used to determine effluent nitrogen permit limits for domestic wastewater treatment plants with outfalls to Puget Sound (identified as marine sources), which includes the City's WWTF. Individual NPDES permits for the same treatment plants will continue independently of, but in conjunction with, the general permit and may be modified as necessary to include facility-specific nutrient-related requirements.

In January 2021, Ecology released a preliminary draft of the Puget Sound Nutrient General Permit (PSNGP) for public comment. The public comment period ended on March 15, 2021, and Ecology has proceeded with developing a formal version, which became effective January 1, 2022, and expires December 31, 2026. Copies of the final PSNGP (Permit No. WAG994538) and accompanying fact sheet are included as **Appendix D**. The following descriptions summarize the final PSNGP, including anticipated permit limits specific to the City's WWTF.

Notice of Intent

The City has filed a Notice of Intent for coverage under the PSNGP and will submit Discharge Monitoring Reports (DMRs) as required by the permit and as discussed as follows.

Nitrogen Optimization Requirements

The City must submit an annual Nitrogen Optimization Plan (NOP) to Ecology no later than March 31, 2026, as defined in the PSNGP. Optimization refers to short-term actions (low-cost controls and process changes) focused on improving existing performance. Optimization processes do not include large scale capital investments. The City must begin optimization immediately upon coverage under the PSNGP.

The NOP must include the following components:

1. Treatment Process Performance Assessment

   Assess the nitrogen removal potential of the current treatment process and have the ability to evaluate optimization strategies prior to implementation.

   a. Evaluation. Develop a treatment process assessment method for the purposes of evaluating optimization approaches during the permit term. This will include an evaluation of current (pre-optimization) process performance to determine the empirical Total Inorganic Nitrogen (TIN) removal rate for the WWTF. The assessment must include an evaluation of possible optimization strategies at the WWTF prior to and after implementation. Determine the optimization goal for the WWTF and develop a list of optimization strategies capable of achieving the optimization goal for the WWTF. Update this list as necessary to continuously maintain a selection of strategies for achieving each optimization goal identified. Any optimization strategy may be excluded from the initial selection if it is found to exceed a reasonable implementation cost or timeframe. Documentation must be provided that includes an explanation of the rationale and financial criteria used for the exclusion determination.

   b. Initial Selection. Identify the optimization strategy selected for implementation. Document the expected percentage of TIN removal (or the expected reduction in effluent load) for the optimization strategy prior to implementation.

2. Optimization Implementation

   The City must document implementation of the selected optimization strategy, which includes the following:

   a. Strategy Implementation. Describe how the selected strategy was implemented during the reporting period, initial implementation costs, length of time to implement (including start date), anticipated and unanticipated challenges, and impacts to the overall treatment performance due to optimization process changes.

b. Load Evaluation. The City must review effluent data collected during the reporting period to determine whether TIN loads are increasing. This includes using all accredited monitoring data to determine the WWTF's annual average TIN concentration and load for each year during the reporting period. The City also must determine the WWTF's TIN removal rate at the end of each year and compare it with the pre-optimization rate previously identified.

c. Strategy Assessment. The City must quantify the results of the implemented strategy and compare them to the expected percentage of TIN removal previously identified. If the TIN loading increased, apply adaptive management, and re-evaluate the optimization strategies and the resulting performance to identify the reason. From this, select a new optimization strategy or revise the implementation for better performance. Document any updates to the implementation schedule and overall plan.

3. Influent Nitrogen Reduction Measures/Source Control

The City must investigate opportunities to reduce influent TIN loads from septage handling practices, commercial, dense residential, and industrial sources and submit documentation with the Annual Report. This includes the following:

a. Review non-residential sources of nitrogen and identify any possible pretreatment opportunities.

b. Identify strategies for reducing TIN from new multi-family/dense residential developments and commercial buildings.

AKART Analysis

Under the PSNGP, all permittees classified as Small Loaders must prepare and submit an approvable all known, available, and reasonable treatment (AKART) analysis to Ecology for the purposes of evaluating reasonable treatment alternatives capable of reducing TIN. Permittees that maintain an annual TIN average of less than 10 milligrams per liter (mg/L) and do not document an increase in load through their DMRs are excluded from this requirement and do not have to submit this analysis.

Monitoring Requirements

The PSNGP will create additional monitoring requirements for the City. These requirements do not replace any requirements stipulated in the City's NPDES Permit. The City will need to comply with both permits separately. Recorded monitoring data should be submitted monthly on the electronic DMR form provided by Ecology within the Water Quality Permitting Portal. The City may use the monitoring locations identified in the NPDES Permit to collect samples for the PSNGP, but must still prepare two separate monthly DMR submittals (one for each permit). Samples must be representative of the flow and characteristics of the discharge, and sampling is not required outside of normal working hours or during unsafe conditions. For each sample taken, the City must record the sample date and time, location, method of sampling, and individual who performed the sampling. The City must use appropriate flow measurement and methods consistent with accepted scientific practices, including proper installation, calibration, and maintenance of all measurement devices. A summary of the anticipated monitoring requirements under the PSNGP and a comparison to the City's NPDES Permit can be found in **Tables 2-10** and **2-11**.

Table 2-10

Comparison of City NPDES Permit and PSNGP Monitoring Requirements for WWTF Influent

Parameter	Units and Specification	Minimum Sampling Frequency (NPDES)	Minimum Sampling Frequency (PSNGP)	Sample Type
Flow	MGD	Continuous	-	Metered/Recorded
BOD_5	mg/L	1/week	-	24-Hour Composite
BOD_5	ppd	1/week	-	Calculated
TSS	mg/L	1/week	-	24-Hour Composite
TSS	ppd	1/week	-	Calculated
$CBOD_5$	mg/L	-	2/month	24-Hour Composite
Total Ammonia	mg/L as N	-	2/month	24-Hour Composite
Nitrate plus Nitrite	mg/L as N	-	1/month	24-Hour Composite
Total Kjeldahl Nitrogen	mg/L as N	-	1/month	24-Hour Composite

Table 2-11

Comparison of City NPDES Permit and PSNGP Monitoring Requirements for WWTF Effluent

Parameter	Units and Specification	Minimum Sampling Frequency (NPDES)	Minimum Sampling Frequency (PSNGP)	Sample Type
Flow	MGD	-	2/month	Metered/Recorded
BOD_5	mg/L	1/week	-	24-Hour Composite
BOD_5	ppd	1/week	-	Calculated
BOD_5	% removal	1/week	-	Calculated
TSS	mg/L	1/week	-	24-Hour Composite
TSS	ppd	1/week	-	Calculated
TSS	% removal	1/week	-	Calculated
Chlorine (Total Residual)	mg/L	1/week	-	Grab
Fecal Coliform	#/100 ml	1/week	-	Grab
pH	Standard Units	1/day	-	Grab
$CBOD_5$	mg/L	-	2/month	24-Hour Composite
Total Organic Carbon	mg/L	-	1/quarter	24-Hour Composite
Total Ammonia	mg/L as N	-	2/month	24-Hour Composite
Nitrate plus Nitrite	mg/L as N	-	2/month	24-Hour Composite
Total Kjeldahl Nitrogen	mg/L as N	-	1/month	24-Hour Composite
Total Inorganic Nitrogen (TIN)	mg/L as N	-	2/month	Calculated
TIN	ppd	-	2/month	Calculated
Average Monthly TIN	lbs	-	1/month	Calculated
Annual TIN, year to date	lbs	-	1/month	Calculated

The City must submit monthly monitoring data using Ecology's WQWebDMR program by the 15^{th} day of the following month. Any pollutant monitoring data collected more frequently than the permit stipulates must be used in calculations and submitted in the DMR.

After 12 months of monitoring, the City may request a reduction in sampling frequency from Ecology if it can demonstrate that the distribution of concentrations can be accurately represented with a lower sampling frequency.

Additional Requirements

The City must retain records of monitoring information or documentation pertaining to permit requirements for a minimum of 5 years following termination of permit coverage. If the City is unable to comply with the conditions of the permit, it must notify Ecology within 24 hours and submit a written report to Ecology via the WQWebPortal within 5 days describing the noncompliance event and duration, and how steps will be taken to correct it. The City must keep the following documentation onsite or within reasonable access to the site: Permit Coverage Letter, PSNGP, DMRs, and attachments to the NOP.

Compost Facility Regulations for Biosolids

Chapter 173-308 WAC is the basis for the state-wide biosolids management program. Facilities that are subject to the permit program apply for coverage under the existing state-wide general permit. The state biosolids program regulates facilities that produce, treat, or land apply sewage sludge or biosolids for beneficial use. The City's Compost Facility is covered under the general permit to produce Class A biosolids as defined in the federal 40 CFR 503 regulations.

Biosolids quality is measured using three parameters: pathogen reduction, vector attraction reduction, and pollutant concentration. Pathogen reduction uses accepted treatment processes or requires measurement of pathogen concentration to determine compliance. To receive classification as Class A, biosolids must go through a rigorous process called a Process to Further Reduce Pathogens. This reduces pathogens below detectable limits. Operators must test all Class A biosolids for pathogens and indicator organisms.

Vector attraction is related to odor control and can be thought of as the appeal that the biosolids present to organisms (e.g., flies) that may transmit pathogens, if pathogens were present in the biosolids. Reduction of vector attraction can be achieved through lime stabilization, reducing volatile solids content, or physical mixing processes.

Pollutant concentration refers to the pollutant limits established in WAC 173-308-160. This sets a ceiling concentration limit for each pollutant, meaning the maximum allowable concentration in biosolids. It also lists the pollutant concentration limit, which is lower than the ceiling limit. Biosolids with pollutants above the pollutant concentration limit are subject to cumulative loading limits on application sites.

The City's existing solids handling system is discussed in **Chapter 7**. Proposed solids handling improvements are discussed in **Chapter 8**.

Compost Facility State Waste Discharge Permit

The City's Compost Facility contains a Sequencing Batch Reactor (SBR) that treats liquids from the composting process and also a portion of the County's septage hauling and discharges to constructed wetlands and then infiltration basins for further treatment and disposal. The Compost Facility's WWTF is covered under the State Waste Discharge Permit (SWDP), which regulates the flow and loading of the SBR and adjacent wetlands. The City's current SWDP (Permit No. ST 6127) has an effective date of July 1, 2019, and expires on June 30, 2024. Copies of the permit and accompanying fact sheet are included as **Appendix E**.

Facility Design Criteria

The permitted flow and loading design criteria for the Compost Facility are included in **Table 2-12**.

Table 2-12

Compost Facility Flow and Loading Design Criteria

Parameter	Design Quantity
Maximum Month Design Flow (MMDF)	4,000 gpd
Daly Maximum Flow	6,200 gpd

gpd = gallons per day

Effluent Limits

SBR effluent water is discharged to infiltration basins, designated as wetlands in the SWDP, west of the Compost Facility. The effluent limits for the SBR and wetland influent and effluent are summarized in **Tables 2-13** and **2-14**.

Table 2-13

State Waste Discharge Permit SBR Effluent Limits

Parameter	Average Monthly	Average Weekly
BOD_5	30 mg/L 1 ppd 85% removal of influent BOD_5	45 mg/L 1.5 ppd
TSS	30 mg/L 1 ppd 85% removal of influent TSS	45 mg/L 1.5 ppd
Parameter	**Minimum**	**Maximum**
pH	6.0 standard units	9.0 standard units

Table 2-14

State Waste Discharge Permit Wetland Effluent Limits

Effluent Limits: Wetland Influent		
Parameter	**Monthly Geometric Mean**	**7-Day Geometric Mean**
Fecal Coliform	200 col/100 mL	400 col/10 mL
Parameter	**Average Monthly**	**Average Weekly**
Total Residual Chlorine	0.5 mg/L	0.75 mg/L
Effluent Limits: Wetland Effluent		
Parameter	**Average Monthly**	**Average Weekly**
Nitrate	10 mg/L as N	-

ADJACENT SEWER SYSTEMS

There are no municipal sewer service systems adjacent to the City. The closest wastewater treatment plant to the City is the Port Townsend Paper Corporation just south of the City limits.

The surrounding areas of unincorporated Jefferson County do not have sewer service, and wastewater is managed with on-site septic systems, community drain fields, or alternative sewage treatment technologies. However, the County is in the process of constructing a sewer plant and collection system in Hadlock that will allow for conversion of existing septic systems to public sewer and growth of housing and businesses within the Hadlock UGA.

Figure 2-6 shows the wastewater treatment facilities within 20 miles of the City.

CITY OF PORT TOWNSEND AND ADJACENT WATER SYSTEMS

City of Port Townsend

The City’s existing retail water service area, which covers an area of approximately 11.2 square miles, is shown on **Figure 2-7** The existing retail service area includes the current City limits and adjacent lands to the west and south of the City limits.

This section provides a brief description of the existing water system and the current operation of the facilities. The water service area, facilities, and supply sources are shown in **Figure 2-7**. Water is supplied to the City’s system by the Big Quilcene and Little Quilcene Rivers.

The City's wastewater facilities are all separated from major drinking water facilities for the City and adjacent drinking water purveyors. As a result of this separation, the City's wastewater facilities are unlikely to conflict with or impact the drinking water facilities or supplies for the City or neighboring purveyors.

Pressure Zones

The City divides the water system into two different pressure zones, the “High Zone” and the “Low Zone.” Prior to 1998, the City was served from a single pressure zone (the Low Zone). Service pressures ranged from above 130 pounds per square inch (psi) near the shoreline of Puget Sound to less than 20 psi at the higher elevations within the service area. To increase system pressures, the City installed a new, taller storage tank, which provides higher service pressures in areas of the City with higher elevations, creating the initial phase of the High Zone. The High Zone serves areas generally above 210 feet of elevation, resulting in a typical High Zone pressure range of 35 psi to 70 psi (although there are localized areas over 70 psi). The City expanded the extent of the High Zone to adjacent northwest areas of similarly higher elevation in 2004 to ensure service pressures in that area were maintained above the Washington State Department of Health minimum criterion of 30 psi. The revised Low Zone pressure range is typically from about 50 psi to above 130 psi, but there are localized areas under 50 psi.

Supply Facilities

Introduction

The City water system is supplied by surface water from the Big Quilcene and Little Quilcene Rivers, which are located approximately 30 and 20 miles south of the City, respectively. The diversions at the Little Quilcene and Big Quilcene Rivers provide flow to Lords Lake and to City Lake, which are both man-made impoundments. The headwaters of each river originate within the Olympic National Forest and Olympic National Park. The U.S. Forest Service manages most of the municipal watershed and the City has a good working relationship with them. The Big Quilcene River is the primary water supply for the City. Water from the Little Quilcene River diversion is used to fill Lords Lake, which has a capacity of approximately 500 million gallons (MG). Lords Lake also can be filled from the Big Quilcene Diversion. The City's surface water supplies are high quality and generally very low in turbidity. When the Big and Little Quilcene Rivers experience high turbidity events, the City and the Port Townsend Paper Corporation use water stored in Lords Lake or City Lake. The entire system operates by gravity from both of the diversions, to Lords Lake, City Lake, and the City. City Lake functions as a raw water equalizing reservoir with approximately 140 MG of storage.

Water Treatment

Prior to treatment, water from City Lake flows through two sets of mesh screen, which prevents objects larger than $^{3}/_{32}$ inch from entering the Olympic Gravity Water System pipeline below City Lake. The new water treatment facility (WTF), completed in 2017, is located adjacent to the City's existing water storage tanks. The WTF has the following features:

- Raw water flow and pressure control valves.
- Mechanical micro-screens for removing algae and larger-sized sediment.
- Pressure ultrafiltration membranes for the removal of microbial pathogens (*Giardia* and *cryptosporidium*), sediment, and semi-colloidal particles.
- Sodium hypochlorite feed to provide primary disinfection and a chlorine residual in the finished water throughout the distribution system.
- Potassium permanganate injection system for treatment of algal toxins in the event toxins are detected in the raw water supply.
- Automated control system.
- Standby power generator.

Pump Station Facilities

The City's water system has two booster pump station (BPS) facilities. The Morgan Hill BPS, constructed in 2004, has two domestic flow pumps (one service, one standby), three high flow pumps (two service, one standby), and emergency power (**Table 2-15**). The BPS serves a closed distribution system with 2,000 gallons of storage via a hydro-pneumatic tank on top of the hill. The second BPS is located at the WTF and pumps water into the High Zone and 1 MG Standpipe reservoir.

Table 2-15

Booster Pump Station Facilities Summary

Facility	Year Constructed	Description/Size	Capacity
Morgan Hill BPS	2004	Domestic Flow Pumps High Flow Pumps	(2) 100 gpm (3) 550 gpm
WTF BPS	2017	Domestic Flow Pumps Low Flow Pump[1]	(2) 2,100 gpm (1) 450 gpm

1. Used to boost Low Zone pressure to serve the High Zone when the 1 MG Standpipe is offline for service.

Storage Facilities

The City's water system has two facilities that provide storage to the water system (**Table 2-16**). A 37-foot-tall, 160-foot-diameter 5 MG prestressed concrete reservoir serves the City's low elevation zone, and an 84-foot-tall, 47-foot-diameter 1 MG steel standpipe serves the City's high elevation zone. Both reservoirs have baffles to increase the contact time (CT) in the reservoir in order to meet CT requirements.

Table 2-16

Storage Facilities Summary

Facility	Year Constructed	Description/Size	Capacity	Construction Materials
5 MG Reservoir	2017	37 Feet Tall 160 Feet Diameter	5 MG	Concrete
1 MG Standpipe	1994	84 Feet Tall 47 Feet Diameter	1 MG	Steel

Distribution and Transmission System

The City's water system contains approximately 110 miles of water main ranging in size from 2 inches to 36 inches. Most of the water main (approximately 33 percent) within the system is 6 inches in diameter or less. Approximately 56 percent of the distribution system is constructed of AC pipe. The majority of the remainder of the piping system is constructed of PVC pipe. The City has complied with water quality testing requirements for asbestos in the water system, demonstrating that concentrations are below state and federal standards.

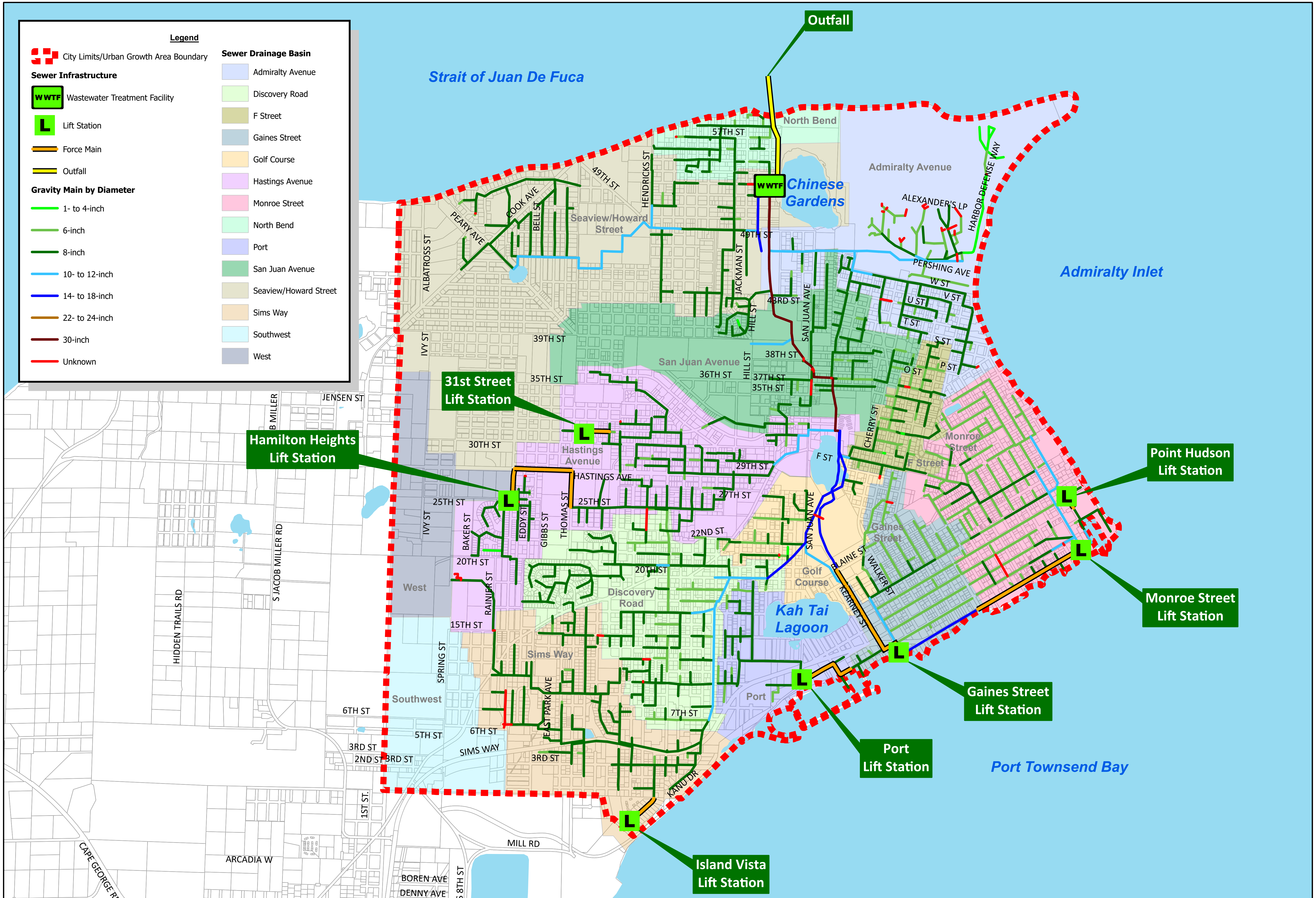
Water System Interties

Water system interties are physical connections between two adjacent water systems. Interties normally are separated by a closed isolation valve or control valve. Emergency supply interties provide water from one system to another during emergency situations only. An emergency situation may occur when a water system loses its main source of supply or a major transmission main, or during firefighting situations, and is unable to provide a sufficient quantity of water to its customers. Normal supply interties provide water from one system to another during non-emergency situations and are typically supplying water at all times.

The City does not have any interties with any adjacent water systems.

Adjacent Water Systems

The City's water service area is shown in **Figure 2-7**. Three water systems share a boundary with the City: Deaner Line, Jamie Kozelisky, and Quimper (Jefferson County Public Utility District (PUD) No.1). Other purveyors located on the Quimper Peninsula, but not sharing a boundary with the City, include Jefferson County PUD No. 1 Vandecar, Cape George, and Jefferson County PUD No. 1 Valiani.



Vicinity Map

Esri, HERE, Garmin, USGS, EPA, NPS

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COORDINATE SYSTEM: NAD 1983 HARN STATEPLANE WASHINGTON NORTH FIPS 4601 FEET
BY: LMOJARAB PLOT DATE: JAN 13, 2023
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Figure 2-1
Existing Sewer System
City of Port Townsend
General Sewer Plan

City of Port Townsend

1 inch : 2,000 Feet
0 1,000 2,000 Feet
DRAWING IS FULL SCALE WHEN BAR MEASURES 1"

RH2
NORTH

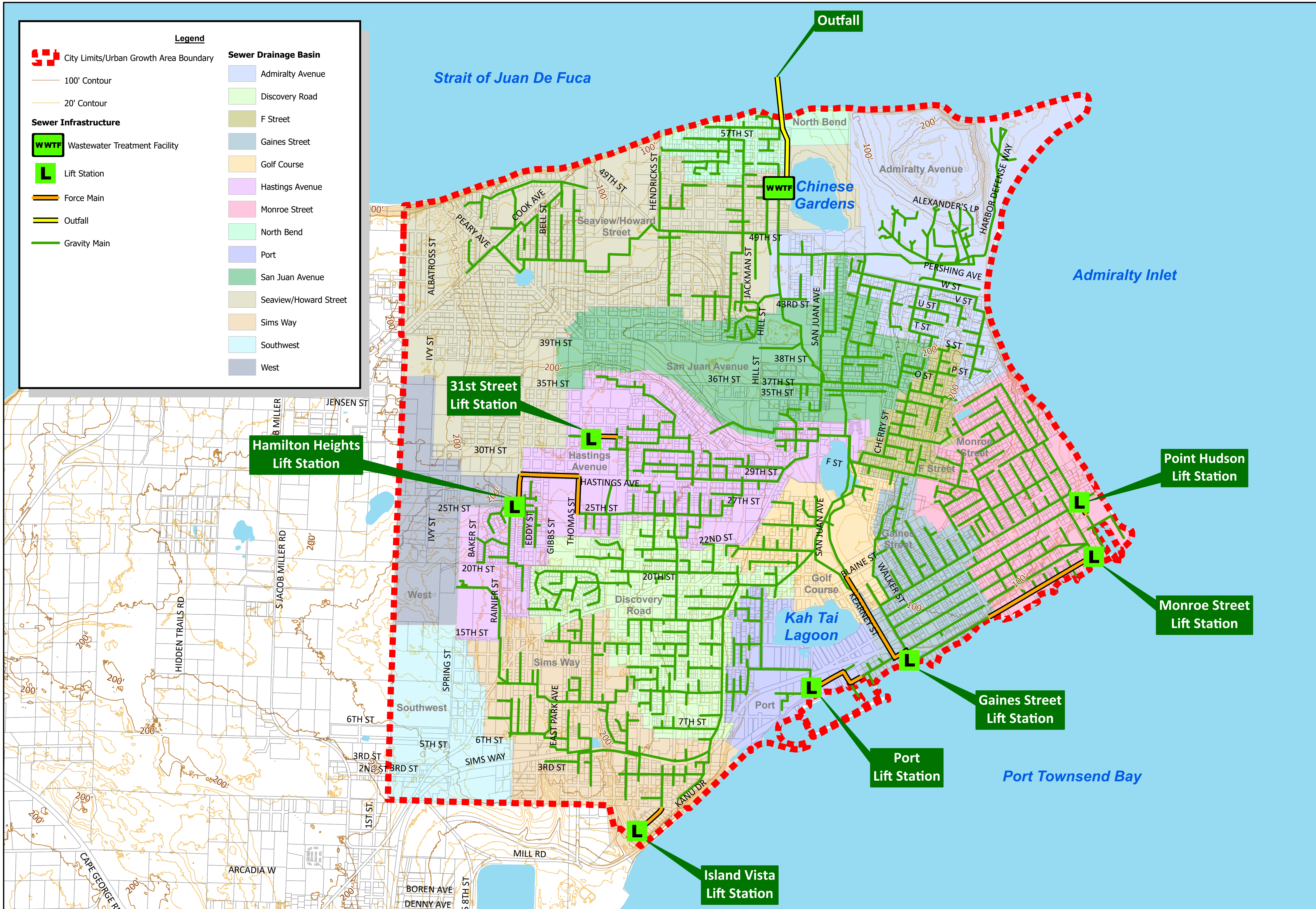

Figure 2-2
Sewer Drainage Basins
City of Port Townsend General Sewer Plan

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City of Port Townsend

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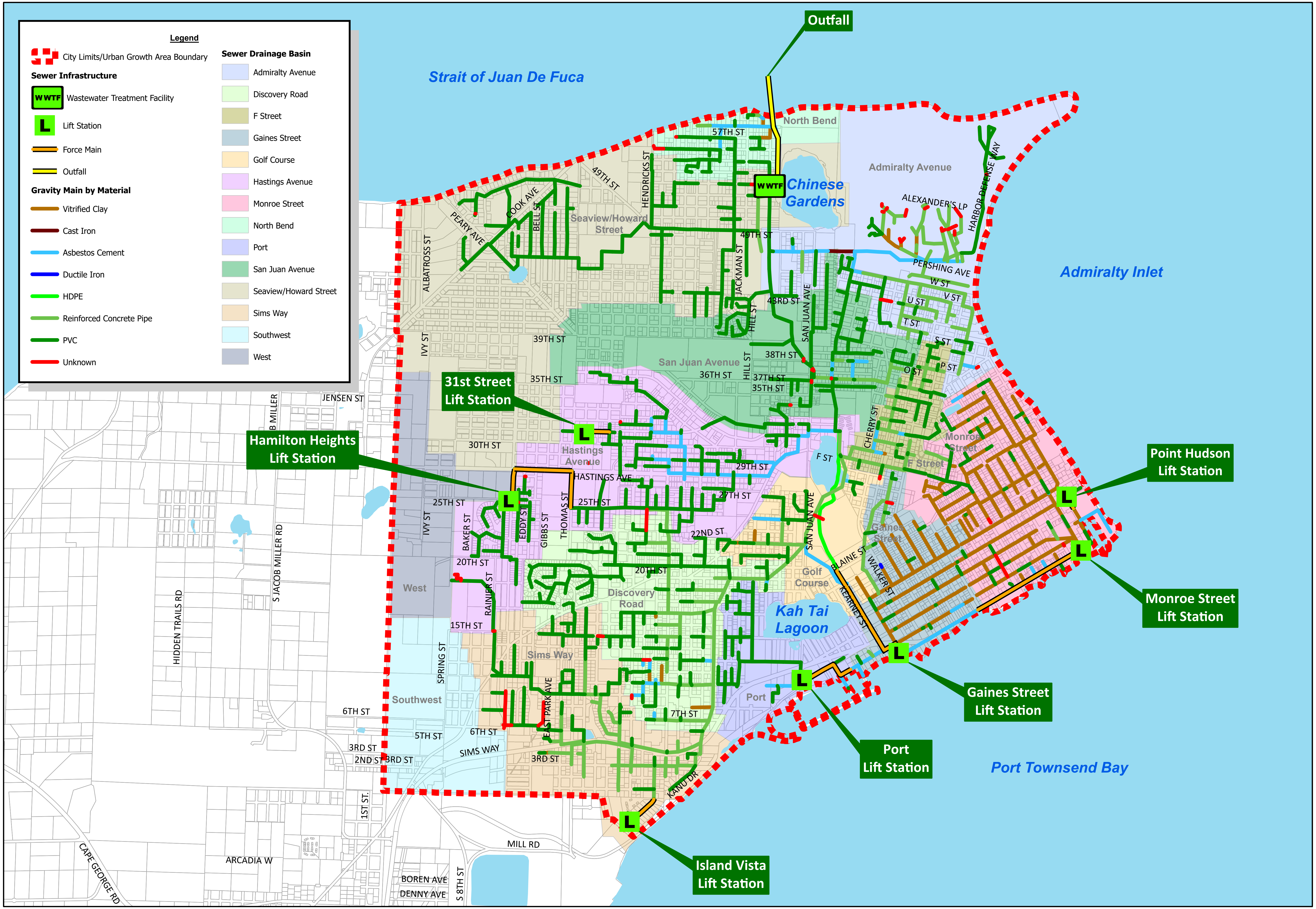

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Vicinity Map

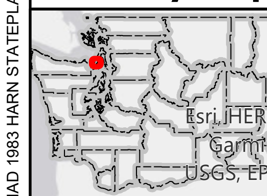

Figure 2-4
Pipe Material
City of Port Townsend General Sewer Plan

City of Port Townsend

1 inch : 2,000 Feet

0 1,000 2,000 Feet

DRAWING IS FULL SCALE WHEN BAR MEASURES 1"

RH2

NORTH

COORDINATE SYSTEM: NAD 1983 HARN STATEPLANE WASHINGTON NORTH FIPS 4601 FEET

BY: LMOJARAB PLOT DATE: JAN 13, 2023

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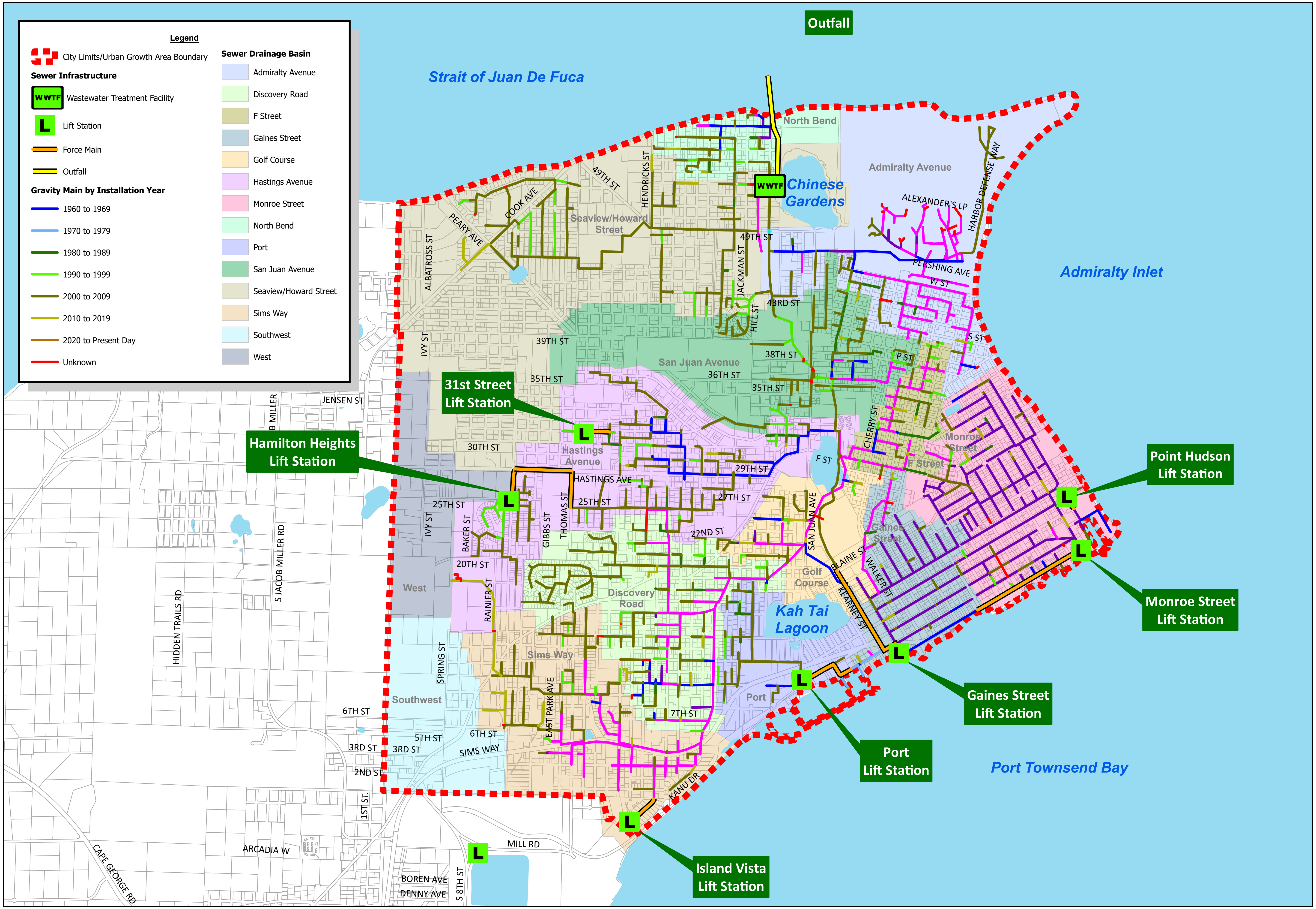

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Vicinity Map

COORDINATE SYSTEM: NAD 1983 HARN STATEPLANE WASHINGTON NORTH FIPS 4601 FEET

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Figure 2-5(a)
Known Pipe Age

City of Port Townsend
General Sewer Plan

City of Port Townsend

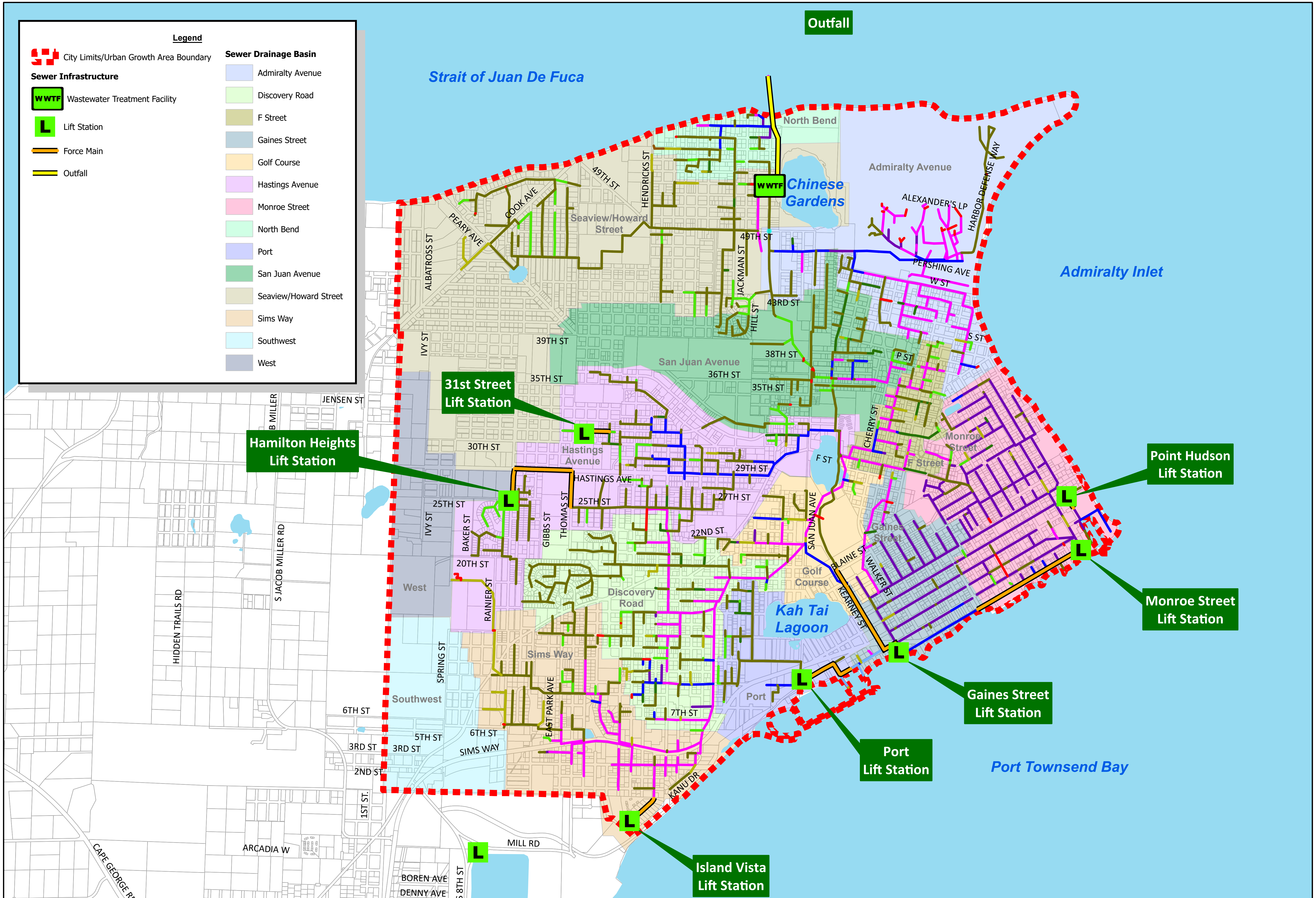
1 inch : 2,000 Feet

0 1,000 2,000 Feet

DRAWING IS FULL SCALE WHEN BAR MEASURES 1"

RH2

NORTH



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Vicinity Map

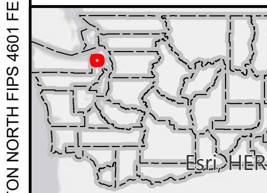

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Figure 2-5(b)
Assumed Pipe Age
City of Port Townsend General Sewer Plan

City of Port Townsend

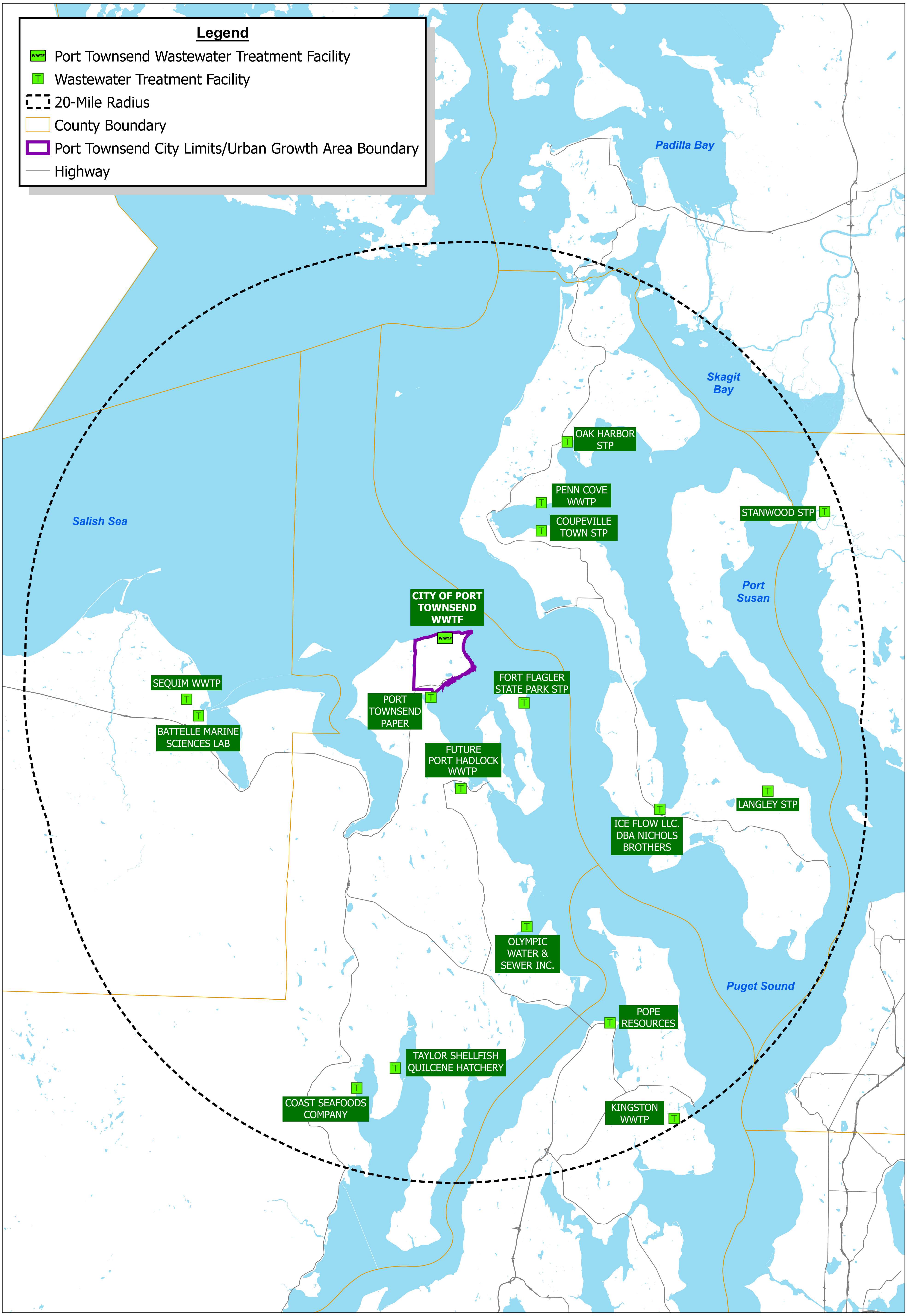
1 inch : 2,000 Feet

0 1,000 2,000 Feet

DRAWING IS FULL SCALE WHEN BAR MEASURES 1"

RH2

NORTH



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RH2

NORTH

1 inch : 12,000 Feet

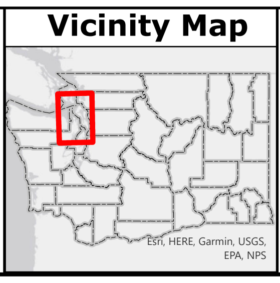
0 12,000 24,000 Feet

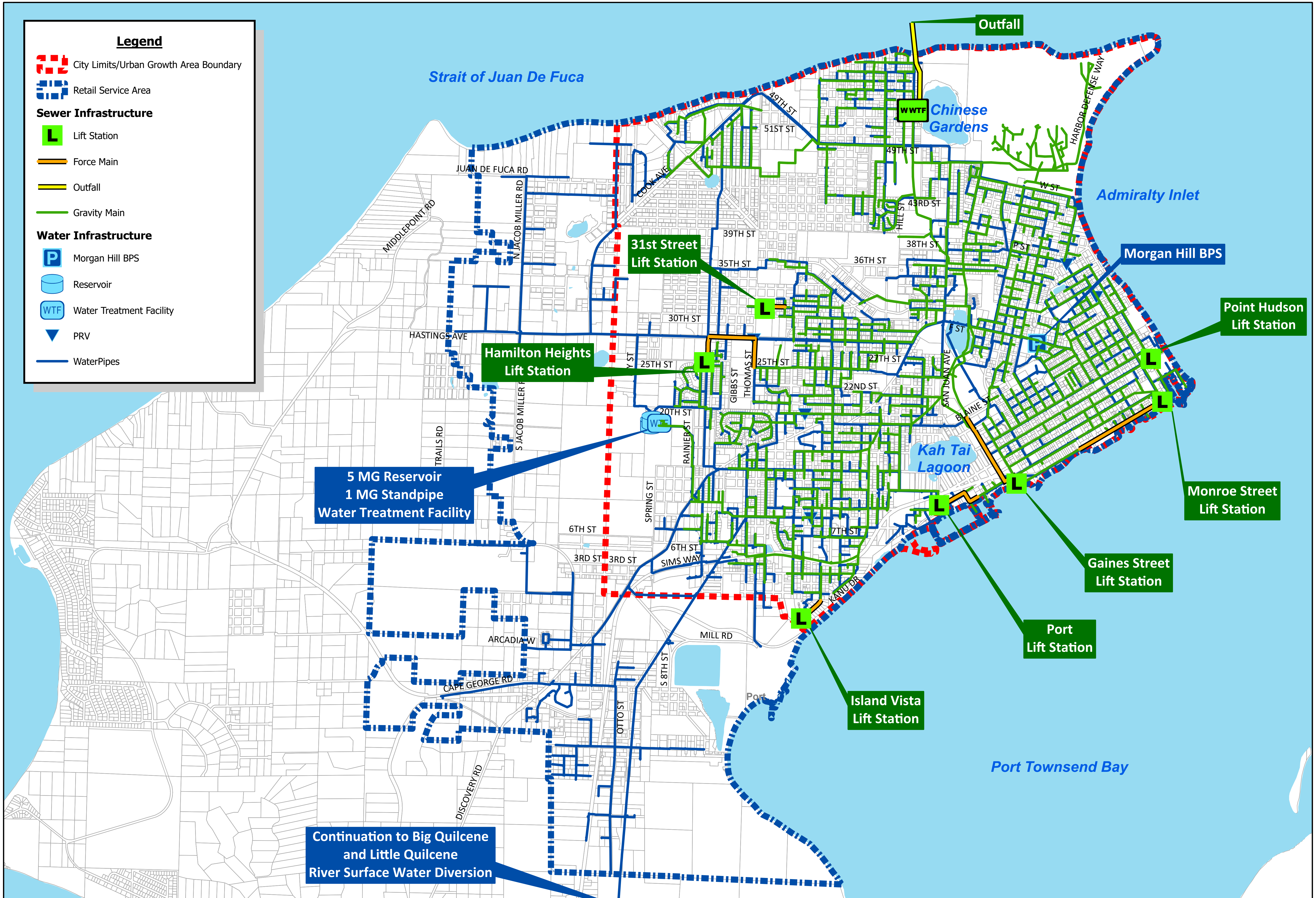
DRAWING IS FULL SCALE WHEN BAR MEASURES 2"

City of Port Townsend

Figure 2-6
WW Treatment Facilities in Vicinity
City of Port Townsend
General Sewer Plan

Vicinity Map





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Vicinity Map

Esri, HERE, Garmin, USGS, EPA, NPS

COORDINATE SYSTEM: NAD 1983 HARN STATEPLANE WASHINGTON NORTH FIPS 4601 FEET

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Figure 2-7
Existing Sewer and Water System

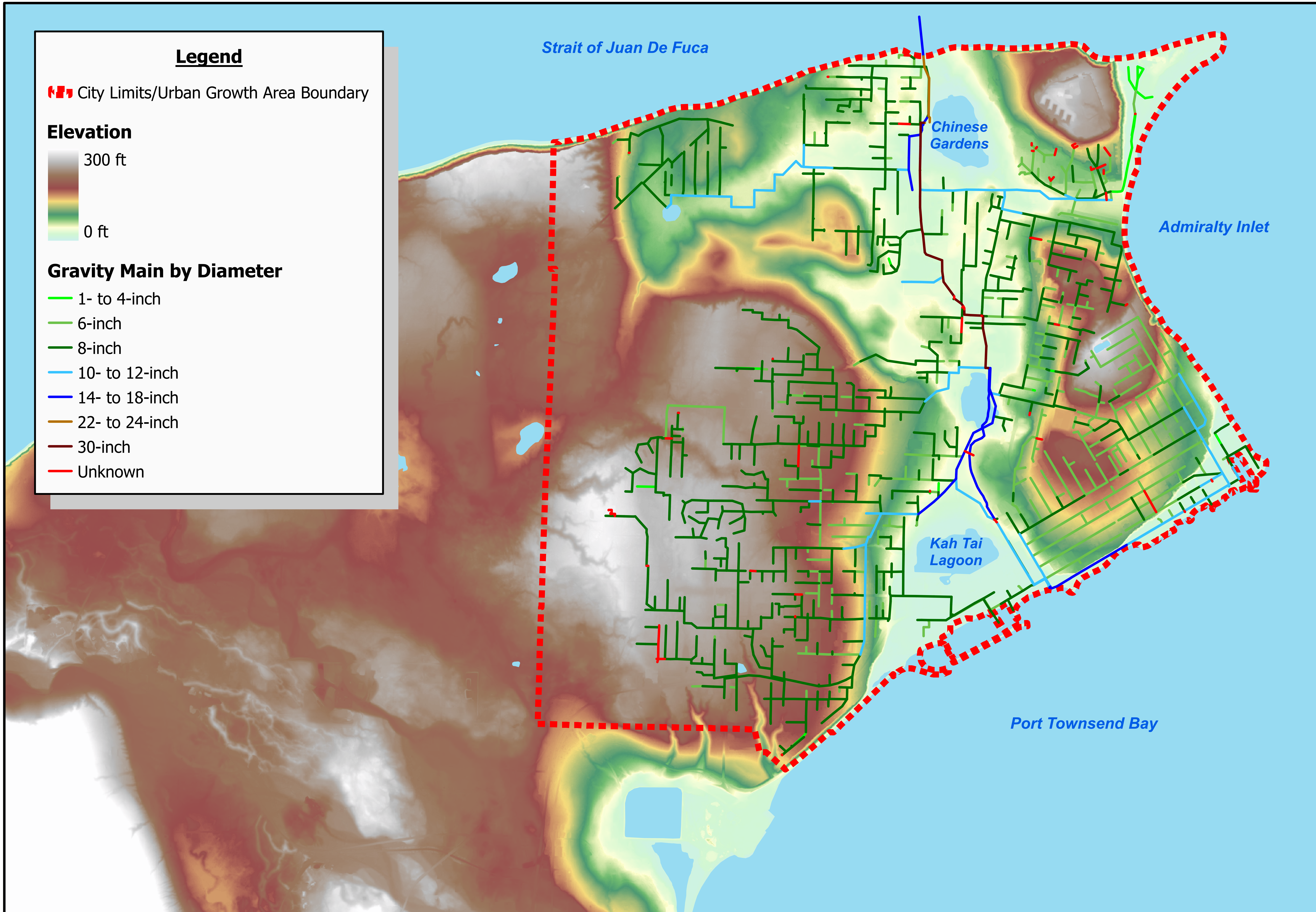
City of Port Townsend
General Sewer Plan

1 inch : 2,500 Feet

0 1,250 2,500 Feet

DRAWING IS FULL SCALE WHEN BAR MEASURES 1"

NORTH



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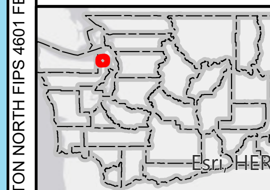

Figure 2-8

Topography Map

City of Port Townsend General Sewer Plan

City of Port Townsend

0 1,000 2,000 Feet

DRAWING IS FULL SCALE WHEN BAR MEASURES 1"

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NORTH

3 | LAND USE AND POPULATION

INTRODUCTION

The State of Washington Growth Management Act (GMA) requires, among other things, consistency between land use and utility plans and their implementation. This chapter demonstrates the compatibility of the City of Port Townsend's (City) General Sewer Plan (GSP) with other plans, identifies the designated land uses within the existing and future service area, and presents population projections within the City's planning area.

COMPATIBILITY WITH OTHER PLANS AND POLICIES

To ensure that the GSP is consistent with the land use policies that guide it and other related plans, the following planning documents were examined.

- State of Washington Growth Management Act
- *Port Townsend Comprehensive Plan*
- Jefferson County County-wide Planning Policies
- *Jefferson County Comprehensive Plan*

Growth Management Act

The State of Washington GMA of 1990 (and its multiple amendments) defined four goals relevant to this GSP:

1. Growth should be in urban areas;
2. There should be consistency between land use and utility plans and their implementation;
3. There should be concurrency of growth with public facilities and services; and
4. Critical areas should be designated and protected.

Urban Growth Area

The GMA requires that Jefferson County (County) designate an Urban Growth Area (UGA) where most future urban growth and development will be directed. The Countywide UGA is defined in the *Jefferson County Comprehensive Plan* and encompasses the area where this urban growth and development is projected to occur over the 20-year planning period. The current Jefferson County UGA boundaries in the vicinity of the City are shown on **Figure 3-1**.

Consistency

The GMA requires planning consistency from two perspectives. First, it requires the consistency of plans between jurisdictions. This means that plans and policies of the City and County must be consistent per Revised Code of Washington (RCW) 36.70A.100. Second, the GMA requires that the implementation of the GSP be consistent with comprehensive plans (RCW 36.70A.120).

Concurrency

Concurrency means that adequate public facilities and services be provided at the time that growth occurs. For example, growth should not occur where schools, roads, and other public facilities are overloaded. To achieve this objective, the GMA directs growth to areas already served or readily served by public facilities and services (RCW 36.70A.110). It also requires that when public facilities and services cannot be maintained at an acceptable level of service, the new development should be prohibited (RCW 36.70A.110).

Critical Areas

The GMA requires that critical areas be designated and protected. Critical areas include aquifer recharge areas, wetlands, frequently flooded areas, streams, wildlife habitat, landslide hazard areas, seismic hazard areas, and steep slopes. The City has adopted development regulations identifying and protecting critical areas as required. The State Environmental Policy Act (SEPA) Checklist in **Appendix F** addresses other environmental concerns.

Port Townsend Comprehensive Plan

The *Port Townsend Comprehensive Plan* was last adopted in 2016. The plan was developed to describe the City's vision for the 20-year planning period and to provide goals and policies for achieving the vision, as well as to meet the requirements of the GMA.

The Land Use Element of the City's *Comprehensive Plan* is the City's vision of how growth and development should occur over a 20-year horizon. While the Land Use Element goals and policies set forth general standards for locating land uses, the Land Use Map (Figure 4-1) indicates geographically where current and future land uses may be appropriate. The Land Use Map is a blueprint for the development of an area. The City's existing land use is shown in **Figure 3-1**.

The Land Use Element considers the general location of land uses, as well as the appropriate intensity and density of land uses given the current development trends of the City. The Transportation, Utilities, and Capital Facilities Elements ensure that new development will be served adequately without compromising adopted levels of service, which is consistent with the principal of concurrency as defined in the GMA.

Jefferson County County-wide Planning Policies

Jefferson County and the City adopted a joint resolution establishing the County-wide Planning Policies on December 21, 1992. The policies are intended to ensure that County and City comprehensive plans are consistent in accordance with the GMA. The County-wide Planning Policies are organized into policies related to UGAs, development and urban services, siting of public facilities, County-wide transportation facilities, affordable housing, economic development and employment, and rural areas. All the City's functional plans are required to be consistent with the County-wide Planning Policies.

Jefferson County Comprehensive Plan

The current version of the *Jefferson County Comprehensive Plan* was last updated in 2018. Chapters include the following.

- Land Use
- Natural Resources
- Housing
- Open Space, Parks & Recreation, Historic & Cultural Preservation
- Environment
- Transportation
- Economic Development
- Capital Facilities & Utilities

The County's plan is focused on ten framework goals, as follows.

I. Preserving Rural Character
II. Sustainable and Suitable Growth Patterns
III. Enhancement of the Rural Economy
IV. Housing Variety and Affordability
V. Allocation of Land to Meet Anticipated Needs
VI. Environmental Consideration
VII. Mobility
VIII. Active and Healthy Living
IX. Continuous and Ongoing Public Involvement
X. Compliant with GMA

The *Jefferson County Comprehensive Plan* guides development and designates land use in unincorporated Jefferson County. County Land Use inside the City's future wastewater service area (which includes the City's UGA) is shown in **Figure 3-1**; the *Jefferson County Comprehensive Plan* can be referenced for County Land Use outside the City's future wastewater service area.

LAND USE

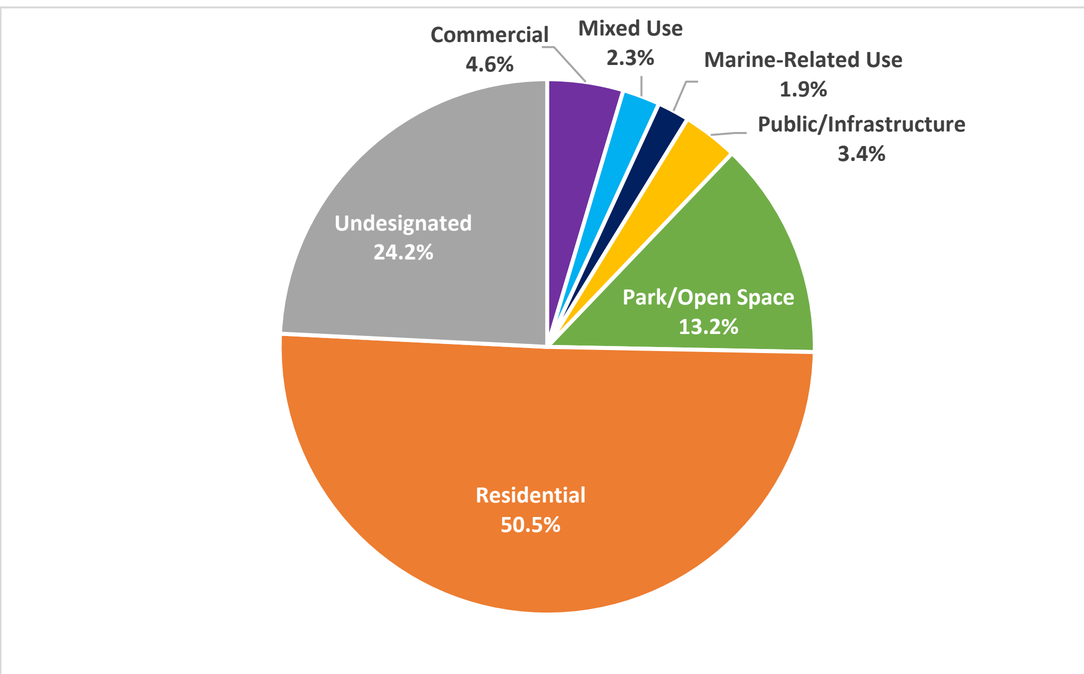
The wastewater service area includes the City limits, which is also the City's UGA boundary, for a total of approximately 7.0 square miles. The Land Use Map, as shown in **Figure 3-1**, guides development and can be used to forecast future wastewater flows and loadings. Land use outside the City is designated by the County, as shown in **Figure 3-1**.

Approximately 50.5 percent of the area within the City's future wastewater service area is designated for residential use, as indicated in **Table 3-1**. Approximately 13.2 percent of the future wastewater service area is designated for open space/parks; approximately 4.6 percent is designated for commercial use; approximately 3.4 percent is designated for public/infrastructure use; and approximately 28.3 percent is designated for other land uses or is undesignated. One key factor to the City's land use is the extensive amount of land that is designated as public right-of-way. Approximately 50 percent of the City's land area is public right-of-way, leaving nearly half the land undevelopable. This is a result of the pre-platted nature of the City and the 200-foot by 200-foot block pattern. This factor will be a key item of discussion in the next *Comprehensive Plan* update and impacts the amount of land generating demand on the utility systems.

Table 3-1

Land Use Inside Future Wastewater Service Area

Land Use Type	Acres	% of Total
Commercial	205	4.6%
Mixed Use	101	2.3%
Marine-Related Use	86	1.9%
Public/Infrastructure	150	3.4%
Park/Open Space	588	13.2%
Residential	2,254	50.5%
Undesignated	1,081	24.2%
Total	**4,466**	**100.0%**



POPULATION

Household Trends

The City's residential areas are largely comprised of single-family residences. The City's 2016 *Comprehensive Plan* estimated that there were over 5,300 housing units in the City. Of these, approximately 4,006 housing units (75.2 percent) were single-family residences, approximately 1,101 housing units (20.7 percent) were multi-family residences, and 219 housing units (4.1 percent) were other types of residences such as mobile homes, boats, and RVs. The City's average household size is estimated to be 1.90 persons per household based on the 2020 U.S. Census Bureau data.

Historical and Future City Population

The City has experienced steady population growth since 2000. The population of the City has increased by approximately 23 percent over the last 20 years. **Table 3-2** illustrates the historical population growth since 1995. The historical population shown in **Table 3-2** represents the population within the City limits. The sources of the historical population numbers are the decennial census and Office of Financial Management (OFM) intercensal estimates.

Table 3-2

Population Trends within the City Limits

Year	City Population
1995	8,165
2000	8,334
2001	8,441
2004	8,543
2007	8,945
2010	9,113
2011	9,240
2012	9,299
2013	9,320
2014	9,504
2015	9,579
2016	9,805
2017	9,871
2018	9,950
2019	10,060
2020	10,148
2021	10,220

Projected future population growth within the City Limits, shown in **Table 3-3** and **Chart 3-1**, is based on current projections from the City's 2016 *Port Townsend Comprehensive Plan*. The City is projected to have a population of 13,300 people in 2043. The buildout population shown in **Table 3-3** is based on data from the City's previous GSP.

The City is currently discussing an expansion to its sewer service area. **Chapter 2** describes factors to consider in serving a Special Study Area and the expansion that would result. The expansion of the service area is dependent on coordination with the County, the Department of Commerce, and the Department of Ecology to ensure compliance with the GMA. The Special Study Area expansion will extend service to two new sewer basins already inside the City limits and could serve the Glen Cove Local Area of More Intense Rural Development (LAMIRD) just outside the City limits. The Special Study Area boundary is approximately shown in **Figure 3-2**. For the purposes of estimating demand on the sewer system, an equivalent population for the industrial area was estimated. The additional population outside of the City limits this expansion would introduce to the sewer service area is included in **Table 3-3** under the assumption the expansion would start in 2025. Note, the actual population growth would be considerably less given business customers do not necessarily add more population to the City.

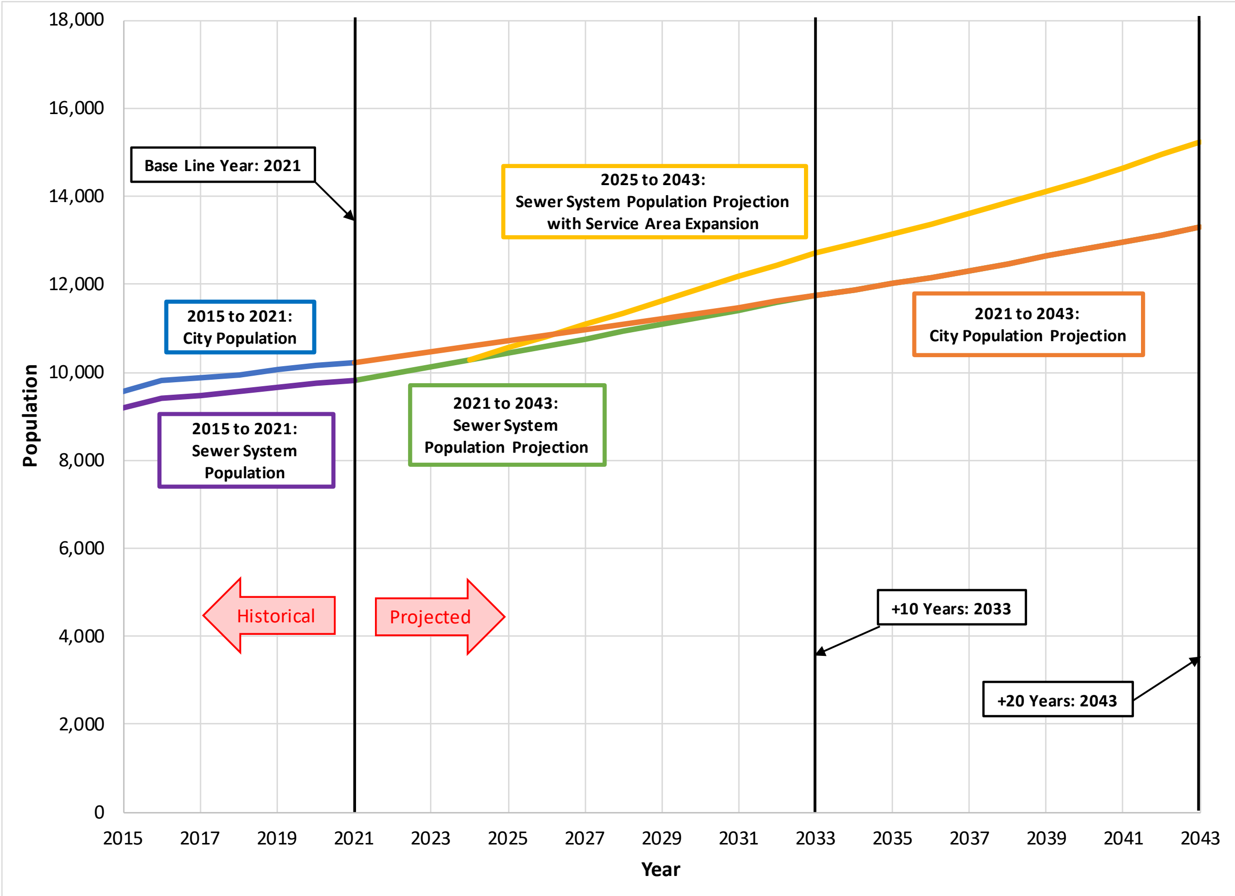
Table 3-3
Population Projections

Year	City Population	City Sewer System Population	Population Served by Septic Systems	Sewer Service Expansion Equivalent Population[1]	Sewer System Population with Expansion
2015	9,579	9,188	391	--	--
2016	9,805	9,414	391	--	--
2017	9,871	9,480	391	--	--
2018	9,950	9,559	391	--	--
2019	10,060	9,669	391	--	--
2020	10,148	9,757	391	--	--
2021	10,220	9,829	391	--	--
2022	10,339	9,981	359	--	--
2023	10,460	10,134	326	--	--
2024	10,582	10,289	294	0	10,289
2025	10,706	10,445	261	108	10,553
2026	10,831	10,603	228	216	10,819
2027	10,958	10,762	196	324	11,086
2028	11,086	10,923	163	432	11,354
2029	11,215	11,085	130	540	11,624
2030	11,346	11,248	98	648	11,896
2031	11,479	11,413	65	755	12,169
2032	11,613	11,580	33	863	12,444
2033 (+10 years)	**11,748**	**11,748**	**0**	**971**	**12,720**
2034	11,886	11,886	0	1,041	12,927
2035	12,025	12,025	0	1,116	13,140
2036	12,165	12,165	0	1,196	13,361
2037	12,321	12,321	0	1,282	13,603
2038	12,479	12,479	0	1,374	13,853
2039	12,639	12,639	0	1,472	14,111
2040	12,801	12,801	0	1,578	14,379
2041	12,965	12,965	0	1,691	14,656
2042	13,132	13,132	0	1,812	14,944
2043 (+20 years)	**13,300**	**13,300**	**0**	**1,943**	**15,242**
Buildout	**23,035**	**23,035**	**0**	**2,771**	**25,973**

1 = Equivalent population is shown based upon the projected flow and is representative of the growth in terms of population.

Chart 3-1

Population Projections



Sewer System Population

The actual number of people served by the City's wastewater system is different than the population of the City limits. The City currently provides sewer service to the entire population within the City limits, except for 206 residential properties that currently are unsewered. The unsewered population and the sewer system population inside the City limits was calculated by multiplying the estimated number of connections by the average household size for the City. As shown in **Table 3-3**, the estimated population served by the sewer system in 2021 was 9,829.

Sewer system population projections through 2043 are shown in **Table 3-3**. It was assumed that by 2033, the current unsewered properties in the City limits would be connected to the City's wastewater system. The wastewater system is expected to provide service to approximately 15,242 people in 2043.

Distribution of Population Assumptions

City planning staff made an estimate of where future growth might occur within the existing sewer service area as shown in the map in **Figure 3-3**. This population forecast was used to allocate future flows in the sewer hydraulic model for the 5-year, 6- to 10-year, and 11- to 20-year design horizons. Flow contributions from the Special Study Area expansion to the Glen Cove Area to be served by the proposed Mill Lift Station are in addition to these allocations.

This map is a graphic representation derived from the City of Port Townsend (City) Geographic Information System. It was designed and intended for City staff use only; it is not guaranteed to survey accuracy. This map is based on the best information available on the date shown on this map.

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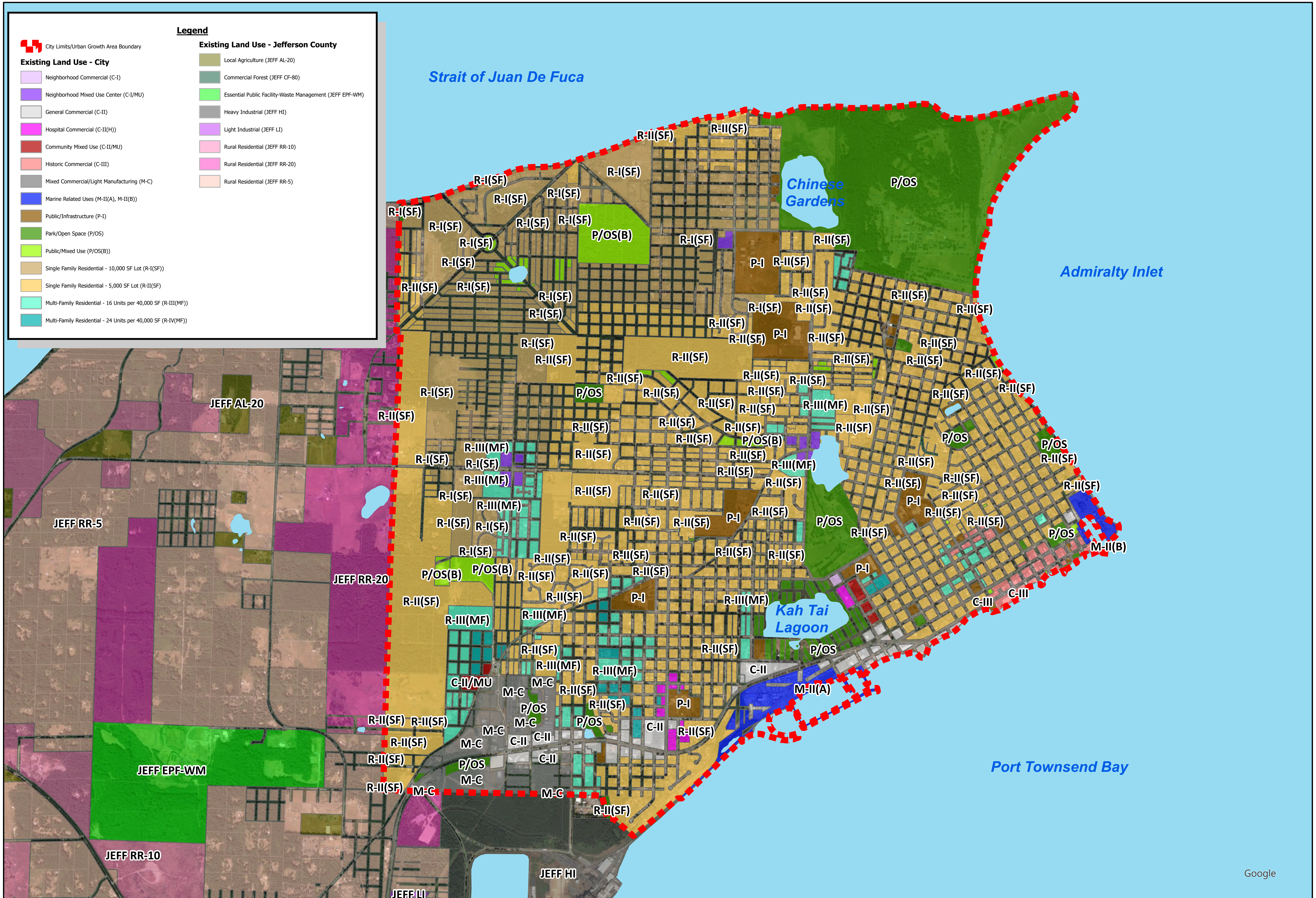

Vicinity Map

Figure 3-1
Existing Land Use

City of Port Townsend
General Sewer Plan

City of Port Townsend

1 inch : 2,000 Feet

0 500 1,000 2,000 Feet

DRAWING IS FULL SCALE WHEN BAR MEASURES 1"

RH2

NORTH

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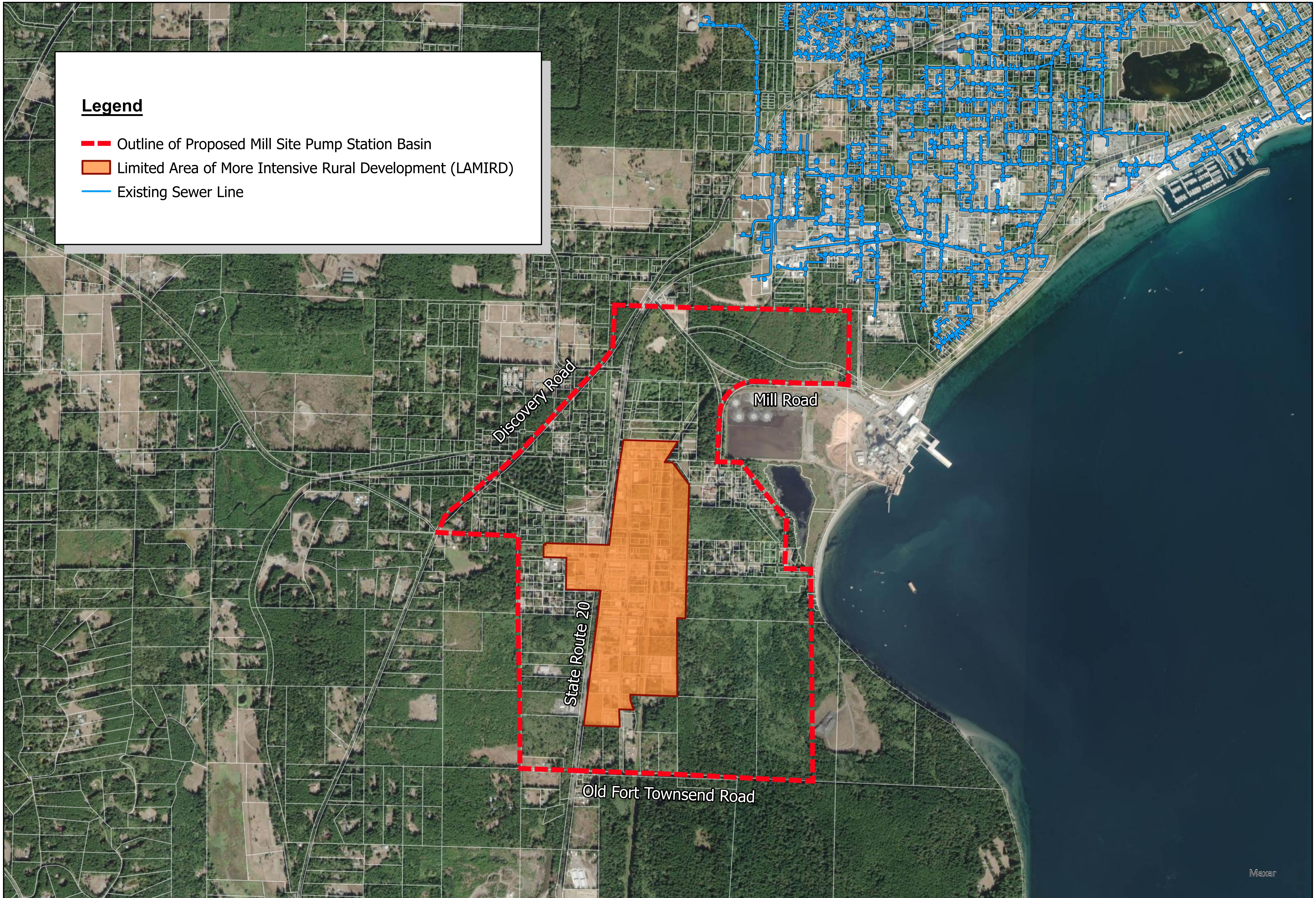

Vicinity Map

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Figure 3-2
Possible Service Area Expansion
City of Port Townsend
General Sewer Plan

City of Port Townsend

1 Inch: 1,500 Feet

0 750 1,500 Feet

DRAWING IS FULL SCALE WHEN BAR MEASURES 1"

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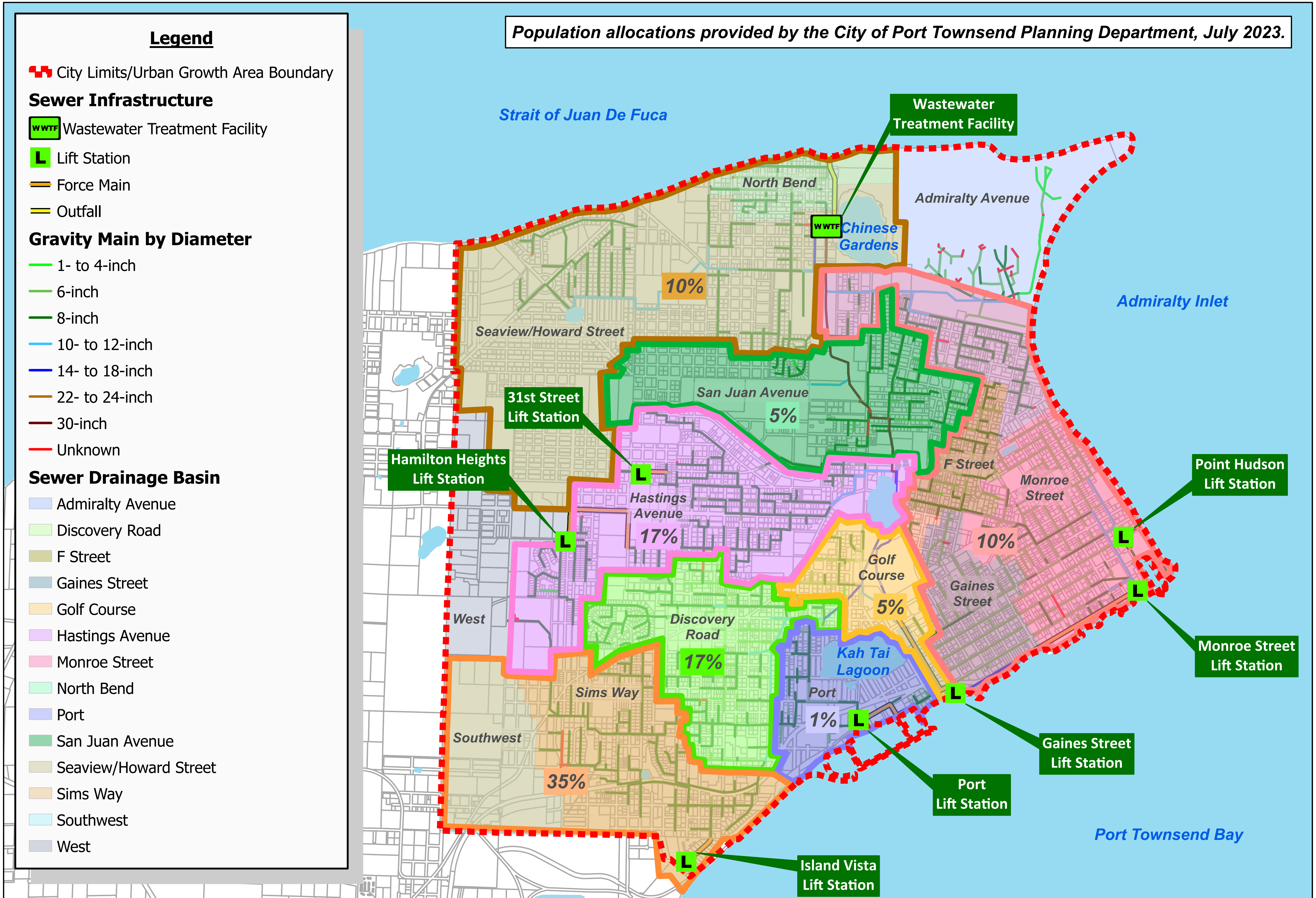

Vicinity Map

Esri, HERE, Garmin, USGS, EPA, NPS

Figure 3-3
Allocation of Future Population by Planning Area

City of Port Townsend
General Sewer Plan

City of Port Townsend

1 inch : 2,000 Feet

0 1,000 2,000 Feet

DRAWING IS FULL SCALE WHEN BAR MEASURES 1"

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4 | FLOW AND LOADING ANALYSES

INTRODUCTION

A detailed analysis of flow and loading is crucial to the planning efforts of a sewer service provider. When analyzing a sewer system, the first step is to identify current flow and load values to determine if the existing system can provide adequate service to its existing customers under the most crucial conditions in accordance with federal and state laws. A projected sewer system analysis identifies projected flow and load values to determine where the system will need to be improved to satisfy projected growth while continuing to meet federal and state laws.

Flow and load values in a sewer system are used to determine the size of gravity collection piping, lift station facilities, and force main piping, as well as the size and type of treatment facilities needed. This information also is used to develop the sewer service provider’s National Pollutant Discharge Elimination System (NPDES) waste discharge permit, which is required by the Washington State Department of Ecology (Ecology). Several different flow scenarios were analyzed for the City of Port Townsend’s (City) sewer system and are addressed in this chapter, including average annual flow (AAF), maximum month average flow (MMF), maximum day flow (MDF), peak hour flow (PHF), and projected flows. The City’s wastewater treatment facility (WWTF) loading, inflow and infiltration (I/I), and peaking factors also are presented.

System design criteria and standards have been developed to ensure that a consistent minimum level of service is maintained throughout the City’s sewer system and to facilitate planning, design, and construction of sewer system projects. A copy of the City’s *Engineering Design Standards Manual* is included in **Appendix G**. Design requirements for sewer systems are available in Ecology’s *Criteria for Sewage Works Design* (commonly known as the “Orange Book”).

SEWER SERVICE CONNECTIONS AND RESIDENTIAL POPULATION

Sewer Service Connections

Table 4-1 presents the City’s historical sewer service connections for 2015 through 2021. As of 2021, there were approximately 4,710 sewer service connections throughout the City’s sewer system. Of these connections, 4,265 were residential services and 445 were commercial/government services. A breakdown of the sewer service connections by customer class is shown in **Chart 4-1**.

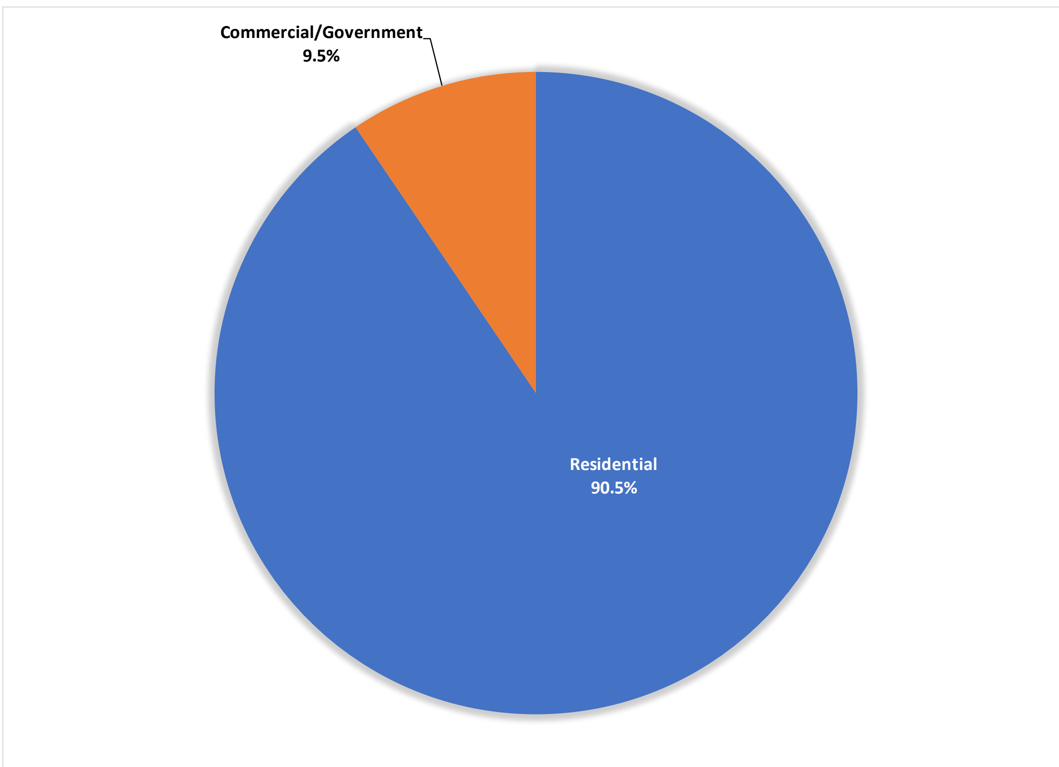
Table 4-1

Historical Sewer Connections Summary

Year	Residential Sewer Accounts	Commercial/Government Sewer Accounts	Total Sewer Accounts
2015	4,048	425	4,473
2016	4,041	429	4,470
2017	4,103	434	4,537
2018	4,145	436	4,581
2019	4,196	444	4,640
2020	4,238	444	4,682
2021	4,265	445	4,710

Chart 4-1

2021 Sewer Service Connections by Customer Class



Sewer Service Population

As presented in **Chapter 3**, the City's 2021 sewer service area population is estimated to be 9,829 people. This estimate is based on the City's population of 10,220 for 2021, and an average household size of 1.90 for areas in the City limits multiplied by 206 unsewered residential properties in the City limits. The average household size for areas in the City limits is based on the City's *Comprehensive Plan*, which was amended in 2016. **Table 4-2** presents the City's historical sewer population for 2015 through 2021.

Table 4-2

Historical Sewer Service Population

Year	City Population	Sewer System Population
2015	9,579	9,188
2016	9,805	9,414
2017	9,871	9,480
2018	9,950	9,559
2019	10,060	9,669
2020	10,148	9,757
2021	10,220	9,829

The City's wastewater collection planning area includes the entire Urban Growth Area (UGA). There are parcels within the City limits that are served by on-site septic systems. Once these systems fail, City code requires that the homeowners connect to the City's municipal wastewater system if the parcel is located within 500 feet of the wastewater collection system. It is assumed for this General Sewer Plan (GSP) that all of these parcels in the City limits will be connected to the City's wastewater collection system by 2033, and the sewer service population will be the same as the UGA population by 2043. This will ensure that the City has the infrastructure in place to serve the entire UGA population.

EXISTING WASTEWATER FLOW AND LOADING

Wastewater Flow

The total influent flow to the WWTF is made up of untreated flow from primarily residential customers, but also includes flow from a number of commercial, hospitality, and retail businesses, schools, and the Jefferson Healthcare Medical Center. The City's existing collection system flow rates were estimated using the WWTF discharge monitoring reports and lift station run time data for the 2016 through 2021 period. The City's sewer collection system drainage basins are shown in **Figure 2-1**.

The City's discharge monitoring reports have been reviewed and analyzed to determine current wastewater characteristics and influent loadings. **Table 4-3** summarizes the historical WWTF AAFs, MMFs, MDFs (including I/I), and PHFs on an annual basis for the 2016 through 2021 period.

Table 4-3

Historical WWTF Influent Flow Summary

Year	Sewer System Population	AAF (MGD)	AAF per Capita (gpcd)	MMF (MGD)	MDF (MGD)	PHF (MGD)	Percent of NPDES Permit Max. Month Limit[1]	Peaking Factors		
								MMF/AAF	MDF/AAF	PHF/AAF
2016	9,414	0.85	91	1.07	1.99	--	52%	1.26	2.33	--
2017	9,480	0.84	88	0.92	1.39	2.79	45%	1.10	1.66	3.33
2018	9,559	0.87	91	1.16	1.82	3.06	57%	1.33	2.09	3.52
2019	9,669	0.78	81	0.87	1.12	2.35	43%	1.11	1.43	2.99
2020	9,757	0.80	82	1.15	2.37	3.34	56%	1.43	2.96	4.17
2021	9,829	0.84	85	1.02	2.18	---	50%	1.22	2.60	---
2016 to 2019 Average[2]		**0.84**	**88**	**1.01**	**1.58**	**2.74**	--	**1.20**	**1.88**	**3.28**
2016 to 2019 Max.[2]		**0.87**	**91**	**1.16**	**1.99**	**3.06**	--	**1.33**	**2.33**	**3.52**

1 = The City's WWTF is permitted for a maximum month average influent flow of 2.05 MGD.

2 = 2020 and 2021 values are not included in the historical averages and maximums due to the COVID pandemic.

The monthly average and maximum influent wastewater flows recorded on the WWTF's discharge monitoring reports for the 2016 through 2021 period are summarized in **Appendix H**. Data from 2020 and 2021 were not included in the historical averages and maximums in **Table 4-3** due to probable shifts in typical wastewater patterns due to the COVID pandemic.

In the 2016 to 2019 period, the average annual flow for the WWTF is 0.84 million gallons per day (MGD), with the highest AAF of 0.87 MGD occurring in 2018. The AAF for 2016 through 2018 has remained at or above the 4-year average. In 2019, the AAF dropped to 0.78 MGD. The MDF for the WWTF has varied from year to year over the same 4-year period, with the lowest MDF of 1.12 MGD occurring in 2019, and the highest MDF of 1.99 MGD occurring in 2016.

The WWTF is currently permitted for a MMF of 2.05 MGD. The City's NPDES permit stipulates that the City shall submit a plan and schedule for continuing to maintain capacity when the flow reaches 85 percent of the permitted flow for 3 consecutive months; 85 percent of the permitted flow is approximately 1.74 MGD. As **Table 4-3** and **Appendix H** show, this limit has not been exceeded in the 2016 through 2019 period. The highest MMF of 1.16 MGD (57 percent of the permitted flow) occurred in 2018. A significant increase in the MMF occurred from 2017 to 2018; however, the MMF dropped again in 2019 to flows similar to 2017.

Wastewater Loading

The City's discharge monitoring reports have been reviewed and analyzed to determine current wastewater characteristics and influent loadings. The 2016 through 2021 historical average annual and maximum month average 5-day biochemical oxygen demand (BOD_5) and total suspended solids (TSS) loadings in pounds per day (ppd) and pounds per capita per day (ppcd) are summarized in **Tables 4-4** and **4-5**, respectively.

Table 4-4

Historical WWTF Influent BOD_5 Loading Summary

Year	Sewer System Population	Average Annual BOD_5 (mg/L)	Average Annual BOD_5 (ppd)	Average Annual BOD_5 (ppcd)	Max. Month BOD_5 (mg/L)	Max. Month BOD_5 (ppd)	Percent of NPDES Permit Max. Month Limit[1]	BOD_5 Max. Month Average/Average Annual Peaking Factor
2016	9,414	332	2,242	0.24	405	2,442	65%	1.09
2017	9,480	329	2,289	0.24	364	2,538	68%	1.11
2018	9,559	363	2,509	0.26	454	2,968	79%	1.18
2019	9,669	400	2,591	0.27	437	2,718	72%	1.05
2020	9,757	336	2,147	0.22	374	2,422	65%	1.13
2021	9,829	334	2,221	0.23	393	2,500	67%	1.13
2016 to 2019 Average[2]		**356**	**2,408**	**0.25**	**415**	**2,667**	---	**1.11**
2016 to 2019 Max.[2]		**400**	**2,591**	**0.27**	**454**	**2,968**	---	**1.18**

1 = The City's WWTF is permitted for a maximum month BOD_5 influent loading of 3,754 ppd.

2 = 2020 and 2021 values are not included in the historical averages and maximums due to the COVID pandemic.

Table 4-5

Historical WWTF Influent TSS Loading Summary

Year	Sewer System Population	Average Annual TSS (mg/L)	Average Annual TSS (ppd)	Average Annual TSS (ppcd)	Max. Month TSS (mg/L)	Max. Month TSS (ppd)	Percent of NPDES Permit Max. Month Limit[1]	TSS Max. Month Average/Average Annual Peaking Factor
2016	9,414	331	2,240	0.24	388	2,458	54%	1.10
2017	9,480	329	2,291	0.24	367	2,564	56%	1.12
2018	9,559	359	2,493	0.26	431	2,799	61%	1.12
2019	9,669	376	2,437	0.25	417	2,686	59%	1.10
2020	9,757	341	2,188	0.22	386	2,725	60%	1.25
2021	9,829	322	2,146	0.22	390	2,481	54%	1.16
2016 to 2019 Average[2]		**349**	**2,365**	**0.25**	**401**	**2,627**	---	**1.11**
2016 to 2019 Max.[2]		**376**	**2,493**	**0.26**	**431**	**2,799**	---	**1.12**

1 = The City's WWTF is permitted for a maximum month TSS influent loading of 4,568 ppd.

2 = 2020 and 2021 values are not included in the historical averages and maximums due to the COVID pandemic.

The average annual and maximum month average BOD_5 and TSS loadings in **Tables 4-4** and **4-5** were estimated from 2016 through 2019 data. Data from 2020 and 2021 are not included in the historical averages due to the COVID pandemic. The monthly average and maximum influent loadings recorded at the WWTF for the 2016 through 2019 period are summarized in **Appendix H**.

In the 2016 through 2019 period, the average annual influent BOD_5 loading has increased overall; however, there have been fluctuations throughout that time period with both significant increases and decreases from year to year. The average annual influent BOD_5 and TSS loadings significantly increased from 2017 to 2018. Average annual BOD_5 and TSS loadings were relatively consistent in 2016 and 2017, before increasing in 2018. As **Tables 4-4** and **4-5** show, the average annual BOD_5 and TSS loading are relatively similar.

The WWTF currently has a permitted capacity for BOD_5 influent maximum month average loading of 3,754 ppd and a TSS influent maximum month average loading of 4,568 ppd. The City's NPDES permit stipulates that the City shall submit a plan and schedule for continuing to maintain capacity when the loading reaches 85 percent of the permitted loading for

3 consecutive months; 85 percent of the permitted loading is 3,191 ppd for BOD_5 and 3,883 ppd for TSS.

As **Tables 4-4** and **4-5** show, the BOD_5 and TSS influent limits have not been exceeded in the 2016 through 2019 time period. The highest maximum month average BOD_5 loading of 2,968 ppd (79 percent of the permitted BOD_5 loading) and the highest maximum month average TSS loading of 2,799 ppd (61 percent of the permitted TSS loading) both occurred in 2018.

INFLOW AND INFILTRATION

I/I is the combination of groundwater and surface water that enters the sewer system. Infiltration is groundwater entering the sewer system through defects in the sewer system infrastructure, such as fractured pipes and leaking maintenance holes and pipe joints. Inflow is surface water that enters the sewer system from sources such as roof and street drains and leaky maintenance hole covers.

A sanitary sewer system must be able to carry the domestic wastewater generated by utility customers and the extraneous I/I that is a part of every sewer collection system. Excessive I/I in the sewer collection system can lead to serious issues within the collection system that may include wastewater system backups and overflows, accelerating the structural deficiencies of the collection system. Excessive I/I also can inflate capacity requirements of the proposed collection and treatment system infrastructure.

Reducing I/I in a sewer collection system can reduce the risk of sanitary sewer overflows and the cost of treating wastewater. By reducing or eliminating I/I sources, the extraneous water that previously occupied the conveyance and treatment system can now be occupied by sewage flows. This leads to delaying conveyance and treatment projects that were needed because of the extraneous I/I water.

The U.S. Environmental Protection Agency (EPA) published a report in May 1985, *Infiltration/Inflow, I/I Analysis and Project Certification*, which developed guidelines to help determine what amount of I/I is considered to be excessive and what amount can be cost-effectively removed. The report established I/I flow rates that are considered normal or acceptable based on surveys and statistical evaluations of data from hundreds of cities across the nation.

Precipitation and temperature data were compiled from the National Oceanic and Atmospheric Administration's (NOAA) website for weather stations in and near the City.

Inflow

The EPA report gives guidelines for determining whether inflow can be classified as non-excessive. Inflow is considered to be non-excessive if the average daily flow during periods of heavy rainfall or spring thaw (i.e. any event that creates surface ponding and surface runoff) does not exceed 275 gallons per capita per day (gpcd). The peak recorded daily flow in the 6 years analyzed for the City (2016 through 2021) was 2.37 MGD, which occurred on February 5, 2020. Per the weather data obtained from NOAA, this day was recorded as having

0.95 inches of precipitation. This peak inflow event equates to a 243 gpcd flow rate, which is below the EPA's maximum of 275 gpcd. The second peak recorded daily flow was 2.36 MGD, which occurred on the following day, February 6, 2020. This day was recorded as having 0.4 inches of precipitation. This peak inflow event equates to a 242 gpcd flow rate, which does not exceed the EPA maximum. The third highest recorded daily flow was 2.18 MGD, which occurred on January 4, 2021. This day was recorded as having 0.64 inches of precipitation and a peak inflow equating to 222 gpcd, which is below the EPA's inflow guideline.

All three peaks are below the EPA's maximum inflow criterion and are considered non-excessive. The City should continue to monitor inflow throughout the system, particularly in areas over 50 years old that previously may have been combined collection systems.

Infiltration

The EPA's guideline for determination of non-excessive infiltration was based on the national average for dry weather flow of 120 gpcd. In order for the amount of infiltration to be considered non-excessive, the average daily flow must be less than 120 gpcd (i.e. a 7- to 14-day average measured during periods of seasonal high groundwater). Although it can be difficult to discern between inflow and infiltration, peak inflow will generally occur immediately during or just after a significant rain event, while peak infiltration will occur during the high groundwater period that follows prolonged precipitation events.

The peak dry weather flow period in the last 6 years (2016 through 2021) of record for the City, occurring after a few consecutive days of rain, was the 5-day period from January 22, through January 26, 2016. This period also was directly preceded by heavy rains, and yielded an average flow of 1.20 MGD, equating to 128 gpcd. The second highest peak dry weather flow period occurred during a 13-day period from February 4, through February 16, 2018. This period was preceded by moderate rainfall and yielded an average flow of 124 gpcd. The third highest peak dry weather flow period occurred during a 14-day period from February 7, through February 21, 2020. This period directly followed a period of heavy rainfall and yielded an average flow of 121 gpcd. All three events are slightly above the EPA's maximum infiltration criterion; therefore, the amount of infiltration is considered excessive. The City should continue to monitor infiltration throughout the system.

Any I/I studies that are conducted in the future should follow the guidelines defined in Chapter C-1 of Ecology's *Criteria for Sewage Works Design* (commonly known as the "Orange Book"). Emphasis should be placed on older sections of the City with concrete, vitrified clay, and asbestos cement mains or in areas suspected of being combined sewers. Lawrence Street is believed to convey both storm and sanitary sewer. **Chapter 10** discusses remediation of this defect..

PROJECTED WASTEWATER FLOW AND LOADING

The City's sewer system is projected to add a total of 5,850 additional persons by 2043, using 2018 as the base year. This increase in population includes the sewer system expansion as discussed in **Chapter 3**.

Peaking Factors

Once existing flow rates are measured and defined, projected flow rates can be developed. Projected flows are used to analyze how well the existing system will perform in the future and determine improvements required to maintain or improve system function. In order to establish projected flow scenarios for a sewer system, peaking factors need to be determined for the existing system, which can then be applied to projected flow rates. Peaking factors are the ratio of higher flows, such as MDF to AAF.

A maximum peak hour flow of 3.34 MGD, based on the highest PHF from the flow data analyzed for this GSP, occurred in 2020 during the COVID pandemic. The AAF for 2020 was lower than typical so the peaking factors were estimated by finding the ratio of the 2020 PHF to the 2016 to 2019 average AAF, establishing a PHF/AAF of 4.00 for the WWTF. **Table 4-6** shows a summary of the peaking factors for flows at the City's WWTF for the 2016 through 2021 period.

Table 4-6

Peaking Factor Summary for Flows

Flow	
Max. Month Average Flow/Average Annual Flow (MMF/AAF)	1.33
Max. Day Flow/Average Annual Flow (MDF/AAF)[1]	2.83
Peak Hour Flow/Average Annual Flow (PHF/AAF)[1]	4.00
BOD_5	
Max. Month Average/Average Annual Loading	1.18
TSS	
Max. Month Average/Average Annual Loading	1.12

1 = The MDF and PHF for 2016 through 2021 both occurred in 2020 during the COVID pandemic. 2020 had a lower than typical AAF, so the PHF/AAF and MDF/AAF peaking factors were estimated with the PHF and MDF from this year divided by the average AAF for 2016 through 2019.

Peaking factors also are developed to determine maximum month average BOD_5 and TSS loading projections. These loading peaking factors are the average historic maximum month to average annual loadings from 2016 to 2019. Data obtained during the COVID pandemic (2020 and 2021) may not represent normal flow and load conditions. For instance, the data from these years shows a wider variability in peaking factors; therefore, it is not included in this calculation. **Table 4-7** shows a summary of the peaking factors for loading at the City's WWTF for the 2016 through 2021 period.

Table 4-7

Peaking Factor Summary for Loadings

Year	BOD_5 Max. Month Average/Average Annual Peaking Factor	TSS Max. Month Average/Average Annual Peaking Factor
2016	1.09	1.10
2017	1.11	1.12
2018	1.18	1.12
2019	1.05	1.10
2020	1.13	1.25
2021	1.13	1.16
Average[1]	**1.11**	**1.11**

1 = The peaking factors used for projections are the averages of the peaking factors from 2016 to 2019. 2020 and 2021 values are not included in these averages due to the COVID pandemic.

The peaking factors presented in **Tables 4-6** and **4-7** were used to project flows and loadings in the following sections.

Projected Wastewater Flow Rates

Once existing flow rates are measured and defined, projected flow rates can be developed. Projected flows are used to analyze how well the existing system will perform in the future and determine improvements required to maintain or improve system function.

The projected flows at the WWTF were developed using the following information:

- Projected AAFs were estimated using the 2018 AAF, which is approximately 0.87 MGD, as the existing baseline. Year 2018 was used as the existing baseline for flow projections because this was the highest AAF over the last 4 years analyzed.
- The highest AAF per capita for 2016 through 2019 was 91 gpcd (**Table 4-3**), which includes I/I and commercial wastewater flows. This value was used for projecting how much additional wastewater flow the projected population growth would contribute to the City's sewer system.
- The flow peaking factors shown in **Table 4-6** were used for estimating MMFs, MDFs, and PHFs from projected AAFs.
- From 2025 to buildout, the population and projected flows include the growth as a result of expanding the sewer service area as described in **Chapter 3**.

Summaries of the projected flows for the sewer system population within the City limits, additional sewer expansion, and the total of the two populations, are presented in **Tables 4-8** through **4-10**, respectively.

Table 4-8

Projected WWTF Influent Flow for Sewer System Population Within City Limits

Year	Equivalent Sewer System Population	Projected AAF (MGD)[1]	Projected MMF (MGD)[2]	Percent of NPDES Permit Max. Month Limit[3]	Projected MDF (MGD)[4]	Projected PHF (MGD)[5]	Projected PHF with Inflow Reduction (MGD)[6]
2018 (Baseline)	**9,559**	**0.87**	**1.16**	**57%**	**1.82**	**3.06**	**--**
2019	9,669	0.78	0.87	43%	1.12	2.35	--
2020	9,757	0.80	1.15	56%	2.37	3.34	--
2021	9,829	0.84	1.02	50%	2.18	---	--
2022	9,981	0.91	1.21	59%	2.57	3.63	--
2023	10,134	0.92	1.23	60%	2.61	3.69	--
2024	10,289	0.94	1.25	61%	2.65	3.75	--
2025	10,445	0.95	1.27	62%	2.69	3.80	--
2026	10,603	0.97	1.29	63%	2.73	3.86	--
2027	10,762	0.98	1.31	64%	2.78	3.92	--
2028	10,923	0.99	1.33	65%	2.82	3.98	--
2029	11,085	1.01	1.35	66%	2.86	4.04	--
2030	11,248	1.02	1.37	67%	2.90	4.10	--
2031	11,413	1.04	1.39	68%	2.94	4.16	--
2032	11,580	1.05	1.41	69%	2.99	4.22	--
2033 (+ 10 years)	**11,748**	**1.07**	**1.43**	**70%**	**3.03**	**4.28**	**3.86**
2034	11,886	1.08	1.44	70%	3.07	4.33	3.91
2035	12,025	1.09	1.46	71%	3.10	4.38	3.96
2036	12,165	1.11	1.48	72%	3.14	4.43	4.02
2037	12,321	1.12	1.50	73%	3.18	4.49	4.07
2038	12,479	1.14	1.52	74%	3.22	4.54	4.13
2039	12,639	1.15	1.53	75%	3.26	4.60	4.19
2040	12,801	1.17	1.55	76%	3.30	4.66	4.25
2041	12,965	1.18	1.57	77%	3.34	4.72	4.31
2042	13,132	1.20	1.59	78%	3.39	4.78	4.37
2043 (+ 20 years)	**13,300**	**1.21**	**1.61**	**79%**	**3.43**	**4.84**	**4.43**
Buildout	**23,035**	**2.10**	**2.80**	**136%**	**5.94**	**8.39**	**7.97**

1 = Projected AAFs were estimated by using the 2018 AAF as the baseline and adding 91 gpcd (which was the highest historic flow per capita for 2016 through 2019) multiplied by the projected increase in sewer population from 2018.
2 = Projected MMFs were estimated by multiplying the projected AAF by the highest historic MMF/AAF peaking factor from 2016 through 2019, which was 1.33 in 2018.
3 = The City's WWTF is permitted for a maximum month average influent flow of 2.05 MGD.
4 = Projected MDFs were estimated by multiplying the projected AAF by the MDF/AAF peaking factor of 2.83.
5 = Projected PHFs were estimated by multiplying the projected AAF by the PHF/AAF peaking factor of 4.00.
6 = Projected PHFs with inflow reduction were estimated by reducing projected PHFs after 2032 by 288 gpm (0.41 MGD) to account for the removal of inflow estimated to be contributed by catch basins connected to the City's sewer system along Lawrence Street.

Table 4-9

Projected WWTF Influent Flow for Sewer System Special Study Area Expansion

Year	Equivalent Sewer System Population	Projected AAF (MGD)[1]	Projected MMF (MGD)[2]	Projected MDF (MGD)[3]	Projected PHF (MGD)[4]
2018 (Baseline)	--	--	--	--	--
2019	--	--	--	--	--
2020	--	--	--	--	--
2021	--	--	--	--	--
2022	--	--	--	--	--
2023	--	--	--	--	--
2024	0	0.00	0.00	0.00	0.00
2025	108	0.01	0.02	0.04	0.07
2026	216	0.03	0.04	0.08	0.14
2027	324	0.04	0.05	0.12	0.21
2028	432	0.05	0.07	0.15	0.28
2029	540	0.07	0.09	0.19	0.35
2030	648	0.08	0.11	0.23	0.42
2031	755	0.10	0.13	0.27	0.49
2032	863	0.11	0.15	0.31	0.56
2033 (+ 10 years)	**971**	**0.12**	**0.16**	**0.35**	**0.63**
2034	1,041	0.13	0.17	0.37	0.68
2035	1,116	0.14	0.19	0.40	0.72
2036	1,196	0.15	0.20	0.43	0.77
2037	1,282	0.16	0.22	0.46	0.82
2038	1,374	0.17	0.23	0.49	0.88
2039	1,472	0.19	0.25	0.53	0.94
2040	1,578	0.20	0.27	0.56	1.00
2041	1,691	0.21	0.28	0.60	1.07
2042	1,812	0.23	0.30	0.65	1.14
2043 (+ 20 years)	**1,943**	**0.24**	**0.33**	**0.69**	**1.22**
Buildout	**2,771**	**0.29**	**0.39**	**0.83**	**1.43**

1 = Projected AAFs are based upon the calculated 2033, 2043, and Buildout expansion flows as the baseline. 2024 to 2033 flows were projected with a straight-line appreciation in conjunction with the City's preference on projected equivalent population growth as a result of the sewer expansion.

2 = Projected MMFs were estimated by multiplying the projected AAF by the highest historic MMF/AAF peaking factor from 2016 through 2019, which was 1.33 in 2018.

3 = Projected MDFs were estimated by multiplying the projected AAF by the MDF/AAF peaking factor of 2.83.

4 = Projected PHFs are based upon the calculated 2033, 2043, and Buildout expansion flows as the baseline. 2024 to 2033 flows were projected with a straight-line appreciation in conjunction with the City's preference on projected equivalent population growth as a result of the sewer expansion.

Table 4-10

Total Projected WWTF Flow including Special Study Area Expansion

Year	Equivalent Sewer System Population	Projected AAF[1] (MGD)	Projected MMF[2] (MGD)	Percent of NPDES Permit Max. Month Limit[3]	Projected MDF[4] (MGD)	Projected PHF[5] (MGD)	Projected PHF with Inflow Reduction[6] (MGD)
2018 (Baseline)	**9,559**	**0.87**	**1.16**	**57%**	**1.82**	**3.06**	**--**
2019	9,669	0.78	0.87	43%	1.12	2.35	--
2020	9,757	0.80	1.15	56%	2.37	3.34	--
2021	9,829	0.84	1.02	50%	2.18	---	--
2022	9,981	0.91	1.21	59%	2.57	3.63	--
2023	10,134	0.92	1.23	60%	2.61	3.69	--
2024	10,289	0.94	1.25	61%	2.65	3.75	--
2025	10,553	0.96	1.29	63%	2.73	3.87	--
2026	10,819	0.99	1.32	65%	2.81	4.00	--
2027	11,086	1.02	1.36	66%	2.89	4.13	--
2028	11,354	1.05	1.40	68%	2.97	4.26	--
2029	11,624	1.08	1.44	70%	3.05	4.39	--
2030	11,896	1.11	1.47	72%	3.13	4.52	--
2031	12,169	1.13	1.51	74%	3.21	4.65	--
2032	12,444	1.16	1.55	76%	3.29	4.78	--
2033 (+ 10 years)	**12,720**	**1.19**	**1.59**	**78%**	**3.38**	**4.91**	**4.50**
2034	12,927	1.21	1.62	79%	3.44	5.01	4.59
2035	13,140	1.24	1.65	80%	3.50	5.10	4.69
2036	13,361	1.26	1.68	82%	3.56	5.20	4.79
2037	13,603	1.28	1.71	83%	3.64	5.31	4.90
2038	13,853	1.31	1.75	85%	3.71	5.42	5.01
2039	14,111	1.34	1.78	87%	3.79	5.54	5.13
2040	14,379	1.36	1.82	89%	3.86	5.66	5.25
2041	14,656	1.39	1.86	91%	3.95	5.79	5.38
2042	14,944	1.42	1.90	93%	4.03	5.92	5.51
2043 (+ 20 years)	**15,242**	**1.46**	**1.94**	**95%**	**4.12**	**6.06**	**5.65**
Buildout	**25,806**	**2.39**	**3.19**	**156%**	**6.77**	**9.82**	**9.40**

1 = Total projected AAF was estimated by adding City limit and sewer system expansion flows together.
2 = Total projected MMF was estimated by adding City limit and sewer system expansion flows together.
3 = The City's WWTF is permitted for a maxium month average influent flow of 2.05 MGD.
4 = Total projected MDF was estimated by adding City limit and sewer system expansion flows together.
5 = Total projected PHF was estimated by adding City limit and sewer system expansion flows together.
6 = Projected PHFs with inflow reduction were estimated by reducing projected PHFs after 2032 by 288 (0.41 MGD) to account for the removal of inflow estimated to be contributed by catch basins connected to the City's sewer system along Lawrence Street.

According to these projections, the WWTF will not exceed the NPDES permit maximum month limit capacity for flow during the 20-year planning period. However, the City should evaluate the WWTF for upgrades when the average MMF exceeds 85 percent of the NPDES permit limit. According to these projections, the City should prepare to plan and design WWTF upgrades for flow by 2038.

Historical Wastewater Flow by Basin

Table 4-11 shows the historical lift station AAF and PHF rates over the 2016 through 2020 period. These flow rates were developed using the run time records and pumping capacities for the City's lift stations.

Table 4-11

Historical AAF and PHF Rates by Lift Station

Lift Station[1]	Existing Design Firm Capacity (gpm)	2016		2017		2018		2019		2020		2016 to 2020 Average	
		AAF (gpm)	PHF (gpm)	AAF (gpm)	PHF (gpm)	AAF (gpm)	PHF (gpm)	AAF (gpm)	PHF (gpm)	AAF (gpm)	PHF (gpm)	AAF (gpm)	PHF (gpm)
Gaines Street	1,500	203	1,120	188	1,027	189	982	171	853	173	1,047	185	1,006
Monroe Street	857	144	990[3]	135	990	136	990	124	916	127	990	133	990
Port	195	23	143	21	143	21	85	19	222	20	163	21	151
Island Vista	135	4	18	4	29	5	47	5	38	3	20	4	31
Hamilton Heights	250	10	38	10	33	10	33	10	33	11	33	10	34
31st Street	100	2	15	2	12	2	13	2	13	2	17	2	14
Point Hudson[2]	150	---	---	---	---	---	---	---	---	---	---	---	---
WWTF	---	593	---	582	1,940	604	2,127	545	1,631	557	2,323	555	2,005

1 = Highlighted flows in gray exceed current firm pumping capacity.

2 = Point Hudson Lift Station is not connected to the City's SCADA system.

3 = 990 gpm, estimated from existing pump curves, is representative of all three pumps in the Monroe Street Lift Station running simultaneously.

The peak hour flow rates for the Gaines Street and Monroe Street Lift Stations are surprisingly close in magnitude considering that the Gaines Street basin is larger. The Gaines Street basin serves approximately 500 equivalent residential units (ERUs) more than the Monroe Street basin, which indicates the flow rate per ERU in the Monroe Street basin is much higher than the Gaines Street basin. As portions of the Lawrence Street sewer are still combined storm and sanitary sewer conveyance, this would correlate to higher flows in the Monroe Street basin.

Recorded data from the pump station's supervisory control and data acquisition (SCADA) systems was used to calculate the base flows for each pump station. Base flow information for the Gaines Street Lift Station is based on a magnetic flow meter that records daily totalized flows. For the Monroe Street Lift Station, timed flow tests were used to verify the station's discharge capacity. Run time records were used to multiply the measured flow rates by the run time to determine the station's peak hour. RH2 recommends the City begin recording flow totalizations at the Gaines Street Lift Station on an hourly basis to provide an improved calculation of the peak hour flow.

Projected Wastewater Flow by Basin

The City is planning for additional growth; however, it is uncertain where growth will occur within the UGA. City planning staff made an estimate of where the future growth might occur as shown in **Figure 3-3**. This population forecast was used to allocate future flows in the sewer hydraulic model for 5-, 10- and 20-year design horizons, as shown in **Table 4-12**. The additional flow associated with the projected population, allocated as shown in **Figure 3-3**, was calculated using the per capita domestic and I/I rates developed in **Chapter 3** with a peak hour factor of 4.

Table 4-12

Existing and Projected AAF and PHF Rates by Basin

	Existing 2023		Projected 2028		Projected 2038		Projected 2043	
Basin	AAF (gpm)	PHF (gpm)	AAF (gpm)	PHF (gpm)	AAF (gpm)	PHF (gpm)	AAF (gpm)	PHF (gpm)
Monroe Street	135	542	189	757	191	763	194	775
North Bend	10	42	12	50	14	55	16	64
Seaview/Howard Street	30	121	39	155	44	175	53	213
Southwest	-	-	-	-	-	-	-	-
West	-	-	-	-	-	-	-	-
Discovery Road	82	329	100	400	111	443	131	524
Sims Way	63	250	140	562	202	809	324	1296
San Juan Avenue	33	131	38	152	41	164	47	188
Port	21	84	21	84	21	84	21	84
Admiralty Avenue	39	158	42	168	44	175	47	186
Golf Course	19	77	24	98	28	110	34	134
Gaines Street	31	125	31	125	31	122	34	134
F Street	18	74	21	84	23	91	26	103
Hastings Avenue	74	297	92	368	103	411	123	492

The flows shown in this table are the summation of the sanitary loads assigned to the respective drainage basin in the hydraulic model and do not include cumulative gravity or pumped flows from upstream basins.

Refer to **Chapter 3** for more information regarding the development of population growth. Refer to **Chapter 6** for more information regarding the collection system evaluation.

Lift Station Hydraulic Capacity Analyses

Current lift station pumping capacities based on the calculated and measured flow rates, as well as the remaining capacity of each lift station, are provided in **Table 4-13**.

The remaining capacity is presented in terms of the remaining population each lift station is capable of supporting and is based upon a maximum per capita AAF of 91 gpcd and a PHF/AAF peaking factor of 4.00.

Table 4-13

Current AAF and PHF Rates and Remaining Capacity by Lift Station

Lift Station[1]	Existing Design Firm Capacity (gpm)	AAF (gpm)	PHF (gpm)	Remaining AAF Capacity (gpm)	Remaining PHF Capacity (gpm)	Remaining AAF Population	Remaining PHF Population
Gaines Street	1,500	189	1,194	1,311	306	20,740	1,209
Monroe Street	857	136	990	721	-133	11,398	-526
Port	195	21	85	174	111	2,757	438
Island Vista	135	5	18	130	117	2,062	464
Hamilton Heights	250	10	38	240	212	3,797	838
31st Street	100	2	7	98	93	1,554	369
Point Hudson[2]	150	1	4	149	146	2,357	578

1 = Highlighted flows in gray exceed current firm pumping capacity.
2 = Point Hudson Lift Station is not connected to the City's SCADA system, so the existing flow for this basin was estimated from the number of homes in this sewer basin.

As indicated in **Table 4-13**, all lift stations, with the exception of Monroe Street, have the capacity to support existing flows from their basins. There are many instances of all three pumps in the Monroe Street Lift Station running, which may be indicative of the lift station being unable to convey the peak flows using only two of the three pumps in the station (the desired standard). Capacity upgrades to this lift station will be necessary in the future to handle projected flows. The Monroe Street basin also experiences the greatest levels of I/I relative to other basins in the City. Operations staff states that the Monroe Street Lift Station discharge surcharges with three pumps operating simultaneously during peak flows but does not overflow.

The City is planning to perform an I/I study to identify improvements that could reduce I/I in the sewer system. These I/I improvements could reduce or mitigate the I/I component of the PHFs in the City's sewer collection system, which could reduce or mitigate projected flows. For example, it is known that Lawrence Street has storm inlets connected to the sanitary sewer. Capacity upgrades to the Monroe Street Lift Station should be performed following with the removal of upstream inflow sources.

Besides the Monroe Street Lift Station, the City's lift stations have ample capacity to convey future flows for the 20-year design horizon (**Table 4-13**). Most of the projected growth will originate in the Mill site area and be pumped by the new Mill Lift Station. All of the discharge from this station will flow by gravity to the WWTF, posing no new loads to existing lift stations. Gravity conveyance upgrades will be substantial, but lift station capacity upgrades will not. Equipment replacements for the City's lift stations will be needed as it wears out, but these costs will be covered under a maintenance line item as described in the Capital Improvement Plan in **Chapter 10**.

Projected Wastewater Loading Capacity

Once existing influent loadings are determined, projected loading capacities can be developed. Projected loadings are used to project future WWTF loading capacities and determine improvements required to increase treatment capacity.

The projected BOD_5 and TSS loadings at the WWTF were developed using the following information:

- Average annual BOD_5 loadings were projected using the 2019 average annual loadings as the baseline and adding 0.20 ppcd, which is the average annual BOD_5 loading per capita per day defined in the Orange Book, multiplied by the projected increase in sewer population from 2019. This estimation from the Orange Book represents residential contributions to loading, and it is assumed that the City's projected population growth will be mainly residential.
- Average annual TSS loadings were projected using the 2018 average annual loadings as the baseline and adding 0.20 ppcd multiplied by the projected increase in sewer population from 2018, similar to the BOD_5 loading projections.
- The loading peaking factors shown in **Table 4-7** were used for estimating maximum month average loadings from projected average annual loadings.
- From 2025 to buildout, the population includes the growth as a result of expanding the sewer service area as described in **Chapter 3**.

Summaries of the projected BOD_5 and TSS loadings for the sewer system population within City limits, additional sewer expansion, and the total of the two populations, are presented in **Tables 4-14** through **4-19**, respectively.

Table 4-14

Projected WWTF Influent BOD_5 Loading for Sewer System Population Within City Limits

Year	Equivalent Sewer System Population	Projected Average Annual BOD_5 (ppd)[1]	Projected Max. Month Average BOD_5 (ppd)[2]	Percent of NPDES Permit Max. Month Limit[3]
2018	9,559	2,509	2,968	79%
2019 (Baseline)	**9,669**	**2,591**	**2,718**	**72%**
2020	9,757	2,147	2,422	65%
2021	9,829	2,221	2,500	67%
2022	9,981	2,654	2,939	78%
2023	10,134	2,684	2,973	79%
2024	10,289	2,715	3,007	80%
2025	10,445	2,747	3,042	81%
2026	10,603	2,778	3,077	82%
2027	10,762	2,810	3,112	83%
2028	10,923	2,842	3,148	84%
2029	11,085	2,875	3,184	85%
2030	11,248	2,907	3,220	86%
2031	11,413	2,940	3,257	87%
2032	11,580	2,974	3,293	88%
2033 (+ 10 years)	**11,748**	**3,007**	**3,331**	**89%**
2034	11,886	3,035	3,361	90%
2035	12,025	3,063	3,392	90%
2036	12,165	3,091	3,423	91%
2037	12,321	3,122	3,458	92%
2038	12,479	3,153	3,493	93%
2039	12,639	3,185	3,528	94%
2040	12,801	3,218	3,564	95%
2041	12,965	3,251	3,600	96%
2042	13,132	3,284	3,637	97%
2043 (+ 20 years)	**13,300**	**3,318**	**3,674**	**98%**
Buildout	**23,035**	**5,265**	**5,831**	**155%**

1 = Projected average annual BOD_5 loadings were estimated by using the 2019 average annual BOD_5 loading as the baseline and adding 0.20 ppcd (which is the BOD_5 loading per capita per day as defined in Ecology's *Criteria for Sewage Works Design*) multiplied by the projected increase in sewer population from 2019.

2 = Projected maximum month average BOD_5 loadings were estimated by multiplying the projected average annual BOD_5 loading by the average historic maximum month to average annual BOD_5 loading peaking factor from 2016 through 2019, which was 1.11.

3 = The City's WWTF is permitted for a maximum month average influent BOD_5 loading of 3,754 ppd.

Table 4-15

Projected WWTF Influent BOD_5 Loading for Sewer System Special Study Area Expansion

Year	Equivalent Sewer System Population[1]	Projected Average Annual BOD_5 (ppd)[2]	Projected Max. Month Average BOD_5 (ppd)[3]
2024	0	0	0
2025	108	22	24
2026	216	43	48
2027	324	65	72
2028	432	86	96
2029	540	108	120
2030	648	130	143
2031	755	151	167
2032	863	173	191
2033 (+ 10 years)	**971**	**194**	**215**
2034	1,041	208	231
2035	1,116	223	247
2036	1,196	239	265
2037	1,282	256	284
2038	1,374	275	304
2039	1,472	294	326
2040	1,578	316	350
2041	1,691	338	375
2042	1,812	362	401
2043 (+ 20 years)	**1,943**	**389**	**430**
Buildout	**2,771**	**554**	**614**

1 = Projected equivalent populations were estimated as a straight line appreciation from 2024 to 2033 per the City's preference on sewer expansion.

2 = Projected average annual BOD_5 loadings were estimated by multiplying the projected equivalent populations by 0.20 ppcd (which is the BOD_5 loading per capita per day as defined in Ecology's *Criteria for Sewage Works Design*).

3 = Projected maximum month average BOD_5 loadings were estimated by multiplying the projected average annual BOD_5 loading by the average historic maximum month to average annual BOD_5 loading peaking factor from 2016 through 2019, which was 1.11.

Table 4-16

Total Projected WWTF BOD_5 Loading including Special Study Area Expansion

Year	Equivalent Sewer System Population	Projected Average Annual BOD_5 (ppd)[1]	Projected Max. Month Average BOD_5 (ppd)[2]	Percent of NPDES Permit Max. Month Limit[3]
2018	9,559	2,509	2,968	79%
2019 (Baseline)	**9,669**	**2,591**	**2,718**	**72%**
2020	9,757	2,147	2,422	65%
2021	9,829	2,221	2,500	67%
2022	9,981	2,654	2,939	78%
2023	10,134	2,684	2,973	79%
2024	10,289	2,715	3,007	80%
2025	10,553	2,768	3,066	82%
2026	10,819	2,821	3,125	83%
2027	11,086	2,875	3,184	85%
2028	11,354	2,928	3,243	86%
2029	11,624	2,982	3,303	88%
2030	11,896	3,037	3,363	90%
2031	12,169	3,091	3,424	91%
2032	12,444	3,146	3,485	93%
2033 (+ 10 years)	**12,720**	**3,202**	**3,546**	**94%**
2034	12,927	3,243	3,592	96%
2035	13,140	3,286	3,639	97%
2036	13,361	3,330	3,688	98%
2037	13,603	3,378	3,741	100%
2038	13,853	3,428	3,797	101%
2039	14,111	3,480	3,854	103%
2040	14,379	3,533	3,913	104%
2041	14,656	3,589	3,975	106%
2042	14,944	3,646	4,039	108%
2043 (+ 20 years)	**15,242**	**3,706**	**4,105**	**109%**
Buildout	**25,806**	**5,819**	**6,445**	**172%**

1 = Projected average annual BOD_5 loadings were estimated by adding City limit and sewer system expansion loadings together.

2 = Projected maximum month average BOD_5 loadings were estimated by adding City limit and sewer system expansion loadings together.

3 = The City's WWTF is permitted for a maximum month average influent BOD_5 loading of 3,754 ppd.

According to these projections, the WWTF will exceed the NPDES permit maximum month limit capacity for BOD_5 during the 20-year planning period. However, the City should prepare the WWTF for upgrades when the maximum month average BOD_5 load exceeds 85 percent of the NPDES permit limit. According to these projections, the City will need to start planning and designing WWTF upgrades by 2027. If the special study area expansion is not implemented, then these upgrades will be delayed until 2029.

Table 4-17

Projected WWTF Influent TSS Loading for Sewer System Population Within City Limits

Year	Equivalent Sewer System Population	Projected Average Annual TSS (ppd)[1]	Projected Max. Month Average TSS (ppd)[2]	Percent of NPDES Permit Max. Month Limit[3]
2018 (Baseline)	**9,559**	**2,493**	**2,799**	**61%**
2019	9,669	2,437	2,686	59%
2020	9,757	2,188	2,725	60%
2021	9,829	2,146	2,481	54%
2022	9,981	2,577	2,862	63%
2023	10,134	2,608	2,896	63%
2024	10,289	2,639	2,930	64%
2025	10,445	2,670	2,965	65%
2026	10,603	2,702	3,000	66%
2027	10,762	2,734	3,035	66%
2028	10,923	2,766	3,071	67%
2029	11,085	2,798	3,107	68%
2030	11,248	2,831	3,143	69%
2031	11,413	2,864	3,180	70%
2032	11,580	2,897	3,217	70%
2033 (+ 10 years)	**11,748**	**2,931**	**3,254**	**71%**
2034	11,886	2,958	3,285	72%
2035	12,025	2,986	3,315	73%
2036	12,165	3,014	3,347	73%
2037	12,321	3,045	3,381	74%
2038	12,479	3,077	3,416	75%
2039	12,639	3,109	3,452	76%
2040	12,801	3,141	3,488	76%
2041	12,965	3,174	3,524	77%
2042	13,132	3,208	3,561	78%
2043 (+ 20 years)	**13,300**	**3,241**	**3,599**	**79%**
Buildout	**23,035**	**5,188**	**5,760**	**126%**

1 = Projected average annual TSS loadings were estimated by using the 2018 average annual TSS loading as the baseline and adding 0.20 ppcd (which is the TSS loading per capita per day as defined in Ecology's *Criteria for Sewage Works Design*) multiplied by the projected increase in sewer population from 2018.

2 = Projected maximum month average TSS loadings were estimated by multiplying the projected average annual TSS loading by the average historic maximum month to average annual TSS loading peaking factor from 2016 through 2019, which was 1.11.

3 = The City's WWTF is permitted for a maximum month average influent TSS loading of 4,568 ppd.

Table 4-18

Projected WWTF Influent TSS Loading for Sewer System Special Study Area Expansion

Year	Equivalent Sewer System Population[1]	Projected Average Annual TSS (ppd)[2]	Projected Max. Month Average TSS (ppd)[3]
2024	0	0	0
2025	108	22	24
2026	216	43	48
2027	324	65	72
2028	432	86	96
2029	540	108	120
2030	648	130	144
2031	755	151	168
2032	863	173	192
2033 (+ 10 years)	**971**	**194**	**216**
2034	1,041	208	231
2035	1,116	223	248
2036	1,196	239	266
2037	1,282	256	285
2038	1,374	275	305
2039	1,472	294	327
2040	1,578	316	350
2041	1,691	338	376
2042	1,812	362	402
2043 (+ 20 years)	**1,943**	**389**	**431**
Buildout	**2,771**	**554**	**615**

1 = Projected equivalent populations were estimated as a straight line appreciation from 2024 to 2033 per the City's preference on sewer expansion.

2 = Projected average annual TSS loadings were estimated by multiplying the projected equivalent populations by 0.20 ppcd (which is the TSS loading per capita as defined in Ecology's *Criteria for Sewage Works Design*).

3 = Projected maximum month average TSS loadings were estimated by multiplying the projected average annual TSS loading by the average historic maximum month to average annual TSS loading peaking factor from 2016 through 2019, which was 1.11.

Table 4-19

Total Projected WWTF TSS Loading including Special Study Area Expansion

Year	Equivalent Sewer System Population	Projected Average Annual TSS (ppd)[1]	Projected Max. Month Average TSS (ppd)[2]	Percent of NPDES Permit Max. Month Limit[3]
2018 (Baseline)	**9,559**	**2,493**	**2,799**	**61%**
2019	9,669	2,437	2,686	59%
2020	9,757	2,188	2,725	60%
2021	9,829	2,146	2,481	54%
2022	9,981	2,577	2,862	63%
2023	10,134	2,608	2,896	63%
2024	10,289	2,639	2,930	64%
2025	10,553	2,692	2,989	65%
2026	10,819	2,745	3,048	67%
2027	11,086	2,798	3,107	68%
2028	11,354	2,852	3,167	69%
2029	11,624	2,906	3,227	71%
2030	11,896	2,960	3,287	72%
2031	12,169	3,015	3,347	73%
2032	12,444	3,070	3,408	75%
2033 (+ 10 years)	**12,720**	**3,125**	**3,470**	**76%**
2034	12,927	3,167	3,516	77%
2035	13,140	3,209	3,563	78%
2036	13,361	3,253	3,612	79%
2037	13,603	3,302	3,666	80%
2038	13,853	3,352	3,721	81%
2039	14,111	3,403	3,779	83%
2040	14,379	3,457	3,838	84%
2041	14,656	3,513	3,900	85%
2042	14,944	3,570	3,964	87%
2043 (+ 20 years)	**15,242**	**3,630**	**4,030**	**88%**
Buildout	**25,806**	**5,742**	**6,376**	**140%**

1 = Projected average annual TSS loadings were estimated by adding City limit and sewer system expansion loadings together.
2 = Projected maximum month average TSS loadings were estimated by adding City limit and sewer system expansion loadings together.
3 = The City's WWTF is permitted for a maximum month average influent TSS loading of 4,568 ppd.

According to these projections, the WWTF will not exceed the NPDES permit maximum month limit capacity for TSS during the 20-year planning period. However, the City should prepare the WWTF for upgrades when the maximum month average TSS load exceeds 85 percent of the NPDES permit limit. According to these projections, the City should prepare for WWTF upgrades for TSS by 2041.

SUMMARY

Table 4-20 provides a summary of the existing, 10-year (2033), planning year (2043), and buildout flow, and BOD_5 and TSS loadings for the City's wastewater collection and treatment systems.

Table 4-20

Summary of Existing and Projected Flow and Loading at the WWTF

		Flow (MGD)		
	Existing (2018)	**Projected 2033**	**Projected 2043**	**Projected Buildout**
Average Annual Flow	0.87	1.19	1.46	2.39
Max. Month Average Flow	1.16	1.59	1.94	3.19
Max. Day Flow	1.82	3.38	4.12	6.77
Peak Hour Flow	3.06	4.91	6.06	9.82
		BOD_5 (ppd)		
	Existing (2019)	**Projected 2033**	**Projected 2043**	**Projected Buildout**
Average Annual BOD_5	2,591	3,202	3,706	5,819
Max. Month Average BOD_5	2,718	3,546	4,105	6,445
		TSS (ppd)		
	Existing (2018)	**Projected 2033**	**Projected 2043**	**Projected Buildout**
Average Annual TSS	2,493	3,125	3,630	5,742
Max. Month Average TSS	2,799	3,470	4,030	6,376

5 | POLICIES AND COLLECTION SYSTEM DESIGN CRITERIA

INTRODUCTION

The City of Port Townsend (City) operates and plans sewer service for the City and associated sewer service area residents and businesses according to the design criteria, laws, and policies that originate from the U.S. Environmental Protection Agency (EPA) and the Washington State Department of Ecology (Ecology).

These laws, design criteria, and policies guide the City's operation and maintenance of the sewer system on a daily basis, as well as the City's plan for growth and improvements. The overall objective is to ensure that the City provides high quality sewer service at a fair and reasonable cost to its customers. These laws, design criteria, and policies also set the standards the City must meet to ensure that the sewer system is adequate to meet existing and future flows. The collection system's ability to handle these flows is detailed in **Chapter 6**, and the analysis of the existing wastewater treatment system is detailed in **Chapter 7**. The recommended improvements for the collection system and wastewater treatment systems are identified in **Chapter 10**.

The City Council adopts regulations and policies that cannot be less stringent or in conflict with those established by the federal and state governments. The City's policies take the form of ordinances, memoranda, and operational procedures, many of which are summarized in this chapter.

The City will maintain an updated General Sewer Plan (GSP) that is coordinated with the Land Use Element of the *Comprehensive Plan* so that new development will be located where sufficient sewer system capacity exists or where the collection system can be efficiently and logically extended.

The policies associated with the following categories are presented in this chapter.

- Regulations
- Customer Service
- Collection System
- Lift Stations
- Operational
- Organizational
- Financial

REGULATIONS

National Pollutant Discharge Elimination System Permit

Wastewater discharge into surface waters of the State shall have a National Pollutant Discharge Elimination System (NPDES) permit from Ecology. Refer to **Chapter 2** for details on the City's NPDES permit. The permit contains a flow limit, influent and effluent quality standards, monitoring requirements, pretreatment requirements, and system maintenance requirements. A copy of the City's NPDES permit is included in **Appendix C**.

Other Regulations and Required Permits

Refer to **Chapter 2** for other regulations and required permits that apply to the City's Wastewater Treatment Facility (WWTF). In addition, Chapter 173-240 Washington Administrative Code (WAC) defines requirements for wastewater facilities plans and reports, and the City follows the guidelines in Ecology's 2008 *Criteria for Sewage Works Design* (Orange Book).

CUSTOMER SERVICE POLICIES

- Evaluate the prioritization of capital facilities to serve the housing and density needs of the City based on the upcoming 2025 periodic update. This likely will replace the current Policy 14.2, concerning tiers, in the Land Use Element of the *Comprehensive Plan*.

Existing Sewer Service and Connection

- Prioritize capital facilities, services, and utilities within the urban growth tiers per Policy 14.2 of the *Comprehensive Plan* and Title 13 of the Port Townsend Municipal Code (PTMC). PTMC 13.01.120 addresses City participation when funds are available as identified in the 6-year capital facilities plan. Chapter 13.23 specifies that in Tier 1, the City will participate in sewer extensions when existing structures connected to an on-site septic system benefit. Historic implementation of the tiering system has not occurred due to the lack of funding for such sewer extensions. As a result, sewer extensions have occurred at the cost of the developer who often has utilized the latecomer fee process for potential reimbursement from benefiting properties.
- Increase the capacity of the collection system and WWTF to reflect increased usage trends influenced by the City's growth and economic development per Policy 14.3 of the *Comprehensive Plan* Land Use Element.
- As the City's Urban Growth Area (UGA) is the same as the City's sewer service area, sewer service shall not extend beyond the City limits.
- Provide sewer service to properties within the City's sewer service area, provided all policies related to service can be met. Ensure that existing and new developments within the UGA have WWTF and collection line capacities to meet their needs, as well as State and federal discharge standards.

- Chapter 13.22 PTMC requires all properties that develop or redevelop within the City limits to connect to the City's sewer system when the development is located within 260 feet of a wastewater collection line with the following exception: new single-family residences that are more than 260 feet from the nearest City sewer main and are subject to review under Chapter 19.05 PTMC, Critical Areas, and the impacts of the system are adequately mitigated and conditioned through critical areas review. Any development that is a subdivision, short plat, or Planned Unit Development subject to PTMC Title 18, a land use or permit approval that requires a threshold determination under Chapter 19.04 PTMC, or structures (other than single-family residences) subject to the Critical Areas ordinance all require sewer connection regardless of location. Additionally, any on-site septic systems must be approved by the Jefferson County Public Health and be on a lot of sufficient size to meet the requirements for on-site systems.
- Sewer system extensions, required to provide sewer service to proposed developments, shall be approved by the Department of Public Works and must comply with the City's most current, adopted Engineering Design Standards, PTMC Title 13, all applicable Revised Codes of Washington (RCWs) and WACs, guidance administered by Ecology, and the WSDOT/APWA Standard Specifications. All costs of the extension shall be borne by the developer or applicant. The City's Wastewater Engineering Standards are included in **Appendix G**.
- For sewer service applications within the City limits, the City will review the availability for sewer service at the time of utility development permit review. During the utility development permitting process, the City will determine if sewer is available for the site and will address the sizing and location of the sewer extension.
- Sewer collection system, lift station, and WWTF capacity will be considered when providing sewer availability to applicants.
- Sewer availability shall expire at the time that the utility development permit expires.
- Time extensions in regard to sewer availability shall be granted in accordance with the associated permit requirements and PTMC.
- Chapters 13.21 through 13.24 PTMC provide regulations for the City's sanitary sewer system.

Proposed Sewer Service and Connection Policies

The following proposed policies are part of this GSP through its adoption by the City Council and approval by Ecology. These proposed policies will need to be memorialized as part of the 2025 periodic *Comprehensive Plan* adoption, as well as updates to the PTMC and the Engineering Design Standards.

- As the City's Urban Growth Area (UGA) is the same as the City's sewer service area, sewer service shall not extend beyond the City limits except as permitted by the Growth Management Act and governing laws according to the Special Study Area expansion described in **Chapter 2**.

- Remove and replace the ineffective tiering system with an alternative approach to achieving the goals of the City concerning sewer extensions.
- Develop policies and incentives to maximize density, including multi-family development.
- Develop policies and incentives to support affordable and attainable housing. For the purpose of this policy, attainable housing will need to be defined in terms of affordability levels or housing type.
- Develop policies to minimize the use of on-site septic systems while recognizing the requirements of WAC 246-272A-0025, which the local health officer is required to follow. This WAC allows for the development of on-site septic systems when a property is located more than 200 feet from a public sewer main. This provision does not apply to land use actions such as subdivisions.
- Develop sewer extension regulations related to pre-platted plots incentivizing development of density on pre-platted lots or preservation of pre-platted lots for future development. This goal is to discourage the combination of pre-platted lots.

Septic System Policies

- Currently, 211 properties within the City limits have been identified as using on-site sewage systems. According to the Growth Management Act, no new on-site septic sewage systems should be allowed in the UGA as new development is intended to be at urban densities that require sewers. In addition, Chapter 70.118 RCW requires counties to develop and implement management plans for on-site sewage systems.
- No new on-site septic systems are allowed inside the City limits on properties where existing City sewer main is within 260 feet of the boundary of the subject property according to PTMC.
- Existing single-family homes with septic systems are required to connect to the City's sewer system unless the nearest sewer main is greater than 260 feet. All septic systems in the City shall be monitored per Jefferson County Public Health regulations.
- All non-developing properties that annex into the City are encouraged to phase out their septic systems and connect to the City's municipal sewer system.
- Property owners with a failing septic system, as documented by Jefferson County Public Health, shall connect to the City's sewer system unless the parcel is greater than 260 feet from the nearest existing sewer main, in which case the septic system may be repaired.
- The City is aware of Engrossed Senate Bill (ESB) 5871, which became effective on July 24, 2015, and requires cities, towns, and counties to offer an administrative appeals process to consider denials of permit applications to repair or replace a septic system where connection to a sewer system is required for single-family residences. The City will review appeals to repair or replace septic systems as they are submitted in accordance with ESB 5871.

COLLECTION SYSTEM POLICIES AND DESIGN CRITERIA

Sanitary Sewer Design Criteria

- Standards for sewer system facilities are defined by WAC 173-240-050.
- All sewer lines and facilities within the City shall be designed in accordance with good engineering practice by a professional engineer with the minimum design criteria presented in the *Criteria for Sewage Works Design*, prepared by Ecology, August 2008, or as superseded by subsequent updates. Chapter C1 of this document includes standards and guidelines for design considerations (e.g., minimum pipe sizes, pipe slopes, and wastewater velocities), maintenance considerations, estimating wastewater flow rates, maintenance hole locations, leak testing, and separation from other underground utilities. These criteria have been established to ensure that the sanitary sewers convey the sewage and protect the public health and environment. The sewer lines also shall conform to the latest regulatory requirements relating to design.
- Sewers shall be designed and constructed in accordance with the City's most current Wastewater Engineering Standards.

Gravity Sewer Design Criteria

- All sewers shall be designed as a gravity sewer whenever feasible and buried at a minimum depth of 5 feet. Exceptions to depth requirements may be made on a limited basis to facilitate gravity sewer extension.
- The layout for extensions shall provide for the future continuation of the existing system as determined by the City. The smallest diameter sewer allowed is 8 inches for gravity mains. A 6-inch sewer may be approved when expansion to serve future customers is not expected.
- Side sewer connection laterals within City rights-of-way shall be 6 inches at a minimum, and side sewer laterals on private property shall be 4 inches at a minimum, in accordance with the Standard Details.
- A 6-inch-diameter lateral is required at a minimum for all commercial, industrial, and multi-family connections. A larger diameter lateral may be required based on the projected wastewater flows from the connection.
- Maintenance holes shall be a minimum of 48 inches in diameter and will be spaced at intervals ideally at every block as set forth in the City's Wastewater Engineering Standards. City blocks are typically 260 feet long. On occasion, maintenance holes may be spaced at 520 feet subject to City Engineer approval. Only new polyvinyl chloride (PVC) pipes will be considered for extending the maintenance hole interval.
- Maintenance holes also shall be located at changes in grade, direction, and pipe size, and at intersections. Maintenance holes located in areas subject to inflow may be required to include a watertight insert at the request of the Public Works Director.
- New mains connecting to an existing main shall be made via a new or existing maintenance hole.

- The minimum sewer main slope shall be 0.40 feet per 100 feet for 8-inch-diameter sewer lines. The minimum slope may be reduced if approved by the City Engineer. Sewers shall have a uniform slope between maintenance holes.
- Testing of the gravity sewer lines and maintenance holes shall be completed in the presence of the City. Testing shall be performed in accordance with WSDOT/APWA Standard Specifications Section 7-17.3(2).

Design Flow Rates

- All new gravity sewers shall be designed and constructed to have a minimum velocity of 2 feet per second when flowing full.
- Existing sewers may surcharge up to 1-foot over the crown of the pipe during the peak hour flow caused by a 20-year, 24-hour storm before requiring replacement. This criterion shall not apply if this storm produces overflows onto the finished floors of any customers. New sewers shall be designed to be no more than 75-percent full during the same storm over the 50-year design life of the main.
- No overflows will be permitted.
- This GSP did not analyze every sub-basin and instead focused on trunkline sewers. When development occurs within a sub-basin, staff and developers will need to check the capacity of the sub-basin's gravity sewer pipes. Slopes in the City generally result in gravity sewers being steeper than minimum slopes. For reference, an 8-inch gravity sewer at 0.4 percent generally will serve 300 single-family units. This is a conservative rule of thumb to check when developing an infrastructure master plan for the City's pre-platted environment and for densification of housing.

Separation Between Sanitary Sewer and Other Utilities

- A minimum horizontal separation of 10 feet and a minimum vertical separation of 3 feet is required between sewer and domestic water lines (edge to edge).
- The City's Wastewater Engineering Standards (**Appendix G**) will be followed, and the guidelines provided in Ecology's *Criteria for Sewage Works Design* should be followed for difficult spacing or other situations.

Design Period

- The design period is the length of time that a given facility will provide safe, adequate, and reliable service. The design period selected is based on the economic life of a given facility, which is determined by the structural integrity of the facility, the rate of degradation, the replacement cost, the cost of increasing the capacity of the facility, and the projected population growth rate serviced by the facility.
- The life expectancy for new sanitary sewers, using current design practices, is in excess of 50 years.

Force Main Design Criteria

- All force mains within the City shall be designed in accordance with good engineering practice by a professional engineer with the minimum design criteria presented in the *Criteria for Sewage Works Design*, prepared by Ecology, August 2008, or as superseded by subsequent updates. Chapter C2 of this document contains design considerations for force mains.

Low Pressure Sewer Design Criteria

Formalizing the use of low pressure sewer installation is necessary for effective implementation. The recommended policy and engineering standards for low pressure sewers should include the following principles:

- Low pressure sewers should only be used where gravity sewers are not reasonably feasible.
- Low pressure sewers should only be used in single-family residential zones where growth is predictable.
- Low pressure sewers should not be used in multi-family zones.
- Low pressure sewer pumps need to be owned and maintained by the property owners. The pump system should be of sufficient quality and contain alarms to minimize the chance of sewer overflow.
- Low pressure laterals are to be privately owned and maintained.
- Low pressure force mains should be designed to City standards and be City owned and maintained.
- Engineering design standards for low pressure sewer mains should specify durable materials such as high-density polyethylene (HDPE) pipe, have ample clean out and flushing ports, and be sized to accommodate entire areas where gravity sewer is not feasible.
- A master plan of locations where low pressure sewers are allowed should be developed as incorporated into the Engineering Design Standards.

Side Sewer Design Criteria

- Side sewers shall be constructed in accordance with all applicable City, local, and State regulations. Refer to the PTMC and the City's Wastewater Engineering Standards (**Appendix G**) for specific criteria.

LIFT STATION POLICIES AND DESIGN CRITERIA

- Lift stations shall be designed in accordance with the City's most current Wastewater Engineering Standards and the Ecology's *Criteria for Sewage Works Design*.
- Lift stations are expensive to operate and maintain; therefore, their installation should be limited to locations where gravity is not reasonably feasible only.

OPERATIONAL POLICIES

Facilities Maintenance

Facility maintenance is performed by the Wastewater and Compost Facility divisions of Public Works. This includes the maintenance of the WWTF, the Compost Facility, and all lift stations.

- Equipment breakdown is given the highest maintenance priority, and repairs should be made as soon as possible.
- Equipment should be replaced when it becomes obsolete.
- Worn parts should be repaired, replaced, or rebuilt before they represent a high failure probability.
- Equipment that is out of service should be returned to service as soon as possible.
- A preventive maintenance schedule shall be established for all facilities, equipment, and processes.
- Spare parts shall be stocked for all equipment items whose failure will impact the ability to meet other policy standards.
- Tools shall be obtained and maintained to repair all items whose failure will impact the ability to meet other policy standards.
- Dry, heated shop space should be available to all maintenance personnel to maintain equipment and store parts.
- Written records and reports will be maintained on each facility and item of equipment showing its operation and maintenance history.

Collection System Maintenance

The collection system is maintained by the Streets Maintenance and Collections Division of Public Works.

- At a minimum, all existing gravity mains shall be video inspected every 10 years.
- The target gravity main video inspection interval is 5 years based on the need to rehabilitate much of the gravity system.
- Gravity mains that experience periodic problems shall be video inspected every 1 to 3 years depending on the documented history of problems.
- Video inspection records will be maintained and incorporated into prioritization of either pipeline replacement or in-situ rehabilitation.
- Cleaning or jetting of sewer lines shall occur based on video inspection records.
- Root cutting of sewer lines shall be based on video inspection records and historical sewer blockage trends. Many gravity sewer lines in the City require annual root cutting. These sewer lines should be prioritized for rehabilitation.
- Many maintenance holes in the collection system are aging past their design life and experiencing corrosion. Some maintenance holes are still mortared rock or brick.

Rehabilitation and replacement of maintenance holes on a systematic basis should be implemented based on inspection records.

Temporary and Emergency Services

- Compliance with construction standards (not water quality standards) may be deferred for temporary sewer service. Provisions for reliability is necessary for temporary service to reasonably prevent system failures such as overflows.
- Compliance with all standards may be deferred for emergency sewer service.
- Compliance with all applicable NPDES waste discharge permit requirements must be met.

Reliabilities

- The City shall invest sufficient resources to ensure that the sewer system is constructed, operated, and maintained to ensure consistent and reliable service is provided to its customers.
- Reliability is achieved through investment in rehabilitation or replacement of collection system components, as well as redundant systems. For example, including back-up generators for critical lift stations improves reliability.
- The entire WWTF is built with redundant systems to ensure reliable operations. When redundant systems are compromised or need repair, restoring redundant systems should be prioritized.

ORGANIZATIONAL POLICIES

Staffing

The sewer treatment and collection systems operate based on the good work of staff. Therefore, adequate staffing with appropriate training and skills is a key to success. The City created a skills development program for the Department of Public Works staff to improve skills and address succession planning. The 2024 budget reflects the addition of a wastewater treatment apprentice position, as well as restoration of a frozen position in the Streets Maintenance and Collections Division. The following staffing policies are included in this GSP:

- The sewer utility staffing levels are established by the City Council based on the financial resources of the City and needs of the sewer utility. Staffing investments are a key portion of the periodic sewer rate modeling and projections. Staffing, capital improvements, and required operational costs are to be balanced based on rates set by City Council.
- The City has three Group II certified wastewater treatment plant operators at the WWTF and two Group I certified wastewater treatment plant operators at the Compost Facility.
- Staffing must comply with the permit-required certification levels associated with both treatment facilities. Both the WWTF and the Compost Facility are Group II operator facilities. The staffing objective is as follows:

    - WWTF – Three certified Group II operators, one of which serves as crew chief for both the WWTF and the Compost Facility.
    - Compost Facility – Two certified Group II operators.
    - WWTF and Compost Facility – A shared entry level position serves as an apprentice to support both facilities' operations.
    - Within the City – Certified electrician capable of working with 480 volt, three-phase power to serve the City's Facilities Division, Water Resources Division, Wastewater Division, and Compost Facility Division of Public Works.
- Personnel certification and training will comply with State-established standards. The City job descriptions reflect the state certification requirements. The City encourages and supports training in terms of continuing education and skill development to work in concert with State certification requirements.

FINANCIAL POLICIES

General

The sewer utility is an enterprise business unit of the City. Enterprise business units by definition are required to be fiscally sustainable in terms of self-supporting through rates and charges. Rates and charges need to be analyzed periodically to ensure revenues match expenses of operations and investment in infrastructure. A balanced approach to establishing reasonably affordable rates along with the needs of the sewer system to ensure compliance with public health and safety laws is the focus of periodic rate reviews. The following fiscal policies help establish this balance. Note, that a number of fiscal assumptions are included in **Chapter 11** with respect to rate setting. The following policies and assumptions in **Chapter 11** must align.

- The City will set rates, charges, and fees to maintain sufficient funds to operate, maintain, and upgrade its sewer system as necessary to provide safe and reliable sewer service to its customers. These rates will comply with State regulations and be evaluated in conjunction with the annual budget process to ensure that forecasted expenses and impacts of regulations are reflected in the rate structure. Typically, rates are established for a 5-year period and then re-evaluated against actual operational costs and capital infrastructure needs. The GSP will be reviewed every 5 years and no less than every 10 years. The annual budgeting process refers to the projected expenses included in the City's rate model.
- Each developed lot or parcel with active water service (excluding irrigation) is required to be connected to the City's sewer system subject to the presence of an existing on-site septic system permitted by Jefferson County Public Health. Each property shall be subjected to a monthly sewer charge whether or not such lot or parcel of real property is actually connected to the sewer system when there is an active domestic water account. The purpose of this policy is financial sustainability of the sewer system to ensure that all developed properties pay a base fee whether discharging to the sewer

system or not. This base fee provides stable funding for the fixed costs incurred by the City for operating a sewer system for the overall benefit of community public health.

- All new development shall be connected to the sewer system unless meeting the exemption requirements outlined in PTMC and state law. Note, that per PTMC, all subdivisions shall be required to provide sewer to all newly created or altered lots intended for commercial and/or residential development.
- The system development charge (SDC) and all applicable connection fees must be paid at the time a sewer connection is obtained. SDCs and fees shall be paid prior to issuance of a final permit approval or prior to occupancy, whichever comes first, accordance with the City's Municipal Code.
- The City shall collect sewer extension charges for owners of properties that individually benefit from publicly built sewer extension facilities, except for those property owners who previously paid for their fair share of such an extension through a Local Improvement District (LID) or ULID. This program has not been established and this policy is recommended to be implemented as a way to create a revolving revenue source to facilitate sewer extensions. The cost of sewer extensions paid by the City can be recovered through Local Facility Charges, frontage fees, or LIDs.
- System development charges should be used to offset rate impacts for capital improvements and not fund debt service.
- Deferral of SDCs should be considered in the setting of system development charge levels to make sure financial objectives are met. For example, if 10 of 50 new housing units per year are affordable, SDCs would need to account for a 20-percent decrease in revenue.
- City Council adopted an income-based discount program. This program should be monitored over time to evaluate participation levels and impacts on rates. The purpose of the income-based discount program is to lower the rate impact to community members burdened by the cost of housing and associated costs.
- If sewer system facilities must be installed or upgraded as a result of a developer's impacts, the new facilities or upgrades shall conform to the City's policies, criteria, and standards and shall be accomplished at the developer's expense. The City, however, shall be responsible for any portion of the costs that are attributable to general facilities, such as over-sizing or over-depth requirements, and offer latecomers fees to developers. Per RCW, the City may participate in developer extension projects and recover costs associated with the City's investment from benefited properties. This practice has not been implemented in the past and is recommended as a future way to recover costs and contribute to revolving investment in sewer infrastructure extensions.
- If written application for service is approved by the City, the application shall be considered as a contract in which the applicant agrees to abide by such rates, rules, and regulations in effect at the time of signing the application or as may be adopted thereafter by the City and to pay all charges, rates, and fees promptly.

- In addition to all other user rates and service connection fees required to be paid to the City, service call fees may apply when made at the request of the owner or occupant of the premises for assistance in locating and/or repairing a plugged sanitary sewer drain in accordance with the City's Municipal Code.
- The City shall manage its income and expenses in a self-supporting manner in compliance with applicable laws and regulations and its own financial policies.
- The City shall establish a CIP that describes the anticipated improvements or modifications to the sewer system, planned replacement of aging facilities, upgrades to existing facilities to provide additional capacity for projected growth, and construction of general facilities to aid growth. The CIP will be updated at a minimum on a 2-year basis associated with the requirement of the Growth Management Act and maintaining a current Capital Facilities Plan.
- The City shall maintain reserves for operations consistent with City reserve policies. The reserves should consider emergencies, bad debts, existing debt coverage, reserve requirements, and fluctuations in revenue.
- The City will maintain information systems that provide sufficient financial and statistical information to ensure conformance with rate-setting policies and objectives.
- Currently, the sewer utility is part of a combined utility with the water utility. It is the policy of the City to separate these utilities into separate funds to ensure accurate cost accounting and sustainability of both utilities.

Connection Charges

Connection fees are an important source of revenue for the sewer, water, and stormwater utilities. The owners of properties that have not been assessed, charged, or borne an equitable share of the cost of the sewer collection system and WWTF pay connection fees for their equitable share of connecting to the system. Connection fees help reduce the burden to existing rate payers. It is noted that some of these charges, such as SDCs for qualifying low income housing, can be deferred according to PTMC. While connection charges are an important source of resources for the sewer utility, SDC levels should be evaluated for impacts on housing and land prices. Higher SDCs combined with other permitting and connection fees typically drive down the price of land to meet market conditions. However, in some cases, land prices do not come down, thereby impacting the total cost of housing. The primary challenge with connection charges for Port Townsend is that much of the City is currently inaccessible to sewer per state and City codes, and many of the pre-platted rights-of-way do not currently have sewer pipes within them. Sewer extensions are costly, and the City sewer utility is already stressed in terms of required upgrades and repairs. Thus, there is a tradeoff between connections fees and housing affecting rates and financial sustainability. One possible approach, when legally allowed, is to expand the City deferral program to more housing options, sizes, and affordability levels or to find additional general fund sources to support objectives.

The following connection fees are available to the City to assist in sewer utility financial sustainability. Some of these strategies have been utilized in the past and others have not.

1. Latecomers Fees (also known as Developer Extension Charges): Latecomers fees are negotiated with the City, developers, and property owners for the reimbursement of a pro rata portion of the original costs of sewer system extensions and facilities and are documented in a Developer Extension Agreement, depending on the application. Latecomer fees have been the primary tool for developers to obtain partial reimbursement for their costs of installing or extending sewer mains. Many latecomers have been filed with the City in the last 20 years. Latecomer reimbursements are due for any new connections to sewer in which an agreement is in place for a period of 20 years.
2. Local Facilities Charges: If applicable, Local Facilities Charges may be due based on established fees by ordinance for specific facilities benefiting specific properties. Pursue the use of Local Facilities Charges for specific system infrastructure, such as trunkline extensions, trunkline upsizing, and lift stations. Local Facilities Charges should be used in areas where new connections are expected. Local Facilities Charges have not been used historically in the City.
3. Frontage Charges: If applicable, Frontage Charges may be due to reimburse the City for investment of sewer pipelines benefiting undeveloped properties. Frontage Charges have not been used historically in the City.
4. LID Assessments: If applicable, these assessments are often paid at the time of connection as required by lending institutions. These assessments take priority lien status right behind taxes. LIDs can be implemented by City Council Resolution or by petition of property owners. LIDs have not been used historically in the City.
5. SDCs: Connection charges shall be assessed against any property connecting to the sewer system. This charge is for the major facilities that deliver the sewage to the WWTF and for the facilities to treat and dispose of the sewage. This charge reimburses customers who have paid for the facilities described and for building capacity to accommodate growth.
6. Outstanding charges resulting from account delinquency.

This GSP recommends the City develop a connection policy reflecting its housing objectives. Examples include the following strategies as detailed previously.

- The City developed an issue paper (white paper) in 2023 suggesting expanding the deferral program for SDCs to housing that is affordable and households earning as much as 200 percent of the Area Median Income. Further study is necessary to determine the appropriate affordability level to ensure gifting of public funds prohibitions are not violated. The intent of this issue paper is to address the inability for many households to obtain housing, including workforce, fixed income, and other situations that result in incomes that cannot afford housing in the City.
- Set SDC levels tied to household size, such as those adopted by Oak Harbor. This recognizes that a small house has less impact on the sewer system than a large house.
- Port Angeles set up a program to reduce fees for middle housing.
- A deferral program or SDC tied to infill housing would recognize the benefit of new housing and rate payers connecting to the system where infrastructure already exists.

- Consider developing a front footage connection fee for all pipes installed by the City to develop a revolving fund for the installation of sewers.
- Using LIDs for new sewer extensions can be a useful tool that captures all benefited properties. This is especially beneficial where there are large unsewered areas of undeveloped properties or where existing septic systems are experiencing failures. LIDs could be implemented in a manner to incentivize development of underutilized property.

Formalization of connection fee policies occurs through City Council adoption of various connection fee levels or programs.

6 | SEWER COLLECTION SYSTEM EVALUATION

INTRODUCTION

This chapter presents the analysis of the existing City of Port Townsend (City) wastewater collection system. Individual sewer system components were analyzed to determine their ability to meet policies and design criteria under both existing and projected flow conditions. The policies and design criteria are presented in **Chapter 5**, and the wastewater system flow and loading analysis is presented in **Chapter 4**. A description of the existing wastewater system facilities and current operation is presented in **Chapter 2**. A distribution of growth map for the purpose of hydraulic modeling of trunklines is included in **Chapter 3**. The capital improvement projects resulting from the existing and projected flow condition analyses are presented in **Chapter 10**.

COLLECTION SYSTEM ANALYSIS

Hydraulic Model

Background

A computer-based hydraulic model of the existing sewer system was created using the SewerGEMS® program developed by Bentley Systems. The entire sewer collection system was modeled, including gravity mains, force mains, and sewer lift stations. The hydraulic model was created using the best information available and data provided by the City. Pipe locations, lengths, diameters, and materials were added based on the previous hydraulic sewer model, GIS data, as-built drawings, various system maps, survey information, and information acquired from the City. Maintenance hole invert and rim elevation data from the City's GIS and survey information was used, if available. The remaining elevation data was extracted from Jefferson County topographic data. Minimum slope and cover values also were used in the development of the model and are annotated in the data files. The output from this model was used to evaluate the capacity of the existing collection system and identify improvements that will be required to handle wastewater flows. The model can be updated and maintained for use as a tool to aid in future planning. Refer to **Appendix I** for basic data used to construct the model.

Model Limitations

Due to the number of data gaps and assumptions used in the model, the accuracy of the model should be confirmed prior to undertaking any replacement or rehabilitation projects, especially for projects not located along a major trunk sewer. The results of the modeling should be considered approximate, and additional investigations, such as field surveys, flow monitoring, and lift station pump down tests, should be performed in the vicinity of any proposed improvements prior to design and construction. If it is found that the input information differs significantly from actual conditions, the model should be updated accordingly and rerun to confirm the original results.

Modeling was performed using a steady-state analysis, which shows all flows reaching all downstream points simultaneously. This is conservative and not truly representative of conditions that occur, since it takes some time for wastewater to travel downstream through the sewer system, which stores and attenuates peak flows.

Flow Data

Existing and projected flow rates for the sewer drainage basins were developed in **Chapter 4**. The total existing flows are shown in **Table 4-3**, and the projected total system flows are shown in **Table 4-10** in **Chapter 4**. **Table 4-11** in **Chapter 4** details existing average annual flow and peak hour flow (PHF) for each sewer lift station. As discussed in **Chapter 4**, the City's projected wastewater flow by basin was estimated from population growth per basin as provided by City planning staff (**Figure 3-3**) and calculated from peaking factors and per capita flows as estimated in **Chapter 4**. The total existing and projected flows by basin are shown in **Table 4-12** in **Chapter 4**. It is recommended that the City obtain additional flow data from the sewer drainage basins to accurately evaluate capacity in areas with suspected deficiencies for future planning and design.

Facilities

The hydraulic model of the existing system contains all active existing system facilities. Available information for the lift stations, such as pump capacity, total dynamic head, horsepower, wet well diameter, wet well depth, and force main diameter, is included in the model. For simplicity, the existing lift stations were modeled as having variable frequency drives (VFDs) on the pumps so that they discharge at the same rate as the influent flow rate regardless of head conditions.

Hydraulic Analyses Results

Hydraulic analyses were performed based on the existing flow rates (2018), as well as projected flow rates for 2028, 2033, and 2043. In the evaluation, the criteria for listing an existing sewer pipe as deficient is that the upstream maintenance hole is surcharged more than 1 foot during the estimated PHF. The results for the 2028, 2033, and 2043 modeling are included in **Appendix I**.

Pipe Capacity Deficiencies

It is intended that this General Sewer Plan (GSP) contain an inclusive list of recommended system improvements; however, additional projects may need to be added or removed from the list as growth occurs or conditions change. The City will evaluate the capacity of the wastewater collection system as growth occurs and development applications are received.

Existing System

Currently, the existing gravity sewers do not have deficient conveyance capacity. That is, no maintenance hole surcharges over 1 foot above the crown of the pipe during existing peak flows. This was observed in the model and confirmed by the City's operations staff. Surcharging only occurs at the discharge of the Monroe Street Lift Station force main to the gravity sewer on Water Street. Design of a new and larger Water Street gravity sewer main to receive the flow is underway; therefore, it is not included in the Capital Improvement Plan (CIP) in **Chapter 10**.

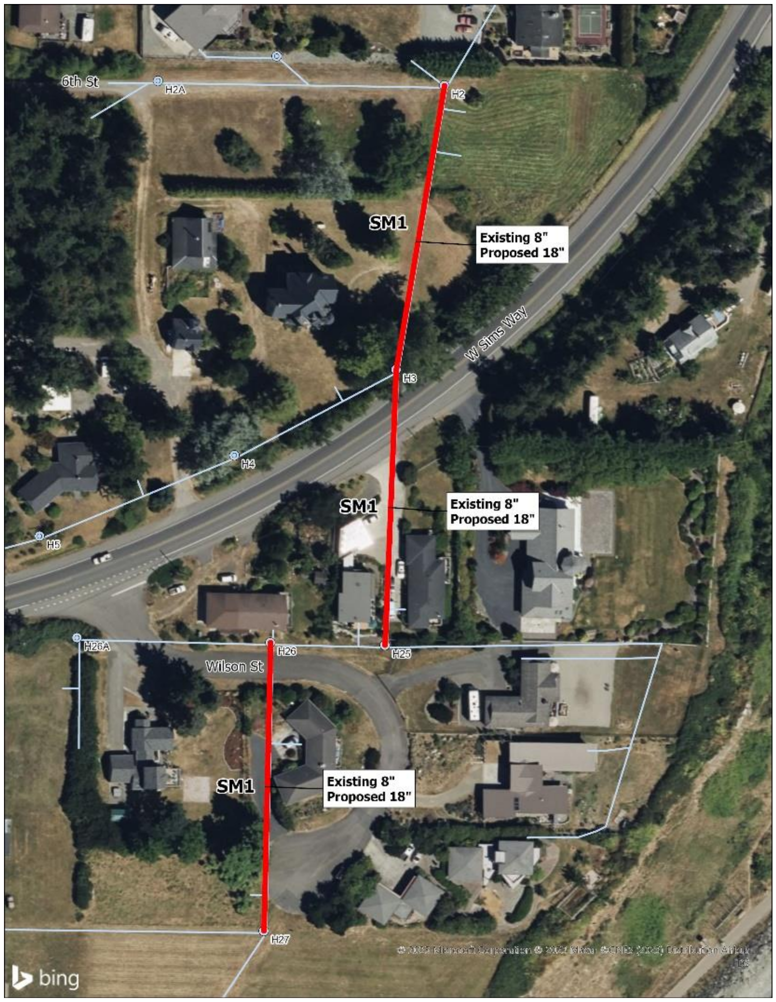
Future Analyses

The primary driver of gravity main capacity improvements for the 5-year, 6- to 10-year, and 11- to 20-year planning periods are the projected flows from the proposed development of the Mill site. Fortunately, this flow will be conveyed by gravity to the wastewater treatment facility (WWTF) following discharge from the proposed Mill Lift Station force main. Existing lift stations will not be taxed by these additional flows; however, substantial investment in the upsizing of existing pipelines will be required over the next 20 years to convey these flows to the WWTF. The following sections provide a summary of gravity conveyance deficiencies for the 5-, 10-, and 20-year design horizons. The colors of the mains to be upsized are red, green, and blue, respectively, for the 5-, 10-, and 20-year scenarios presented here and in **Chapter 10**.

5-Year Forecast Hydraulic Deficiencies

Figure 6-1 shows CIP SM1. These pipelines are estimated to be hydraulically deficient within the next 5 years after the construction of the Mill Lift Station. The pipelines, shown in red, may need their alignment shifted from existing to get more distance from existing structures.

Figure 6-1 – CIP SM1



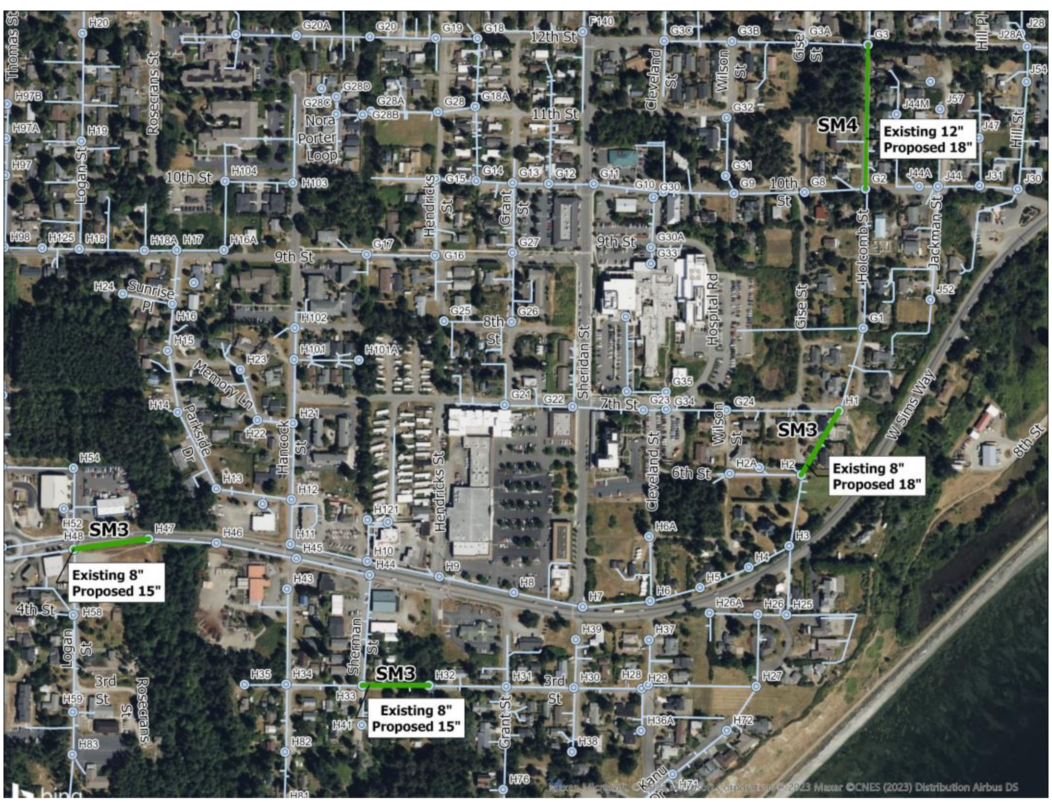
CIP SM1 must be upgraded simultaneously with the construction of the Mill Lift Station.

6- to 10-Year Forecast

The growth of the Mill site will warrant upsizing the gravity pipelines shown in green in **Figures 6-2** and **6-3** by the year 2033.

Figure 6-2 – CIP SM2

Figure 6-3 – CIPs SM3 and SM4



11- to 20-Year Forecast

Sewer mains shown in blue in **Figures 6-4** through **6-6** are anticipated to need upgrades by 2043 to be able to convey anticipated flows without causing the pipelines to flow more than 75-percent full.

Figure 6-4 – CIP SM5

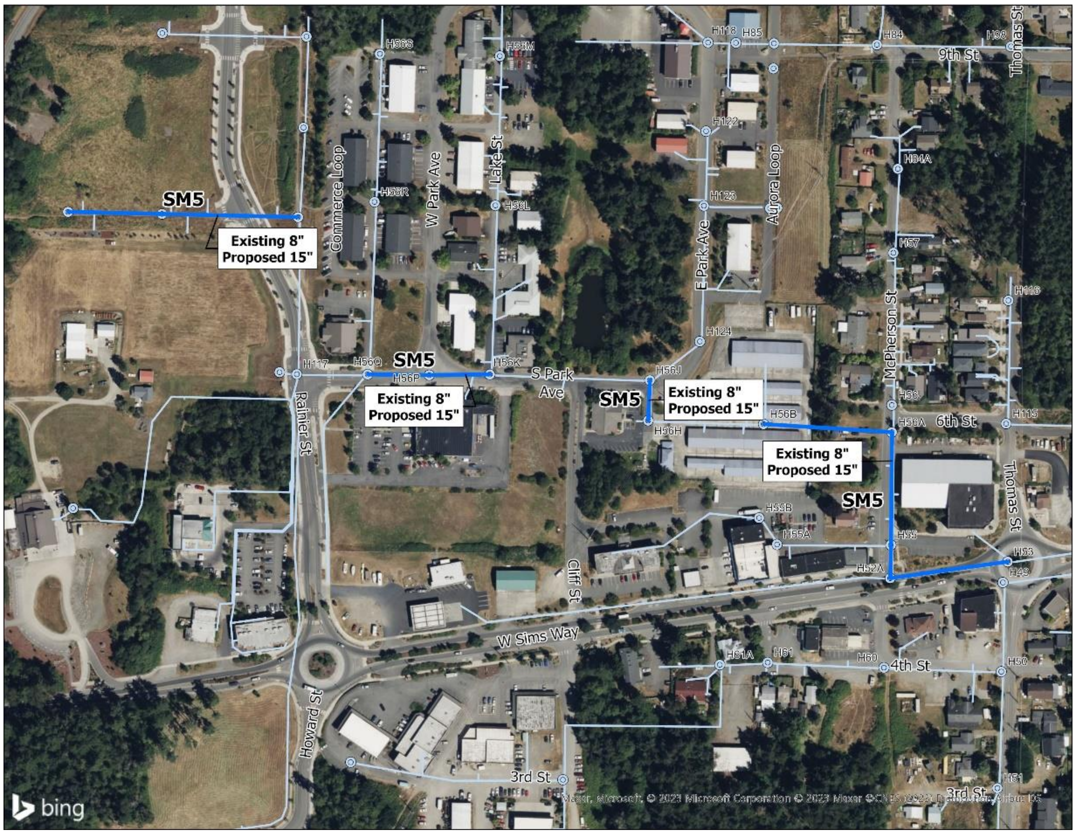
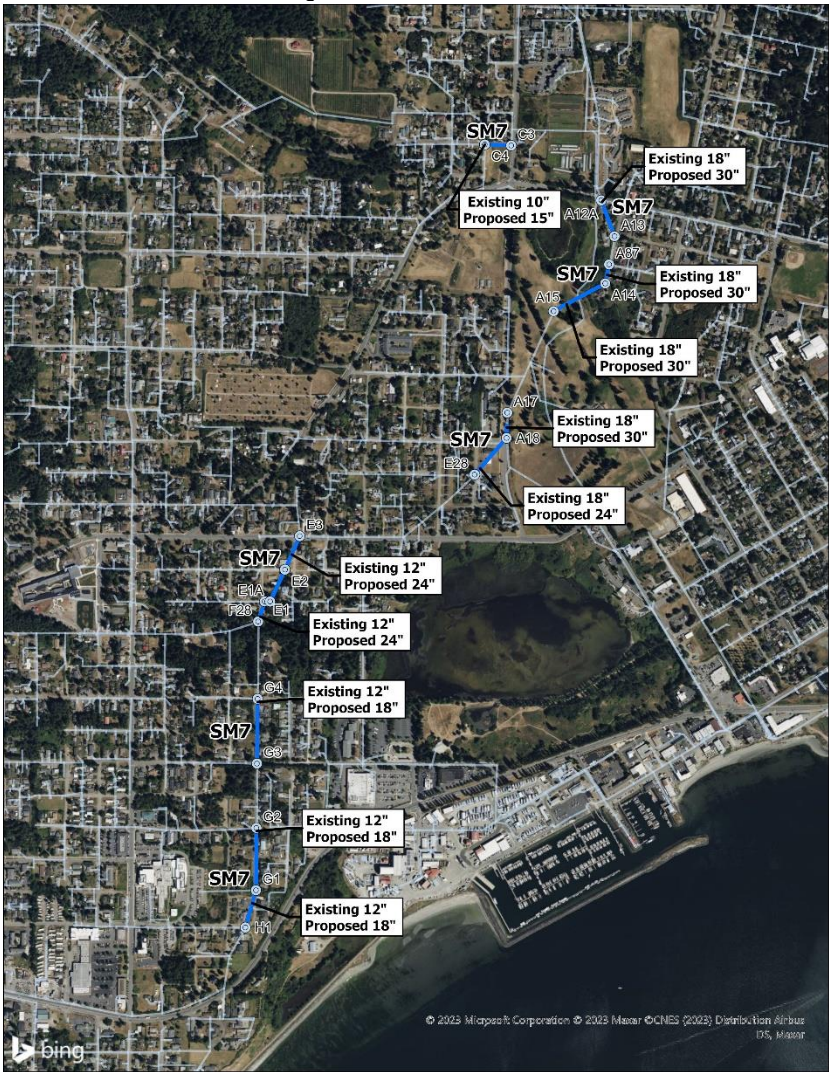


Figure 6-5 – CIP SM6

Figure 6-6 – CIP SM7



Other Existing Gravity Collection System Deficiencies

The City does not have complete knowledge about the condition of its collection system because of antiquated and broken video inspection equipment. During the attempted inspection of the Water Street gravity main in 2023, a contracted video inspection company recorded mains suspected of being structurally deficient. The results of these inspections were alarming, as some pipelines contained earthen sediments (Water Street) and others were cracked, crushed, and becoming oval in cross-section (Washington Street; **Figures 6-7** and **6-8**). Only a small sampling of the City's collection system was inspected and significant structural defects were found. It is imperative that the City begin a systematic inspection plan with a goal of viewing the interior of all pipes and maintenance holes within the next 5 to 10 years. As these inspections are performed, pipe materials should be noted and recorded in the City's GIS system to improve system records. Many pipelines are of unknown material, making pipe lifespan predictions difficult. Gaining knowledge about the existing collection system will allow the City to identify those mains that are most urgently in need of repair or replacement and will help prevent occurrences like the collapse of the Water Street gravity sewer on December 27, 2022. The City's ability to maintain and update the collection system will be greatly aided by recording pipe materials and conditions and storing this information in the GIS system it has established. Purchase of modern inspection equipment and committing employees to the inspection of pipelines will yield savings and prevent future wastewater overflows.

Figure 6-7 – CIP SM10

This section of pipe in Washington Street is in danger of imminent collapse.

Figure 6-8 – Washington Street Sewer with Cracks

Longitudinal cracks and deformation in Washington Street sewer portend collapse.

LIFT STATION ANALYSIS

Lift Station Capacity

Existing System

The hydraulic analysis of the City's existing lift stations (**Table 4-12**) shows that only the Monroe Street Lift Station does not have adequate capacity. As discussed previously, capacity analyses of each lift station are based on estimated PHF. According to discussions with the system operators, there are no known capacity deficiencies in the City's existing lift stations during current operating conditions except for the Monroe Street Lift Station. These deficiencies are discussed later in this chapter.

2028, 2033, and 2043 Lift Station Needs

Only modest population growth is forecast within the current City limits and it is dispersed throughout the City as shown in **Figure 3-3**. Of this growth, less than 20 percent is forecast to occur in the existing lift station basins. The remainder will flow by gravity to the WWTF. There will be small, incremental increases to each existing lift station over the next 20 years, leaving the total flow to be pumped by each station below each their firm capacities. None of the existing lift stations are forecast to have capacity shortfalls, except for the Monroe Street Lift Station. The station handling most of the new growth will be the proposed Mill Lift Station. Predesign studies show that a 1,062 gallons per minute (gpm) capacity is required. Refer to **Appendix J** for an estimation of the flows for this lift station. Capacity upgrades are needed for the Mill and Monroe Street Lift Stations.

Monroe Street Lift Station

The Monroe Street Lift Station is currently under capacity and regularly has all three of the station's pumps operating to convey peak flows. The station has not overflowed, but it is the City's standard to have two pumps with one redundant pump to accommodate PHFs. For this reason, the capacity must be increased, or the peak flow tributary to the station must be reduced. As part of the Water Street Sewer Replacement project, scheduled for 2024, new pump impellers will be installed for each of the station's pumps. The existing electric motors have spare capacity to accommodate larger impellers that could deliver approximately 100 gpm more from the station. However, this will not be enough to bring the lift station into compliance with desired capacity standards. RH2 Engineering, Inc., (RH2) recommends that inflow in the basin draining to the lift station be reduced to decrease the load on the lift station.

Lawrence Street, between Fillmore and Monroe Streets, has stormwater inlets connecting to the gravity sewer (**Figure 6-9**). This is a likely cause for the Monroe Street Lift Station's overload. This inflow also taxes the capacity of the WWTF unnecessarily with stormwater. Separation of the storm and sanitary sewer could possibly reduce the hydraulic loads entering the Monroe Street Lift Station. Smoke testing and video inspection of the sewer main in

Lawrence Street should be performed to locate the connections between the storm and sanitary sewer systems.

Figure 6-9 – CIP SM9

The sanitary and storm sewers in Lawrence Street must be separated to reduce hydraulic loads on wastewater facilities.

In addition to capacity shortfalls, the Monroe Street Lift Station is aging and near the shoreline, placing it at risk for flooding due to forecasted sea level rise. The *City of Port Townsend Sea Level Rise and Coastal Flooding Risk Assessment* (City of Port Townsend & Cascadia Consulting Group, 2022) (**Appendix K**) lists the Monroe Street Lift Station as a public facility at risk of flooding with the potential for "high consequence." The lift station access hatches must be elevated or the lift station must be relocated to higher ground. All pumps, pipes, valves, electrical panels, and controls must be replaced with new units to increase the reliability of this vital lift station. Flow measurement also should be added to the station to assist the City in quantifying the inflow tributary to the lift station.

Hydraulically, the lift station's force main is performing well and appears to be in good condition. It is approaching 60 years in age, and record drawings show that it is cast iron pipe. When the existing 10-inch cast iron force main is exposed for any reason, the exterior should be inspected for pitting and corrosion. Cast iron pipe from the 1960s came with cement mortar lining, and the main could still be in good condition. Out of caution, the City should monitor the discharge pressure characteristics of the lift station closely. Sudden decreases in pressure could indicate a breach in the pipe. Increases show occlusion of the pipeline due to corrosion or sediment deposition. The City should take all opportunities to observe the main's exterior for deterioration since exterior corrosion of the iron main is a risk in the marine environment.

Work to separate the Lawrence Street storm and sanitary sewers should be completed prior to designing improvements for the Monroe Street Lift Station. This will allow the pumps to be sized appropriately if inflow is substantially reduced. RH2 suspects that PHF could drop dramatically with the storm inlets removed from the sanitary sewer. This may be adequate to provide a temporary solution to the Monroe Street Lift Station's capacity problem. This temporary solution may allow the full lift station rehabilitation or relocation to be delayed by 5 to 10 years.

Other Lift Station Improvements

A budget will be set aside in the CIP for minor repairs and replacements of pump motors, pump impellers, telemetry unit replacement, valve overhauls, panel replacements, generator replacements, force main repairs, and other minor improvements to keep the existing lift stations operating reliably. The City has two existing major lift stations: Monroe Street and Gaines Street. Gaines Street was upgraded in 2021, and Monroe Street will be scheduled for upgrades as discussed previously. The Mill site will add another major lift station within the next 2 to 3 years. All major lift stations will be relatively new and/or rehabilitated in the 2020s, and no additional capacity or significant upgrades will be needed during the 20-year planning horizon. The remaining lift stations are small with minor replacement needs. The CIP will include a general allowance to cover these needs.

7 | EXISTING TREATMENT FACILITIES ASSESSMENT

BACKGROUND

History and Introduction

The City of Port Townsend's (City) original wastewater treatment facility (WWTF) was constructed in 1967 to receive wastewater from approximately 90 percent of the City's sewer services and to provide primary treatment and disinfection with chlorine gas. The WWTF was expanded in 1993 to provide full secondary treatment. This expansion included a new Headworks facility, oxidation ditches, secondary clarifiers, chlorine contact basins, conversion of the original plant primary treatment tanks to aerobic sludge holding tanks, a Control building, and electrical and supervisory control and data acquisition (SCADA) system improvements.

The City's Compost Facility is located at the Jefferson County Landfill and receives dewatered biosolids from the WWTF, as well as dewatered septage from Jefferson County (County), yard waste from the City and County, and other wood wastes. Liquids generated from these processes, including septage filtrate, contaminated stormwater runoff, and compost aeration condensate, are treated in a separate wastewater treatment facility consisting of a sequencing batch reactor (SBR) with disinfection and effluent disposal to constructed wetlands followed by discharge to infiltration basins for ultimate disposal.

This chapter presents the evaluations of the existing WWTF and Compost Facility conditions, including the existing liquid stream and solids handling processes. It also presents an evaluation of the electrical and SCADA systems. Deficiencies identified from the evaluations are described, and recommendations for capital improvements are summarized. The analyses of needed improvements to the treatment facilities for water quality and capacity are provided in **Chapter 8**. All WWTF capital improvements are identified in **Chapter 10**.

System Overview

Wastewater from the City's collection system is conveyed to the WWTF and flows via gravity to the Influent Pump Station located on the WWTF site. Wastewater from the Influent Pump Station, which also includes facility-generated wastewater and process drains, is pumped to the inlet of the Headworks. From the Headworks, wastewater enters the oxidation ditches, secondary clarifiers, and chlorine contact basins before heading to the Strait of Juan de Fuca through an outfall structure. Waste sludge is captured in the aerobic sludge holding tanks and pumped to the belt press, and dewatered solids are hauled off to the City's Compost Facility. An important consideration in a wastewater treatment system is that virtually all of the system components must have redundant or back-up components. For example, the plant must be able to run with one clarifier out of service. Thus, upgrades to a system also require upgrades to the redundant components. This adds to the cost of upgrades significantly but is a requirement to ensure that the plant operates reliably.

The approximate locations of major WWTF process units are outlined in **Figure 7-1** and shown schematically in **Figure 7-2**.

Figure 7-1 – Existing WWTF Overall Site Plan

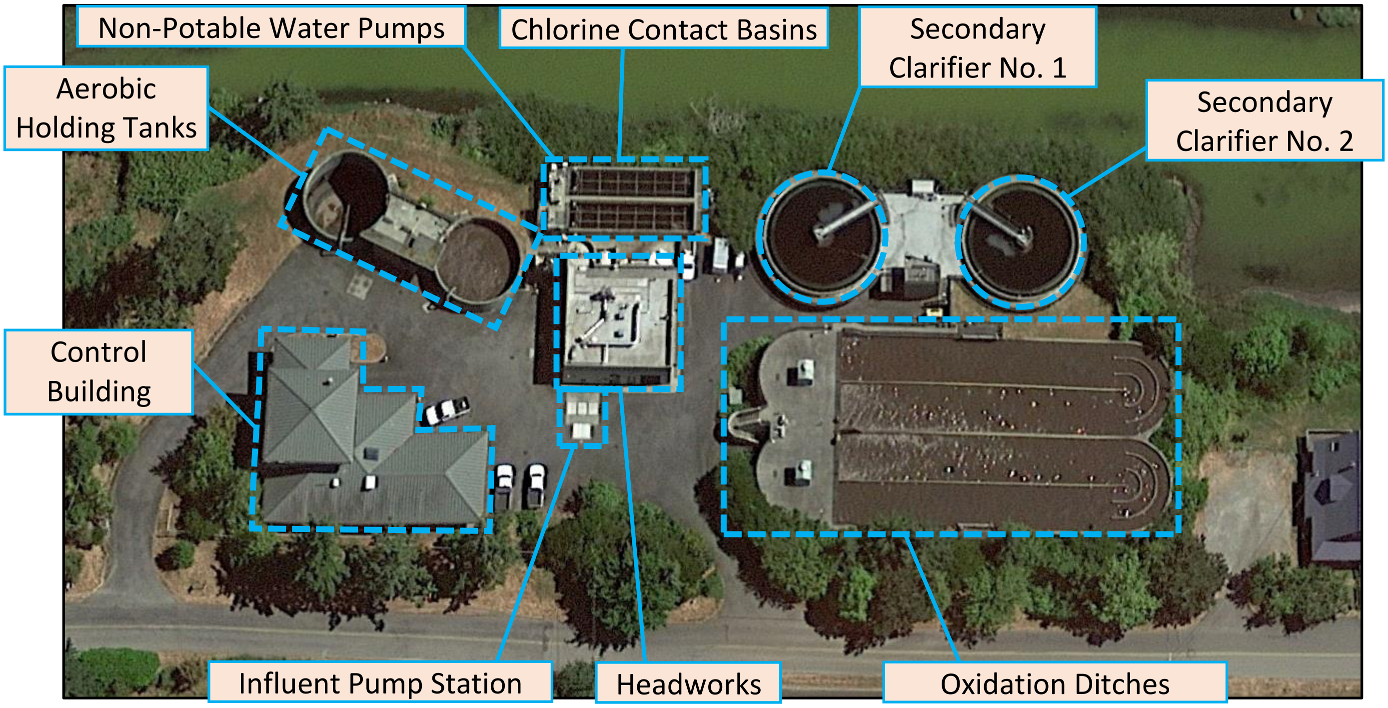
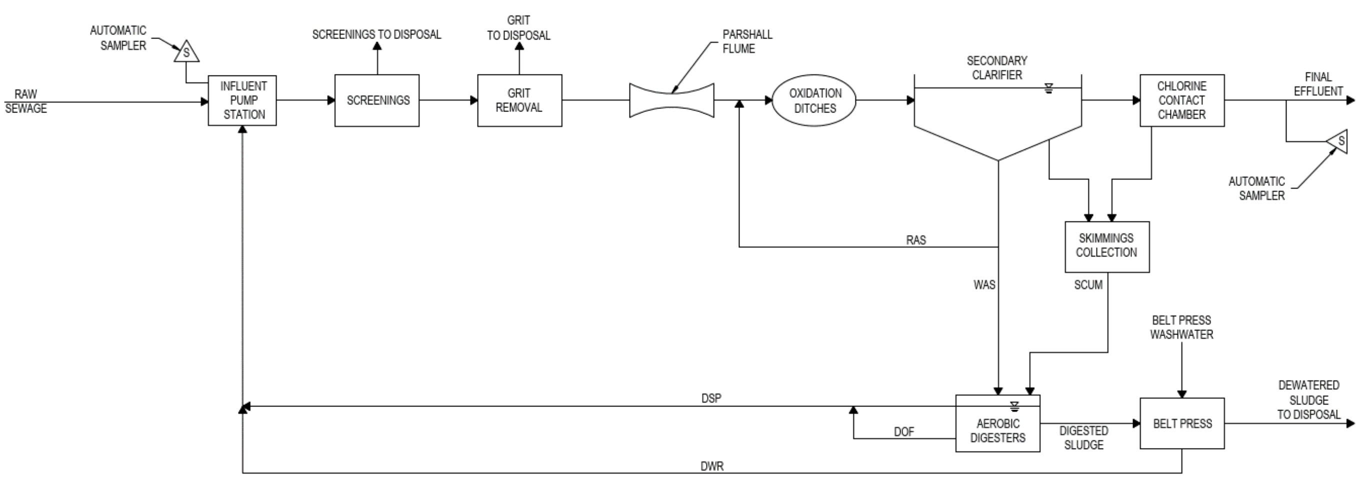


Figure 7-2 – Existing WWTF Process Schematic



Historical WWTF Performance

The historical performance of the WWTF from 2019 through 2022 is compared to the City's National Pollutant Discharge Elimination System (NPDES) Permit limits as shown in **Table 7-1**.

Table 7-1

WWTF Performance Based on NPDES Permit Effluent Limits (2019-2022)

Parameter	Interval	NPDES Limit	Highest Recorded Value by Year 2019	2020	2021	2022
BOD (mg/L)	Avg. Month	30	5.8	6.0	5.9	5.1
	Avg. Week	45	7.7	7.2	6.9	5.6
TSS (mg/L)	Avg. Month	30	3.6	4.0	4.5	3.4
	Avg. Week	45	5.0	4.8	5.9	3.8
Total Residual Chlorine (mg/L)	Avg. Month	0.50	0.02	0.03	0.03	0.03
	Avg. Week	0.75	0.03	0.10	0.06	0.04
pH	Daily Min.	6.0	7.3	7.2	7.2	7.2
	Daily Max.	9.0	7.4	7.3	7.6	7.4
Fecal Coliform Bacteria (colonies/100 mL)	Monthly[1]	200	14	6	6	7
	Weekly[1,2]	400	29	20	37	<400

1 = Geometric mean.

2 = December 2022 weekly geometric mean data unavailable but no exceedances were noted.

As shown in the table, the City has maintained compliance with its NPDES Permit limits and no exceedances of the permit were reported for the last 4 years. As required by the NPDES Permit, the City also monitors priority nutrients, priority pollutants, and other parameters and undergoes whole effluent toxicity testing in the winter and summer of the final year of each permit cycle. None of these items have prompted additional activities or permit actions in recent years. The WWTF is well maintained and earned the Washington State Department of Ecology's Outstanding Performance Award for the 25th consecutive year in 2022.

As noted in **Chapter 2**, the City also is subject to the Puget Sound Nutrient General Permit (PSNGP). Starting in February 2022, the City was required to monitor and report nitrogen compounds on its Discharge Monitoring Reports. **Table 7-2** is a summary of the monthly sampling results for 2022.

Table 7-2

Monthly Nitrogen Sampling Results

Sample Date	Calculated TIN (mg/L)	Sample Date	Calculated TIN (mg/L)
2/2/2022	8.44	2/9/2022	6.92
3/2/2022	4.89	3/9/2022	5.51
4/5/2022	6.93	4/12/2022	4.71
5/3/2022	2.58	5/10/2022	2.13
6/7/2022	3.94	6/14/2022	5.91
7/5/2022	0.91	7/12/2022	0.65
8/2/2022	0.80	8/9/2022	1.06
9/6/2022	35.20	9/13/2022	1.66
10/4/2022	3.61	10/11/2022	4.49
11/1/2022	8.83	11/8/2022	7.56
12/6/2022	10.50	12/13/2022	8.25

The average annual Total Inorganic Nitrogen (TIN) is well below 10 milligrams per liter (mg/L). Only two samples exceeded 10 mg/L in the sampling period.

WWTF EXISTING PROCESS UNITS EVALUATION

Introduction

The WWTF secondary treatment expansion in 1993 was the last major improvement or expansion to the facility. This section provides a review of the general conditions of each major process or area within the WWTF. The analyses and findings provided herein were based on observation of visible areas around the WWTF, discussions with City operations and maintenance staff, and a 2019 *Condition Assessment Summary Report* performed by Jacobs (**Appendix L**).

Although most equipment and processes continue to function satisfactorily and meet existing demands, several of these systems are nearing the end of their design life and need to be replaced or upgraded. In general, these include major improvements to the Influent Pump Station, Headworks, secondary clarifiers, oxidation ditches, and electrical and SCADA systems. Other minor improvements that were previously noted are also described in this chapter.

Overall, the visible elements of the WWTF generally appear to be in good physical condition except where noted otherwise. The age of the equipment and processes is one of the main drivers for the WWTF improvements, and details are provided in the subsequent sections.

Influent Pump Station

Overview

The City's collection system includes two influent gravity sewer mains that enter the Influent Pump Station (IPS), which is located near the center of the WWTF site. The IPS also receives various WWTF process drains.

The IPS consists of a below-grade, cast-in-place concrete structure that houses 3 submersible influent pumps, each with a nominal capacity of 2,250 gallons per minute. Each of the three pumps have below-grade check valve systems outside of the wet well. Downstream of the check valve systems, the discharge piping from the pumps combines to a common force main that directs flow up to the elevated Headworks channels.

Under normal operating conditions, one pump operates as the lead pump, a second lag pump turns on during extreme flow events, and the third pump serves as a redundant pump. The pumps are cycled weekly to avoid overuse of any single pump and to prolong the service life of all three pumps.

Condition Assessment

IPS Structure

The existing IPS structure was constructed as part of the 1993 secondary treatment expansion project. The interior liner is detaching from the concrete and portions of the cast-in-place concrete walls and ceiling are corroding. There is notable exposed aggregate and the surfaces need to be rehabilitated in the near term to prolong the useful life of this structure.

IPS Mechanical

The original submersible pumps from the 1993 WWTF secondary treatment expansion project experienced corrosion and were replaced after the expansion with Flygt N-style impeller pumps. Since then, minimal corrosion has been noted and no major repairs have been necessary for the Flygt pumps. The stainless steel pump guide rails are generally in satisfactory condition with only minor corrosion. Due to the IPS needing to remain in operation, the pump discharge piping and fittings were not able to be observed. However, due to the age and condition of the IPS infrastructure, it is recommended to further evaluate this system during other improvement work in the IPS and prioritize replacing mechanical components if determined necessary.

Major Electrical and Control Equipment

Major improvements to the IPS electrical and control equipment are expected during the planning period due to significant corrosion and aging infrastructure. The junction boxes, conduits, and level instrumentation directly inside the IPS, as well as the power raceways and variable frequency drives (VFDs) from the electrical room need to be replaced in the near term. Additionally, one of the electrical conduits has corroded to the point where one of the pumps is now out of service. In an emergency, this pump can be brought back into service by a quick pump wiring change; however, this is an example of the urgency needed to rebuild the IPS. The power and control cables of the pumps are connected to plugs located near the top of the IPS. These plugs are accessible and should be maintained to allow WWTF staff to efficiently disconnect and remove pumps from the IPS if needed.

Summary of Major Findings

Based on the conditions assessment, a summary of the recommendations for major improvements to the IPS is as follows:

1. Rehabilitate the concrete infrastructure inside the IPS wet well. Coat the interior walls and ceiling for future corrosion protection.
2. Evaluate the condition of the mechanical equipment in the IPS and replace it if necessary.
3. Replace the electrical equipment associated with the IPS, including raceways, VFDs, and instrumentation.

Headworks

Overview

The Headworks building was constructed as part of the 1993 WWTF secondary treatment expansion project to include a mechanical bar screen in the covered concrete influent channel. In approximately 2009, the original screen was replaced with a new automatic Parkson Aqua Guard mechanical bar screen that has a 66-inch nominal width. The IPS discharges raw water into the influent channel through the bar screen. Screenings are dewatered in a compactor system that discharges to the screenings and grit hopper in the Headworks building before being disposed offsite. A bypass channel is adjacent to the main influent channel and houses a manual bar screen that can be isolated with stop gates.

Screened influent enters the original Smith and Loveless Pistagrit vortex-style grit removal chamber located on the northern side of the Headworks building. The grit chamber is 10 feet in diameter and is nominally rated at 7 million gallons per day. Screened influent also can be diverted to bypass the grit chamber if necessary. De-gritted influent from the grit chamber flows through a 1-foot-wide Parshall flume in a separate concrete channel and combines with return activated sludge (RAS) at the end of the Headworks before entering the oxidation ditches. The settled grit slurry in the grit removal chamber is directed to the grit classifier, which dewaters and washes the grit, before being discharged to the screenings and grit hopper and disposed offsite. The grit classifier was replaced around 2009 and is located on the main level of the Headworks building.

The Headworks screen and grit removal system is an important part of the plant operation. However, failures in the system do not disrupt plant operation. The result of a Headworks equipment failure is that grit is transferred to the oxidation ditches, which creates the need for additional cleaning. Careful maintenance and inspection of the equipment, maximizing the life of the equipment, can extend when equipment replacement would be needed. There is budget provided in the Capital Improvement Plan (CIP) for replacement if needed. However, given the Headworks ultimately will be replaced, if staff can extend the life of this equipment to the time of the Headworks building replacement, savings in the overall CIP will be realized.

Condition Assessment

Headworks Influent Channels Structure

The influent channels are cast-in-place concrete. These structures appear to be in satisfactory condition, requiring only some rehabilitation work relating to the interior liner system. The embedded liner was not adequately installed on a concrete support column in the RAS return basin and is peeling away at the corners of the column. Liner failure also was observed previously near the temporary gates. Significant liner failures exist over the RAS and influent splitter weirs and under the cover of the influent wet well, which will need to be improved. Concrete corrosion has been noted previously at the bottom of the Parshall flume; however, the Parshall flume and associated instrumentation appear to provide accurate influent flow readings.

Mechanical Screens

The mechanical screen appears to be functioning well with minimal corrosion observed. Other components, including channel covers and gates, appear to be in good condition. Near the screen, a short section of ductile iron non-potable water pipe was previously observed to be uncoated and moderately corroded where there was no thermal insulation.

Grit Removal Chamber and Grit Room

The original vortex grit unit appears to be functioning well with minor wearing that are not uncommon or of concern. However, the grit unit was not dewatered and out of service during the site visit, so submerged components could not be reviewed. No significant grit accumulation downstream of the grit unit has been reported. The air lift tube and cyclone have been rebuilt previously due to the original units wearing out and appear to be in good condition. The screenings compactor and compactor tube have been noted to be in good condition; overall, no corrosion issues have been observed in the grit room.

Summary of Major Findings

Based on the conditions assessment, a summary of the recommendations for major improvements to the Headworks is as follows:

1. Repair the embedded plastic liner on the concrete columns and walls in the Headworks influent channels. These improvements should be included with the IPS concrete liner system improvements as previously discussed. These improvements should occur in the near term and more details are included in **Chapter 10** (**CIP F1**).
2. Due to the age of infrastructure, it is recommended to plan for the replacement of the screen and grit removal equipment within the next 5 to 10 years. More details are included in **Chapter 10**.

Summary of Minor Findings

Based on the conditions assessment, a summary of the recommendations for minor improvements to the Headworks is as follows:

1. Repair and coat the ductile iron non-potable water pipe near the mechanical screen.
2. Perform minor repairs to Headworks equipment to extend its life until the Headworks building is replaced.

Activated Sludge System

Overview

Prior to the addition of secondary treatment to the WWTF, the facility provided treatment utilizing two primary treatment tanks and chlorine disinfection. During the secondary treatment improvements in 1993, the activated sludge system was added to the WWTF and included two oxidation ditches and two secondary clarifiers. The existing primary treatment tanks were converted into aerobic sludge holding tanks. The current activated sludge system is a suspended growth system that utilizes microorganisms in the liquid of the oxidation ditches to provide biological treatment of the wastewater. The oxidation ditches and secondary clarifiers were configured within the hydraulic profile such that influent could flow by gravity from the Headworks to the oxidation ditches, the secondary clarifiers, and then the chlorine contact basin before reaching the outfall. Each of the activated sludge components is discussed in greater detail as follows.

Oxidation Ditches

The oxidation ditches are where biological treatment occurs. This system utilizes a combination of mixing wastewater and oxygen to break down organics. The ditches also are operated such that a small anaerobic zone provides some nitrogen removal. Wastewater from the Headworks and RAS processes combine and flow to the two oxidation ditches using isolation gates. The oxidation ditches are original Eimco Carrousel Systems, each with a nominal volume of 0.57 million gallons. Each ditch contains a deck-mounted vertical paddle mixer/aerator that supplies dissolved oxygen into the ditch. These mixer/aerators operate on a two-speed mode, high and low, and each utilizes a 75-horsepower motor. The gearbox assemblies for the mixer shafts are housed in noise enclosure structures on top of the ditches. The mixed liquor enters the oxidation ditches, flows around the Carrousel system, and exits over adjustable weirs to downstream processes.

Secondary Clarifiers and Processes

Clarifiers serve the purpose of separating solids from water after the biological treatment has occurred in the oxidation ditches. After exiting the oxidation ditches, the mixed liquor is split between two 50-foot-diameter Eimco secondary clarifiers. The two secondary clarifiers are circular concrete tanks that are identical in size and construction. The secondary clarifier mechanisms are original, each operating on a 0.75-horsepower drive motor. Each clarifier mechanism directs settled mixed liquor to three RAS pumps that return to the splitter box downstream of the Headworks Parshall flume. Each mechanism also collects floatable items (referred to herein as scum) and directs the collected material to a scum box in each clarifier. An existing scum pump conveys scum to the aerobic holding tanks. Settled sludge from the clarifiers also is pumped to the aerobic holding tanks using two waste activated sludge (WAS) pumps. Clarified effluent exits over the clarifier weirs and discharges to the chlorine contact basins.

Chlorine Contact Basins

Prior to discharge to the Strait of Juan de Fuca, treated water must be disinfected. The current system utilizes a chlorination system approach to disinfection. The clarified effluent from the secondary clarifiers enters the chlorine contact basins and is disinfected with chlorine, dechlorinated with sodium bisulfite, and finally discharged through the outfall of the WWTF. The two chlorine contact chamber structures are original, and two feed pumps are used to dose liquid sodium hypochlorite into the clarified effluent. The original fiberglass reinforced plastic (FRP) tank holding the hypochlorite was previously replaced with a 6,200-gallon high density polyethylene (HDPE) tank. Once dosed with hypochlorite, the effluent flows through a serpentine path throughout the chlorine contact basins to meet contact time requirements. The effluent is then dechlorinated with liquid sodium bisulfite before being discharged through the outfall. The sodium bisulfite is held in a 1,100-gallon tank manufactured by Chemical Proof Corporation. Two Peabody Floway non-potable water pumps at the end of the chlorine contact basins supply part of the effluent back throughout the plant for various processes. Scum also is collected near the end of these basins and pumped to the aerobic holding tanks.

Condition Assessment

Oxidation Ditches

The visible concrete of the oxidation ditches generally appeared to be in good condition; however, submerged concrete was not observed due to both ditches remaining in operation. The mixer/aerators appear to be in good condition with minimal vibration and both gearbox enclosures appear to be sufficiently ventilated. The paddle of one mixer/aerator was replaced previously and there is a spare motor available. Further assessment of the ditches is provided in **Chapter 8**.

Secondary Clarifiers and Processes

The original clarifier mechanisms appear to be in satisfactory condition and the original drives and motors are still in service. These items have been in service for over 30 years now, and have reached their expected design life. However, with careful monitoring and maintenance, the design life can be extended. Minor corrosion has been noted on the mechanism in areas with coating defects that have become noticeable over time; however, no major mechanical or capacity issues have previously been noted. The original carbon steel fasteners on the mechanisms were replaced previously with stainless steel hardware due to past failures, and other carbon steel support brackets have been previously observed to be corroding. Minimal corrosion issues have been noted on the concrete floor inside the secondary clarifiers, with only minor leaching and exposed aggregate observed in the clarifier launders. The steel walkway, FRP weirs, and baffles of the clarifiers all appear to be in sufficient condition.

There have been no major concerns with the WAS/RAS station between the two secondary clarifiers as the piping and appurtenances are in a good overall condition. Only minor replacement and maintenance work has been required in the past. No major capacity, functionality, or conditions-based issues have been observed for the RAS, WAS, and scum systems.

Chlorine Contact Basins

Overall, the chlorine contact basins are in satisfactory condition with only a few issues noted. The gate operator stems have been observed to be corroding at the water surface and a few wood planks above the water are rotting. The conditions of the planks below water have not been observed. No major capacity, functionality, or conditions-based issues were observed with these basins. No corrosion issues have been noted for the sodium hypochlorite or sodium bisulfite systems, and no issues have been noted on the HDPE hypochlorite storage tank. The City has observed previously that the existing non-potable water pumps have corrosion issues.

Discharge Outfall

The existing discharge outfall into the Strait of Juan de Fuca was not evaluated as part of this General Sewer Plan (GSP). The City is separately actively working with the Washington State Department of Ecology (Ecology) and Jacobs on the outfall replacement/upgrade, and that work was in progress at the time of this GSP. Further discussion is contained within **Chapter 8**.

Summary of Major Findings

Based on the conditions assessment, a summary of the recommendations for major improvements to the activated sludge system is as follows.

Oxidation Ditches

Chapter 8 discusses operational modifications to maintain nutrient reduction within the existing system capacity and improve actual treatment capacity. Ultimately, the oxidation ditches will have to be replaced with larger ditches to address increasing demands on the system and nutrient removal. Interim improvements will be needed for nutrient removal. The evaluation in **Chapter 8** provides the recommended next steps for improvements on the oxidation ditches; more details are provided in **Chapters 8** and **10**.

Secondary Clarifiers and Processes

Clarifier upgrades are included in the CIP. The clarifiers need to be maintained as they are not planned to be replaced in the next 20 years. Extending the life of the clarifiers provides significant savings over the long term.

1. Re-coat the concrete launders of both secondary clarifiers.
2. The existing mechanisms of both secondary clarifiers are at or nearing the end of their design life. Continue to monitor mechanisms annually and at manufacturer recommended frequency on drive units and consider oil testing as recommended by the manufacturer. Plan to replace the mechanisms and replace or rehabilitate the drive units.

Chlorine Contact Basins

Continued maintenance of the chlorine contact basins is recommended as these facilities are not planned to be replaced in the next 20 years.

1. Replace the non-potable water pumps in-kind and associated electrical equipment in the near term.

Summary of Minor Findings

Based on the conditions assessment, a summary of the recommendations for minor improvements to the activated sludge system is as follows.

Secondary Clarifiers and Processes

1. Replace the carbon steel weir support brackets with stainless steel brackets in the near term.
2. Re-coat areas of the mechanisms that have notable spot corrosion.

Chlorine Contact Basins

1. Repair or replace gate operator stems with notable corrosion.
2. Evaluate the condition of all wood planks associated with the chlorine contact basins and repair or replace components as necessary.

Sludge Holding, Dewatering, and Disposal

Overview

The WAS pumped from the secondary clarifiers enters the aerobic holding tanks that provide sludge storage prior to dewatering. The sludge in these holding tanks is aerated to stay mixed and aerobic. Rotary lobe blowers located in the lower level of the Control building supply the air into the holding tanks. Decanting is required to thicken the sludge before it is pumped to the belt filter press for dewatering. This process is facilitated by the addition of polymer solution into the feed sludge for enhanced dewatering. The dewatered sludge produced from the WWTF is loaded onto a sludge hauling truck via a shaftless screw conveyor and delivered offsite to the City's Compost Facility.

Condition Assessment

No major capacity or conditions-based issues have been observed in either the aerobic holding tanks or the blower room. The rotary lobe blowers have been noted to be in good overall condition with adequate capacity. Some coarse bubble diffusers also have been previously noted to be missing. The aerobic holding tanks were converted from the original primary treatment tanks and a thorough evaluation is recommended to evaluate the structural integrity of the infrastructure.

The belt press is original and appears to be in good condition with no significant corrosion. The belt press room is well ventilated with only minor corrosion previously noted at the entrance steel door base frame and on light fixture metal housings. The aluminum platforms and grating are in good condition, but the grout under the aluminum column bases has deteriorated. No issues have been noted with the shaftless screw conveyor for sludge disposal.

Summary of Major Findings

Based on the conditions assessment, a summary of the recommendations for major improvements to the sludge holding system is as follows:

1. Due to aging infrastructure, it is recommended to plan for upgrades to the solids handling equipment, including the existing rotary lobe blowers, WAS pumps, and belt press unit within the next 5 to 10 years. More details are provided in **Chapter 8**.
2. Evaluate the structural integrity of the aerobic holding tanks and plan for repairs within the next 5 to 10 years. More details are provided in **Chapter 8**.

Summary of Minor Findings

Based on the conditions assessment, a summary of the recommendations for minor improvements to the sludge holding system is as follows:

1. Identify coarse bubble diffusers that are potentially missing and replace as needed.
2. Repair the grout under the aluminum column bases in the belt filter press room.
3. Repair minor corrosion within the belt filter press room as needed.

Odor Control System

Overview

The odor control system focuses on removing foul air from the most odoriferous locations in the treatment process, including the IPS, Headworks, and grit and screenings holding room. The original odor control system directs air from the Headworks influent channel, influent wet well, and grit room to a carbon scrubber vessel located outside and adjacent to the Headworks building. The odor control fan for pulling this air is located adjacent to the carbon scrubber vessel.

Condition Assessment

As described previously, severe corrosion and degradation of the concrete liner within the Headworks has been noted, indicating the potential build-up of sulfuric gases. Historically, there have been infrequent off-site odor complaints, indicating there may be sufficient air exchange to contain odors but not enough to reduce sulfuric gas formation on contact surfaces. Spot penetrations have been noted along the ducting from the Headworks to the carbon vessel, which could be a result of internal corrosion. The carbon scrubber vessel that holds activated carbon appears to be in good physical condition.

Summary of Major Findings

Based on the conditions assessment, a summary of the recommendations for major improvements to the odor control system is as follows:

1. Upgrade the odor control fan and activated carbon system to increase treatment capacity.
2. Replace the odor control ducting from the top of the Headworks to the carbon scrubber vessel.

Electrical and SCADA Existing Systems Evaluation

Electrical Components

Overview

Wastewater treatment plants are highly dependent on electricity. Electrical systems, including back-up power, deserve critical attention to avoid system failures. The existing electrical service and distribution equipment dates back to the 1993 WWTF expansion and upgrades. Electrical utility service is supplied to the facility by Jefferson County Public Utility District (PUD) from a PUD-owned 1,000 kilovolt-amperes pad-mounted transformer. The secondary electrical service to the facility is a 1,600 Amperes (A) service with the main service disconnect located within Motor Control Center (MCC) No. 1. MCC No. 1 resides in the ground level of the Headworks building. Located within MCC No. 1 are feeder circuit breakers that feed power to other MCCs located throughout the WWTF. MCC No. 1 feeds power to MCC No. 1X, which also is located on the ground level of the Headworks building, MCC No. 2 is located in the RAS/WAS pump station, MCC No. 3 is located in the Control building, and MCC No. 4 is located at the digesters. The MCCs are used to distribute power to all motors and equipment throughout the facility. Critical electrical loads and equipment that require backup power are supplied from MCC No. 1X. MCC No. 1X includes a 600 A automatic transfer switch (ATS) for automatically switching to backup power in the event of a power failure. A 475 kilowatt standby diesel generator, manufactured by Caterpillar, is located in the ground level of the Headworks building. This generator is connected to the ATS in MCC No. 1X and supplies backup power to all the electrical loads and equipment powered out of MCC No. 1X. The existing

MCC equipment throughout the facility is manufactured by Cutler-Hammer/Eaton and are Unitrol model MCCs.

Some of the motors throughout the facility utilize variable frequency drives (VFDs) for modulating motor speed. These motors include the influent pumps, RAS pumps, and the belt press feed pump. The VFDs are manufactured by Reliance Electric.

Condition Assessment

- The existing MCC equipment looks to be well maintained and in good condition considering the age of the equipment. This equipment is approximately 30 years old and is nearing the end of its expected lifespan. The typical lifespan for similar electrical equipment is approximately 25 to 40 years. One of the issues with maintaining older equipment is locating replacement parts when equipment fails. Fortunately for the City, Eaton has robust aftermarket support and is still able to support replacement of components for the Unitrol model MCC. However, that may not be the case for long. It is estimated that this equipment has approximately 5 to 10 years of life remaining.
- The City's existing VFDs, manufactured by Reliance Electric, are no longer supported and are obsolete. Reliance Electric was purchased by Rockwell Automation in 1996, and Rockwell Automation no longer supports these drives. Replacement of all seven VFDs at the WWTF is recommended.
- An Arc Flash Analysis has not been performed for the existing electrical distribution system, which is required by the National Electrical Code (NEC) for services of this size. It is recommended that a plantwide electrical short circuit, protective device coordination, and arc flash analysis be completed soon. These studies need to be completed to be in compliance with the NEC and need to be updated every 5 years.
- The standby generator, while also nearing the end of its expected 25- to 40-year lifespan, looks to have been maintained well and is in good working condition. Similar to the MCC equipment, it is estimated that this equipment has approximately 5 to 10 years of life remaining.
- Significant corrosion was observed on the conduits and conduit supports inside the IPS. Replacement of the conduits, supports, conductors, and cables inside the IPS is recommended.
- Some corrosion and rust were observed throughout the WWTF on various enclosures, flexible conduits, and fittings. It is recommended to remove this rust where able to do so and add rust protectant coating to extend the life of these components. Full replacement may be needed in some areas if corrosion is severe enough.

Summary of Major Findings

Based on the conditions assessment, a summary of the recommendations for major improvements to the electrical system is as follows:

1. Plan for MCC and standby generator replacement within the next 5 to 10 years.
2. Budget for near-term replacement of all seven VFDs.

3. Perform a short circuit, protective device coordination, and arc flash analysis on the electrical distribution system.
4. Replace conduits, supports, conductors, and cables inside the IPS.
5. Address electrical enclosure and conduit corrosion as needed throughout the WWTF.

Central SCADA System

Overview

The SCADA system is the computer and electronic control element of the plant. SCADA allows for automation of system processes and monitoring and is the system that enables plant operators to control physical processes within the plant. The central components of the SCADA system and instruments are from the 1993 WWTF upgrades. The existing SCADA system consists of three control panels located throughout the facility that are interconnected via a DH+ serial communication protocol. A SCADA human machine interface (HMI) computer located at the WWTF allows the City to monitor and control the system. The HMI computer was last upgraded around 2017. The three control panels include the Main Control Panel, CP-3, which is located in the Control building. The other two control panels are considered Remote Input/Output (I/O) panels as they do not contain a central processing unit (CPU) and instead allow for an I/O extension to the Main Control Panel. The first Remote I/O panel, CP-1, is located on the ground level of the Headworks building. The second Remote I/O panel, CP-2, is located in the RAS/WAS pump station.

Condition Assessment

- All three control panels are equipped with obsolete Allen-Bradley PLC-5 programmable logic controller (PLC) equipment. These were considered obsolete by Allen-Bradley in 2011, so parts are difficult and expensive to obtain. Replacement of these components with Allen-Bradley ControlLogix PLC equipment is recommended.
- The SCADA HMI computer does not require major additional upgrades at this time. The computer hardware should be replaced within the next 5 years. The typical lifespan of SCADA computer hardware is 5 to 10 years. The Factory Talk View SE software currently installed can be reinstalled on the new hardware.
- Uninterruptible power supply (UPS) equipment located within each of the control panels is well maintained but has exceeded its useful expected life. Replacement of the UPS equipment is recommended.
- PLC and UPS replacements should occur as soon as possible.
- The communication network infrastructure is using an outdated serial network platform. The new PLC CPUs require Ethernet-based communications instead of serial communication. Replacement of the existing serial communication network with an Ethernet-based network is required when the PLCs are updated. This network can be either a copper-based Ethernet network or a fiber optic based Ethernet network. A fiber optic network is recommended as it is not subject to electrical interference or lightning, it can be installed at longer distances, and it will provide the City with a higher speed network.

- The Parshall flume flow meter transmitter (FIT-460) has issues with the LCD display. The original manufacturer, Magnetrol, no longer supports replacements, so this meter should be replaced as soon as possible.
- The instruments inside the IPS are corroded and need to be replaced. The gas transmitter inside the wet well is extremely corroded and there is no reading on the panel meter, which indicates failure.
- Many instruments have been abandoned in place, including:
    - Network radio antenna;
    - Milltronics MultiRanger Plus transmitter (previously used for hypochlorite tank level measurement); and
    - De-energized Dechlor controller (Strantrol 190-300).

Summary of Major Findings

Based on the conditions assessment, a SCADA system overhaul is recommended in the near term. A summary of the recommendations for major improvements to the central SCADA system is as follows:

- Replace existing LE and LIT-210 wet well level instruments with a single-sealed unit, equal to VegaPLUS WL61.
- Replace existing LSH and LSL-210 wet well low-level and high-level float switches with new switches, Intrinsic Safety Barriers, and 316L SST mounting pole.
- Replace existing AE and AIT-240 wet well explosive gas sensor instruments with a new remote sensor that draws and returns samples to the wet well.
- Replace all conduit inside the wet well and under buried conditions with handhole access and sealed transitions to protect all cables.
- Replace obsolete Allen-Bradley PLC-5 system with ControlLogix PLC equipment.
- Replace Serial Remote I/O network with Ethernet Device Level Ring network. Fiber optic cable is recommended.
- Replace existing UPSs at the three control panels.
- Replace the Parshall flume flow meter with a new FIT-460.
- Plan for replacement of the SCADA HMI computer hardware.

COMPOST FACILITY EXISTING SYSTEMS EVALUATION

Overview

The City's Compost Facility is located at the Jefferson County Transfer Station Site and handles yard waste and septage accepted from both the County and the City. The dewatered sludge generated from the WWTF also is delivered to this facility. The compost mixtures incorporate dewatered biosolids and yard waste to produce compost piles that are aerated. The compost is transferred with a front-end loader to be cured before it is screened and prepared for distribution in conformance with Ecology requirements.

The septage received at the Compost Facility is screened in a septage screening vault and held in two steel, aerated 10,000-gallon tanks. The septage is then dewatered and the filtrate from this process, as well as all other liquid waste streams around the facility, drain to a sequencing batch reactor (SBR) for treatment. Dewatered sludge feeds into the facility's compost mixing process as previously discussed. The SBR is approximately 42,000 gallons and consists of a submerged turbine aerator, methanol feed pump, WAS pump, and supernatant pump station. The WAS from the SBR is pumped back to the septage screening vault, while the supernatant is disinfected with sodium hypochlorite and discharged to constructed wetlands for further treatment. The constructed wetlands are made up of two cells, each with an area of approximately 6,500 square feet, that have a combined approximate maximum detention time of 17 total days. The treated effluent from these wetlands enters a flow control structure and discharges to the infiltration basins for final disposal.

Odors resulting from the septage holding tanks and compost aeration system are treated with biofilter media. This media consists of finished compost, soil and/or wood chips, and ground yard waste, and it is monitored for temperature, moisture content, and pH for process control and operation. A fan provides air pressure to discharge odorous air through the biofilter media evenly.

Figure 7-3 shows the approximate locations of the major Compost Facility processes, and **Figure 7-4** shows the general process schematic of the Compost Facility.

Figure 7-3 – Existing Compost Facility Overall Site Plan

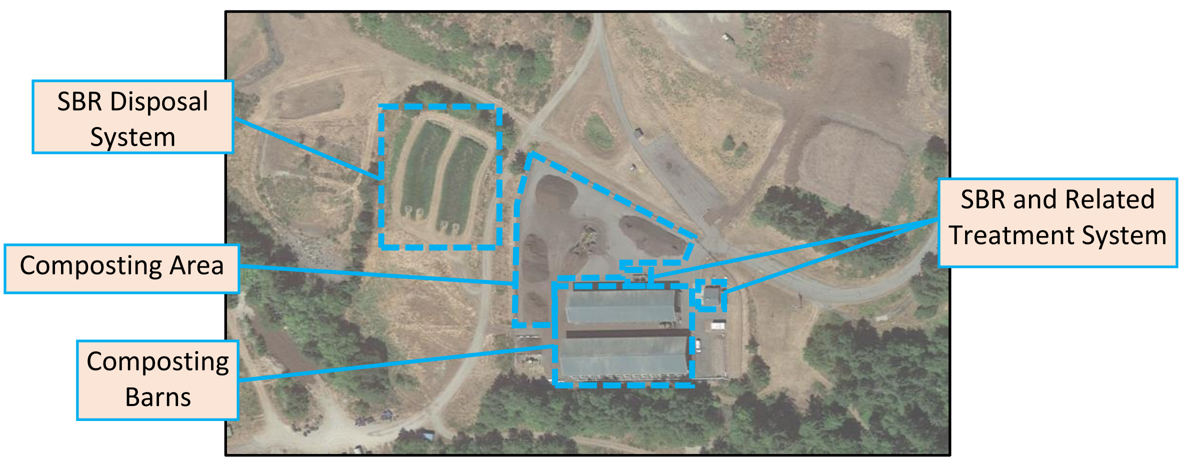
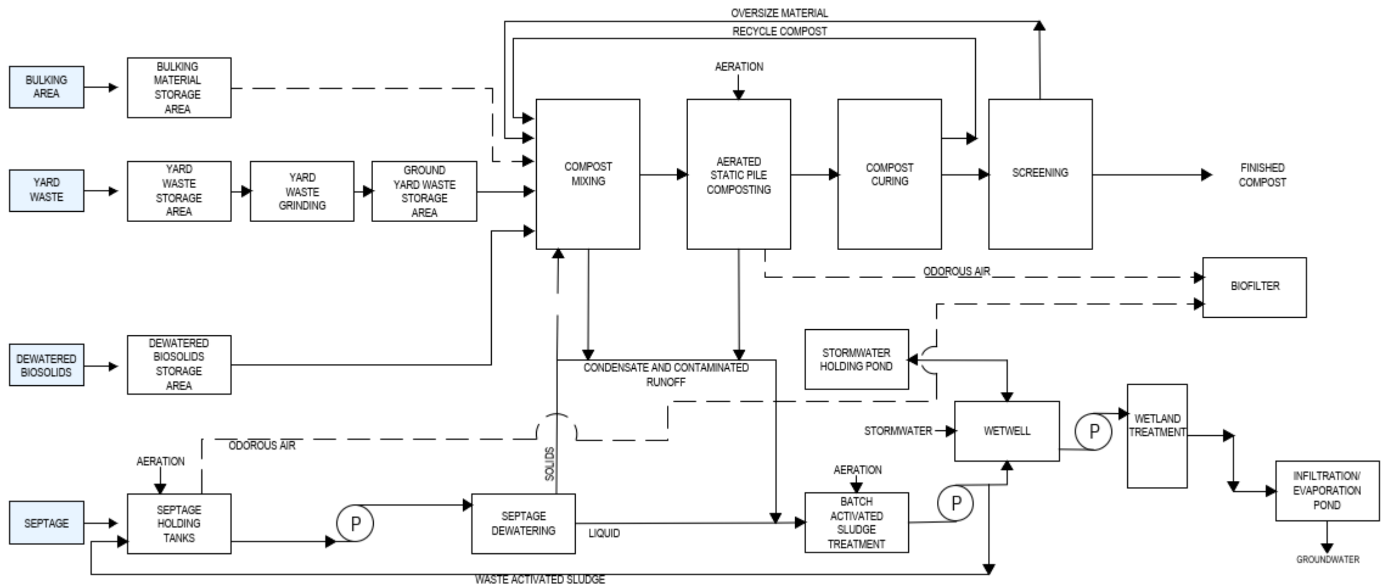


Figure 7-4 – Existing Compost Facility Process Schematic



Condition Assessment

Solids Handling Influent System

Septage haulers manually rake the bar screen and wash down the septage receiving area and screening vault. From the initial screening, septage is sent to one of two holding tanks. A significant amount of grit has been noted in one of the two 10,000-gallon septage holding tanks such that only the other tank is usable and is limiting the overall holding capacity. Grit is difficult to remove from these tanks. A new holding tank with a larger capacity should be installed, along with associated blowers to provide aeration into the holding tank. The influent system should be automated by installing a new packaged septage screening and grit removal system with an influent meter to monitor flow.

Septage Treatment System

The existing SBR appeared to be in good physical condition and continues to provide sufficient treatment. However, the blowers, pumps, and other associated equipment are aging and should be considered for replacement in the future.

Compost Facility Infrastructure

Due to the age of infrastructure and equipment, the composting screen, front-end loader, and aeration blowers associated with the composting process are nearing the end of their useful life and should be replaced. The concrete supports of the compost pole building have notable deterioration and need to be refurbished. Around the facility, the asphalt has degraded and should be repaired. In the existing pole building, the lighting is insufficient. Adequate accommodations and sufficient on-site fire flow capacity should be available to operational staff who will be present regularly.

Summary of Major Findings

Based on the conditions assessment, a summary of the recommendations for major improvements to the Compost Facility is as follows. Refer to the Proposed CIP Implementation Schedule in **Chapter 10** for the timeframes of the recommendations.

Solids Handling Influent System

1. Install an automated, packaged septage screening and grit removal system.
2. Install an influent meter to monitor flow.

Septage Treatment System

1. Remove the two existing septage holding tanks and install a new larger septage holding tank.
2. Install new aeration blowers for the new septage holding tank.
3. Replace aging SBR equipment.
4. Replace the WAS, chlorination, and wetland disposal pumps.

Compost Facility Infrastructure

1. Replace the composting screen.
2. Replace the composting front-end loader.
3. Replace the composting aeration blowers.
4. Refurbish the compost holding bay concrete supports.
5. Repair and seal asphalt around the facility.
6. Install new lighting inside the existing pole building.
7. Install a new hydrant connected to the water main feeding the facility.
8. Construct a new office for staffing accommodations.

TREATMENT FACILITIES ASSESSMENT CONCLUSION

This chapter described the recommended major and minor improvements for the City's WWTF and Compost Facility based on an evaluation of existing conditions. Given the major capital improvements and impacts on City operations, the next three chapters provide a basis for a capital improvement plan. Alternatives analyses for major capital improvements are presented in **Chapter 8**, and the recommended capital improvement projects are identified and further detailed in **Chapter 10**. The City's operations and maintenance program is presented in **Chapter 9**.

8 | TREATMENT FACILITIES ANALYSIS

INTRODUCTION

The future regulatory requirements for the wastewater treatment facility (WWTF) are outlined in **Chapter 2** of this General Sewer Plan (GSP). **Chapter 4** projects growth of the influent flow and loading. **Chapter 7** evaluates the condition of the existing facilities. In addition to these items, this chapter evaluates the ability of the City of Port Townsend's (City) WWTF to reliably meet the requirements of its National Pollutant Discharge Elimination System (NPDES) Permit through the planning period given the major considerations presented in previous chapters. This chapter analyzes alternatives to meet the needs of the WWTF through the planning period and provides recommendations for improvements.

MAJOR CONSIDERATIONS FOR WWTF IMPROVEMENTS

Based on the analyses of the previous chapters, the major factors influencing the WWTF planning are:

- Growth;
- Future regulations, specifically nitrogen removal requirements;
- Footprint constraints of the WWTF;
- Age and condition of the existing facility components.

Each factor is briefly introduced in the following sections.

Growth in Flow and Loading

The existing and projected flow and loading is defined in **Chapter 4**. The projected values are summarized in **Table 8-1**, along with the current rated capacity of the WWTF per the NPDES Permit.

Table 8-1

Projected Influent Flow and Loading

Parameter	Existing	2033	2043	Buildout	NPDES Permit Rating	85% of Permit Rating
Hydraulic Loading (MGD)						
Annual Average Daily Flow	0.87	1.19	1.46	2.39	1.44	1.22
Maximum Month Daily Flow	1.16	1.59	1.94	3.19	2.05	1.74
Maximum Day Flow	1.82	3.38	4.12	6.77	-	-
Peak Hour Flow	3.06	4.91	6.06	9.82	-	-
BOD Loading (ppd)						
Annual Average Daily BOD	2,591	3,202	3,706	5,819	3,754	3,191
Maximum Month Daily BOD	2,718	3,546	4,105	6,445	-	-
TSS Loading (ppd)						
Annual Average Daily TSS	2,493	3,125	3,630	5,742	4,568	3,883
Maximum Month Daily TSS	2,799	3,470	4,030	6,376	-	-

Green shaded cells exceed 85% of the rated capacity and orange shaded cells exceed 100% of rated capacity.

TSS = total suspended solids

As shown in the table, the projected 2043 flow and biochemical oxygen demand (BOD) loading is very near to the permitted capacity of the WWTF. Further, the projected 2033 BOD loading exceeds 85 percent of the rated capacity. The City's NPDES Permit requires the City to begin planning for an expansion of facility capacity when flow and loading exceeds 85 percent of the permitted maximum month value for 3 consecutive months. It takes considerable time (up to 10 years) to properly plan for and permit major treatment plant expansion, and as such, it is recommended that the City begin planning for such an expansion in the first 5 years of the planning period.

Regulatory Changes – Nitrogen Reduction

As discussed in **Chapter 2**, the future regulations that will most significantly influence WWTF planning are the nitrogen limits proposed by the Puget Sound Nutrient General Permit (PSNGP), which became effective in 2022. The City is considered to be in the category of "WWTFs with small [Total Inorganic Nitrogen] TIN loads" by the PSNGP. As detailed in **Chapter 2**, the PSNGP requires dischargers in this category to:

- Develop and implement a Nitrogen Optimization Plan (NOP). The general intent of the NOP is to assess and recommend optimization strategies to maximize TIN removal at the existing WWTF primarily through operational changes, minor on-site improvements, and off-site source control. The dischargers were required to select an initial optimization strategy by December 31, 2022. The NOP should analyze and document the performance of the selected optimization strategy. The NOP must be submitted by March 31, 2026; and
- Complete an all known available and reasonable methods of prevention, control, and treatment (AKART) analysis that evaluates reasonable treatment alternatives that will maintain the WWTF annual average effluent TIN below 10 milligrams per liter (mg/L). This analysis must include wastewater characterization, analysis of treatment technologies,

economic evaluation, environmental justice review, recommendation of the most reasonable treatment alternative, and an implementation schedule. The AKART analysis must be submitted by December 31, 2025. Notably, the PSNGP states that "permittees that maintain an annual TIN average of < 10 mg/L and do not document an increase in load through their [Discharge Monitoring Reports] DMRs do not have to submit this analysis."

- Meet additional monitoring and record retention requirements as discussed in **Chapter 2**.

For the purposes of this GSP, an annual average effluent TIN below 10 mg/L is considered the benchmark for analyzing alternatives for improvements to the WWTF. The existing WWTF was not designed with a dedicated denitrification process, which would be necessary to reliably provide TIN reduction at the permitted flow and loading conditions. Upgrading the WWTF to provide TIN reduction at the permitted flow and loading would necessitate a major reconfiguration of the facility.

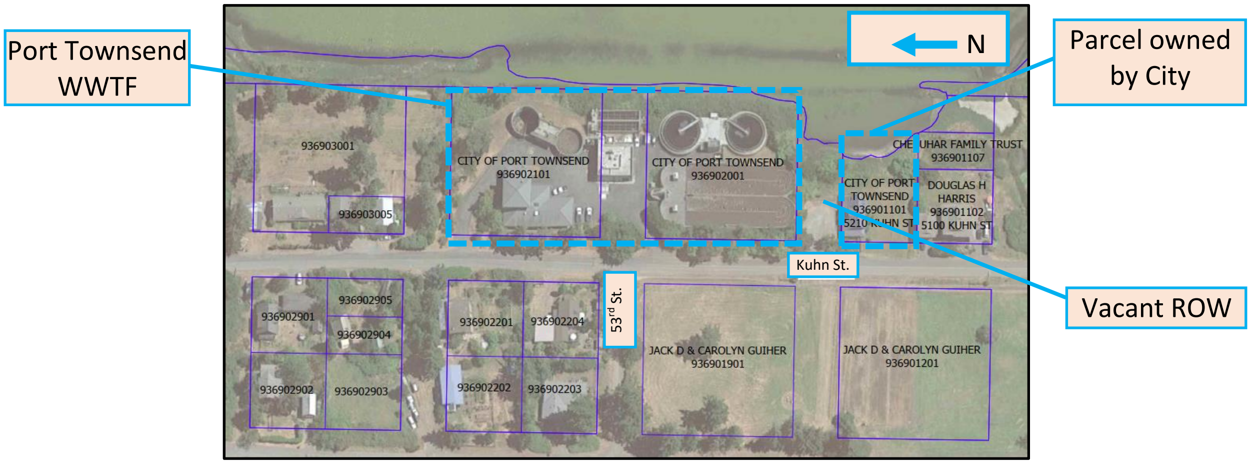
It is understood that continued modeling by the Washington State Department of Ecology (Ecology) or other factors may change the structure of the final TIN limit. It should be noted that the final TIN limit may be different from an annual average of 10 mg/L for the City, and as such, it is likely in the City's best interest to extend the useful life of the existing WWTF infrastructure and defer the need to make major improvements until the future effluent nitrogen limits have been finalized. As discussed in the **Activated Sludge System** section, the City is currently utilizing an optimization strategy to meet a TIN limit of 10 mg/L. This chapter discusses improvements of limited mechanical and structural scope that could be made to allow the TIN limit to continue to be reliably met for at least a portion of the planning period.

It should be noted that if regulatory conditions result in more stringent limits, the timeline for planning improvements may be accelerated and capital costs increased, which would require either significant grant resources and/or larger rate increases.

WWTF Site Footprint

One of the major factors influencing WWTF planning is the constrained nature of the existing WWTF site. The site is bounded to the east by the body of water referred to as the Chinese Gardens. To the west, the site is bounded by Kuhn Street. **Figure 8-1** shows the existing site aerial with parcel lines and ownership, as well as the surrounding areas.

Figure 8-1 – WWTF and Surrounding Parcels

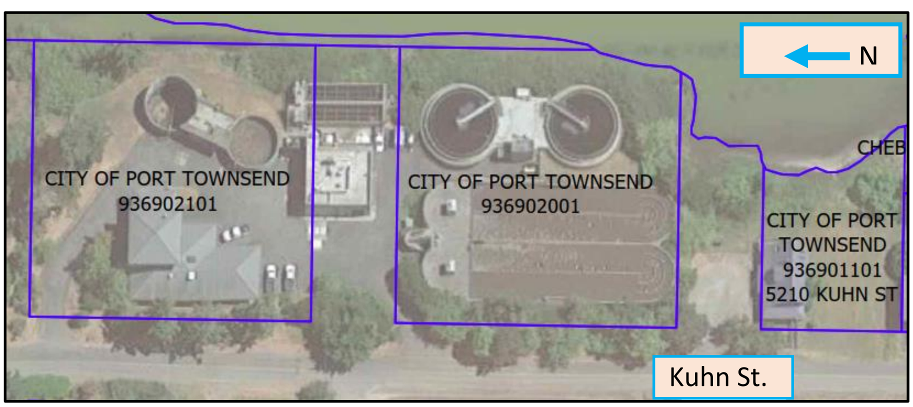


The WWTF occupies two parcels transected by platted right-of-way (ROW) extending from 53rd Street. The City owns an additional parcel to the south of the WWTF that contains a single structure (house converted to an office). This parcel is separated from the WWTF parcels by platted, vacant ROW. Similarly, a platted strip of vacant ROW lies immediately north of the northmost WWTF parcel. To the north and south beyond are private parcels.

The platted and vacant ROW section north and south of the WWTF parcel must be maintained for public access to the waterfront per Revised Code of Washington (RCW) 35.79.035. This area potentially could be used for below-grade utilities, but it is not prudent to plan any above-grade tankage and infrastructure in these areas.

Figure 8-2 shows the current WWTF and parcels.

Figure 8-2 – WWTF Site Aerial



On **Figure 8-2**, there are three general spaces within the existing WWTF footprint that are not occupied with permanent, above-grade WWTF infrastructure:

- The northeast corner of the site, north of the existing sludge holding tanks, is vacant and could be utilized. However, this area is relatively small and is isolated from the main process piping and interconnections. This space may be used for ancillary improvements. <u>However, this space does not readily facilitate any significant expansion of the WWTF</u>;

- The southmost parcel, which contains one existing building, could potentially be repurposed for expansion of the WWTF. However, as previously stated, the southern section of unused ROW cannot be used for permanent, above-grade infrastructure. As such, this parcel will remain somewhat isolated from the main WWTF infrastructure. Relative to the size of the existing WWTF, the parcel is also relatively small and could support only limited new infrastructure. Similar to the northeast corner of the WWTF, this parcel does not readily facilitate any significant expansion of the WWTF; and
- The paved area north of the oxidation ditches is relatively small and encumbered by significant below-grade utilities. The area also is used for parking and vehicle access. This area does not readily facilitate any significant expansion of the WWTF.

In general, the existing WWTF infrastructure occupies most of the area included in the City parcels and there is not sufficient available space on these parcels to plan for a major expansion of the WWTF.

Age and Condition

Chapter 7 summarized the existing conditions of the major unit processes and areas of the WWTF. The facility has been exceptionally well maintained. However, the last major improvements to the facility were made over 30 years ago and numerous improvements will be needed during the planning period due to the age of the infrastructure. It is known that major changes to the facility will be needed during the planning period to meet new regulations and growth. The recommendations in this chapter seek to avoid unnecessarily investing in the rehabilitation of aging items that are likely to be substantially reconfigured or replaced later in the planning period. The intent is to make improvements that maintain the operability and reliability of the WWTF and extend its useful life while avoiding major sunk costs for such improvements.

Due to its size, the concrete oxidation ditch tankage is the largest and most valuable asset at the WWTF. Understanding the remaining useful life of this tankage is critical in analyzing the activated sludge system improvements. As noted in **Chapter 7**, the existing oxidation ditch concrete appears to be in good physical condition. However, these tanks were designed over 30 years ago and will be over 50 years of age at the end of the planning period. Further, the tankage was not designed to current codes and may not meet current requirements for seismic conditions, as an example. As discussed in the **Activated Sludge System** section, major improvements will be needed later in the planning period to expand facility capacity while meeting nitrogen reduction requirements. Some options for these improvements include reuse of the existing oxidation ditch tankage. It should be noted that any significant reconfiguration of the oxidation ditches will require substantial structural modifications to meet current codes. This likely will be very costly and may not be prudent given the advanced age of the structure at the time of the improvements. This factor warrants significant consideration when analyzing activated sludge system improvements in the subsequent sections of this chapter.

APPROACH TO WWTF ANALYSES

Improvements to the activated sludge system (oxidation ditches and clarifiers) are needed for nitrogen reduction and to expand WWTF capacity. These improvements are expected to have the largest impact on WWTF planning; therefore, the major WWTF processes are reviewed in the following order:

1. Activated sludge system.
2. Preliminary treatment system.
3. Effluent disinfection system.
4. Solids handling system.

ACTIVATED SLUDGE SYSTEM

Existing Activated Sludge System

Original Design Criteria

The existing activated sludge system consists of two oxidation ditches and two secondary clarifiers. Each ditch contains a single two-speed mechanical surface aerator (referred to herein as mixer/aerators). The design criteria for the oxidation ditches is included in **Table 8-2** from the original construction drawings.

Table 8-2

Original Oxidation Ditch Design Criteria

Oxidation Ditches	Quantity
Aeration Basin	2
Volume, Each (MG)	0.57
MLSS (mg/L)	2,800
MLVSS (mg/L)	2,100
Hydraulic Retention Time (hrs)	
Average Annual Design	22
Maximum Month Design	15
Maximum Day Design	9
Solids Retention Time (Days)	
Average Day	15
F/M	
Average	0.10
Maximum Month	0.14
Oxygen Required (lb/hr)	
Average	100
Maximum Day	340
Surface Aerators, 2 Speed	2
Size, Each (hp)	75

MG = million gallons
MLVSS = mixed liquor volatile suspended solids
lb/hr = pounds per hour
hp = horsepower

The original design criteria shown in **Table 8-2** assumes two basins are online. At the average annual condition, with a solids retention time (SRT) of 15 days, the predicted mixed liquor suspended solids (MLSS) concentration is 2,800 mg/L with two basins online. The original design loading for the WWTF is included in **Table 8-3**.

Table 8-3

Original Facility Design Flow and Load

WWTF Influent - Design Loadings and Flow Rates		
	YR 1993	**YR 2013**
Design Flow Rates (MGD)		
Average Annual (AAF)	0.96	1.27
Maximum Month (MMF)	1.33	1.81
Maximum Day (MDF)	2.34	2.92
Peak Hour (PHF)	4.35	5.27
Design BOD Loadings (ppd)		
Average Day	1,444	2,054
Maximum Month	2,055	2,804
Maximum Day	3,846	5,346
Design TSS Loadings (ppd)		
Average Day	1,444	2,054
Maximum Month	2,158	3,018
Maximum Day	5,121	7,102

It should be noted that the 20-year design values (2013 values) shown in the table are slightly below the currently permitted values shown in **Table 8-1**. For the purposes of this chapter, the permitted values generally are used for the subsequent analyses.

Capacity Analysis

The ability to settle the biological floc of an activated sludge system in the secondary clarifiers typically constrains the capacity of the system. The solids loading rate (SLR) to the clarifiers represents the allowable solids load per unit of clarifier operating surface area. The typical secondary clarifier SLR design criteria is an average of 25 pounds per square foot per day (lb/sf/d) and a peak SLR of 40 lb/sf/d for conventional activated sludge. As the microbial population increases in the oxidation ditches (represented by the MLSS concentration), clarifier SLR generally increases proportionally. As SRT increases, so does the MLSS concentration due to the extended time available for microbial growth. As such, the SRT and MLSS are both indirectly limited by the settleability of the activated sludge. The existing WWTF includes two 50-foot diameter secondary clarifiers. **Table 8-4** shows the calculated SLR for operating scenarios with one or two clarifiers online. This table assumes both oxidation ditches are online and the MLSS is constant at 2,800 mg/L for all conditions.

Table 8-4

Predicted Clarifier SLR for Existing Activated Sludge System at MLSS 2,800 mg/L

Condition	MM Influent Flow (MGD)	One Clarifier SLR (lb/sf/d)	Two Clarifiers SLR (lb/sf/d)
Design Average Annual	1.27	23	11
Design Maximum Month	1.81	32	16
Permitted Maximum Month	2.05	37	18

RAS rate at 50% of the influent flow rate per design criteria.

As shown in the table, at the original maximum month design condition of 1.81 million gallons per day (MGD), as well as at the permitted maximum month condition of 2.05 MGD, the clarifier SLR is below the recommended range with two oxidation ditches and two clarifiers in service. However, if one clarifier is out of service, as must be considered for normal maintenance or a failure, the SLR will exceed the recommended range. Although not shown in the table, a similar result would be expected if one oxidation ditch is out of service with two clarifiers online.

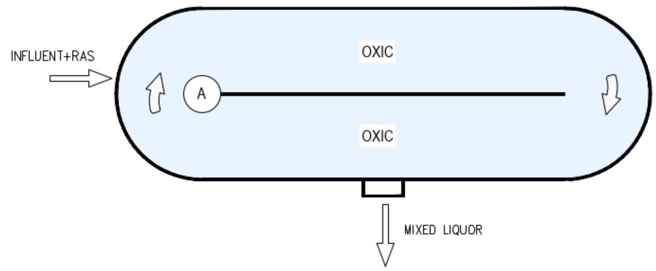
Due to the existing constraints presented in the **WWTF Site Footprint** section, there appears to be no simple method to add a third clarifier to the site, which would otherwise alleviate the potential single clarifier condition. The third clarifier would most practically be located immediately adjacent to the existing clarifiers to facilitate the large and complex pipe connections. This is not feasible with the current oxidation ditches and parcel boundaries.

As shown in this analysis, the clarifier SLR effectively limits the WWTF capacity approximately at the current WWTP rating. Further, there is no readily available location to add a third clarifier on the site to alleviate this capacity restraint.

Current Strategy for Nitrogen Reduction

The original activated sludge system was designed and expected to produce fully nitrified effluent (ammonia converted to nitrate). At the design loading with the existing aerators at full speed, there should be sufficient oxygen transfer and SRT to allow for full nitrification. However, in this configuration, minimal denitrification is likely to occur, which is necessary to convert nitrate to nitrogen gas to reduce overall nitrogen in the effluent. At the time the WWTF was designed, denitrification was not a consideration. For denitrification to occur, an anoxic environment must be provided in the system. No dedicated anoxic environment was provided in the oxidation ditches as originally configured. The oxidation ditches each consist of an entirely aerated, closed loop reactor as shown in **Figure 8-3**.

Figure 8-3 – Existing Oxidation Ditch Configuration

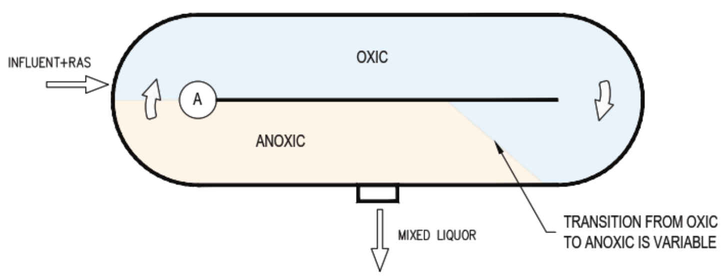


Note: Single ditch shown.

The result of this configuration is minimal TIN reduction in the effluent. Further, nitrification consumes alkalinity and without denitrification it can be difficult to maintain effluent pH within NPDES Permit limits without supplementing alkalinity to the process.

As previously noted, the WWTF is required to implement and monitor an optimization strategy to reduce effluent TIN as required by the PSNGP. When operated as designed, the aerators provide sufficient oxygen to maintain adequate dissolved oxygen (DO) concentration throughout the entirety of the reactor. As an optimization strategy, the operators are currently operating the aerator for each ditch in low speed. By doing this, the oxygen transfer is limited, which allows for the creation of an anoxic area that is low or devoid of oxygen on the downstream end of the reactor loop. This configuration is similar to that described in Table 8-24, row (o) of *Wastewater Engineering: Treatment and Resource Recovery,* 5th edition (2013, Metcalf & Eddy). **Figure 8-4** illustrates this configuration.

Figure 8-4 – Current Operation of Existing Oxidation Ditch with Aerator at Low Speed



Note: Single ditch shown.

This approach has generally allowed the operators to reliably maintain effluent TIN below 10 mg/L at the current flow and loading conditions. However, this approach has several drawbacks, which are discussed as follows:

- **Reduction in capacity:** By limiting the aerators to low speed, the capacity of the oxidation ditches is effectively reduced. The oxidation ditch design criteria (**Table 8-2**) assumed that the aerators are operating at a high speed to provide peak oxygen transfer. Maintaining the aerators at a low speed, to create the anoxic zone, reduces the capacity of the system to oxidize influent constituents and significantly reduces the design capacity for BOD removal. Currently, the influent is below the design BOD load, but with growth, it is expected that the aerators will need to run at high speed more consistently to meet BOD demand. Without a dedicated anoxic zone, the entire ditch volume is expected to be aerobic with the aerators in high speed and TIN reduction will not substantially occur.

- **Anoxic zone variability:** Currently, there is no automation that would control the mixer/aerator speed between low and high speed based on loading conditions and the resulting DO demand. As such, the aerators are operated manually and predominately in low speed. With the normal diurnal variability in loading and subsequent DO utilization, the size of the anoxic zone may vary significantly and is generally uncontrolled. This issue will be exacerbated as flow and loading increases and will make reliably meeting the permit limits more challenging.
- **Anoxic zone location:** In the current optimization strategy, the anoxic zone is inherently at the downstream end of the reactor. Typically, activated sludge systems designed for nitrogen removal include anoxic zones upstream of oxic zones such that some influent carbon can be used by organisms to perform denitrification. This configuration allows for efficient use of carbon and a higher rate of denitrification. The current optimization strategy does not allow for this approach.
- **Filamentous Organism Growth:** Filamentous organisms can reduce the settleability of activated sludge significantly, which, as previously discussed, restrains the capacity of activated sludge systems. These organisms can thrive in low DO environments and should be a significant concern with the current optimization strategy, which inherently creates areas of low DO. The WWTF's current sludge volume index values, which measure the settleability of the activated sludge, tend to be in the range of 150 to 250. These values generally are considered to be indicative of relatively poor settling sludge. This issue will be of further concern with growth in flow and loading.

The current optimization strategy is reducing effluent TIN substantially and has been implemented without incurring capital expenditures. The City's operators are effectively managing the system to reliably produce TIN below 10 mg/L. While this approach has been valuable to the City in meeting the initial PSNGP requirements, for the reasons previously stated, it is not recommended that this strategy be relied upon for more than approximately the next 5 years (2028).

It is in the best City's interest to maintain TIN reduction going forward. The current optimization strategy should continue to be utilized, but more permanent improvements should be prioritized in the next 5 years. Given this, the remaining analyses of this chapter review improvements of limited scope that can be made soon to continue to provide TIN reduction, extend the useful life of the activated sludge system, and allow for deferral of significant improvements to the WWTF.

Screening of Nitrogen Treatment Options

Nitrogen is reduced via biological treatment of wastewater through aerobic activated sludge treatment as discussed previously. Aerobic activated sludge systems have been utilized for this purpose in a variety of configurations. To support nitrogen reduction, each process seeks to provide nitrification though an aerobic system and denitrification through an environment low in, or devoid of, dissolved oxygen. There are two general categories of activated sludge systems: suspended growth and attached growth. Within these categories and subcategories, many variations exist.

Suspended Growth Processes

Suspended growth processes are detailed in Chapter 8 of Metcalf & Eddy (2013) and generally include the basic subcategories for each system as listed.

- Complete-mix systems – Large, single stage tanks with substantial mixing/recirculation equipment to dilute influent into the tank and avoid short circuiting.
  - The existing oxidation ditch system is an extended aeration system that constitutes a special type of complete-mix system. An oxidation ditch is completely mixed due to the high rate of recycle but also contains of single point of aeration that creates an oxygen gradient along the flow path of the reactor.
- Plug flow, staged systems – Typically consist of long, narrow basins with multiple zones.
- Sequencing batch reactors (SBRs) – Consist of two or more tanks to which batches of influent are cycled for treatment.

Of the three general subcategories of suspended growth processes, complete-mix and plug flow, staged systems are applicable for analysis at this site as discussed further in this chapter. Improving the existing oxidation ditch system is reviewed first in the **Improvements to Existing Oxidation Ditch System** section. Implementing a plug flow, staged system would constitute complete replacement of the existing activated sludge system and is evaluated in the **Replacement of the Existing Oxidation System** section.

SBRs are not considered practical to implement at the existing WWTF site as they represent an entirely new process configuration with new tankage. As previously established in the **WWTF Site Footprint** section, there is not sufficient available space on the site to maintain the operation of the existing system while adding the new tankage that would be necessary for an SBR system.

Attached Growth Processes

Attached growth processes are detailed in Chapter 9 of Metcalf & Eddy (2013) and generally include the basic subcategories for each system as listed.

- Standard biofilm processes – Various configurations in which flow passes through either stationary or moving carriers to which biofilm is attached.
- Integrated biofilm and activated sludge processes – Various configurations in which either stationary or moving biofilm carriers are utilized with suspended growth activated sludge to provide treatment.

Similar to SBRs, most standard biofilm processes are not practical for consideration at the existing site. However, one standard biofilm process and three integrated processes are screened for applicability in this section. These systems typically are promoted as supplemental equipment options intended to represent minimally invasive improvements to existing activated sludge systems and include the following.

- Integrated biofilm and activated sludge processes
  - Integrated fixed film activated sludge (IFAS)
  - Membrane aerated biofilm reactors (MABR)
  - Mobile organic biofilm (MOB)

- Standard biofilm processes
    - Denitrification filters for tertiary treatment

Attached Growth – IFAS

IFAS is a biological treatment that integrates suspended growth activated sludge with fixed film growth. IFAS adds inert carriers, typically plastic, to the activated sludge system to facilitate fixed film growth. A screen retains the carriers in the reactors while suspended growth is carried through the normal flow path to the secondary clarifiers and returned by the return activated sludge (RAS) or wasted. Multiple manufacturers provide IFAS systems, with many proven installations. The typically stated benefits of this system include:

- Biomass density can be increased through the addition of fixed film organisms without proportionally increasing the secondary clarifier SLR;
- Simultaneous nitrification and denitrification can potentially occur within the biofilm; however, there is not enough information to verify that this can reliably be achieved at all operating conditions;
- Nitrification and denitrification can be achieved at SRTs lower than conventional flocculant sludge;
- The likelihood of microbial washout at high flows is decreased due to the retention of the fixed film organisms; and
- Reduced yield of waste sludge.

However, IFAS is not considered compatible with a closed loop oxidation ditch system and surface aerators. Floor-mounted diffused aeration is necessary to ensure that the media remains adequately suspended throughout the reactor. Further, multiple partitioned zones would be necessary to ensure that the media remains evenly distributed along the length of the reactor. These requirements would incur a high capital cost and would be difficult to implement. Further, the system likely would only incrementally increase the overall capacity of the activated sludge system. This option is not considered further.

Attached Growth – MABR

MABR is biological treatment that integrates suspended growth activated sludge with fixed film growth. In this system, cassettes of membranes are installed into one or more zones of an activated sludge system. The membrane cassettes are similar to those used in membrane bioreactor systems; however, with MABR, the membranes are used as both a fixed biofilm carrier and an aeration device. The membranes are stationary in the tank and biofilm attaches to the surface of the membranes. The membranes are used to transfer oxygen directly to the biofilm. Suspended growth activated sludge develops in the bulk liquid, is passed to subsequent zones, and is returned from the secondary clarifiers. The MABR process has been characterized in Ecology's *Criteria for Sewage Works Design* as a new and developmental technology as defined in Section G1-5.4.1.

The typically stated benefits of MABR include:

- Biomass density can be increased through the addition of fixed film organisms without proportionally increasing the clarifier SLR;
- The total system oxygen transfer efficiency is increased as a portion of the total oxygen is delivered through the membranes directly to the biomass in lieu of passing through the bulk liquid;
- Simultaneous nitrification and denitrification potentially can occur within the biofilm, but there is not enough information to verify that this can be achieved reliably at all operating conditions;
- Nitrification and denitrification can be achieved at SRTs lower than conventional flocculant sludge;
- The likelihood of microbial washout at high flows is decreased due to the retention of the fixed film organisms; and
- Reduced yield of waste sludge.

The primary difficulty with implementing MABR into the existing WWTF is that MABR cassettes typically are installed within the initial partitioned zone of a plug flow system. It is unlikely that MABR could be integrated into a closed loop oxidation ditch system. Implementing this system would require many of the same elements as IFAS; therefore, this option is not considered further.

Attached Growth – MOB

MOB is a biological treatment process intended to enhance suspended growth activated sludge systems. Nuvoda is currently the only company known to sell such systems. The MOB process consists of adding small organic carriers to an activated sludge system to facilitate biofilm development. The porous organic carriers are manufactured from Kenaf plant stalks. The carriers vary in size but are generally near 1 millimeter in diameter. These organic carriers have a very high surface area relative to the particle size and facilitate faster settling compared to conventional flocculant sludge. As such, the process intends to intensify activated sludge systems by adding a biofilm component to increase biomass concentration while increasing settleability. The carriers are removed from the RAS stream via a rotary drum screen and returned to the basins.

The MOB process has been implemented at a few municipal facilities over approximately the last 5 years. Notably, demonstration of the Nuvoda process was undertaken at the Edmonds WWTF in Washington and the Forest Grove WWTF in Oregon in recent years. However, neither of these facilities include oxidation ditches, so the findings are not directly applicable to the City.

By adding MOB directly to the existing oxidation ditch, the carriers should add a biofilm component to the activated sludge, which may allow for some denitrification within the anoxic environment internal to the biofilm. However, the relative effect that this will have on effluent TIN is difficult to predict based on the limited data from similar operating facilities. Further, the system requires screening to be added to the RAS system, which will require additional process building space that will be costly and challenging to implement on the already constrained site. For these reasons, the City's WWTF is not recommended to be an early adopter of this technology.

Attached Growth – Denitrification Filters for Tertiary Treatment

Various tertiary treatment systems exist for the purposes of removing nutrients from the secondary effluent. The existing oxidation ditches are shown to full nitrify the effluent at design conditions; therefore, a tertiary treatment system that provides denitrification may be considered for this facility. Denitrification filters are the logical technology to review. These filters are a subset of biofilm processes that can be used as a tertiary treatment process to aid in effluent TIN reduction. In this process, nitrified effluent (in which most ammonia has been converted to nitrate) is passed through a filter bed containing heterotrophic organisms that metabolized nitrate into nitrogen gas in the anoxic conditions of the filter bed. This typically requires a carbon feed ahead of the filter as most of the influent carbon has been reduced through the preceding secondary process.

For this technology to be applied at the City, an effluent pump station would be required to lift secondary effluent from downstream end of the clarifiers to the denitrification filters. This is not recommended as the construction of an effluent pump station and filters on the existing site would be extremely difficult to configure and implement, would be costly, and would further reduce the available footprint at the WWTF. Further, implementation of a tertiary treatment system of any sort will not inherently increase the WWTF capacity as it will not improve the activated sludge system. As such, tertiary treatment systems, such as denitrification filters, are not considered further for this facility.

Improvements to the Existing Oxidation Ditch System

Based on the analyses of the previous section, improving the existing oxidation ditch system is likely to be the only feasible approach that does not constitute a complete replacement of the existing system. The intent of this section is to review options for improving the existing system that include limited mechanical and structural improvements, are relatively low cost, would extend the useful life of the existing infrastructure, and would delay the need for major improvements. The applicable options include:

1. The addition of anoxic tankage external to the oxidation ditches;
2. The creation of a dedicated anoxic zone internal to the oxidation ditches; and
3. Cyclic aeration of the oxidation ditches.

The anoxic zone tankage would need to equate to approximately 20 to 30 percent of the volume of the existing ditches. There is no feasible method to add external anoxic tankage of this size to the site based on the constraints identified in the **WWTF Site Footprint**. As such, the first option is not considered applicable.

The two remaining options are analyzed in the following sections.

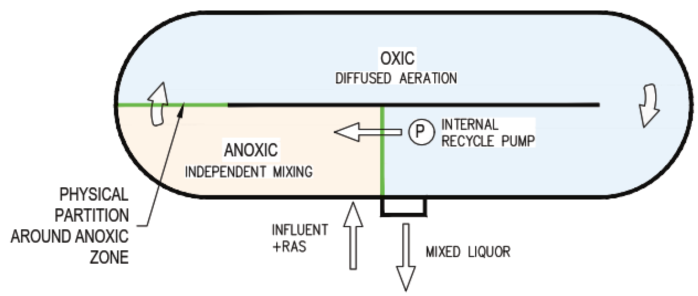
Creation of Dedicated Anoxic Zone Internal to Oxidation Ditches

The existing optimization strategy represents one method of creating an anoxic zone within the oxidation ditches by reducing aeration to create a zone relatively devoid of oxygen. As previously discussed, this configuration has significant limitations that preclude relying on this option through the planning period.

Another option consists of physically partitioning an anoxic zone and adding new equipment to the system. The Modified Ludzack-Ettinger (MLE) process that fits this approach is one of the most common activated sludge processes used for biological nitrogen removal. This process is shown in Table 8-24, row (b) of Metcalf & Eddy (2013). The MLE configuration creates a dedicated anoxic zone upstream of the aerobic zone. An internal recycle pump returns mixed liquor from the downstream end of the aerobic zone to the anoxic zone at a high rate (typically 3 to 5 times the influent flow rate) to return the nitrate for denitrification in the anoxic zone. Placement of the anoxic zone upstream of the aerobic zone allows for influent carbon to be utilized for denitrification.

To implement this configuration within the existing tankage at the WWTF, an anoxic zone would be created with a physical partition within the ditch as shown in **Figure 8-5**.

Figure 8-5 – Conceptual Conversion of Existing Oxidation Ditches to MLE Configuration



Note: Single ditch shown.

As shown in the figure, this fundamental change to the ditch configuration essentially converts the ditch from a closed-loop reactor to a staged, continuous flow reactor. The mixer/aerator, which is necessary to provide a high degree of mixing and recirculation in a closed-loop reactor, would be removed. The MLE configuration would utilize an internal recycle pump, new mixing equipment in the anoxic zone, and diffused aeration with external blowers for the oxic zone. Additionally, it would be prudent to place the partition adjacent to the mixed liquor outfall and relocate the influent/RAS discharge location as shown in the figure to make the best usage of the tankage volume.

These changes would consist primarily of mechanical equipment additions. There would be significant new motor loads for the aeration blowers, mixing equipment, and internal recycle pumps that likely would prompt major electrical system changes. Any approach that continues to utilize the existing aerators and minimize equipment additions would be less costly than conversion to the MLE configuration shown.

Further, these improvements would not be expected to significantly expand the system's capacity beyond the projected 2043 loading values. The system will remain inherently limited by the SLR capacity of the two clarifiers. The MLE system could allow for modest improvements in aeration system oxygen transfer and mixed liquor settleability, but these would only be expected to incrementally increase the capacity of the activated sludge system with the existing two clarifiers.

The cost and complexity of this configuration, coupled with the minimal capacity expansion that it affords, preclude this option from further consideration.

Cyclical Operation of the Oxidation Ditches

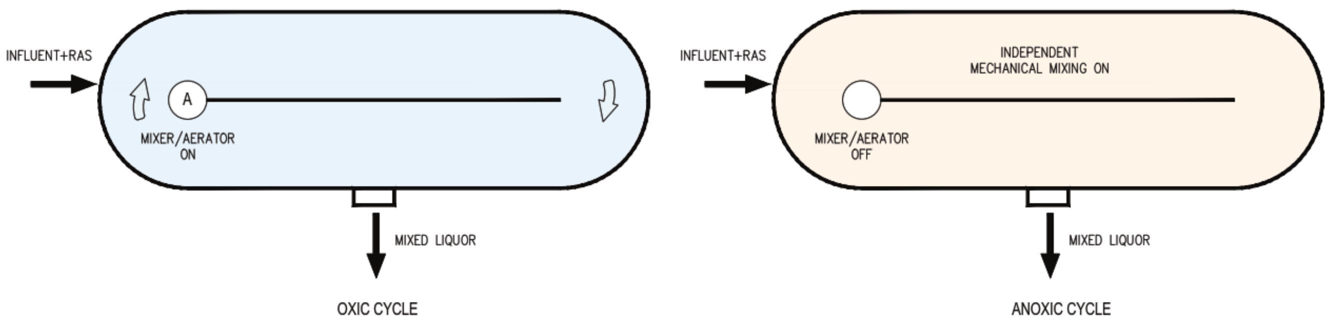
As previously discussed, the City's current TIN reduction optimization strategy creates an anoxic environment in the oxidation ditches by operating the aerators in low speed. This approach creates an anoxic zone internal to the ditch without necessitating physical partitions and other improvements discussed in the **Creation of Dedicated Anoxic Zone Internal to Oxidation Ditches** section.

Another approach to creating an anoxic environment in the ditches without physical partitions is to create anoxic cycles by cyclically turning off the aerator periodically each day. This approach has been utilized in multiple similar facilities to reduce TIN below 10 mg/L or less and is described in Table 8-24, row (p) of Metcalf & Eddy (2013). This approach is readily applicable for retrofitting facilities with two oxidation ditches. At a minimum, it would be necessary to add the following items to the existing ditches:

- Mechanical mixing equipment for each ditch to maintain the activated sludge in suspension during the anoxic cycles when the mixer/aerators are offline. This equipment likely would consist of one or two low speed, large blade, submersible mixers.
- Oxidation-reduction potential control equipment to determine when the nitrate is depleted to suspend the anoxic cycle.

Figure 8-6 illustrates the cyclical operation of the two oxidation ditches.

Figure 8-6– Conceptual Conversion of Existing Oxidation Ditches to Cyclic Operation



Note: Single ditch shown in either oxic or anoxic cycle.

There are some significant benefits to this approach. First, it represents limited structural and mechanical improvements consisting primarily of small equipment additions and control system programming. Further, it allows for continued use of the mixer/aerators, which decreases the cost of this option relative to conversion to an MLE process. Lastly, this option could be implemented with a relatively short outage of the existing tankage and by taking each ditch offline in series.

Conversion to cyclic operation generally should regain most of the permitted capacity of the WWTF while providing for TIN reduction to below 10 mg/L. It is recommended that the capacity of this system be based on an average annual clarifier SLR of 25 lb/d/sf. Based on **Table 8-4**, this would equate to 1.40 MGD with one clarifier online, which is approximately the same as the current rated capacity of the WWTF (1.44 MGD average annual). An average annual flow of 1.4 MGD is projected to occur in approximately 2040 per **Table 8-1**. As previously noted, the City must begin planning for an expansion of WWTF capacity when the facility exceeds 85 percent of its rated capacity.

Assuming a capacity of 1.4 MGD with cyclical ditch operation, 85 percent would equal an approximate average annual flow of 1.20 MGD, which is projected to occur by 2033.

Implementing cyclic operation is recommended soon as it will assist the WWTF in maintaining TIN below 10 mg/L as growth in flow and loading occurs. These improvements are of limited mechanical and structural scope and represent a relatively low-cost approach to regaining WWTF capacity and maintaining TIN reduction with the existing system. Further, the ultimate TIN requirements of the PSNGP are not yet finalized; therefore, delaying major improvements by extending the useful life of the existing infrastructure is in the best interest of the ratepayers. This approach is predicated on major improvements to the activated sludge system likely occurring between 2033 and 2040, as 85 percent of the WWTF capacity is expected to be exceeded by 2033.

Replacement of the Existing Oxidation Ditch System

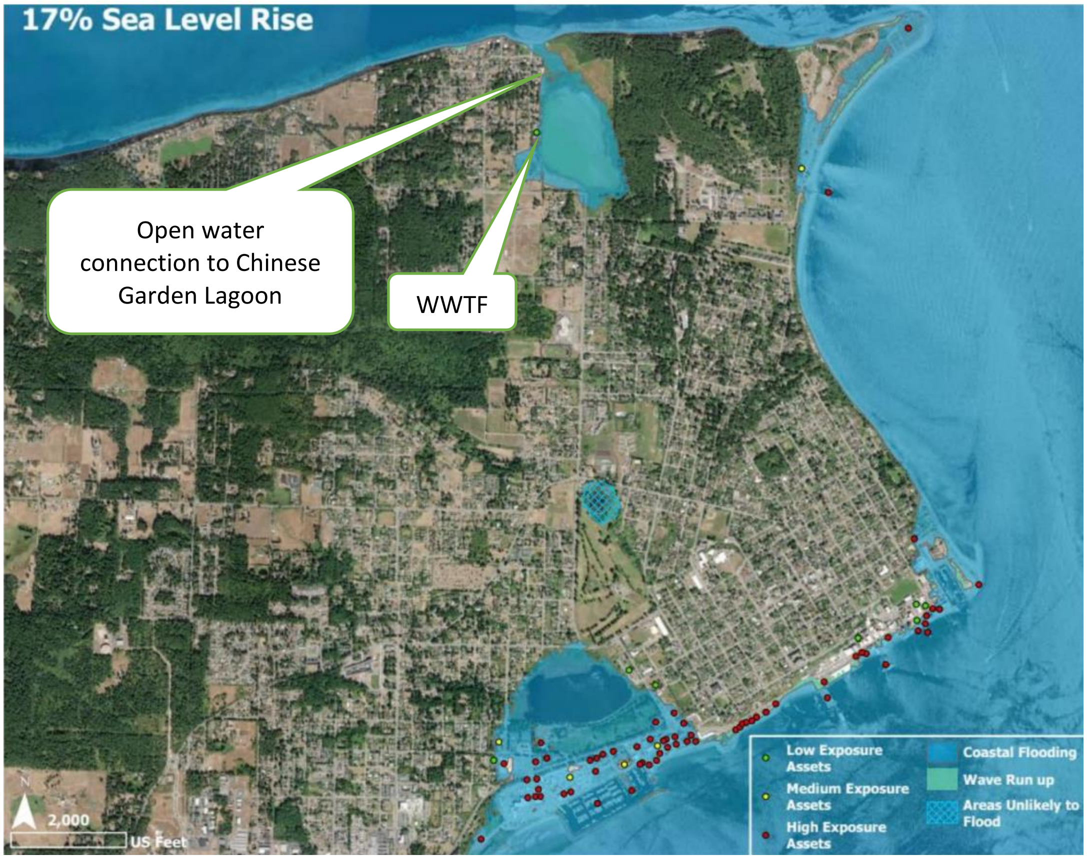
The analyses of the previous sections resulted in recommending cyclical operation of the oxidation ditches as a near-term improvement that is minimally invasive to the WWTF. As discussed, this approach may provide reliable TIN reduction as the City grows, although major improvements should be planned and implemented to ensure continued, reliable treatment. Major improvements also are anticipated given the age of the infrastructure. The useful life and capacity of this infrastructure could be extended to approximately 2040 by making improvements to implement cyclical oxidation ditch operation in the next 5 years. The City is fortunate to be able to get extended life out of the oxidation ditches and replacement will be timely in addressing its age and growth concurrently.

None of the options previously analyzed were shown to meet the TIN objectives at the flow and loading levels expected at the end of the planning period due to the SLR limitation of the two secondary clarifiers. Based on the initial review of alternatives in the **Screening of Nitrogen Treatment Options** section, conversion to a plug flow, staged system is the only other practical alternative that should be considered for the longer term improvements and capacity expansion of the WWTF.

Plug flow, staged systems have been configured to provide a much higher rate of treatment relative to oxidation ditches. A prudently designed plug flow system can allow for treatment capacity that is double that of an oxidation ditch system with a similar footprint. The activated sludge in a plug flow system should have substantially improved settleability compared to that of an oxidation ditch system, which allows for a much higher clarifier SLR to be achieved. This enables significantly increased MLSS concentrations to be achieved, which allows for a higher rate of biological treatment per reactor area.

In 2022, the City commissioned a study on sea level rise impacts on Port Townsend, including wastewater infrastructure. The *City of Port Townsend Sea Level Rise and Coastal Flooding Risk Assessment* (Cascadia Consulting Group, 2022) is contained in **Appendix K**. As noted in the study, in the long term, there will be impacts that could affect wastewater infrastructure. Any future planning for improvements intended to last beyond the next 20 years should factor this study and latest available information on sea level rise into the siting and hydraulics of the proposed improvements. **Figure 8-7** illustrates an open water connection between the Strait and Chinese Garden Lagoon. This plan for future improvements (lasting beyond 20 years) takes into account this probability of sea level rise as illustrated in **Figure 8-10**. Refer to the **Outfall** section in this chapter for further discussion on sea level rise.

Figure 8-7 – Sea Level Rise Projects for 17% Probability of Exceedance including Storm Surge



Given the effects of sea level rise, site constraints, and the need to apply the best known and available technology to replace aging infrastructure and to improve the capacity of the WWTF, options for replacing the oxidation ditches with a plug flow system are reviewed in this section.

On-Site Implementation of Plug Flow Reactors – Replace Existing Oxidation Ditches

It is likely that the only location plug flow reactors could be constructed onsite are within the existing footprint of the oxidation ditches. Various methods of constructing such basins were considered. The two primary approaches consist of the following:

- Option 1 – Conversion of each ditch, in series, into a plug flow aeration basin with multiple partitioned zones, floor-mounted diffused aeration, internal recycle, and other improvements.
- Option 2 – Complete demolition of the existing oxidation ditches and reconstruction of plug flow aeration basins in this location.

The result of these analyses is that neither option is recommended for similar reasons noted in the analyses of converting the existing oxidation ditches to an MLE or similar process. Substantial structural improvements would be necessary for each ditch to ensure reliability and longevity. There also would be significant new equipment, access platforms, electrical, and control items to install. These items necessitate months of construction, resulting in an extended outage period for each ditch. This outage would reduce the reliability and redundancy of the existing activated sludge system and expose the City to substantial risk of permit violation for an extended period.

Further, this approach would not facilitate the future construction of a third clarifier as it would be unlikely to create additional unused space on the WWTF site.

This approach is not considered further.

Off-Site Implementation of Plug Flow Reactors

The previous analyses have not identified a practical approach to provide sufficient treatment capacity with TIN reduction at the existing WWTF beyond approximately 2040. As flow and loading growth continues, constructing major improvements on the existing site becomes even more challenging as the existing tankage must be maintained in operation through construction to provide reliable treatment. As previously noted, limited improvements for cyclical ditch operation should allow for continued use of the existing WWTF infrastructure to approximately 2040, which will allow the City to begin planning for a major expansion of the WWTF. It is recommended that this expansion be planned to be offsite and near the existing WWTF.

Figure 8-8 shows the existing site aerial with parcel lines and ownership, as well as the surrounding areas.

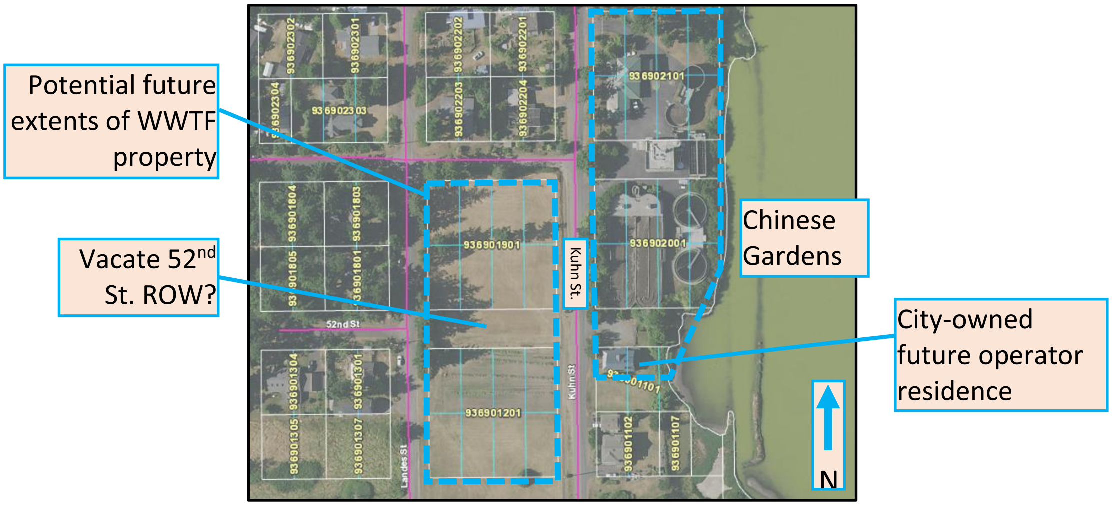
Figure 8-8 – WWTF and Surrounding Parcels

Two parcels immediately west of Kuhn Street with the same owner could provide sufficient space for an expansion of the WWTF. The utilization of these parcels most likely would include construction of activated sludge system tankage, specifically plug flow aeration basins, at this location.

In addition to procuring these parcels, vacating the 52nd Street ROW separating both parcels for the purposes of providing a single contiguous parcel would help provide ample space for new oxidation ditches and future facilities that may be needed well beyond the planning period.

Figure 8-9 shows these major considerations.

Figure 8-9 – Adjacent Parcel Acquisition Considerations



Activated Sludge System Recommendations

The previous analyses resulted in the following major findings:

- The facility is projected to exceed 85 percent of the permitted BOD loading by 2033.
- The facility flow and loading is projected to reach its rated capacity at approximately 2043.
- The current optimization strategy effectively reduces TIN below 10 mg/L but results in a significant reduction in the realistic capacity of the activated sludge system.
- Implementation of cyclical oxidation ditch operation, as an alternative to the current optimization strategy, would be a relatively low cost approach to maintaining TIN reduction until the expansion can occur.
- Providing TIN reduction at the flow and loading projected late in the planning period would necessitate a major expansion of the WWTF that will be most effectively completed through the acquisition of off-site adjacent parcels.

The recommended basic approach and phasing of the WWTF improvements follows.

Years 0 to 5 (2024 to 2028)

In the next 5 years, the City will need to coordinate with Ecology and the requirements of the Puget Sound Nutrient General Permit, which may require the need to implement cyclical oxidation ditch operation to ensure continued TIN reduction and maintain the existing activated sludge system capacity. The City also should begin the early work preparing for the future major expansion of the WWTF. This work generally should include the following:

- Complete a preliminary design for the cyclical oxidation ditch improvements (**Capital Improvement Project (CIP) F8** in **Chapter 10**). Determine if an Engineering Report meeting the requirements of Washington Administrative Code (WAC) 240-173-060 will be required by Ecology.
- Complete improvements to implement cyclical oxidation ditch operation (**CIP F8** in **Chapter 10**).

- Complete a Nitrogen Optimization Plan per the PSNGP and submit to Ecology by March 31, 2026.
- Complete other WWTF rehabilitation work to extend the life of the existing infrastructure in the most economical manner feasible to avoid significant capital costs for items that will be removed or reconfigured with the major expansion of the WWTF (**Chapter 10**).
- Acquire parcels of land to support the major expansion of the WWTF (**CIP F11** in **Chapter 10**).

Years 6 to 10 (2028 to 2033)

- Complete an Engineering Report per WAC 173-240-060 for the major expansion of the WWTF. Submit the report for review and approval by Ecology (**CIP F12** in **Chapter 10**).
- Commence permitting, preliminary design, and funding acquisition related to the major expansion of the WWTF (**CIP F12** in **Chapter 10**).

Years 11 to 20 (2034 to 2043)

During this period, the design and construction of the major expansion of the WWTF (**CIP F12** in **Chapter 10**) should be completed. A basic description of the proposed major improvements is discussed in this section.

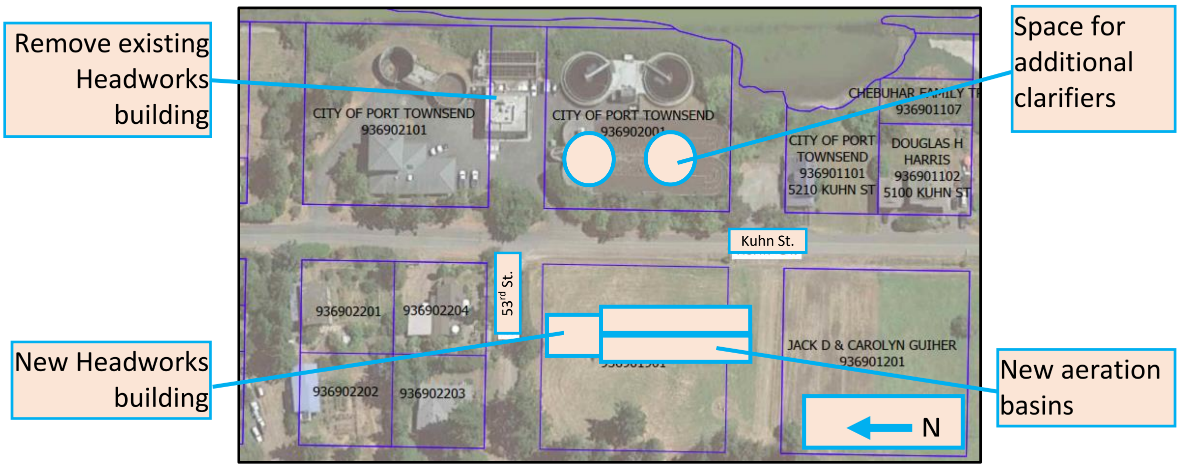
Pending the land acquisition and configuration of the new parcels, at a minimum, a new activated sludge system would be constructed on the new parcels. The existing secondary clarifiers likely could remain at the current location. With the implementation of biological treatment on the new parcels, the existing oxidation ditches could be removed. This would allow for future secondary clarifiers to be constructed within the footprint of the demolished oxidation ditches.

To provide TIN reduction, a conservative approach to planning the new activated sludge system consists of two plug flow, staged aeration basins on the new parcels. The exact size, configuration, and equipment options would be analyzed thoroughly and determined in a future Engineering Report.

All influent flow by gravity to the existing WWTF is collected at the Influent Pump Station (IPS) and pumped to the existing Headworks, with subsequent gravity flow to the oxidation ditches. The proposed future configuration of the WWTF, with biological treatment on the higher ground of the new parcels, will prompt significant changes to the hydraulic profile of the WWTF. Influent will need to be lifted to the new aeration basins. In order to avoid an additional pump station between the existing Headworks and the new basins, it would be most practical to construct a new Headworks on the new parcels and refurbish or replace the existing IPS at or near its existing location. This is further discussed in the following **Preliminary Treatment** section.

Figure 8-10 schematically displays a conceptual reconfiguration of the WWTF utilizing the currently undeveloped parcels west of Kuhn Street.

Figure 8-10 – Basic Configuration of Expanded WWTF



PRELIMINARY TREATMENT

Chapter 7 identified improvements to rectify conditions-based needs for the IPS and Headworks. The most significant of these improvements include:

1. Wet well rehabilitation, piping and pump replacement, and electrical raceway replacement at the IPS; and
2. In-kind replacement of the existing screen and grit equipment, and concrete channel rehabilitation at the Headworks.

Summary of Analysis

Table 8-5 shows the design criteria for the existing IPS and Headworks from the original construction drawings.

Table 8-5

Preliminary Treatment Design Criteria from 1990 Project

Influent Pumps	
Type	Submersible, VS
Number	3.00
Capacity, Each (gpm)	2,250
Horsepower, Each (hp)	35
Headworks	
Parshall Flume	1
Throat Width (in)	12
Bar Screen	1
Width (ft)	1.50
Screenings Press	1
Grit Removal	1
Diameter (ft)	10.00
Peak Capacity (MGD)	7
Grit Classifier	1

As shown, two pumps in service should provide a nominal flow of 4,500 gallons per minute (gpm) (6.48 MGD). This is in excess of the projected 2043 peak hour flow of 6.06 MGD with one pump out of service. The IPS should provide sufficient capacity and redundancy through the planning period.

In general, the Headworks equipment and channels were designed for a peak flow of approximately 7 MGD, which is above the projected 2043 peak hour flow of 6.06 MGD. The Headworks includes a single mechanical bar screen and a back-up channel with a manually raked bar screen. However, the mechanical screen should provide sufficient capacity and the back-up screen provides sufficient redundancy. As previously noted, a budgetary allocation is established for the in-kind replacement of the screen if needed during the planning period.

Similarly, the grit removal system is expected to provide sufficient capacity through the planning period, and any improvements needed will be for the in-kind replacement of aging equipment as previously noted.

Recommendations

Based on this review, the existing IPS and Headworks should not require replacements during the planning period to increase capacity or redundancy. As noted in Chapter 7, age and condition may require replacement or repair in the next 5 to 10 years. However, as discussed in the **Activated Sludge System** section, future replacement of the activated sludge system likely would provide the opportune time to replace the existing preliminary treatment system. The overall approach to the activated sludge system improvements involves constructing new aeration basins offsite, on the currently vacant parcels west of Kuhn Street. As noted, this likely would necessitate constructing a new Headworks facility on the new parcels, adjacent to the new aeration basins. With this configuration, it is most likely that the IPS would be significantly changed or replaced and potentially relocated. The IPS would lift all influent and return flows up to the new Headworks location. The configuration of this infrastructure would be analyzed thoroughly in the future Engineering Report as discussed in the **Activated Sludge System** section. Given that the preliminary treatment system is expected to be replaced in conjunction with the activated sludge system improvements planned for the second half of the planning period, it is prudent to extend the life of this infrastructure through limited rehabilitation while avoiding significant sunk costs in improving this system.

Further, the new Headworks will allow for improvements over the existing configuration. For instance, the new Headworks should include mechanical fine screening, which will provide 2-dimensional screening with much improved screenings capture compared to the existing 1-dimensional bar screen. The fine screens would provide a minimum of ⅜-inch screening, and ¼-inch screening could be considered. Additionally, two mechanical screens could be included in the new Headworks for redundancy and to reduce operational labor in the event of an outage of a single mechanical screen. Similarly, a new grit removal system would present opportunities for improvements relative to the existing grit system. Such improvements are not feasible to make to the existing Headworks; therefore, it is prudent to extend the life of the existing infrastructure as feasible while planning for a future new, off-site Headworks.

EFFLUENT DISINFECTION

Chapter 7 identified relatively minor repair and replacement needs for the existing chlorination system. Replacement of the non-potable water pumps also was recommended and represents the only capital improvement project identified based on the conditions assessment of the disinfection system.

Summary of Analysis

The design criteria for the existing chlorine contact chambers is compared to the 2043 average and peak hour flow values in **Table 8-6**.

Table 8-6

Disinfection System Design Criteria from 1990 Project

Design Criteria	Quantity
Chlorine Contact Chamber	2
Volume, Each	
cubic feet	6,480
gallons	48,500
2043 Average Annual Flow (MGD)	1.46
2043 Peak Hour Flow (MGD)	6.06
Contact Time (Both Tanks Online) (min)	
at Average Annual Flow	96
at Peak Hour Flow	23
Maximum Chlorine Dose at Peak Flow (mg/L)	6
Hypochlorite Feed Pumps	2
Hypochlorite Storage Tank (gal)	5,200

The typical design range for disinfection contact time based on average design flow is 30 to 120 minutes per Metcalf & Eddy (2013). With two contact tanks online at the 2043 average annual flow of 1.46 MGD, there is 96 minutes of contact time, which is well within the accepted range. With one tank offline, the contact time would be approximately 48 minutes, which is still within the recommended range.

Typical design ranges for disinfection contact time based on peak design flow is 15 to 90 minutes per Metcalf & Eddy (2013). The contact time of 23 minutes with two tanks online at the projected 2043 peak hour flow is within the recommended range. With one tank out of service, the contact time would be reduced to approximately 12 minutes. While this is below the recommended range and could cause an increase in coliform discharge, it is likely that weekly and monthly average coliform values would remain below permit limits as the average contact times are sufficient.

Based on this analysis, expanding capacity, or improving redundancy of the chlorination system, should not be required during the planning period.

Recommendations

No major improvements appear to be needed for the effluent disinfection system during the planning period. Minor repairs and rehabilitation should be completed as necessary to maintain reliable operation of the system. However, future sea level rise and other considerations may in the long term require improvements to, or replacement of, the existing disinfection system.

OUTFALL

The City has received funding and is actively working with Ecology and Jacobs Engineering Group on an evaluation and modifications to the existing outfall. The project is currently under further alternatives evaluation. Initial evaluations of the outfall dating back to the 2000 *Wastewater Facilities Plan* suggest that sliplining and pumping would be the least cost option. Since that time, significant work has been completed, including the approval of a Facilities Plan Amendment in 2019 by Ecology. This amendment recommends digging in a parallel pipe to the existing pipe and replacing the diffusers. This option has been recommended as the least cost option. Prior to entering the permitting phase of the project, resource agencies and the public spoke out against the project due to potential impacts to eel grass and kelp beds. **Figure 8-11** illustrates the approximate outfall configuration. Note, the difference between the Chinese Garden Lagoon and the WWTF outfall. The Chinese Garden Lagoon outfall often is exposed on the beach and is confused by the public as being the WWTF outfall.

The City's WWTF outfall is always submerged; however, storms periodically expose and damage the existing concrete pipe on the beach. Staff immediately repairs the concrete when damaged. One need for the outfall project, no matter the solution, is to replace the beach section of pipe and protect it against heavy North Beach surf.

Figure 8-11 – Approximate Outfall Configuration

Staff is re-evaluating possible solutions, including sliplining the pipe. Staff also is considering the impact of sea level rise on the Chinese Garden Lagoon. Currently, the outfall does not use the Chinese Garden Lagoon; however, at a Marine Resources Committee meeting, a suggestion was made to look for environmental improvements of combining the sewer outfall with the Chinese Garden Lagoon.

Given this work is already underway, further evaluation in this GSP is not included and will be handled in separate documents that will be submitted to Ecology for review and approval.

TERTIARY TREATMENT – WATER REUSE/RECLAMATION

The City currently discharges all of its effluent to the existing outfall. The City frequently hears from the community about its desire to implement water reuse practices in the name of water conservation and environmental stewardship. A detailed description of water reuse as it relates to regulations and standards is included in Chapter 4 of the adopted 2019 *Water System Plan* (WSP) (available on the City website). Given water reuse begins at the WWTF, the following information is provided concerning the application of water reuse opportunities in the City, as well as financial limitations.

How would reclaimed water from the WWTF be used in Port Townsend? Chapter 4 of the WSP, specifically Table 4-7, lists all of the allowable uses and the associated class of reclaimed water allowable for such use. In general, higher levels of treatment are required for reclaimed water where there is a potential for human exposure, such as irrigation water. What is the greatest environmental and societal benefit? How is water reuse helpful in the light of climate change and sea level rise? These are all very good questions. The WSP outlines that the cost would be prohibitive, thus no specific actions or investments are included in the WSP. This GSP outlines the most common comments heard by the City and likely the most probable applications of water reuse, recognizing that there is benefit to seeking opportunities. Practically, this GSP does not include specific investments in the CIP given the rate impacts. However, staff recommends keeping water reuse on the horizon and looking for grant opportunities to negate the capital cost of operating a water reuse system. The following brief discussion of potential water reuse applications provides very high level considerations.

- Water reuse for industrial process water is one option available. This option requires the least amount of treatment because industrial water is non-contact use. Given that the City has a huge industrial water user, the Port Townsend Paper Mill, this thought was brought up in the recent Water Supply Agreement discussions. The City could reliably provide approximately 900,000 gallons of the mill's average daily use of 11 million gallons. A reclaimed water pipeline would have to be constructed across the City from the WWTF to the Paper Mill. This water supply pipeline would cost in the tens of millions to construct. Depending on whether or not workers were exposed to the water determines the level of treatment required. Likely, Class A treatment would be required. If tertiary or enhanced treatment is required, funding for an order of magnitude cost estimate of $20 million would be needed.
- Irrigation is the most common beneficial use of reclaimed wastewater. Due to human exposure in parks and to food in gardens, Class A reclamation standards must be met. To make reclaimed water available throughout the City, a second water system would need to be created. These systems are constructed of purple pipe to reduce the chance of accidental cross connection. Cities with reclaimed water available for irrigation also require extensive investment at each property for cross-connection prevention as required by the Washington State Department of Health. A more likely beneficial use of reclaimed irrigation water is to focus on the large expanses of irrigated areas such as the Fort, golf course, parks, and school play fields. This would help reduce peak water use by the City during the summer months when irrigation demands increase water consumption from 1 MGD to nearly 2 MGD. Note, water reclamation is limited to the irrigation season between May and October for this application. Dedicated water pipelines, reservoirs, and pumps stations are required to accomplish any type of irrigation use. The cost of this infrastructure is in addition to the cost of enhanced or tertiary treatment. Given tertiary or enhanced treatment is required, funding for an order of magnitude cost estimate of $20 to $50 million would be required to build an irrigation system. Irrigation of the Fort, Jefferson County fairgrounds, and nearby schools would require the least amount of infrastructure development.
- Water reclamation for environmental benefit might be the most practical implementation strategy. For example, the City is currently exploring options for enhancing the water quality of the Chinese Garden Lagoon given its propensity for algae blooms. With sea level rise, the lagoon will ultimately connect with the Strait of Juan de Fuca and provide an

inland estuary that will result in great habitat enhancements. The question for this application would be whether accelerating this connection would make sense or not with wastewater discharge to the lagoon.

- Water reclamation for groundwater augmentation could be another practical use. Groundwater injection occurs through either direct injection or percolation. The aquifer under the City is not a drinking water supply and is approximately at sea level. A number of irrigation wells exist within the City, including one owned by the City. Pumping of this aquifer invites salt water intrusion on all three sides of the City. Infiltration of reclaimed water can offset the impact of pumping. The exact configuration of the aquifer is not readily known; therefore, a great amount of research would be required to validate this approach for reclaimed water reuse. Depending on the level of treatment, investment levels likely approach $10 million for this option.

All of the applications discussed require extensive permitting to ensure unintended consequences are not a result. Given the extensive needs of investment in the foundational systems of the WWTF and collection system, the rate payers may not be willing to pay for a reclaimed water system at this time. Adding reclaimed water to the capital plan would require nearly doubling the investment levels, which would more than triple current sewer rates. Therefore, this GSP recommends expending resources on water reuse only if an environmental improvement grant makes it financially feasible.

The improvements noted in the previous sections and in the **Chapter 10** CIP will still need to be implemented, even if the City decides to pursue tertiary treatment for water reclamation. Given the space limitations and capital cost concerns, pursuing this further at this time is not feasible.

SOLIDS HANDLING

The conditions assessment in **Chapter 7** identified primarily minor improvements to maintain reliable operation of the solids handling system during the planning period. This chapter reviews the potential improvements needed to ensure sufficient system capacity and redundancy is available with this system. The analyses are divided between the on- and off-site solids handling system components.

On-Site WWTF Solids Handling System

The existing on-site solids handling system includes two aerobic holding tanks followed by sludge dewatering via a single belt press. The aerobic holding tanks where retrofitted during the 1990 project to provide waste activated sludge (WAS) storage. These concrete tanks originally were constructed in approximately 1970. The dewatering system was installed in the 1990 project. Dewatered sludge is composted as discussed in the **Off-Site Compost Facility** section.

Summary of Analysis

The on-site solids handling system is not intended to provide substantial stabilization of the WAS as the solids are stabilized via off-site composting. As currently configured, the on-site system is generally intended to equalize and store WAS to enable periodic operation of the dewatering belt press during normal staff hours. As such, the aerobic holding tanks are not required to provide significant volatile solids destruction, and the dewatered sludge is not intended to meet Class B requirements. The design criteria from the 1990 project for the existing aerobic holding tanks is shown in **Table 8-7**.

Table 8-7

Aerobic Holding Tank Design Criteria from 1990 Project

Aerobic Digesters	Quantity
Number of Digesters	2
Total Volume (ft^3)	6,480
Total Volume (gal)	360,000
Digester Blowers	3
Capacity Each (cfm)	720
Horspower, Each (hp)	75

At the 2043 maximum month loading condition, the WWTF is expected to produce WAS at approximately 4,000 pounds per day (ppd) total solids. At an average concentration of 8,000 mg/L, this equates to 60,000 gallons per day (gpd). As shown in **Table 8-7**, the two aerobic holding tanks provide a total volume of approximately 360,000 gallons. With one tank offline, the system should provide approximately 3 days of storage volume without thickening. The operators currently decant the tanks to increase the solids concentration and reduce the volume fed to the belt press. With or without decanting, 3 days should be sufficient equalization for the dewatering system should one tank be offline. The aeration system also appears sufficiently sized to maintain an aerobic environment in the tanks without allowing significant volatile solids destruction. By utilizing the composting system to provide sludge stabilization, the aerobic holding tank system is expected to provide sufficient capacity and redundancy in WAS storage through the planning period.

The design criteria from the 1990 project for the dewatering system is shown in **Table 8-8**.

Table 8-8

Dewatering System Design Criteria from 1990 Project

Dewatering System	Quantity
Size (meters)	1.5
Feed Rate (gpm/meter)	50
Polymer Usage (lb/dry ton)	30

The belt press is currently operated up to 3 days per week for approximately 8-hour shifts. Based on staff input, it is preferred that the belt press be operated no more than 4 days per week for 8 hours per day. Given this, the belt press is operating at about 75 percent or less of the allowable operating time per week. Based on the projected increase in flow and loading in **Table 8-1**, sludge production would be expected to increase approximately 20 percent by 2033 and 40 percent by 2043 compared to existing levels. As such, it is likely that the belt provides sufficient capacity to approximately 2033 by operating up to 4 days per week. Beyond 2033, the belt press may need to be operated up to 5 days per week to provide sufficient capacity or be replaced with a larger unit.

It should be noted that the City has a single belt press, so there is no inherent dewatering system redundancy. If needed, the City could rent a mobile dewatering unit to process sludge. Appropriately sized units for the City's WWTF should be readily available for rental in an emergency.

Recommendations

As noted in **Chapter 7**, the existing on-site solids handling system is generally in good condition. As discussed in this section, the system provides sufficient capacity and redundancy for the City's needs. However, the aerobic holding system tankage is expected to be over 70 years of age at the end of the planning period, while the belt press and ancillary equipment will generally be over 50 years of age by 2043. It is prudent to plan for replacement of the major mechanical equipment for the solids handling equipment, such as the belt press, sludge pumps, blowers, etc., as well as other refurbishments, such as the aerobic holding tankage, late in the planning period. It is difficult to predict the scope of this work. Further, the WWTF is expected to be significantly reconfigured by the end of the planning period as discussed in the **Activated Sludge System** section. Based on these factors, it is recommended that the City establish a budgetary allocation for on-site solids handling system improvements late in the planning period. As an initial allocation, $3 million is recommended. The scope of the improvements and associated costs should be reviewed thoroughly in the future, likely as part of the Engineering Report that will be required for the major WWTF expansion project.

Off-Site Compost Facility

The City operates a Compost Facility at the Jefferson County (County) Transfer Station site. The City transports dewatered sludge from the WWTF to the facility for composting. An aerial image of the facility is included in the **Chapter 7**.

Summary of Analysis

The composting system utilizes the aerated static pile method. The facility includes two covered areas, referred to as "barns." The south barn occupies approximately 11,000 square feet (sf) and is used for the aerated static piles. The north barn is 8,000 sf and is primarily used as a finishing/storage barn. The City received carbon in the form of yard waste collected by the City's solid waste hauler and provided by self-haulers at the Jefferson County transfer station. The City chips yard waste annually for use as a bulking agent in the composting process. The City owns screening equipment, a front-end loader, and other heavy equipment necessary to operate the composting system.

Based on the projected increase in loading shown in **Table 8-1**, sludge hauled to the compost facility would be expected to increase approximately 20 percent by 2033 and 40 percent by 2043 compared to existing levels.

The City is also contracting to take waste activated sludge from the new Port Hadlock WWTF. Port Hadlock will purchase and operate a gravity dewatering system and haul the dewatered sludge to the Compost Facility. The City will mix with the Port Hadlock sludge with the City's WWTF solids to compost on site. It is estimated that Port Hadlock will supply a 5 yard load approximately 8 times per year.

The Compost Facility site has ample space for the existing operation and has sufficient available space to expand in the future if desired. As growth occurs, the City likely will convert the north barn first to house additional aerated static piles. At a minimum, this would consist of adding aeration equipment to this barn. An additional barn likely would be the next major addition with growth.

Septage Receiving System

As discussed in **Chapter 7**, the City also receives septage to the Compost Facility from the County, which necessitates a small SBR treatment plant at the facility. The SBR system discharges to an engineered wetland treatment system west of the Compost Facility. As noted in **Chapter 7**, some improvements to the SBR are required to replace and rehabilitate aging items. Septage solids are mixed with City sludge and composted. For the purposes of this GSP, it is assumed that if septage receiving were expanded, the overall impact on the solids portion of the composting operation would not be significantly impacted. On the other hand, if septage receiving was expanded, significant improvements to the liquid treatment potion of the compost facility would be required.

The current CIP in **Chapter 10** includes operations and maintenance and repair/replacement projects to keep the existing septage facility running for the next 20 years. This would keep the system functioning at the same treatment capacity as current. However, the City was approached by the County to evaluate options to take all of the County's septage.

The City's septage receiving facility currently handles approximately 40 percent of the County's total annual septage generation. The remainder is trucked to facilities outside of the County for treatment. When including 20 years of growth, the facility would need to treat a maximum month average daily flow of 6,500 gpd, and a peak day of 10,000 gallons. This is significantly higher than the rated capacity of the existing facility.

Alternatives were analyzed, including upgrading the on-site facilities, trucking to the City's main WWTF, and building a pump station and pumping from the septage facility to the main WWTF. The recommended alternative was to expand capacity at the site, as the other alternatives were much more costly or unfeasible. The upgrade alternative would cost approximately $4M (2023 dollars). This information was presented to County staff and County Commissioners for review.

The County is considering their options and the availability of funding. The next step for this upgrade would be a dedicated Engineering Report to analyze and recommend the SBR improvements and detail the associated costs.

As noted previously, this GSP only includes repair/replacement projects at this time. If expansion is decided upon, and funding is found by the County, then a separate amendment would be submitted.

ELECTRICAL AND CONTROLS

Chapter 7 identified necessary improvements for the electrical and control systems. **Chapter 10** includes the CIP projects for these items to maintain the reliability and operability of these systems. However, one of the main considerations for electrical improvements is the timing of the recommended motor control center (MCC) and generator replacements due to these items nearing the end of their useful life. As discussed in this chapter, a major reconfiguration of the WWTF is planned to support the necessary treatment objectives. As noted in the **Activated Sludge System Recommendations**, the major improvements to the WWTF are likely to consist of abandonment of the existing Headworks and oxidation ditches and replacement with a new Headworks and plug flow aeration basins on adjacent property. Additionally, the IPS will be reconfigured or replaced to pump to the new Headworks at a higher elevation than the existing Headworks. The project also may include, or at least allow provisions for, an additional secondary clarifier on the existing site.

The improvements associated with the major reconfiguration of the WWTF will significantly impact the electrical system at the WWTP by decommissioning major motor loads through removal of existing processes, as well as adding new motor loads associated with the new systems. It would be most economical for the City to maintain the existing MCCs and generator until they are completely replaced through the major reconfiguration project. However, **Chapter 7** conservatively recommended replacement of this equipment in 5 to 10 years. This timing may be slightly in advance of the major improvements that are expected to occur between 10 and 20 years. For conservative planning purposes, it is recommended that the City budget for replacement of this equipment in 5 to 10 years. However, pending the progress on the major improvements project, as well as continued spare parts availability for the existing electrical equipment, it may be possible to forego some of the recommended in-kind electrical equipment replacements prior to the major reconfiguration project.

REFERENCES

Metcalf & Eddy Inc., Tchobanoglous, G., Burton, F. L., Tsuchihashi, R., & Stensel, H.D. (2013). *Wastewater engineering: Treatment and resource recovery* (5^{th} ed.). McGraw-Hill Professional.

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9 | OPERATIONS AND MAINTENANCE

INTRODUCTION

The City of Port Townsend's (City) wastewater operations and maintenance (O&M) program consists of the following elements:

1. Normal operation of the wastewater collection system, wastewater treatment facility (WWTF), and Compost Facility.
2. Emergency operation of the wastewater collection system, WWTF, and Compost Facility, when one or more of the components is not available for normal use due to natural or human-made events.
3. A preventive maintenance program to ensure that the wastewater system is receiving maintenance in accordance with generally accepted standards.

NORMAL OPERATIONS

City Personnel

The City's wastewater division functions under the provisions of the City's National Pollutant Discharge Elimination System (NPDES) Permit and the direction of the Public Works Director. Wastewater treatment facilities have special employment requirements for staff as outlined in Chapter 70A.212 Revised Code of Washington (RCW).

In accordance with the RCW, it shall be unlawful for any person, firm, corporation, municipal corporation, or other governmental subdivision or agency to operate or maintain a wastewater treatment facility unless the individual persons performing the duties of an operator as defined in NPDES Permit S.5.3.B, or in any lawful rule, order, or regulation, without being duly certified under the provisions of the chapter.

The municipality is required to designate a person on site at its WWTF as the operator in responsible command of the operation and maintenance of the system. This person is required to be certified at a level equal to or higher than the classification rating of the facility, or Group II for the City.

The WWTF also is required, while staffed on more than one daily shift, to have a shift supervisor designated in charge of each shift at a level no lower than one level lower than the classification rating of II for the City. Based on the RCW, all staff shall be subordinate to the operator in responsible charge.

The current wastewater division organization structure is as shown in **Figure 9-1**. Staff must:

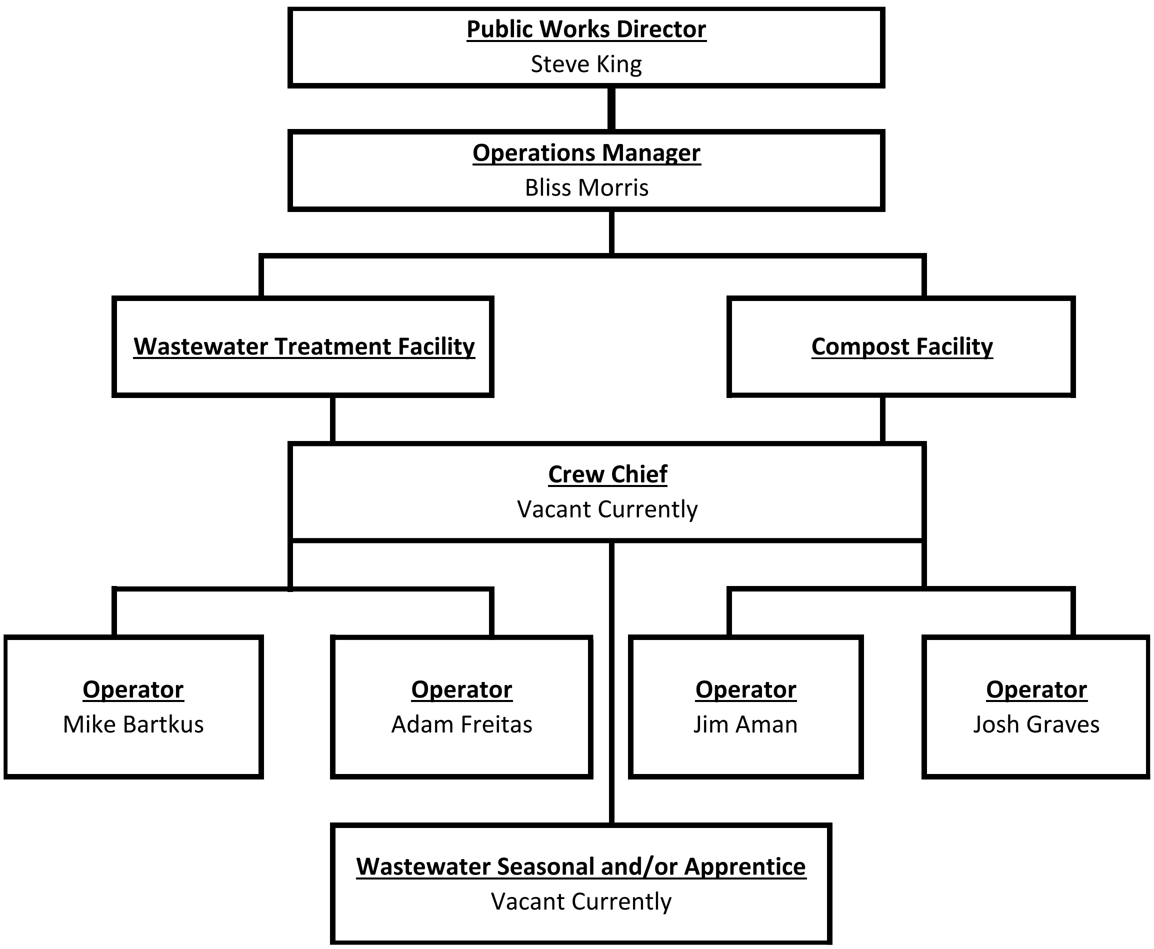
1. Institute adequate O&M programs for the entire sewage system;
2. Keep maintenance records on all major electrical, supervisory control and data acquisition (SCADA), and mechanical components of the WWTF, as well as the collections system and pumping stations. Such records must clearly specify the

frequency and type of maintenance recommended by the manufacturer and must show the frequency and type of maintenance performed;

3. Ensure all operations and maintenance tasks done on the WWTF process equipment or systems are operated or supervised by an operator certified by the State of Washington. The Permittee may allow qualified mechanics, programmers, network engineers, electricians, or other trained tradespersons appropriate for specific tasks to perform work on equipment as long as a certified operator is on site to supervise, authorize, and verify that the work performed does not adversely impact facility operations, effluent quality, or process monitoring and alarm reliability; and
4. Make maintenance records available for inspection at all times.

Figure 9-1

Wastewater Division Organization Chart



Personnel Responsibilities

The key responsibilities of the wastewater O&M staff are summarized as follows.

Public Works Director – Under the direction of the City Manager, the Public Works Director leads or facilitates planning, implements capital improvement projects, and directs the long-term programs of the department, including Engineering and Construction, Streets Maintenance and Collections, Stormwater, Transportation, Water Resources, Wastewater, Compost Facility, Parks, Facilities, and contractual management of Trash Collection/Recycling.

Operations Manager – Under the direction of the Public Works Director, the Operations Manager provides oversight and management of the City's wastewater division. This position coordinates planning objectives, capital improvement projects, and O&M plans to implement City-defined objectives for the wastewater division. The Operations Manager coordinates closely with other divisions and City departments to develop operational strategies, budgets, and long-range planning efforts. The Operations Manager also serves as Operator in Charge when there are vacant positions.

WWTF Operator Crew Chief – The Operator Crew Chief serves to assist the Operations Manager in the leadership and management of the WWTF. This position provides backup and support when the Operations Manager is unavailable or on leave.

WWTF Operators – The Operator is a fully skilled journey level position capable of operating and maintaining all functional areas of the WWTF with minimal guidance or direction.

Compost Facility Operator – The Operator is a fully skilled journey level position capable of operating and maintaining all functional areas of the Compost Facility with minimal guidance or direction.

Wastewater Seasonal and/or Apprentice – The Apprentice will serve both the Compost Facility and the WWTF to help with additional work and receive training to become a certified Operator. This position will be especially important during construction of the WWTF upgrades, when staff is stressed with additional work caused by construction disruptions.

Certification of Personnel

Table 9-1 shows the current certifications of the City's WWTF and Compost Facility O&M staff.

Table 9-1
Personnel Certification

Last Name	First Name	Certificate Number	Group
Morris	Bliss	7234	II
Bartkus	Mike	6354	II
Freitas	Adam	8277	II
Aman	Jim	8839	I
Graves	Josh	8721	I

It is City policy to maintain a well-qualified, technically trained staff. The City annually allocates funds for personnel training, certification, and membership in professional organizations. The City believes that the time and money invested in training, certification, and professional organizations are necessary to provide safety and meet permit compliance.

Available Equipment

The wastewater division has several types of equipment available for daily routine O&M of the wastewater system. If additional equipment is required for specific projects, the City will rent or contract with a local contractor for the services needed. A stock of supplies in sufficient quantities for normal system O&M and anticipated emergencies are stored at each facility. A list of major equipment and chemicals used in the normal operation of the wastewater division can be found in **Table 9-2**.

Table 9-2

Wastewater Division Equipment List

WWTF	Compost Facility	Collection System
	Equipment	
MultiQuip Power 45 Tow Behind Generator	Case Loader	Vactor Truck with Rodder and Cutter
Katolight Tow Behind Generator	John Deere Loader	Push Camera
Chambers Boss LTG Light Tower	John Deere Backhoe	CCTV Camera Truck
12-inch Cargo Sport Box Trailer	Rotomix Mixer	(2) International Dump Truck (25%)
--	Kubota/Brush Hog (33%)	GMC Dump Truck (33%)
--	International Dump Truck	John Deere Loader (25%)
--	--	Excavator (25%)
--	--	John Deere Backhoe (33%)
--	--	Skid Steer with Attachments (33%)
--	--	Kenworth Dump Truck (25%)
--	--	HMA Trailer (15%)
--	--	Asphalt Roller (15%)
--	--	Equipment Trailer (25%)
	Chemical Inventory	
--	Polymer	RootX
--	Methanol	--
--	Chlorine Gas	--

The following representatives typically provide supplies and chemicals to the City.

- Supplies: MASCO Petroleum, 727 Marine Drive, Port Angeles, WA 98363, (360) 640-4444
- Equipment: NAPA Auto Parts, 2321 W Sims Way, Port Townsend, WA 98368, (360) 385-3131
- Equipment: McGuire Bearing Company, 915 S Center Street, Tacoma, WA 98409, (253) 572-2700

Wastewater division employees are equipped with cell phones. The phones provide the capability for personnel to communicate with other cities and Jefferson County as needed.

Routine Operations

Routine operations involve the analysis, formulation, and implementation of procedures to ensure that the facilities are functioning efficiently and treating sewer to meet discharge standards.

Continuity of Service

As the local sewer authority and publicly owned treatment works, the City shall maintain a structure of authority and responsibility to ensure that wastewater service is continuous. For example, changes in City Council or staff shall not have a pronounced effect on the City's level of treatment in terms of meeting the requirements of the NPDES Permit and water quality standards.

Routine Wastewater Quality Sampling

The Washington State Department of Ecology (Ecology) has adopted federal regulations that specify minimum monitoring requirements for the wastewater system. There are two types of reporting at the treatment facility: process and compliance reporting. Process reporting involves collecting data by analyzing samples collected in the facility and reporting the data to the operations team. The data is used by the operations team to evaluate the facility's performance, monitor trends, and make appropriate daily adjustments. These minor daily adjustments ensure the facility is continuously operated meeting the discharge limits identified in the NPDES Permit. Compliance testing includes analytical and record data reported to Ecology that demonstrates the City is compliant with the discharge limits. Reporting requirements are contained in the NPDES Permit, a copy of which is included in **Appendix C**.

EMERGENCY OPERATIONS

Capabilities

The City is well equipped to accommodate short-term system failures and abnormalities. Its capabilities are as follows.

Emergency Equipment

The City is equipped with the necessary tools to deal with common emergencies. If a more serious emergency should develop, the City will hire a local contractor who has a stock of spare parts necessary to make repairs to alleviate the emergency condition. The primary emergency response tool for the collection system are two Vactor trucks and a portable back-up generator. The WWTF and lift stations are monitored by staff through the Mission telemetry system.

Emergency Telephone

The wastewater division has an emergency phone number for public or City staff to directly contact sewer department personnel after normal business hours. The number is (360) 344-9779.

Standby Personnel

The designated standby person can generally respond to a call within 30 minutes. A list of emergency telephone numbers is provided to each on-call employee. New employees will be added to the end of the list at the beginning of the next calendar year's standby schedule.

Contacts

The City maintains a list of utility and agency contacts for routine and emergency use as shown in **Table 9-3**.

Table 9-3

Utility and Agency Contacts

Agency	Phone
Utility Contacts	
Jefferson County Public Utility District	(360) 385-5800 (24 Hours)
Astound	(800) 427-8686
CenturyLink	(833) 591-0933
JeffCom Non-Emergency Line	(360) 344-9779
Other Emergencies	911
Agency Contacts *For collection system overflows, plant bypasses, upsets, or loss of disinfection, contact the following immediately.*	
Ecology SW Regional Office	(360) 407-6300 (24 Hours)
Department of Health Shellfish	(360) 236-3330 (Daytime) (360) 789-8962 (After Hours)
Jefferson County Health Department	(360) 385-9444

Material Readiness

Some critical repair parts, tools, and equipment are on-hand and kept in fully operational condition. As repair parts are used, they are re-ordered. Inventories are kept current and adequate for most common emergencies that reasonably can be anticipated. The City has ready access to an inventory of repair parts, including parts required for repair of each type and size of pipe within the service area. Additionally, the City has been provided with after-hours emergency contact phone numbers for key material suppliers, which gives the City 24-hour access to parts not kept in inventory. The City's 24-hour contact at Ferguson is Daryl Clark at (360) 340-8088.

PREVENTIVE MAINTENANCE

Maintenance schedules that meet or exceed manufacturer's recommendations have been established for all critical components in the City's wastewater system.

Each year the Public Works Department cleans approximately one-quarter of the City's sewer lines. This process begins in March and is completed by the end of October.

The sewer lines are cleaned with a cleaning nozzle that is propelled from one maintenance hole to the next using water under high pressure (1,500 to 2,000 pounds per square inch). The nozzle is then pulled back to the starting maintenance hole. As the nozzle is pulled back, water scours the inside of the sewer pipe. Any debris in the pipe is pulled back with the water. The debris is removed from the maintenance hole with a vacuum unit. If roots are found, they are cut with a root cutter. The City cleans and root cuts any problem areas once or twice per year. City sewer lines requiring a higher level of maintenance are cleaned annually or semi-annually.

Per the recommendations in **Chapter 6**, the City will begin a video inspection program with the goal of viewing the interior of all pipes and maintenance holes within the next 5 to 10 years. This program will help identify mains most urgently in need of repairs or replacement and will help prevent overflows.

The lift stations are checked three times weekly and include wireless monitoring and alarm equipment for flows, backups, and power outages.

The following schedule is used as a minimum for preventive maintenance; the manufacturer's recommendations should be followed where conflict exists.

Wastewater Division

Wastewater Treatment Facility	
Frequency	***Task or Activity***
Daily	Sample influent and effluent water quality per state and federal requirements.
As Needed	Adjust the treatment process in the field as influent wastewater quality or quantity changes to maintain high quality effluent.
As Needed	Dewater the biosolids produced at the WWTF and haul the dewatered biosolids to the Compost Facility.
As Needed	Repair, maintain, and replace WWTF equipment.
As Needed	Clean, paint, and perform small repairs at the WWTF buildings.
As Needed	Clean and perform small repairs for the WWTF vehicles.
As Needed	Water, mow, and trim the landscaping.

Compost Facility	
Frequency	***Task or Activity***
Monthly	Grease blowers, mixer, screen, and rotary screen thickener (RST). Check mixer gear box and fill, if needed.
Monthly	Run bio-filter fans and grease, if needed.
Monthly	Exercise valves, spin blower shafts, and lift station heaters.
Monthly	Fill shower drain and flush with hot water. Inspect fire extinguishers.
Monthly	Change dissolved oxygen membrane and loader bucket pin.
Every 2 Months	Spray down sequencing batch reactor (SBR).
Every 2 Months	Sample compost for finished product quality.
Quarterly	Sample water quality at the facility per state and federal requirements.
Quarterly	Inspect the first aid kit.
Quarterly	Clean the bar screen. Drain and clean the RST flock mixer tank.
Every 4 Months	Clean catch basins and septage holding tanks.
Every 6 Months	Grease motor control center room vent fan.
Every 6 Months	Change oil for septage blower nos. 1 and 2 and the SBR blower.
Annually	Sample water quality at the facility per state and federal requirements.
Annually	Perform an annual safety inspection of the facility. Change batteries in the smoke detectors.
Annually	Grease screens and bio-filter fans. Change oil for the septage pump, air filters, and tractor. Change fluids for the SBR mixer.
Annually	Deep clean the RST and inspect lube latches.
Every 2 Years	Change fuel at the filter diesel tank.
Every 2 Years	Change oil for the pond pump, waste pump, filtrate pump, air compressor, and pressure washer.
As Needed	Water, mow, and trim the landscaping.

Sewage Lift Stations	
Frequency	***Task or Activity***
3 Times per Week	Inspect and maintain the Gaines Street, Monroe Street, and Port Lift Stations.

Weekly	Inspect and maintain the remaining smaller lift stations.
As Needed	Perform routine maintenance on the pumps, valves, and controls.
As Needed	Perform routine maintenance of lift station structures and surrounding site.

Collection System	
Frequency	***Task or Activity***
Semi-Annually	Clean identified problem sewer lines of clogs and debris. Cut roots if found.
Annually	Clean approximately 2.4 miles of sewers not identified as problem lines.
As Needed	Inspect, clean, and evaluate maintenance holes and sewer pipeline condition when hours are available for the program.
As Needed	Perform unscheduled cleaning of periodic clogs and backups in the sewer system.
As Needed	Perform minor construction to maintain the existing system, including maintenance hole cover replacements, maintenance hole replacements, and spot pipe repairs.

STAFFING

The preventive maintenance procedures, as well as the normal and emergency operations of the utility, are described in the previous sections. The hours of labor and supervisory activity required to effectively provide this ongoing maintenance and operations schedule forms the basis for determining adequate staffing levels.

Current Staff

The City's wastewater division staff currently includes approximately eight personnel assigned to the operation and maintenance of the sewer system. The staff is made up of management personnel and operators as shown in **Figure 9-1**.

Currently, the City's wastewater collections, which is part of the Streets Maintenance and Collections crew, consists of 2.23 full-time equivalents (FTEs). In addition, the WWTF has a total of 3.5 FTEs, and the Compost Facility has a total of 2.5 FTEs.

Proposed Staffing

The City currently is preparing a rate study for the wastewater division. The following FTEs will be planned for as part of this study.

The 2024 budget includes a position to increase the wastewater collections FTE count to 2.56. In addition, the City is hoping to retain two seasonal positions, which would equate to 0.33 FTE annually, for seasonal assistance with the collections system. Therefore, a total of 2.6 FTEs is recommended for the wastewater collections.

The City has budgeted in 2024 to add 1.0 FTE for the WWTF and Compost Facility. This new position would be a shared maintenance worker with the ability to become an operator. This position also is intended to help with the additional workload caused by projects being performed at the WWTF. As a result, 0.5 FTE would be added to the WWTF, for a total of 5.0 FTEs. The other 0.5 FTE would assist with the Compost Facility, for a total of 3.0 FTEs. Finally, the City has budgeted for a full-time electrician to be shared between the Facilities (0.5), Water (0.2), and Wastewater (0.3) divisions.

After positions have been filled according to the 2024 budget, the following FTE counts apply (including the Operation Manager's pro-rated portion):

- Wastewater Collections – 2.6
- WWTF – 5.0
- Compost Facility – 3.0
- Total is 10.6 FTEs

10 | CAPITAL IMPROVEMENT PLAN

INTRODUCTION

This chapter presents proposed improvements to the City of Port Townsend's (City) sewer system that are necessary to resolve existing system deficiencies and plan for the projected sewer system growth. The sewer system improvements were identified from the results of the collection system evaluation presented in **Chapter 6**, the Wastewater Treatment Facility (WWTF) and Compost Facility evaluation presented in **Chapter 7**, and WWTF improvements alternatives analyses presented in **Chapter 8**. The sewer system improvements were sized to meet the system's projected 2040 flow and loading conditions.

A Capital Improvement Plan number, herein referred to as a CIP number, has been assigned to each improvement. The improvements are organized and presented in this chapter according to the following primary categories. *Note: The number symbol will be replaced with a corresponding improvement number in the descriptions.*

- 5-Year System Improvements
    - Wastewater Treatment Facility Improvements (CIP F#)
    - Compost Facility and Solids Handling Improvements (CIP C#)
    - Lift Station and Miscellaneous Collection System Improvements (CIP WW#)
    - Sewer Main Improvements (CIP SM#)
- 6- to 10-Year System Improvements
    - Wastewater Treatment Facility Improvements (CIP F#)
    - Sewer Main Improvements (CIP SM#)
- 11- to 20-Year System Improvements (long-term planning capital improvements)
    - Wastewater Treatment Facility Improvements (CIP F#)
    - Compost Facility and Solids Handling Improvements (CIP C#)
    - Sewer Main Improvements (CIP SM#)
- Planning Improvements
    - Miscellaneous and Planning Improvements (CIP M#)

The remainder of this chapter presents a brief description of each group of improvements, the criteria for prioritization, the basis for the cost estimates, and the schedule for implementation.

For planning purposes, the improvement projects described herein are based on one alternative route or conventional concept for providing the necessary improvement. Other methods of achieving the same result, such as obtaining flow capacity increases by adding one large gravity main versus using multiple gravity pipes, force main/gravity main combinations, or multiple force mains, should be considered during design to ensure the best and lowest cost alternative design is selected. Further evaluation should be performed when more information is available regarding when and where future developments will occur.

DESCRIPTION OF IMPROVEMENTS

This section provides a general description of each group of improvements and an overview of the system deficiencies they will resolve. Some of the improvements are necessary to resolve existing system deficiencies. These improvements are discussed in **Chapters 6**, **7**, and **8**.

Collection system improvements to accommodate new growth are not shown in detail in this CIP. It is assumed that most of the new growth will occur at or near the Mill site. This CIP includes a lift station to allow development of the Mill site and conveyance for the new lift station's discharge throughout the existing collection system.

It is intended that this General Sewer Plan (GSP) contain an inclusive list of recommended system improvements; however, additional projects may need to be added or removed from the list as growth occurs or conditions change. The City will evaluate the capacity of the wastewater collection system, WWTF, and Compost Facility as growth occurs and as development permits are received.

5-Year System Improvements

The following improvements were identified by City staff, from the results of the WWTF and system analyses, and from previously prepared CIPs, as discussed in **Chapters 6**, **7**, and **8**. These improvements are primarily necessary to serve the existing sewer service area. The improvements include the major pipeline and facility construction that is required to properly serve the existing sewer service area now and within the next 5 years. The improvement costs shall be borne by the existing customers unless over-sizing of the improvements provides a benefit to developers, in which case the City may pass those costs on depending on goals and policies for development, especially as it relates to housing.

The improvements are based on existing peak hour flow rates; however, the proposed pipe diameters for recommended replacement pipelines are based on peak hour flow projections. The proposed system improvements are illustrated in **Figure 10-1**. RH2 Engineering, Inc.'s (RH2) analysis shows the best apparent replacement alignment for the collection system improvements based on information currently available. A variety of alternatives are possible for the collection system CIP projects listed, and alternatives should and will be considered during the design of each project.

Wastewater Treatment Facility Improvements (F#)

CIP F1 – Influent Pump Station and Odor Control Improvements

Deficiency: Portions of the Influent Pump Station (IPS) are heavily corroded, and the interior liner is detaching from the concrete. The electrical conduits and equipment inside the pump station also have corroded severely. In addition, a 2019 conditions assessment by Jacobs Engineering Group (Jacobs) recommended odor control system improvements to increase treatment capacity.

Improvement: Repair the concrete liner system within the IPS and Headworks channels. Repair the ductwork of the odor control system, upsize the fan, and add a new carbon tank. A full conditions assessment of the mechanical components inside the IPS is recommended to determine if the pipes and fittings need to be replaced. Replace the electrical and supervisory control and data acquisition (SCADA) equipment and instrumentation inside the IPS. All flows entering the IPS will need to be temporarily bypassed while improvements within the IPS are being performed.

Cost: $2,120,000

CIP F5 – Non-Potable Water Pump Replacements (City to Install)

Deficiency: The existing non-potable water (NPW) pumps located at the end of the chlorine contact basins are heavily corroded and in need of replacement.

Improvement: Replace the NPW pumps in-kind. Provide equipment and instrumentation necessary to allow a fully functional and integrated system. This work is anticipated to be completed by City staff.

Cost: $120,000

CIP F6 – SCADA Upgrades

Deficiency: The existing SCADA system at the WWTF is aging and in need of replacement as spare parts become harder to acquire. The existing software is outdated and needs updating.

Improvement: Replace the programmable logic controller (PLC) and uninterruptible power supply (UPS) equipment in all three control panels and replace the existing SCADA human machine interface (HMI) computer hardware. Upgrade the network to an Ethernet Device Level Ring network and convert the existing Allen-Bradley PLC-5 system to ControlLogix PLC equipment.

Cost: $1,140,000

CIP F7 – Electrical Upgrades

Deficiency: Most of the existing electrical equipment and instrumentation is original to the WWTF and is recommended to be upgraded or replaced as failures occur.

Improvement: Replace aging electrical equipment as failures occur and/or stock up on spare parts. Replace all variable frequency drives (VFDs), aging field instrumentation, and miscellaneous panel components.

Cost: $630,000

CIP F8 – Near-Term Oxidation Ditch Improvements

Deficiency: Near-term improvements are recommended to upgrade the equipment at the oxidation ditch. The system is losing treatment capacity due to the nitrogen removal operations at the WWTF.

Improvement: Upgrade the oxidation ditches to replace one of the mixer aerators in-kind, and install independent mechanical mixers and instrumentation and access platforms at both ditches. Install the necessary equipment and instrumentation to automate flow isolation into the ditches. These improvements will enable cyclical operation of the ditches by alternating between oxic and anoxic cycles as discussed in **Chapter 8**. A preliminary design for the ditches is recommended before implementing the improvements. While the improvements are being performed within the ditches, rehabilitate the structures and remove sludge and grit as necessary.

Note that the engineering will begin in the 5-year plan, but the City has currently budgeted construction in the 6- to 10-year CIP for purposes of rate mitigation. However, if funding can be procured, this project should be constructed sooner to minimize potential risk.

Cost: $2,940,000

CIP F9 – Outfall Upgrades

Deficiency: The existing outfall needs to be replaced due to the age of the infrastructure.

Improvement: Plan and design a replacement outfall project.

Cost: $4,000,000

CIP F11 – Land Acquisition for WWTF Expansion

Deficiency: The WWTF will require additional footprint to construct additional infrastructure necessary for providing sufficient long-term treatment capacity.

Improvement: In anticipation of the future WWTF expansion, acquire additional parcels of land as described in **Chapter 8**.

Cost: $2,000,000

Compost Facility and Solids Handling Improvements (C#)

CIP C1 – Solids Handling Influent Screening and Grit Removal

Deficiency: The bar screens currently are manually raked and washed down by haulers. This process should be automated and grit should be removed in the process.

Improvement: Install a packaged septage screening and grit removal system with a new influent meter to monitor flow.

Cost: $890,000

CIP C2 – Solids Handling Tank Replacement and Mechanical Upgrades

Deficiency: One of the two existing septage holding tanks has accumulated a significant amount of grit, making only one tank operable. The equipment associated with the septage treatment system also needs to be replaced due to its age.

Improvement: Replace the existing solids handling tanks with a larger 50,000-gallon holding tank with new blowers. Replace the pumps for the waste activated sludge (WAS), chlorination, and wetland disposal processes, and replace the sequencing batch reactor (SBR) blower.

Cost: $700,000

CIP C3 – Compost Screen Replacement

Deficiency: The existing composting screen is nearing the end of its useful life and is due for replacement.

Improvement: Install a new compost screen to replace the existing screen.

Cost: $460,000

CIP C4 – Compost Case Loader Replacement

Deficiency: The existing front-end loader in the Compost Facility is nearing the end of its useful life and is due for replacement.

Improvement: Replace the existing front-end loader with a new loader.

Cost: $390,000

CIP C5 – Compost Blowers Replacements

Deficiency: The existing composting aeration blowers are nearing the end of their useful life and are due for replacement.

Improvement: Replace the existing compost blowers with new compost blowers.

Cost: $80,000

CIP C7 – 6-Inch Hydrant Line

Deficiency: The Compost Facility needs additional water supply to meet process demands.

Improvement: Install approximately 1,100 linear feet (lf) of 6-inch water main from the facility's primary water main and connect to a hydrant located on the Compost Facility site.

Cost: $670,000

CIP C8 – Office with Dedicated Lunchroom

Deficiency: Expanding the Compost Facility and its associated processes will require more space for City staff.

Improvement: Add an office space with a dedicated lunchroom for City operators and staff use.

Cost: $300,000

Lift Station and Miscellaneous Collection System Improvements (WW#)

CIP WW1 – Existing Monroe Street Lift Station Improvements

Deficiency: The existing Monroe Street Lift Station does not have adequate pumping capacity to meet existing hydraulic loads. The sewers on Lawrence Street, tributary to the Monroe Street Lift Station, are still combined and the station is overwhelmed by stormwater inflow during peak rainfall events. These extreme events cause all three pumps at the station to run. The pump capacity deficiency could be mitigated by the separation of storm sewers from sanitary sewers on Lawrence Street. For this reason, the upgrade of the lift station should be performed after the Lawrence Street sewer separation project (CIP SM9) and after flows into the Monroe Street Lift Station have been observed for at least 2 years.

The station must be relocated or elevated to prevent the access hatches from being inundated as sea level continues to rise.

Improvement: Relocate the station to a new site that minimizes the risk of flooding over a 75-year design life. Rebuild the Monroe Street Lift Station with pumps, valves, and electrical gear capable of handling the higher flow rates being received. Begin predesign for this project after the Lawrence Street storm and sanitary sewer separation project has been completed and influent flows have been analyzed. It is possible that influent flows to the Monroe Street Lift Station could be significantly reduced with the Lawrence Street improvement project.

Cost: $5,000,000

CIP WW2 – Sewer Camera Van, Video Camera and Tractor, Recording Software and Hardware, and Staff Training

Deficiency: The City’s existing video inspection equipment is outdated and no longer functioning. New pipeline video equipment is needed to allow the City to inspect every pipe in its system at least once every 10 years, and preferably every 5 years. Lack of functioning video inspection equipment leaves the City unaware of the condition of its aging collection system. The Water Street collapse may have been avoided if the City were able to see its deteriorating condition. Knowledge of pipeline condition is an essential component of an asset management system to schedule and budget repairs and replacements of aging mains and maintenance holes.

Improvement: Procure new video camera, camera tractor, and software to record, store, and annotate digital videos. Procure a van to house the equipment with power supply, cable reels, and workstation with multiple monitor screens. This CIP item also includes training for the new equipment.

Cost: $300,000

CIP WW3 – General Lift Station Improvements

Deficiency: Replace components at various lift stations as needed due to aging parts and equipment failures.

Improvement: Replace pumps, generators, valves, electrical power supply equipment, and other essential lift station components as needed.

Cost: $1,000,000

CIP WW4 – Mill Lift Station

Deficiency: Currently, there is no sewer service at the Mill site. This lift station and force main will allow for development of the Mill site to its potential.

Improvement: Procure property and construct a submersible lift station with an ultimate firm capacity of 1,062 gallons per minute. The station is to include backup power generation and a 4,500-foot-long, 10-inch-diameter force main as shown in **Figure 10-1**. Costs also include gravity piping in the area to supply the lift station.

Cost: $6,300,000

Sewer Main Improvements (SM#)

CIP SM1 – Sims Way Crossing and Wilson Street Realignment

Deficiency: The concrete gravity sewer main in W Sims Way and Wilson Street lacks the hydraulic capacity to convey the projected 5-year flows from the proposed Mill Lift Station. Furthermore, portions of this pipeline pass beneath an existing residence.

Improvement: Replace approximately 786 lf of existing 8-inch gravity pipe with new 18-inch gravity sewer in a different alignment on an easement to be procured. This project must be completed concurrently with the construction of the Mill Lift Station (CIP WW4).

Cost: $1,212,000

CIP SM8 – Sewer System Defect Investigation and Repair

Deficiency: There are a number of known structural deficiencies throughout the sewer system, particularly in the older parts of the sewer collection system. The degree of structural degradation at sites the City was able to video inspect indicate there may be additional structural defects in other areas of the system.

Improvement: Systematically investigate and repair high priority, compromised sewer mains with an emphasis on the areas of known structural degradation. Investigations will include video inspections with some smoke testing of gravity sewer mains in areas where defects are suspected by the City's collections operations staff. Replacements will be made to the extent allowed by the yearly collection system repair budget.

Cost: $3,300,000

CIP SM9 – Lawrence Street Combined Sewer Separation

Deficiency: The Lawrence Street sewer combines sanitary sewer and stormwater in the same pipe. Stormwater peak flows impose significant hydraulic loads on the sanitary sewer collection system and the Monroe Street Lift Station and consumes treatment capacity at the WWTF.

Improvement: Reconstruct the storm and sanitary sewer collection pipelines in Lawrence Street from Fillmore Street to Monroe Street to fully separate the storm drains. Perform smoke testing and video inspection of the Lawrence Street sewer first to determine the level of connectivity between the storm and sanitary sewers. The amount of asphalt disturbance will require full street repaving and modification of street geometric design to provide Americans with Disabilities Act compliant ramps at intersections. This project is split evenly with the City's stormwater division because of the magnitude of the cost and the equal benefit received by the wastewater and stormwater divisions. The cost shown is the half share to be funded by the City's wastewater division.

Cost: $2,826,000

CIP SM10 – Suitcase Pipe Replacement on Washington Street

Deficiency: During a video inspection in 2023, it was observed that the vitrified clay pipe in Washington Street between Taylor and Adams Streets was becoming crushed and in imminent danger of collapse. The video inspector classified the failure as a "suitcase" because of cracks observed at the 12, 3, 6 and 9 o'clock positions on the pipe. These cracks were acting like hinges, allowing the pipe to slowly close like a suitcase. Replacement of this main is urgent to prevent it from completely losing its ability to convey wastewater.

Improvement: Replace the existing pipeline with new 8-inch polyvinyl chloride (PVC) pipe by open-cut methods.

Cost: $399,000

CIP SM12 – Water Street Sewer Replacement

Deficiency: The existing 14-inch-diameter, asbestos cement pipe in Water Street collapsed during a king tide on December 27, 2022. After an emergency repair of the collapse, video inspection of the 14-inch gravity sewer detected corrosion, broken pipe, and sediment accumulation in the main, indicating a breach in the pipeline. The sediment prevented a full pipeline inspection and hydraulic cleaning methods were abandoned because of the risk to the fragile main. In early 2023, the City deemed the main to be in immediate need of replacement and applied for funding. The City received funding from the State of Washington's Public Works Board in August 2023, and design has been underway since that time with the intent of constructing the project in 2024.

Improvement: Replace approximately 1,600 lf of existing 14-inch gravity pipe by extending the Monroe Street Lift Station force main by approximately 1,600 feet. This extension will be made by horizontal directional drilling (HDD). Approximately 350 feet of the gravity main will be converted to force main by pipe bursting or sliplining the existing gravity main. Four service laterals, currently connected to the gravity main being converted to a force main, will be transferred to an 8-inch main sliplined into the failing 14-inch gravity sewer.

Cost: $2,100,000

6- to 10-Year System Improvements

The 6- to 10-year improvements were identified from the results of the WWTF and system analyses discussed in **Chapters 6** and **7** and the WWTF improvements alternatives analyses presented in **Chapter 8**.

The 6- to 10-year system improvements are illustrated in **Figure 10-1**. Alternatives for the collection system improvements are possible, and further evaluation should be performed when more information is available regarding when and where future developments will occur.

Wastewater Treatment Facility Improvements (CIP F#)

CIP F2: Headworks Rehabilitation

Deficiency: The existing Headworks screen and grit mechanism are aging and in need of replacement.

Improvement: Install a new replacement screen and remove the existing grit mechanism to install a new mechanism and appurtenances. Increase the power feeder size and provide instrumentation for a fully integrated system.

Cost: $1,200,000

CIP F3 – Clarifier No. 1 Improvements

Deficiency: The original secondary clarifier mechanisms are reaching the end of their useful life and are in need of replacement. Improvements are planned to be phased so that one clarifier can remain online.

Improvement: Replace the existing Clarifier No. 1 mechanism with a stainless steel mechanism, replace the drive unit, and recoat the launder. Remove the existing power feeder conductors and re-land the conductors after the mechanism replacement is complete. Perform a conditions assessment to determine if other improvements are needed.

Cost: $1,250,000

CIP F4 – Clarifier No. 2 Improvements

Deficiency: The original secondary clarifier mechanisms are reaching the end of their useful life and are in need of replacement. Improvements are planned to be phased so that one clarifier can remain online.

Improvement: Replace the existing Clarifier No. 2 mechanism with a stainless steel mechanism, replace the drive unit, and recoat the launder. Remove the existing power feeder conductors and re-land the conductors after the mechanism replacement is complete. Perform a conditions assessment to determine if other improvements are needed.

Cost: $1,250,000

Sewer Main Improvements (CIP SM#)

CIP SM2 – Howard Street and S Park Avenue

Deficiency: The gravity sewer main in Howard Street and S Park Avenue has hydraulic capacity deficiencies, and a portion of these sewer mains need to be upsized.

Improvement: Replace approximately 1,079 lf of existing 8-inch gravity pipe with new 15-inch gravity sewer pipe by open-cut methods as shown in **Figure 10-1**.

Cost: $1,578,000

CIP SM3 – Sims Way, 3rd Street, and Gise Street

Deficiency: The gravity sewer mains in Sims Way, 3rd Street, and Gise Street have hydraulic capacity deficiencies, and a portion of these sewer mains need to be upsized.

Improvement: Replace approximately 273 lf of existing 8-inch gravity pipe with new 18-inch gravity sewer pipe, and replace approximately 523 lf of existing 8-inch gravity pipe with new 15-inch gravity sewer pipe by open-cut methods as shown in **Figure 10-1**.

Cost: $1,186,000

CIP SM4 – Holcomb Street

Deficiency: The gravity sewer main in Holcomb Street has hydraulic capacity deficiencies and a portion of the sewer main needs to be upsized.

Improvement: Replace approximately 531 lf of existing 12-inch gravity pipe with new 18-inch gravity sewer pipe by open-cut methods as shown in **Figure 10-1**.

Cost: $819,000

11- to 20-Year System Improvements (Long-Term Planning Capital Improvements)

The long-term improvements were identified from the results of the WWTF and system analyses discussed in **Chapters 6** and **7** and the WWTF improvements alternatives analyses presented in **Chapter 8**. These improvements are necessary to serve projected population growth in the City and expansion areas. The improvements include the major facility and conveyance construction that will be required to serve those areas.

The additional system improvements required for long-term improvements are illustrated in **Figure 10-1**.

Wastewater Treatment Facility Improvements (CIP F#)

CIP F12 – Long-Term WWTF Expansion (Budgetary Estimate)

Deficiency: Long-term, major expansion of the WWTF is required to provide biological treatment for the projected flow and loads and to provide nitrogen removal.

Improvement: Construct a new activated sludge system consisting of aeration basins and secondary clarifiers. This involves constructing new aeration basins on the newly acquired parcels and removing the existing oxidation ditches to construct future secondary clarifiers within the existing footprint. Modify the hydraulics of the WWTF such that influent flow is lifted to the new aeration basins. This may involve constructing a new Headworks and refurbishing or replacing the existing IPS.

Cost: $30,000,000

Compost Facility and Solids Handling Improvements (C#)

CIP C6 – Compost Facility Infrastructure Upgrades

Deficiency: The Compost Facility needs infrastructure upgrades to bring the facility up to current codes and to ensure safety for the operators.

Improvement: Perform infrastructure upgrades at the Compost Facility, including repairing and sealing the asphalt around the facility, adding lights to the barns, and reinforcing the existing concrete support poles of the barns.

Cost: $410,000

Sewer Main Improvements (SM#)

CIP SM5 – Howard Street, S Park Avenue, and McPherson Street

Deficiency: The gravity sewer mains in Howard Street, S Park Avenue, and McPherson Street have hydraulic capacity deficiencies, and a portion of these sewer mains need to be upsized.

Improvement: Replace approximately 1,685 lf of existing 8-inch sewer with new 15-inch gravity sewer pipe by open-cut methods as shown in **Figure 10-1**.

Cost: $2,463,000

CIP SM6 – West Sims Way and 3rd Street

Deficiency: The existing 8-inch concrete gravity sewer mains in West Sims Way and 3rd Street have hydraulic capacity deficiencies, and a portion of these sewer mains need to be upsized.

Improvement: Replace approximately 1,150 lf of existing 8-inch concrete sewer main with new 15-inch gravity sewer pipe by open-cut methods as shown in **Figure 10-1**.

Cost: $1,679,000

CIP SM7 – Future Interceptor Sizing

Deficiency: Existing 8-, 10-, 12-, and 18-inch sewer interceptor in the City's collection system is failing and has hydraulic capacity deficiencies. Portions of the sewer interceptor need to be upsized.

Improvement: Replace approximately 3,785 lf of existing 10-, 12-, and 18-inch sewer interceptor. Install approximately 220 lf of new 15-inch sewer interceptor, approximately 1,365 lf of new 18-inch sewer interceptor, approximately 1,165 lf of new 24-inch sewer interceptor, and approximately 1,035 lf of new 30-inch sewer interceptor by open-cut methods as shown in **Figure 10-1**.

Cost: $6,722,000

CIP SM11 – Long-Term Sewer System Investigation and Refurbishment

Deficiency: It is suspected that there are many structurally deficient sewer mains in the City's collection system. There are several known structural deficiencies, particularly in the older parts of the collection system that have been video inspected. The degree of structural degradation observed (such as Water and Washington Streets) indicates there are other structurally deficient mains in the older parts of the sewer collection system. The condition of the collection system is not well known because of a lack of adequate inspection equipment. The pipe material and age of many of the mains is also unknown because of incomplete record drawings. RH2 believes that many structurally deficient mains will be discovered once the City begins a regular video inspection program and many of these mains will need to be replaced or repaired.

Improvement: Systematically investigate all un-inspected sewer mains with an emphasis on the areas of known structural degradation that pose a threat of imminent pipe collapse. Replace or line the existing mains and maintenance holes that are structurally deficient. The cost presented represents the "least optimistic" scenario. That is, all pipes that are of concrete, vitrified clay, asbestos cement, or unknown material are assumed to be deficient and will need lining using cured-in-place pipe (CIPP) starting in 10 years. The estimated cost could be reduced if vitrified clay pipes are still in good condition or if unknown pipes are made of PVC. If pipes are in such dire condition that they cannot be lined (like the Water Street sewer in 2023), a more expensive open-cut replacement method will be required. To be conservative, RH2 has estimated that all pipes of substandard or unknown material will be lined with CIPP.

Cost: $56,000,000

Planning Improvements

Miscellaneous and Planning Improvements (CIP M#)

CIP M1 – Arc Flash Analysis

Improvement: Perform an electrical short circuit, protective device coordination, and arc flash analysis for the electrical distribution equipment at the City's wastewater facilities. Prepare a report summarizing the calculations and recommendations for protective device settings and Personal Protective Equipment requirements.

CIP M2 – Public Works Shop (Sewer Collection Share)

Deficiency: The City Shops is home to the water, streets, stormwater, and wastewater collections maintenance crews and equipment. The shops are in disrepair and a new maintenance facility is needed. The first step is to do a schematic design and needs assessment.

Improvement: The cost shown is the share to be funded by the City's Sewer Utility. The estimated cost for the sewer utility portion of this assessment is $100,000.

CIP M3 – General Sewer Plan Update

Deficiency: The City's GSP should be updated every 10 years in coordination with its Water System Plan update.

Improvement: The City plans to update its GSP every 10 years. In addition, the City may review the GSP at the 5-year mark and adjust the projections and improvements as necessary. This may be completed between 2032 and 2033, and 2042 and 2043.

CIP M4 – Downtown Restrooms

Improvement: The cost shown is the share to be funded by the City's Sewer Utility. The estimated sewer fund cost is $250,000. Costs may vary depending on the location and size of the facility. This estimate is planning-level only and anticipates use of other funding sources to assist in the project development.

ESTIMATING COSTS OF IMPROVEMENTS

Project costs for the proposed improvements were estimated based on costs of similar recently constructed sewer projects around the Puget Sound area and are presented in 2023 dollars. The unit costs for each pipe size are based on estimates of all construction-related improvements, such as materials and labor for installation, services, maintenance holes, connections to the existing system, trench restoration, asphalt surface restoration, and other work for a complete installation. Project cost estimates for sewer pipe projects were determined from the unit costs (i.e., cost per foot-length) shown in **Tables 10-1** and **10-2** and the proposed diameter and approximate length of each improvement. The costs shown in

Tables 10-1 and **10-2** include indirect costs estimated at 50 percent of the construction cost for engineering preliminary design, final design, construction contract administration, project administration, permitting, and legal and administrative services.

Table 10-1
Gravity Sewer Pipe Unit Costs for Open-Cut Construction

Sewer Main Diameter (in.)	Project Cost per Linear Foot (2023 $ per lf)
8	$1,314
12	$1,394
15	$1,461
18	$1,542
21	$1,668
24	$1,802
30	$2,119
36	$2,501

Table 10-2
Gravity Sewer Pipe Unit Costs for Cured-in-Place Pipe

Sewer Main Diameter (in.)	Project Cost per Linear Foot (2023 $ per lf)
6	$350
8	$322
10	$331
12	$341
14	$399
15	$399
16	$475
18	$475
22	$686
24	$974
30	$1,357

The cost estimates shown in **Table 10-3** include the estimated construction cost of the improvement and indirect costs estimated at 50 percent of the construction cost for engineering preliminary design, final design, construction contract administration, project administration, permitting, and legal and administrative services. The construction cost estimates include a sales tax of 8.6 percent.

Cost estimates prepared by RH2 for projects in the CIP are Class 5 estimates, based on standards established by the American Association of Cost Engineers (AACE). Class 5 estimates are described as generally being prepared with limited information and subsequently have wide accuracy ranges. The typical accuracy range for this cost estimate class is from -20 percent to -50 percent on the low side and from +30 percent to +100 percent on the high side.

The final cost of the projects will depend on actual labor and material costs, actual site conditions, productivity, competitive market conditions, final project scope, final project schedule, and other variable factors. As a result, the final project costs likely will vary from those presented. Because of these factors, funding needs must be reviewed carefully prior to making specific financial decisions or establishing final budgets.

PRIORITIZING IMPROVEMENTS

The existing system improvements were prioritized by the City based on the perceived need for the improvement to be completed prior to projects with fewer deficiencies or less risk of damage due to failure of the system. Priority and schedule for any future developer-funded projects is dependent on the timing and design of specific developments areas.

Future projects that are not identified as part of the City's CIP may become necessary. Such projects may be required to remedy an emergency situation or address unforeseen problems. Due to budgetary constraints, the completion of such projects may require modifications to the recommended CIP. The City retains the flexibility to reschedule, expand, or reduce the projects included in the CIP and to add new projects to the CIP, as best determined by rate payers and the City Council, when new information becomes available for review and analysis.

SCHEDULE OF IMPROVEMENTS

The results of prioritizing the improvements were used to assist in establishing an implementation schedule that can be used by the City for preparing its CIP. The implementation schedule for the proposed improvements is shown in **Table 10-3**. It should be noted that the implementation schedule shown is, to some extent, flexible. The implementation schedule should be modified based on City preferences, budget, or as development fluctuates. The City should review **Table 10-3** at least annually and reprioritize as necessary to match budget, growth, flows, and other City conditions/priorities. This provides the City with the flexibility to coordinate these projects with road or other projects within the same area.

Future Project Cost Adjustments

All cost estimates shown in the tables are presented in 2023 dollars. Therefore, it is recommended that future costs be adjusted to account for the effects of inflation and changing construction market conditions at the actual time of project implementation. Future costs can be estimated using the Engineering News Record Construction Cost Index for the Seattle area or by applying an estimated rate of inflation that reflects the current and anticipated future market conditions.

The CIP presented in **Table 10-3** is based on the information currently available. As the City implements the recommendations, the cost and timing of projects may be revised.

Table 10-3
Proposed CIP Implementation Schedule

CIP No.	Project Description	Length (LF)	Estimated Cost (2023 $)	2024	2025	2026	2027	2028	6-10 years	11-20 years
	Sewer Main Improvements									
SM1	Sims Way Crossing and Wilson Street Realignment	786	$1,212,000	$100K	$606K	$506K				
SM2	Howard Street and S Park Avenue	1,079	$1,578,000						$1,578K	
SM3	Sims Way, 3rd Street, and Gise Street	796	$1,186,000						$1,186K	
SM4	Holcomb Street	531	$819,000						$819K	
SM5	Howard Street, S Park Avenue, and McPherson Street	1,685	$2,463,000							$2,463K
SM6	West Sims Way and 3rd Street	1,149	$1,679,000							$1,679K
SM7	Future Interceptor Upsizing	3,785	$6,722,000							$6,722K
SM8	Sewer System Defect Investigation and Repair	--	$3,300,000	$150K	$350K	$350K	$350K	$350K	$1,750K	
SM9	Lawrence Street Combined Sewer Separation*	1,800	$2,826,000		$500K	$1,163K	$1,163K			
SM10	Suitcase Pipe Replacement on Washington Street	303	$399,000		$399K					
SM11	Long-Term Sewer System Investigation and Refurbishment**	--	$56,000,000							$56,000K**
SM12	Water Street Sewer Replacement	1,600	$2,100,000	$2,100K						
Total - Sewer Main Improvements			**$80,284,000**	**$2,350K**	**$1,855K**	**$2,019K**	**$1,513K**	**$350K**	**$5,333K**	**$66,864K**
	Lift Station Improvements									
WW1	Existing Monroe Street Lift Station Improvements		$5,000,000					$500K	$4,500K	
WW2	Sewer Camera Van, Video Camera and Tractor, Recording Software and Hardware, and Staff Training		$300,000	$300K						
WW3	General Lift Station Improvements		$1,000,000	$50K	$50K	$50K	$50K	$50K	$250K	$500K
WW4	Mill Lift Station		$6,300,000	$1,100K	$3,200K	$2,000K				
Total - Lift Station Improvements			**$12,600,000**	**$1,450K**	**$3,250K**	**$2,050K**	**$50K**	**$550K**	**$4,750K**	**$500K**
	Wastewater Treatment Facility Improvements									
F1	Influent Pump Station and Odor Control Improvements		$2,120,000	$300K	$1,820K					
F2	Headworks Rehabilitation		$1,200,000						$1,200K	
F3	Clarifier No. 1 Improvements		$1,250,000						$1,250K	
F4	Clarifier No. 2 Improvements		$1,250,000						$1,250K	
F5	Non-Potable Water Pump Replacements (City to Install)		$120,000	$60K		$60K				
F6	SCADA Upgrades		$1,140,000		$150K	$990K				
F7	Electrical Upgrades		$630,000			$630K				
F8	Near-Term Oxidation Ditch Improvements		$2,940,000		$100K			$400K	$2,440K	
F9	Outfall Upgrades		$4,000,000	$500K	$600K	$2,900K				
F10	On-Site Solids Handling Improvements		$3,000,000						$3,000K	
F11	Land Acquisition for WWTF Expansion		$2,000,000		$2,000K					
F12	Long-Term WWTF Expansion (Budgetary Estimate)		$30,000,000							$30,000K
Total - Facility Improvements			**$49,650,000**	**$860K**	**$4,670K**	**$4,580K**	**$0K**	**$400K**	**$9,140K**	**$30,000K**
	Compost Facility and Solids Handling Improvements									
C1	Solids Handling Influent Screening and Grit Removal		$890,000			$160K	$365K	$365K		
C2	Solids Handling Tank Replacement and Mechanical Upgrades		$700,000		$150K	$130K	$130K	$130K	$160K	
C3	Compost Screen Replacement		$460,000	$460K						
C4	Compost Case Loader Replacement		$390,000		$390K					
C5	Compost Blowers Replacements		$80,000	$19K	$19K	$19K	$23K			
C6	Compost Facility Infrastructure Upgrades		$410,000		$15K					$395K
C7	6-inch Hydrant Line		$670,000		$100K	$285K	$285K			
C8	Office with Dedicated Lunchroom		$300,000		$300K					
Total - Facility Improvements			**$3,900,000**	**$479K**	**$974K**	**$594K**	**$803K**	**$495K**	**$160K**	**$395K**
	Miscellaneous and Planning Improvements									
M1	Arc Flash Analysis		$90,000		$90K					
M2	Public Works Shop - Sewer Collection Share		$2,850,000		$100K				$2,750K	
M3	General Sewer Plan Update		$250,000							$250K
M4	Downtown Restrooms		$250,000		$250K					
Total - Miscellaneous Improvements			**$3,440,000**	**$0K**	**$440K**	**$0K**	**$0K**	**$0K**	**$2,750K**	**$250K**
Total Estimated Project Costs of City-funded Improvements			**$149,874,000**	**$5,139K**	**$11,189K**	**$9,243K**	**$2,366K**	**$1,795K**	**$22,133K**	**$98,009K**

*50% cost shown in the CIP table. It is assumed an additional 50% will be paid by the Road and Storm Drainage departments.

**Costs are budgetary for pipe replacement of unknown materials. As the City video inspects the system and updates condition, this is subject to change. Rate analysis only includes anticipated grants to reduce City expenditure to $21 million.

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Vicinity Map

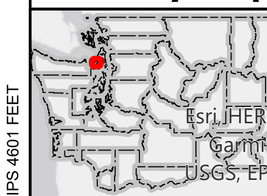

Figure 10-1
Capital Improvement Plan Map
Collection System
City of Port Townsend
General Sewer Plan

COORDINATE SYSTEM: NAD 1983 STATEPLANE WASHINGTON NORTH FIPS 4601 FEET   PLOT DATE: SEP 27, 2023   BY: MEMOTO   J:\DATA\TWNSD\21-0226\GIS\MODEL\MODEL PIPES - COPY.APRX

City of Port Townsend

1 inch : 2,000 Feet

0 500 1,000 2,000 Feet

DRAWING IS FULL SCALE WHEN BAR MEASURES 2"

RH2

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11 | FINANCIAL ANALYSIS

INTRODUCTION

The financial analysis assesses the ability of the City of Port Townsend's (City) sewer utility to remain financially viable during the planning period, considering its recent historical performance as well as anticipated future needs. It also evaluates the affordability of the City's sewer rates, both at existing levels and with any rate increases needed to support the planned capital program.

FINANCIAL HISTORY

The City tracks the financial activities of its water and sewer utilities in a set of joint funds.

- Water/Sewer Operating Fund (411)
- Water/Sewer Capital Fund (415)
- Olympic Gravity Water System Fund (417)
- Water/Sewer Debt Reserve Fund (430)
- System Development Charge Fund (495)

The City has historically recovered the cost of ongoing operations and maintenance through a combination of base fees and volume fees, imposing a separate capital surcharge to recover costs associated with debt service and capital investment. Though the City originally introduced the capital surcharge in 2013 to communicate the rate impacts of major capital projects to ratepayers, it has decided to consolidate it into the "main" rate structure to recognize that capital investment is an ongoing obligation of the City's sewer utility. As a result, this analysis includes capital surcharge revenue in the definition of "rate revenue."

Table 11-1 summarizes the financial performance of the City's sewer utility from 2018 through 2023, given its allocated share of revenues, expenses, and reserve balances from each of the funds listed above. Key findings include:

- Though the City historically transferred utility taxes directly to its General Fund, it began to account for utility tax revenue in Fund 411 in 2019. Excluding the impacts of this change in accounting practices, the City's sewer rate revenue increased by about 10 percent from 2018 to 2023. Most of this increase is attributable to the City's decisions to increase its sewer base fees and volume fees by a total of approximately 9 percent during this period. The remainder can be explained by recent growth in the City's sewer customer base;
- Excluding the impacts of the City's change in utility tax accounting practices, the sewer utility's operating expenses increased by about 38 percent from 2018 to 2023. Inflation likely contributed significantly toward this increase, as the Consumer Price Index for the Seattle-Tacoma-Bellevue area increased by 26 percent during this period. In addition, labor costs, including salaries and benefits, have increased at a rate exceeding inflation;

Table 11-1

Summary of Historical Financial Performance ($000s)

Fund Resources and Uses Arising from Cash Transactions – Sewer Utility Share	**2018 Actual**	**2019 Actual**	**2020 Actual**	**2021 Actual**	**2022 Actual**	**2023 Budget**
Beginning Cash & Investments ($000s)	$2,160	$1,803	$2,288	$3,142	$4,057	$4,767
Operating Revenues						
Intergovernmental	$ -	$ -	$ 0	$ 0	$ -	$ -
Rate Revenue	2,626	3,168	3,080	3,251	3,414	3,450
Other Charges for Services	258	285	190	200	198	222
Miscellaneous	3	10	8	10	13	2
Total ($000s)	$2,886	$3,463	$3,279	$3,461	$3,625	$3,675
Operating Expenses						
General Government	$ 221	$ 217	$ 228	$ 0	$ -	$ -
Utility Operations	1,885	2,527	2,477	2,911	3,067	3,456
Total ($000s)	$2,106	$2,743	$2,704	$2,911	$3,067	$3,456
Net Operating Income (Loss)	**$780**	**$720**	**$575**	**$550**	**$558**	**$219**
Operating Ratio	***1.37***	***1.26***	***1.21***	***1.19***	***1.18***	***1.06***
Other Increases (Decreases) in Fund Resources						
Capital Revenues	19	544	396	495	617	259
Custodial Activities (Net)	(1)	-	-	-	-	-
Debt Proceeds	-	-	189	-	2	-
Net Transfers In (Out)	(236)	(90)	32	115	743	(8)
Debt Service	(168)	(167)	(113)	(119)	(64)	(52)
Capital Expenditures	(751)	(484)	(224)	(126)	(1,175)	(339)
Net Other Resources (Uses)	0	(38)	-	-	28	-
Net Change in Fund Position ($000s)	(357)	485	855	915	710	80
Ending Cash & Investments ($000s)	$1,803	$2,288	$3,142	$4,057	$4,767	$4,847
Days of Cash on Hand	***313***	***304***	***424***	***509***	***567***	***512***

- The operating ratio provides a means of evaluating the self-sufficiency of the City’s sewer utility as an enterprise, measuring the ability of annual operating revenues to cover annual operating costs. A ratio of 1.0 indicates that the City’s sewer utility is collecting exactly enough revenue to pay for its operating costs. **Table 11-1** indicates that while the sewer utility was generally able to cover its operating expenses from 2018 to 2023, there was a net cash flow deficiency in 2018 for the sewer funds overall after capital expenditures and interfund transfers had been covered; and
- Days of cash on hand is a measure of financial security, quantifying how long the City’s sewer utility would be able to fund daily operating and maintenance costs if it received no additional revenue. It is calculated by dividing unrestricted cash by the average daily cost of operations. While there is no formal minimum standard for this metric, bond rating

agencies have recently expressed a preference for a minimum of 180 days of cash on hand for utilities seeking the highest bond ratings. Considering its operating and capital reserves, the sewer utility maintained over 300 days of cash on hand between 2018 and 2023.

CAPITAL FUNDING RESOURCES

Other than cash financing, the City may fund the sewer Capital Improvement Plan (CIP) from a variety of sources, described in further detail below.

Grant and Low-Cost Loan Programs

Historically, federal and state grant programs were available to local utilities for capital funding assistance. However, these assistance programs have been mostly eliminated, substantially reduced in scope and amount, or replaced by loan programs. Remaining miscellaneous grant programs are generally lightly funded and heavily subscribed. Nonetheless, the benefit of low-interest loans makes the effort of applying worthwhile. **Appendix N** includes a document published by the Washington State Department of Commerce that outlines state programs, eligibility requirements, and contact information.

System Development Charges (SDCs)

SDCs are a form of connection charge authorized in Revised Code of Washington (RCW) 35.92.025. The City imposes SDCs on development seeking to connect (or upsize an existing connection) to its sewer system as a condition of service, and are in addition to any other costs of connection. Typically based on a blend of historical and planned future capital investment in system infrastructure, the underlying premise is that growth (future customers) will pay for growth-related costs that the utility has incurred (or will incur) to provide capacity to serve new customers. The key components of the SDC calculation are described below.

- **Existing Cost Basis:** The SDC recovers a proportionate share of the cost of existing assets from growth. City records indicate a cumulative investment of $26.7 million in existing assets.
- **Interest:** RCW 35.92.025 allows up to 10 years of interest accrued on existing assets to be included in the cost basis. Based on the original cost and acquisition date of the sewer utility's assets, the SDC cost basis includes $14.9 million in interest.
- **Future System Costs:** The SDC recovers a proportionate share of costs associated with future capital projects from growth to recognize that growth either directly drives or otherwise benefits from these projects. **Table 10-3** indicates a total projected capital cost of $115.7 million in 2023 dollars – the SDC cost basis is adjusted to exclude $6.8 million in costs that the City expects to fund with grants and other sources external to the sewer utility on the premise that the SDC should only recover a share of the investment made in the sewer system by the utility and its ratepayers. In addition, the SDC calculation deducts a provision for future asset retirements to recognize that certain projects in the CIP will replace existing assets. This adjustment intends to avoid double charging development for an asset and its replacement concurrently, recognizing that the assets added through the

CIP will generally cost more than the historical acquisition costs of the existing assets. Based on the projected cost of replacement projects and the expected life of the facilities being replaced, the estimated provision for asset retirements is $3.6 million.

- **System Capacity:** The City imposes sewer SDCs based on water meter size as a representation of how much wastewater a connection could generate, using meter-and-service equivalent (MSE) ratios published by the American Water Works Association (AWWA) to assign equivalent residential units (ERUs) to each meter size. (AWWA also publishes equivalency ratios based on maximum continuous flow capacity, which the City uses to assign ERUs to water service connections – because water meters are often sized to meet demands that do not enter the sewer system, such as irrigation and fire flow, the City's SDC methodology uses MSEs to assign sewer ERUs.)

  The SDC analysis estimates the ERU capacity of the sewer system by:

  1. Estimating the number of existing ERUs using utility billing records. Based on a current inventory of sewer customers by meter size, the City serves an estimated 4,781 ERUs;
  2. Estimating the average flow/loading contributions per ERU using influent data from the City's wastewater treatment plant. An average of 2016 to 2021 data suggests that an ERU contributes 174 gallons per day (gpd) of flow on an annual average basis, 216 gpd of flow on a maximum month basis, 0.54 pounds per day of maximum month 5-day Biochemical Oxygen Demand, and 0.55 pounds per day of maximum month total suspended solids; and
  3. Equating the design capacity of the wastewater treatment plant to an equivalent number of ERUs, given the constraining measure of capacity. Based on the unit flows/loadings summarized above, the wastewater treatment plant can accommodate an estimated 6,673 ERUs based on annual average daily flow capacity of 1.44 million gallons per day.

Table 11-2 summarizes the sewer SDC calculation.

Table 11-2

Sewer SDC Calculation

Sewer SDC Cost Basis ($000s)	
Existing Assets as of 12/31/22	$ 26,685
Plus: Estimated 2023 Expenditures (Net of 50% Grant Funding)	300
Less: Estimated Cost of Assets Being Retired Through CIP Projects	(3,567)
Plus: Interest on Existing Assets	14,905
Future Capital Projects (2023 Dollars)	115,128
Less: Projects Funded by Grants or External Contributions	(6,796)
Net SDC Cost Basis	$146,655
System Capacity in ERUs	6,673
Maximum Sewer SDC per ERU	**$21,978**

Table 11-2 indicates that the City could justify increasing its sewer SDC to $21,978 per ERU. Recognizing that such a high SDC could adversely impact growth in the City's service area and

contradict the City's objective to encourage the development of affordable housing, the City adopted the following changes effective April 1, 2024 (Ordinance 3330):

- Increasing the sewer SDC from $3,758 to $5,258 per ERU based on inflation in the Engineering News-Record Construction Cost Index (20-City Average) from 2013 (when the SDC had last been updated) to 2023. The financial plan assumes that beginning in 2025, the City will adjust the sewer SDC annually for inflation.
- Establishing an alternate methodology for assigning ERUs to single-family connections based on house size (excluding garages). Parcel data from the Jefferson County Assessor informed the proposed structure, which includes five tiers based on square footage:

Residential – Single-Unit and Mobile Home

House Size in Square Feet (SF)	Number of ERUs	SDC
Up to 750 SF	0.36	$1,871
751 – 1,500 SF	0.70	$3,676
1,501 – 1,900 SF	1.00	$5,258
1,901 – 2,600 SF	1.30	$6,819
Larger Than 2,600 SF	1.90	$10,011

Bonds

While general obligation bonds pledge the full faith and credit of the issuing entity, revenue bonds are typically secured by utility revenues. With this limited commitment, revenue bonds normally bear higher interest rates than other types of debt and also require additional security conditions intended to protect bondholders from default risk. These conditions may include the maintenance of dedicated reserves and minimum standards of financial performance (e.g., debt service coverage).

Revenue bonds can be issued in Washington State without a public vote. While there is no explicit statutory bonding limit, the conditions that come with revenue bonds often impose practical limits on a utility's level of indebtedness. An excessive debt burden may reduce a utility's flexibility to phase in rate increases, also resulting in a higher overall cost of capital investment given the related interest payments. It is worth noting that bond rating agencies also consider a utility's debt service coverage when assigning a rating – higher levels of indebtedness make it more difficult for a utility to meet the coverage ratios that the rating agencies require for the highest ratings (and the lowest interest rates). In recent years, these coverage ratios have often exceeded the minimum legal standards outlined in the applicable bond covenants.

CURRENT REVENUE

The primary goal of the financial analysis is to develop a viable financial plan to support execution of the planned capital projects while funding ongoing operations and maintaining affordable rates. This study defines the amount of revenue needed to meet the system's financial obligations including:

- Operation and maintenance costs;
- Administrative and overhead costs;

- Policy-based needs (e.g., reserve funding);
- Capital costs; and
- Existing/new debt service obligations.

The City operates its sewer utility as an enterprise, relying on revenue from its sewer rates (as opposed to taxes or other external resources) to cover the expenses outlined above. The rate-setting process includes both operating and capital elements.

Financial Policies

The ensuing discussion summarizes the key financial policies used in this analysis.

Utility Reserves

Reserves are a key component of any utility financial strategy, as they provide the flexibility to manage variations in costs and revenues that could otherwise have an adverse impact on ratepayers. The financial analysis separates resources into the following funds:

- Operating Reserve: Providing an unrestricted cash balance to accommodate the short-term cycles of revenues and expenses, these reserves are intended to address variations in revenues and expenses (including anticipated variations in billing/receipt cycles, as well as unanticipated variations due to weather or economic conditions). The financial analysis assumes a minimum balance target of 60 days of operating expenses for this reserve, which based on projected 2024 operating expenses equates to about $725,000.
- Capital Reserve: Providing a source of cash for emergency asset replacements or capital project overruns, this reserve enforces an appropriate segregation of resources restricted or designated for capital purposes. This analysis does not include a minimum balance for this reserve, assuming that the City would be able to delay or seek external funding for capital projects as needed.
- Bond Reserve: Bond covenants establish reserve requirements as a means of protecting bondholders against the risk of nonpayment. While the City’s sewer utility does not currently have outstanding debt that requires such a reserve, the forecast assumes a minimum balance equal to one year’s debt service payment for future revenue bonds.

Recognizing that revenue bonds will likely be needed to fund at least part of the projected capital costs, this analysis also targets a combined unrestricted cash balance (including both operating and capital reserves, but not restricted bond reserves) of 180 days of operating expenses. Though not a formal requirement, this policy is based on recommendations from the bond rating agencies for borrowers seeking to optimize their bond ratings. Given the near-term expense forecast, the combined target balance would be roughly $2,178,000 in 2024.

Financial Performance Standards

The financial plan (revenue requirement analysis) uses a pair of sufficiency tests to establish the amount of revenue needed to meet the annual financial obligations of the City’s sewer utility.

- Cash Flow Test: To satisfy this test, operating revenues must be adequate to fund all known cash requirements, including operations and maintenance (O&M) expenses, debt service, rate-funded capital outlays, and reserve funding.
- Coverage Test: Though the sewer utility currently has no debt requiring coverage, the financial analysis assumes that the utility's net revenue would need to be greater than or equal to 1.25 times annual parity debt service (based on the requirements typically outlined in bond covenants) in the event of future debt issuance.

The annual revenue requirement is broadly defined as the amount of revenue needed to satisfy both of these tests. Short-term cash flow deficits may occur as part of a strategy to phase rate increases in, as long as the utility has sufficient reserves on hand to absorb them; however, any applicable debt service coverage requirements must always be met.

Capital Funding Plan

As shown in **Table 11-3**, the sewer utility's 20-year CIP includes $115.1 million in project costs (in 2023 dollars) with $51.9 million expected to occur in the next 10 years (2024 to 2033). Based on input from City staff, the financial plan assumes construction cost inflation of 5 percent for 2024 and 4 percent per year thereafter. Adjusting for inflation, **Table 11-3** shows a total 20-year capital expenditure of $180.1 million, of which $63.8 million is projected to occur within the next 10 years. Note that **Table 11-3** only includes $21.3 million of the $56.0 million estimated for the long-term sewer system refurbishment program – due to financing constraints, the remainder will either need to be funded by grants or delayed beyond the 20-year period.

Shown in further detail in **Table 11-4**, the capital funding plan for the 10-year CIP (2024 to 2033) consists of the following components:

- $6.3 million in grant funding, including $4.1 million for the Mill Road Lift Station, $1.2 million for the Lawrence Street Combined Sewer Separation, and $1.1 million for the Water Street Sewer Replacement (in addition to $300,000 in grant funding attributable to 2023 expenditures on the Water Street project).
- $483,000 in funding from the City's Equipment Rental & Replacement (ERR) Fund for the purchase of a new screen for the City's Compost Facility (the ERR Fund is an internal service fund of the City that is external to the sewer utility).
- $1.1 million in Public Works Trust Fund loans for the Water Street Sewer Replacement. At an interest rate of 0.86 percent, the annual payment on this loan (including an additional $300,000 attributable to 2023 expenditures on this project) would be about $80,000.
- A $4.5 million State Revolving Fund (SRF) loan for the outfall upgrades. At an interest rate of 1.2 percent, the annual payment on this 20-year loan would be about $253,000.
- $30.9 million in revenue bond proceeds to fund various capital projects over the 10-year planning period. With interest rates of 3.5 to 4.0 percent, the annual payment on these 20-year bonds would increase to $2.3 million by the end of the planning period.

- $2.0 million in Local Facilities Charges imposed on properties in the area benefitting from the Mill Road Lift Station at the time of connection.
- $18.6 million in sewer utility cash resources, including $3.1 million in SDCs and $15.5 million of cash contributions generated through rates.

Table 11-3

Capital Cost Forecast

Capital Project Expenditures ($000s)	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	Future	Total
Sewer Main Improvements												
Sims Way Crossing & Wilson Street Realignment	$ 100	$ 606	$ 506	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,212
Howard Street & South Park Avenue	-	-	-	-	-	-	-	-	400	1,178	-	1,578
Sims Way, Third Street, & Gise Street	-	-	-	-	-	-	-	-	300	886	-	1,186
Holcomb Street	-	-	-	-	-	-	-	-	150	669	-	819
Howard St., South Park Ave, & McPherson St.	-	-	-	-	-	-	-	-	-	-	2,463	2,463
West Sims Way & 3rd Street	-	-	-	-	-	-	-	-	-	-	1,679	1,679
Future Interceptor Upsizing	-	-	-	-	-	-	-	-	-	-	6,722	6,722
Sewer System Defect Investigation & Repair	150	350	350	350	350	350	350	350	350	350	-	3,300
Lawrence Street Combined Sewer Separation	-	500	1,163	1,163	-	-	-	-	-	-	-	2,826
Suitcase Pipe Replacement on Washington St.	-	399	-	-	-	-	-	-	-	-	-	399
Long-Term Sewer System Refurbishment	-	-	-	-	-	-	-	-	-	-	21,250	21,250
Water Street Sewer Replacement	2,100	-	-	-	-	-	-	-	-	-	-	2,100
Lift Station Improvements												
Existing Monroe St. Pump Station Improvements	-	-	-	-	500	1,000	3,500	-	-	-	-	5,000
Sewer Camera Van, Video Camera, & Tractor	300	-	-	-	-	-	-	-	-	-	-	300
General Lift Station Improvements	50	50	50	50	50	50	50	50	50	50	500	1,000
Mill Road Lift Station	1,100	3,200	2,000	-	-	-	-	-	-	-	-	6,300
Wastewater Facility Improvements												
Influent Pump Station & Odor Control Improvements	300	1,820	-	-	-	-	-	-	-	-	-	2,120
Headworks Rehabilitation	-	-	-	-	-	100	500	600	-	-	-	1,200
Clarifier No. 1 Improvements	-	-	-	-	-	150	475	625	-	-	-	1,250
Clarifier No. 2 Improvements	-	-	-	-	-	150	475	625	-	-	-	1,250
NPW Pump Replacements	60	-	60	-	-	-	-	-	-	-	-	120
SCADA Upgrades	-	150	990	-	-	-	-	-	-	-	-	1,140
Electrical Upgrades	-	-	630	-	-	-	-	-	-	-	-	630
Near-Term Oxidation Ditch Improvements	-	100	-	-	400	150	1,072	1,222	-	-	-	2,944

Table 11-3

Capital Cost Forecast (Continued)

Capital Project Expenditures ($000s)	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**	**Future**	**Total**
Outfall Upgrades	500	600	2,900	-	-	-	-	-	-	-	-	4,000
Onsite Solids Handling	-	-	-	-	-	200	1,300	1,500	-	-	-	3,000
Land Acquisition for WWTP Expansion	-	2,000	-	-	-	-	-	-	-	-	-	2,000
Long-Term WWTP Expansion	-	-	-	-	-	-	-	-	-	-	30,000	30,000
Compost Facility & Solids Handling Improvements												
Solids Handling Influent Screening & Grit Removal	-	-	160	365	365	-	-	-	-	-	-	890
Solids Handling Tank Repl. & Mechanical Upgrades	-	150	130	130	130	32	32	32	32	32	-	700
Compost Screen Replacement	460	-	-	-	-	-	-	-	-	-	-	460
Compost Case Loader Replacement	-	390	-	-	-	-	-	-	-	-	-	390
Compost Blower Replacements	19	19	19	23	-	-	-	-	-	-	-	80
Compost Facility Infrastructure Upgrades	-	15	-	-	-	-	-	-	-	-	395	410
6-Inch Hydrant Line	-	100	285	285	-	-	-	-	-	-	-	670
Office with Dedicated Lunchroom	-	300	-	-	-	-	-	-	-	-	-	300
Miscellaneous & Planning Improvements												
Arc Flash Analysis	-	90	-	-	-	-	-	-	-	-	-	90
Public Works Shop (Sewer Collection Share)	-	100	-	-	-	-	-	-	-	2,750	-	2,850
General Sewer Plan Update	-	-	-	-	-	-	-	-	-	-	250	250
Downtown Restrooms	-	250	-	-	-	-	-	-	-	-	-	250
Total (2023 Dollars)	$5,139	$11,189	$ 9,243	$2,366	$1,795	$2,182	$ 7,754	$5,004	$1,282	$5,915	$ 63,259	$115,128
Total Projected Expenditures (with Inflation)	**$5,396**	**$12,218**	**$10,497**	**$2,795**	**$2,205**	**$2,787**	**$10,302**	**$6,914**	**$1,842**	**$8,840**	**$116,270**	**$180,067**

Table 11-4

Capital Funding Strategy

Capital Reserve Projections ($000s)	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**	**2024-2033 Total**
Beginning Balance	$ 259	$ 5,019	$11,309	$2,783	$ 1,502	$10,948	$9,786	$1,648	$4,273	$5,924	$ 259
Plus: Interest Earnings	4	75	170	42	23	164	147	25	64	89	802
Plus: Grants – Mill Lift Station Project	1,000	3,100	-	-	-	-	-	-	-	-	4,100
Plus: Grants – Lawrence Street Sewer Separation Project	-	-	581	582	-	-	-	-	-	-	1,163
Plus: Grants – Water Street Sewer Replacement	1,050	-	-	-	-	-	-	-	-	-	1,050
Plus: PWTF Loan – Water Street Sewer Replacement	1,050	-	-	-	-	-	-	-	-	-	1,050
Plus: SRF Loan – Outfall Upgrades	4,474	-	-	-	-	-	-	-	-	-	4,474
Plus: Revenue Bonds	-	14,200	-	-	10,100	-	-	6,600	-	-	30,900
Plus: ERR Reserves – Compost Screen Replacement	483	-	-	-	-	-	-	-	-	-	483
Plus: Transfer from Operating Fund	1,552	570	637	288	903	813	1,644	2,534	3,040	4,233	16,216
Plus: Transfer from SDC Fund	344	363	382	403	425	448	173	180	188	197	3,103
Plus: Local SDC for Mill Road Lift Station Project	200	200	200	200	200	200	200	200	200	200	2,000
Less: Capital Expenditures	(5,396)	(12,218)	(10,497)	(2,795)	(2,204)	(2,787)	(10,302)	(6,914)	(1,842)	(8,840)	(63,796)
Ending Balance	$5,019	$11,309	$ 2,783	$1,502	$10,948	$9,786	$ 1,648	$4,273	$5,924	$1,803	$1,803

Revenue Requirement

The revenue requirement analysis evaluates the sewer utility's ability to cover its projected costs under its currently adopted rates. In the event of any projected deficiencies, this analysis will serve as the basis for a strategy of recommended rate revenue adjustments.

Projected Financial Performance

The revenue requirement analysis is developed from the City's adopted 2023 Budget with other assumptions:

- The forecast of sewer rate revenue is based on 2023 budgeted revenue provided by the City, adjusted for customer growth. Based on the forecast of the City's sewered population presented in **Table 3-3**, the analysis assumes growth of about 1.4 percent per year (the long-term annual average growth rate) through 2029 and 0.5 percent annual growth thereafter. These projections are somewhat lower than the population projections presented in **Table 3-3**, recognizing the difference between conservatism for financial planning and conservatism in system planning. As previously noted, the projection of "rate revenue" reflects the consolidation of the capital surcharge into the "main" sewer rate structure;
- Interest earnings are calculated on the sewer utility's projected fund balances assuming an annual interest earnings rate of 1.5 percent;
- The operating forecast generally holds most of the sewer utility's other operating revenues at 2023 levels moving forward;
- The forecast of operating expenses generally adjusts the 2023 budgeted expenditures for inflation assuming 5.0-percent inflation for 2024 and 4.0-percent inflation thereafter. Though lower than recent inflation observed in the Consumer Price Index, these inflation assumptions intend to recognize longer-term inflationary trends while maintaining a reasonable degree of conservatism; and
- Taxes are calculated based on the projected revenues and prevailing rates:
  - City Utility Tax: 16.0 percent;
  - State Excise Tax (Sewer): 3.852 percent; and
  - Business & Occupation (B&O) Tax: 1.75 percent.

Table 11-5 summarizes the sewer utility's projected financial performance and rate revenue needs.

Table 11-5

Projected Financial Performance and Revenue Requirements ($000s)

	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Revenue										
Rate Revenue at 2023 Rates	$3,072	$3,114	$3,156	$3,199	$3,243	$3,287	$3,304	$3,321	$3,337	$3,354
Other Operating Revenues	237	237	237	237	237	237	237	237	237	237
Use of Fund 430 for Debt Service	18	83	873	-	-	-	-	-	-	-
Total Revenues	$3,327	$3,433	$4,266	$3,436	$3,480	$3,524	$3,541	$3,558	$3,574	$3,591
Expenses										
Operating Expenses	$4,417	$4,061	$4,210	$4,364	$4,525	$4,692	$4,812	$4,985	$5,165	$ 5,351
Debt Service	69	335	1,421	1,421	1,420	2,230	2,230	2,229	2,758	2,758
Direct Funding for Capital Projects	-	-	-	-	-	-	169	-	-	2,627
Additions to Operating Reserve	-	-	24	25	26	27	20	29	29	31
Total Expenses	$4,487	$4,397	$5,655	$5,810	$5,971	$6,949	$7,231	$7,243	$7,952	$10,767
Net Cash Flow	($1,160)	($964)	($1,389)	($2,374)	($2,491)	($3,425)	($3,690)	($3,685)	($4,378)	($7,176)
Annual Rate Increase	**39.7%**[1]	**13.0%**	**13.0%**	**13.0%**	**13.0%**	**13.0%**	**13.0%**	**13.0%**	**13.0%**	**13.0%**
Rate Revenue After Rate Increases	$3,986	$4,915	$5,630	$6,449	$7,387	$8,462	$9,609	$10,913	$12,393	$14,074
Net Cash Flow After Rate Increases	($411)	$512	$662	$313	$930	$841	$1,495	$2,563	$3,070	$1,637
Debt Coverage After Rate Increases	(N/A)	(N/A)	1.62	1.98	2.54	1.92	2.19	2.59	2.46	2.96
Projected Ending Balances (Sewer Share)										
Operating Fund	$ 726	$ 668	$ 692	$ 717	$ 744	$ 771	$ 791	$ 819	$ 849	$ 880
Capital Fund	5,019	11,309	2,783	1,502	10,948	9,786	1,648	4,273	5,924	1,803
Total	$5,745	$11,977	$3,475	$2,220	$11,692	$10,558	$2,439	$5,093	$6,773	$2,683
Combined Balance as Days of O&M	*475 Days*	*1,076 Days*	*301 Days*	*186 Days*	*943 Days*	*821 Days*	*185 Days*	*373 Days*	*479 Days*	*183 Days*

1. The 2024 rate increase reflects the consolidation of the capital surcharge into the "main" sewer rate, targeting a 13.0% increase over the total existing sewer bill.

Table 11-5 indicates that at 2023 rates, the City's sewer revenues are insufficient to cover the sewer utility's expenses – with inflation, projected increases in debt service, and capital funding needs, the cash-flow deficiency generally grows larger over time (except in 2025, when total operating expenses are expected to decrease after accounting for several one-time expenses built into the 2024 projections). **Table 11-5** shows a strategy of 13.0-percent annual rate increases from 2024 to 2033, which are projected to enable the sewer utility to cover the projected needs while maintaining a combined fund balance of at least 180 days of operating expenses. The City Council passed Ordinance 3332 at its February 20, 2024, meeting, adopting the rate increases for 2024 (effective April 1, 2024) through 2028 – the City intends to revisit the sewer financial plan in 2028 and assess whether the rate increases shown for 2029 and future years are still needed given any capital funding assistance (e.g., grants, low-cost loans, forgivable principal loans) that the City is able to obtain.

CURRENT AND PROJECTED SEWER RATES

The City imposes a two-tiered base rate on residential users, with residences using more than 3,000 gallons paying a higher base rate than those using 3,000 gallons or less. Multi-family, commercial, and governmental users pay a base rate based on their water meter size and a volume rate per thousand gallons of water usage. Effective April 1, 2024, the City eliminated the capital surcharge and increased the rest of the sewer rate structure proportionately to maintain revenue neutrality. **Table 11-6** shows the sewer rate schedule adopted by the City Council on February 20, 2024.

Table 11-6

Sewer Rate Forecast

Sewer Rate Structure (Including Utility Tax)	Jan-Mar 2024	Apr-Dec 2024	2025	2026	2027	2028
Monthly Base Rate						
Residential (Including Duplexes)						
Usage ≤ 3,000 Gallons	$46.46	$63.36	$71.60	$80.91	$91.42	$103.31
Usage > 3,000 Gallons	$57.44	$78.33	$88.51	$100.02	$113.02	$127.71
Multi-Family/Commercial/Government:						
5/8” – 3/4” Meter	$41.18	$56.16	$63.46	$71.71	$81.03	$91.57
1” Meter	$61.77	$84.23	$95.18	$107.56	$121.54	$137.34
1-1/2” Meter	$102.94	$140.37	$158.62	$179.24	$202.55	$228.88
2” Meter	$157.84	$215.24	$243.23	$274.84	$310.57	$350.95
3” Meter	$576.48	$786.12	$888.32	$1,003.80	$1,134.29	$1,281.75
4” Meter	$645.11	$879.72	$994.08	$1,123.31	$1,269.34	$1,434.35
6” Meter	$960.80	$1,310.22	$1,480.55	$1,673.02	$1,890.51	$2,136.28
8” Meter	$1,317.67	$1,796.87	$2,030.46	$2,294.42	$2,592.69	$2,929.74
Volume Rate per 1,000 Gallons						
Multi-Family (3+ Units)	$4.73	$6.45	$7.29	$8.24	$9.31	$10.52
Commercial A (2” or Smaller Meter)	$6.38	$8.70	$9.83	$11.11	$12.55	$14.18
Commercia B (3” or Larger Meter)	$4.18	$5.70	$6.45	$7.28	$8.23	$9.30
Government	$6.24	$8.51	$9.62	$10.87	$12.29	$13.88
Capital Surcharge per Month						
Standard	$9.00	-	-	-	-	-
Low-Income	$4.50	-	-	-	-	-

Utility Rate Affordability Analysis

A key objective of this financial chapter is to evaluate the City’s ability to execute the planned capital improvement projects while maintaining reasonable sewer rates. Recognizing that a holistic assessment of rate affordability must consider the total utility bill, **Table 11-7** shows a forecast of combined utility bills under the adopted rates for a residential customer using 3,000 gallons of water per month.

The City has historically offered citizens with income levels at or below 150 percent of the poverty level (PL) for Jefferson County a 50-percent discount on their water base charge (excluding volume charges), their sewer charge, and their stormwater charge. Effective April 1, 2024, the City replaced its low-income discount program with an income-based discount program consisting of the following tiers:

Income Level	Discount to Water Base Charge, Sewer Charge, and Stormwater Charge
> 350% of PL	0% (Customer Pays 100% of Charges)
300% – 350% of PL	25% (Customer Pays 75% of Charges)
200% – 300% of PL	50% (Customer Pays 50% of Charges)
≤ 200% of PL	75% (Customer Pays 25% of Charges)

Table 11-7 shows the bills for residential customers using 3,000 gallons of water per month under each of these income thresholds.

Table 11-7

Combined Utility Bill Forecast

Average Monthly Residential Bill @ 3,000 Gallons	Jan-Mar 2024	Apr-Dec 2024	2025	2026	2027	2028
Income > 350% of PL						
Water[1]	$ 70.84	$ 74.31	$ 76.86	$ 77.79	$ 80.90	$ 84.14
Sewer	55.46	63.36	71.60	80.91	91.42	103.31
Stormwater	16.89	20.05	22.01	24.41	27.02	29.62
Total	$143.19	$157.72	$170.47	$183.11	$199.34	$217.07
Change from Prior Year		+$14.53	+$12.75	+$12.64	+$16.23	+$17.73
Percent Change from Prior Year		+10.1%	+8.1%	+7.4%	+8.9%	+8.9%
Income Between 300% – 350% of PL						
Water[1] (25% Discount to Base Charge)	$ 70.84	$ 59.14	$ 61.14	$ 61.91	$ 64.39	$ 66.96
Sewer (25% Discount)	55.46	47.52	53.70	60.68	68.57	77.48
Stormwater (25% Discount)	16.89	15.04	16.51	18.31	20.27	22.22
Total	$143.19	$121.70	$131.35	$140.90	$153.23	$166.66
Change from Prior Year		($21.49)	+$9.65	+$9.55	+$12.33	+$13.43
Percent Change from Prior Year		-15.0%	+7.9%	+7.3%	+8.8%	+8.8%
Income Between 200% – 300% of PL						
Water[1] (50% Discount to Base Charge)	$ 70.84	$43.97	$45.43	$46.04	$ 47.88	$ 49.80
Sewer (50% Discount)	55.46	31.68	35.80	40.46	45.71	51.66
Stormwater (50% Discount)	16.89	10.03	11.01	12.21	13.51	14.81
Total	$143.19	$85.68	$92.24	$98.71	$107.10	$116.27
Change from Prior Year		($57.51)	+$6.56	+$6.47	+$8.39	+$9.17
Percent Change from Prior Year		-40.2%	+7.7%	+7.0%	+8.5%	+8.6%
Income ≤ 150% of PL						
Water[1] (75% Discount to Base Charge)	$42.40	$28.79	$29.72	$30.16	$31.37	$32.62
Sewer (75% Discount)	27.73	15.84	17.90	20.23	22.86	25.83
Stormwater (75% Discount)	8.27	5.01	5.50	6.10	6.76	7.41
Total	$78.40	$49.64	$53.12	$56.49	$60.99	$65.86
Change from Prior Year		($28.76)	+$3.48	+$3.37	+$4.50	+$4.87
Percent Change from Prior Year		-36.7%	+7.0%	+6.3%	+8.0%	+8.0%

1. Assumes 4% inflationary increases for 2027 and 2028; the City has only adopted water rates through 2026.

While the term "reasonable" is relatively subjective in its definition, agencies that offer low-cost loans to utilities often use an "affordability index" based on median household income (MHI) to define a threshold beyond which utility rates impose financial hardship on ratepayers. The benchmark most often used in this evaluation is 4.5 percent of the median household income in the relevant demographic area for the combined water/sewer bill. The 2022 American Community Survey indicates a median income of $59,193 (in 2022 dollars) for households in the City of Port Townsend – adjusting for increases in the state minimum wage from 2022 to 2024 (12.3 percent), the equivalent 2024 median income level would be $66,505. **Table 11-8** summarizes the affordability evaluation of the City's rates based on median household income.

Table 11-8

Monthly Utility Bill as a Percentage of Median Household Income

	Jan-Mar 2024	Apr-Dec 2024	2025	2026	2027	2028
Water Bill @ 3,000 Gallons	$ 70.84	$ 74.31	$ 76.86	$ 77.79	$ 80.90	$ 84.14
Sewer Bill @ 3,000 Gallons	55.46	63.36	71.60	80.91	91.42	103.31
Combined Monthly Water/Sewer Bill	$126.30	$137.67	$148.46	$158.70	$172.32	$187.45
Annual MHI[1]	$66,505	$66,505	$69,166	$71,932	$74,809	$77,802
Combined Bill as Percent of MHI	2.3%	2.5%	2.6%	2.6%	2.8%	2.9%

1. Assumes that MHI increases annually with inflation at 4% per year.

Table 11-8 shows that the combined water/sewer bill at 3,000 gallons is expected to remain within the range of 2.5 to 3.0 percent of MHI through 2028 – even without the assumed inflationary adjustments to MHI, the combined bill would only reach about 3.4 percent of MHI by 2028. Though the City's rates could be considered "affordable" by this standard, there has been a growing consensus in the industry that median household income is of limited value in assessing the impacts of utility rates on customers with income levels far below the area median. As discussions about rate affordability continue to evolve, two alternative metrics have been gaining traction as providing a more meaningful basis for evaluating affordability:

Hours at Minimum Wage (HM)

HM quantifies the amount of time that someone earning minimum wage (currently $16.28 per hour in Washington State) would need to work in order to pay their combined water/sewer bill, assuming that they use a "lifeline" volume of 50 gallons per capita per day (gpcd). Based on the City's average household size of 1.85 people, this assumption equates to just over 2,800 gallons per month per household (for simplicity, this assessment rounds the usage level up to 3,000 gallons per month). The literature discussing HM recommends 8.0 hours as a threshold for defining "affordable" rates.

Affordability Ratio at the 20th Income Percentile (AR_{20})

AR_{20} expresses the combined water/sewer bill (at 50 gpcd) as a percentage of the net disposable income (NDI) of a household in the 20th income percentile after accounting for the cost of food, housing, power, healthcare, and taxes.

- Based on data from the American Community Survey, the estimated gross income of a household at the 20th income percentile is about $25,113 (roughly $2,100 per month).

- Based on data from the Bureau of Labor Statistics' Consumer Expenditure Survey, the estimated annual expenditures for the essential needs listed above add up to $20,605 for a household of two and $15,852 for a household of three. Though it is somewhat counterintuitive that a household of two would spend *more* than a household of three on these essential needs, the Consumer Expenditure Survey data suggests that on average, a household of three gets a greater tax refund than a household of two (possibly due to dependent tax credits) and spends less on healthcare despite spending more in most other areas.

The parameters above suggest that the NDI for a household in the 20th income percentile falls into the range of $376 to $772 per month, depending on whether the expense estimates for the two-person or three-person household (which is more common for households in Washington State) are used. The literature discussing AR_{20} recommends 10.0 percent of NDI as a threshold for "affordable" rates.

Both HM and AR_{20} focus specifically on the combined water/sewer bill and do not explicitly account for stormwater charges. While this is possibly because residential stormwater charges have historically been low compared to water and sewer charges, stormwater rate increases driven by infrastructure investments and water quality improvements are at a point where they arguably should be considered in an affordability assessment. It is reasonable to expect that the methodology for determining these metrics (as well as the suggested affordability thresholds) may evolve over time as a result of stormwater rate increases. With this caveat, **Table 11-9** summarizes the affordability analysis for low-income residents based on the current definitions of HM and AR_{20}.

Table 11-9

Rate Affordability Assessment Based on HM and AR_{20}

	Jan-Mar 2024	Apr-Dec 2024	2025	2026	2027	2028
Residential (Income > 350% of PL)						
Monthly Water/Sewer Bill @ 3,000 Gallons	$126.30	$137.67	$148.46	$158.70	$172.32	$187.45
Bill as HM (Target: ≤ 8.0 Hours)	7.8 Hours	8.5 Hours	8.8 Hours	9.0 Hours	9.4 Hours	9.8 Hours
Bill as % of NDI (AR_{20}, Target: ≤ 10.0%)	16.4 – 33.6%	17.8 – 36.6%	19.2 – 39.5%	20.6 – 42.2%	22.3 – 45.8%	24.3 – 49.9%
Residential (Income Between 300 – 350% of PL)						
Monthly Water/Sewer Bill @ 3,000 Gallons	$126.30	$106.66	$114.84	$122.59	$132.96	$144.44
Bill as HM (Target: ≤ 8.0 Hours)	7.8 Hours	6.6 Hours	6.8 Hours	7.0 Hours	7.3 Hours	7.6 Hours
Bill as % of NDI (AR_{20}, Target: ≤ 10.0%)	16.4 – 33.6%	13.8 – 28.4%	14.9 – 30.5%	15.9 – 32.6%	17.2 – 35.4%	18.7 – 38.4%
Residential (Income Between 200 – 300% of PL)						
Monthly Water/Sewer Bill @ 3,000 Gallons	$126.30	$75.65	$81.23	$86.50	$93.59	$101.46
Bill as HM (Target: ≤ 8.0 Hours)	7.8 Hours	4.6 Hours	4.8 Hours	4.9 Hours	5.1 Hours	5.3 Hours
Bill as % of NDI (AR_{20}, Target: ≤ 10.0%)	16.4 – 33.6%	9.8 – 20.1%	10.5 – 21.6%	11.2 – 23.0%	12.1 – 24.9%	13.1 – 27.0%
Residential (Income ≤ 150% of PL)						
Monthly Water/Sewer Bill @ 3,000 Gallons	$70.13	$44.63	$47.62	$50.39	$54.23	$58.45
Bill as HM (Target: ≤ 8.0 Hours)	4.3 Hours	2.7 Hours	2.8 Hours	2.9 Hours	3.0 Hours	3.1 Hours
Bill as % of NDI (AR_{20}, Target: ≤ 10.0%)	9.1 – 18.7%	5.8 – 11.9%	6.2 – 12.7%	6.5 – 13.4%	7.0 – 14.4%	7.6 – 15.5%
Projected Minimum Hourly Wage[1]	$16.28	$16.28	$16.93	$17.61	$18.31	$19.05
Monthly NDI of Household @ 20th Percentile[2]	$376 – $772	$376 – $772	$376 – $772	$376 – $772	$376 – $772	$376 – $772

[1]Assumes that minimum wage increases annually with inflation (assumed to be 4% per year) per RCW 49.46.020.
[2]Range based on two-person and three-person homes; remains the same since both income and expenses are assumed to increase with inflation.

Table 11-9 shows that under the City's "standard" residential rate schedule (applicable to customers with annual income above 350 percent of PL), the bill for a residential customer using 3,000 gallons per month generally exceeds the suggested affordability thresholds based on HM and AR_{20}. The City's introduction of a new income-based discount program in April 2024 appears to materially improve the affordability of rates for customers below 350 percent of PL. It is worth noting that the estimated annual income for a household in the City at the 20th income percentile ($25,113) represents approximately 123 percent of the 2024 Federal Poverty Guideline of $20,440 for a household of two – in **Table 11-9**, this household would fall into the lowest income category (150 percent of PL).

Rate Burden (EPA Methodology)

The U.S. Environmental Protection Agency (EPA) has developed a method for evaluating the household burden of utility rates associated with water utilities. The framework for measuring household affordability and financial capability include:

1. The Household Burden Indicator (HBI), defined as basic water service costs (includes water, wastewater, and stormwater combined) as a percent of the 20th percentile household income (i.e., the Lowest Quintile of Income (LQI) for the Service Area); and
2. The Poverty Prevalence Indicator (PPI), defined as the percentage of community households at or below 200 percent of the Federal Poverty Level (FPL).

Table 11-10 summarizes the guidelines for evaluating the relative rate burden using the EPA's methodology.

Table 11-10

Summary of Rate Burden Evaluation Based on EPA Methodology

HBI – Water Costs as a Percent of Income at LQI	PPI – Percent of Households Below 200% of FPL		
	≥ 35%	20 – 35%	< 20%
≥ 10%	Very High Burden	High Burden	Moderate-High Burden
7 – 10%	High Burden	Moderate-High Burden	Moderate-Low Burden
< 7%	Moderate-High Burden	Moderate-Low Burden	Low Burden

Rates are generally considered to be "high burden" if total basic water costs are a relatively high percentage of household income for the LQI household, and a relatively large proportion of the community households are economically challenged. However, if less than 20 percent of households are below 200 percent of FPL, the community as a whole may be affluent enough to pay for water at a relatively cost without it becoming a high burden (although some households might still struggle). This approach also suggests that utility service may be highly burdensome and unaffordable if a large proportion of the community's households are below 200 percent of FPL, even if water bills are a relatively low percent of LQI (the lower-left portion of **Table 11-10**).

City staff estimated that approximately 29.5 percent of households in the City have income levels below 200 percent of FPL. **Table 11-11** summarizes the evaluation of rate burden under the EPA methodology.

Table 11-11

Rate Burden Assessment Based on EPA Methodology

	Jan-Mar 2024	Apr-Dec 2024	2025	2026	2027	2028
Annual Income at 20th Income Percentile[1]	$25,113	$25,113	$26,118	$27,162	$28,249	$29,379
Monthly Income at 20th Income Percentile[1]	$2,093	$2,093	$2,176	$2,264	$2,354	$2,448
Residential (Income > 350% of PL)						
Monthly Water/Sewer Bill @ 3,000 Gallons	$126.30	$137.67	$148.46	$158.70	$172.32	$187.45
Bill as % of Monthly Income @ 20th Percentile	6.8%	7.5%	7.8%	8.1%	8.5%	8.9%
Rate Burden	Mod. Low	Mod. High	Mod. High	Mod. High	Mod. High	Mod. High
Residential (Income Between 300 – 350% of PL)						
Monthly Water/Sewer Bill @ 3,000 Gallons	$126.30	$106.66	$114.84	$122.59	$132.96	$144.44
Bill as % of Monthly Income @ 20th Percentile	6.8%	5.8%	6.0%	6.2%	6.5%	6.8%
Rate Burden	Mod. Low	Mod. Low	Mod. Low	Mod. Low	Mod. Low	Mod. Low
Residential (Income Between 200 – 300% of PL)						
Monthly Water/Sewer Bill @ 3,000 Gallons	$126.30	$75.65	$81.23	$86.50	$93.59	$101.46
Bill as % of Monthly Income @ 20th Percentile	6.8%	4.1%	4.2%	4.4%	4.5%	4.7%
Rate Burden	Mod. Low	Mod. Low	Mod. Low	Mod. Low	Mod. Low	Mod. Low
Residential (Income ≤ 150% of PL)						
Monthly Water/Sewer Bill @ 3,000 Gallons	$70.13	$44.63	$47.62	$50.39	$54.23	$58.45
Bill as % of Monthly Income @ 20th Percentile	3.7%	2.4%	2.4%	2.5%	2.6%	2.7%
Rate Burden	Mod. Low	Mod. Low	Mod. Low	Mod. Low	Mod. Low	Mod. Low

[1]Assumes that minimum wage increases annually with inflation (assumed to be 4% per year) per RCW 49.46.020.

Table 11-11 shows that under the "standard" residential rate schedule (applicable to customers with annual income above 350 percent of PL), the bill for a residential customer using 3,000 gallons per month would be considered a "moderate-high" rate burden. The City's introduction of the income-based discount program in April 2024 appears to help alleviate the burden to an extent, reducing it to the "moderate-low" level through at least 2028. Given the expected rate increases shown in **Table 11-5** for 2029 and future years, it is reasonable to expect that the rate burden may shift to higher levels over time unless the City can secure additional grant funding for the capital plan.

Table 11-11 (as well as **Table 11-9**) show affordability assessments under each of the levels in the City's income-based discount program to recognize that: (a) not all qualifying customers will enroll in the program; and (b) customers with below-average income levels that exceed the 20th percentile might also be burdened by rates.

CONCLUSION

Table 11-5 indicates that the City will need to increase its sewer rates significantly in order to cover projected debt service payments on debt issued to fund several of the City's upcoming capital projects. In addition to debt service, this rate strategy also considers the need to keep up with rising operating costs. The recommended strategy envisions rate increases of 13 percent per year and inflationary increases to the City's sewer SDC to provide additional funds to offset system capital costs.

The affordability assessment suggests that the City's utility rates may impose a significant burden on lower-income citizens. By expanding its rate discount program, the City has taken a significant step to alleviate the rate burden for customers that qualify for and enroll in the program.

Though the City Council has adopted sewer rates through 2028, the City may be able to reduce future rate increases if it is successful in obtaining additional funding assistance for its capital program. It would be prudent for the City to regularly monitor the financial position of its sewer utility, revisiting the key underlying assumptions to ensure that the utility's revenues remain sufficient to meet its financial obligations.

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